A STRATEGY TO IMPROVE AGRICULTURAL PRODUCTION IN A RURAL COMMUNITY THROUGH ON-FARM RESEARCH AND TECHNOLOGY TRANSFER

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A STRATEGY TO IMPROVE AGRICULTURAL PRODUCTION IN A RURAL COMMUNITY THROUGH ON-FARM RESEARCH AND TECHNOLOGY TRANSFER

by

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DECLARATION

The study represents original work by the author and has not been submitted in any other form to another university. Where use was made of the work of others, it has been duly acknowledged in the text.

Signed:

....6/04/2005..........

J F de Villiers Date

As supervisor I hereby agree to submission of thesis for examination

Signed:

....6/04/2005..........

Professor Frits H J Rijkenberg Date

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ABSTRACT

Agriculture is a potentially important activity to address poverty, hunger and unemployment in rural communal areas. To cater for the needs of the many small-scale farmers in KwaZulu-Natal, the Farming Systems Research Section (FSRS) was mandated in the mid-1990s to conduct on-farm, client-orientated research in rural communal areas. The identification of the Obonjaneni community as target area by the Extension staff was based on the fact that agriculture was in a poor state and that very few agricultural activities were taking place in Obonjaneni. Members of the community endorsed this by describing agriculture as *"dead and not sick"* when the FSRS arrived in the community during late 1997.

Secondary information gleaned from the Bioresource Programme indicated that there was considerable potential for improved crop and vegetable production in Obonjaneni. Livestock in the community was destructive and prevented crop production activities in the communal cropping fields.

A diagnostic study took place during March 1998, when 17 people engaged in agriculture were individually interviewed at their homesteads. Of the 17 respondents interviewed, 10 (59%) were involved with both crops and livestock, six (35%) planted crops only and one (6%) had only livestock. Most of the agricultural products were retained to satisfy household food requirements, with a very small proportion of products (29% of respondents indicated a once-off income through selling of potatoes, maize or livestock) being marketed in the community. The diagnostic survey, and further discussions with members of the community, revealed that agriculture was in a poor state, in terms, for example, of productivity, community interest in agriculture and livestock control. The two main issues which had a negative impact on the agricultural activities in Obonjaneni were identified as stray animals and a lack of agricultural expertise. Indications were that no-one in the community was permanently involved in agriculture and no-one seemed to rely on agriculture as a source of income. Obonjaneni is, however, an area with high agricultural potential and reports were that, in the past, the community was actively involved in agriculture. At the time of the interviews, no activity was taking place in the 40 ha of communal cropping fields, which had been unplanted for five to seven years at the time of the interviews, due largely to the major problem of stray animals. Maize was the main crop produced in Obonjaneni in areas around the homesteads, with 16 (94%) of the respondents interviewed planting it. People interviewed harvested between 100 kg and 1000 kg of shelled maize, while the yield averaged

approximately 300 kg per household. The maize yields obtained from the small areas at the homesteads in general did not meet the requirements of households. People in the community did not use lime when growing crops and vegetables. Soil analyses indicated that soil fertility, and particularly the high soil acidity levels, were negatively affecting the production of crops and vegetables. Another important finding was that all the people interviewed spent money on some fertilizer, but 94% of the farmers interviewed had never had their soils tested. The community garden was in a poor state, with low vegetable yields and despondent garden members.

Poverty, the agricultural constraints identified and the low agricultural production justified the focus of an on-farm research and technology dissemination programme. The objective of the intervention was to revive agriculture in Obonjaneni. The constraints were used as the basis for planning the research programme. The on-farm trials confirmed that the Obonjaneni area has considerable agricultural potential. It was found to be extremely difficult to initiate a livestock programme to address the constraints. The main reason for this was the absence of an organised community livestock association in Obonjaneni to provide support and to guide a research programme.

The main technology dissemination events were (i) activities such as planting, management (*e.g.* weeding and pest and disease control) and harvesting of trials (ii) farmers' field days and (iii) feedback meetings on trial results. The farmers' field days drew participation from across all sectors of the community, including community leaders, participating and non-participating farmers (including some farmers from neighbouring communities) and pupils, who had agriculture as a subject, from the local secondary school. An important input was obtained from members of the community's Amazizi Maize Association, who shared their knowledge and experiences at the farmers' field days and at meetings. Feedback from farmers and the questions asked by them were encouraging and showed that some farmers were benefiting from the on-farm trials.

A very strong indicator of the growing interest in agriculture between 1997 and 2002, when a comprehensive impact evaluation study was conducted as part of the study, was the increase in the number of fields being cultivated and planted in the communal cropping area. In 1997 not one field was planted; during the cropping season of 1998/1999 eight fields were planted with maize, 16 fields during 2001/2002 and 44 fields in January 2003 (41 fields with maize and 3 with potatoes). Records kept by two farmers showed net profits during the 2001/2002 season of R3 572 and R2 443 from the maize they produced.

During the impact evaluation study conducted in September and October 2002, individual interviews were held and 113 questionnaires were completed from a selected sample of 223 out of a possible 937 homesteads in Obonjaneni. Women in 68% of these households were found to be responsible for agricultural activities. The feedback from 65% of the respondents was that the state of agriculture in Obonjaneni has improved at the time of the interviews, compared to the situation prior to the on-farm research and technology dissemination programme, when the people had described agriculture as *"dead and not sick"*. The improved production of crops contributed largely to the view that agriculture in Obonjaneni had improved. Bearing in mind the poor state of agriculture, and the total absence of any cropping activity in the communal fields when the FSRS arrived in Obonjaneni. Five years later approximately 90% of the respondents in October 2002 were of the view that agriculture had a good and bright future for agriculture in the community. An important aspect was that approximately 23% of the respondents had the vision of being upgraded from "a small- to a large-scale farmer" category.

The on-farm research and technology dissemination programme conducted in Obonjaneni between 1998 and 2002 contributed to the revival of agriculture and benefited people in terms of improved crops and vegetable production, especially in the communal cropping fields and community garden. It was responsible for some employment opportunities (*e.g.* weeding and harvesting of maize) and for the production of produce to sell and buy in their own community.

The intervention of the FSRS engendered new enthusiasm for agricultural production in the Obonjaneni community and contributed to the appreciation by farmers of the enormous potential that agriculture holds for food security and the upliftment of people living in the community.

This thesis includes chapters dealing with target area selection, secondary information, diagnostic studies, on-farm research and technology dissemination, the selection of a sample and the results of an impact evaluation study. The many lessons learned during this intervention are translated into recommendations for use in future initiatives of a similar kind.

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CHAPTER 1

INTRODUCTION

KwaZulu-Natal, one of South Africa's nine provinces, has a population of some 9.4 million people (21% of South Africa's population) (2001 Census), making it the most densely populated province. It is located on the eastern seaboard, between 27° and 31° south and 29° and 31° east, is approximately 300 km long and 300 km wide, 8 860 683 ha in extent and constitutes approximately 7% of the area of South Africa. The natural resources found in KwaZulu-Natal are generally favourable for agriculture (Camp, 1999), a diversity of enterprises occurring, ranging from commercial to subsistence farming.

Medium- to large-scale commercial farming enterprises occur mainly on traditionally 'white' agricultural land, while small-scale and subsistence farming are practised by the many black people residing in the former 'homelands' of South Africa (Van Zyl *et al.*, 1996). The homelands came into existence in response to the separatist policies of the former white government. The Tomlinson Commission in the mid-1950s vigorously promoted the concept of small-scale farming as a development strategy in these areas (Van Rooyen & Botha, 1998). The Tomlinson vision included the concept of an 'economic unit' farm size to enable a rural household to produce a livable income through full-time farming (Van Rooyen & Botha, 1998). In practice, however, the Tomlinson strategy was reduced largely to rural land-use planning, fencing and the provision of some infrastructure, which was called "betterment planning". Land units for arable production were small (about two hectares), support services were lacking and there was no major incentive to be involved in agriculture (Van Rooyen & Botha, 1998). Before "betterment", people lived in clusters of homesteads, along hills or ridges, with their fields near rivers and streams (De Wet, 1987). They grazed their cattle on the hills and in the forests, or further from home. With "betterment" they changed to new fields and to new residential areas. The new land use system was inflexible; people found themselves with smaller fields and gardens than before and had to walk greater distances to fetch fuel, water and thatching grass (De Wet, 1987). This was accompanied by very unpopular stock-culling measures, triggering peasant resistance to "betterment" throughout the homelands (Cross, 1990). Farming in the homelands therefore remained a subsistence type of production under resource-poor conditions (Kirsten *et al.*, 1994) and little attention was paid to services supporting those in farming, while infra-structural and institutional support was restricted (Van Rooyen & Nene, 1998).

The communal rural areas in KwaZulu-Natal are characterized by overpopulation, low agricultural productivity, under-development and unemployment which, together with a high rate of illiteracy, has resulted in extreme poverty and a high dependency on remittances. It could perhaps further be said that the communal sector supports a rural population which is not primarily agriculturalist because of population density, low rainfall, limited arable soil and a lack of interest in farming (De Lange, 1994). The natural resources (grassland and soils) in these rural areas are frequently degraded. The people living in these areas, in an attempt to survive, have in general little incentive to conserve soil, to protect groundwater, control livestock numbers or to preserve trees, with the result that land is overused and its natural fertility depleted, forests are ravaged, rangelands overgrazed, water supplies exhausted and wildlife eliminated. Thus, one of the tragedies of rural poverty is the destructive pressure it can exert on natural resources – land, forests and water – on which the livelihoods of future generations depend (Uphoff *et al.,* 1998).

The 1999 South African National Food Consumption Survey found that subsistence agriculture is not a major source of food and that most of the food (even maize) is purchased (Steyn *et al.,* 1999). Subsistence farming, according to Steyn *et al.* (1999), accounts for only 6% of the total income of non-urban families. Household income was found to be a decisive factor in the procurement and consumption of food. Agricultural activities have positive and significant nutritional benefits only for households which are 'seriously' involved in agricultural activities (Kirsten *et al.*, 1998). Subsistence agriculture and communal vegetable gardening, according to Kirsten *et al.* (1998), may result in slight improvements in micronutrient status, but do not yield sufficient produce to improve the energy intake of household members. These observations concur with the findings of a national survey on the impact of agricultural deregulation (Ebony Consulting International, 2002), which showed that cash income remains the single most important determinant of a household's ability to meet its food security needs.

A nutritional assessment of children between 0 and 60 months old in rural households in KwaZulu-Natal revealed that 35 percent of households had stunted children (Kirsten *et al.*, 1998). Anthropometric findings in 1994 indicated that one in four children was stunted and one in ten was underweight. In practical terms, this means that about 660 000 preschool children were underweight and 1.5 million were stunted due to chronic under-nutrition. Malnutrition was most prevalent in the Eastern Cape, Northern Province (Limpopo) and in KwaZulu-Natal (Labadarios & Middelkoop, 1994.)

Although land redistribution policies of the new democratic government (post-1994) are redressing past injustices to land ownership, for millions of people residing in communal areas food security continues to remain a major concern. In 1996 it was estimated that there were between 360 000 and 400 000 rural families in KwaZulu-Natal, while the rural population of about 5.3 million was 63 percent of that of the Province (White Paper, 1996). Unfortunately, the plight of rural blacks in KwaZulu-Natal is by no means unique. It is reported that, of the 181 million people living in the sub-Saharan Africa region, about 70% live in rural areas, with the proportion below the poverty line ranging from 50 to 90% (Stroebel, cited by Van Rooyen *et al.*, 2001).

The HIV/AIDS pandemic has brought a new dimension to the food crisis in developing countries, including the province of KwaZulu-Natal. Food security is weakened, in that those normally responsible for agricultural activities are indisposed or deceased, or they need to spend more time caring for a sick, HIV-positive relative. In addition, the chain of knowledge being passed down from generation to generation is lost.

Food is the major ingredient for human existence, social development and livelihood in rural areas (Blight, 1998). Greater emphasis should therefore be placed on rural development, with agriculture as one of the main focus areas. Access to farmland *per se* does not guarantee improved food production and nutrition; of equal importance for increased farm production is the existence of effective support services such as extension, training and access to inputs and technology, credit, infrastructure, research and marketing (Van Rooyen & Van Zyl, 1998a).

With two-thirds of the people in Africa engaged in agriculture, and with population growth outpacing food production on the continent, the revitalizing of its agrarian economy is critical to Africa's future economic growth (Rukuni & Anandajayasekeram, 2001). Conway (2001) believed that an on-farm research and extension approach has to concentrate on the needs of the rural poor. It is, after all, here where the chronically undernourished, the underweight children and the iron-deficient women predominantly live – and will still be living in the early decades of the 21st century. Extension and research are both important role-players in any development programme, but it is important to realize that agricultural research findings have no value unless the farming community applies them (Asopa & Beye, 1997). Where research findings are successfully implemented, phenomenal successes have been reported. Thus, for example, a rural development programme initiated by World Neighbors with poor villagers in Guatemala, in the 1970s, increased yields of maize and beans fourfold within seven years (Krishna & Bunch, 1997).

The Governmental Agricultural Extension Service in South Africa is perfectly positioned to have an impact on the lives of thousands of households. However, the poor use of fields, the low yields of crops, the unproductive community gardens and neglected livestock testify to the fact that the impact of extension on small-scale agriculture has been very limited. It is noteworthy that the agricultural extension service in South Africa has been criticized for not doing enough and for not being relevant in developing areas (Rivera, 1991). This is not a problem unique to South Africa. In the Third World, and particularly in Africa, extension, according to Düvel (2000), has failed to have an impact in the long term and there is a need to look at new and more effective approaches. An evaluation of crop and livestock practices which have been recommended by extension over the last 15 to 20 years in the former "homelands" in South Africa showed low levels of adoption and impact (Bembridge *et al.*, 1993). The low adoption rates may be ascribed, to some extent, to the fact that generalized recommendations for practices were designed for more progressive farmers and were not necessarily appropriate to resource-poor farmers, especially in marginal cropping areas. A problem faced by many extension services is not the lack of appropriate methodologies to deliver messages to farmers, but the absence of suitable messages (Blackie, 1989).

Commercial farmers in South Africa have for many years benefited from well-structured and integrated research and extension support services (Van Rooyen & Van Zyl, 1998b). Technology developed through on-station research has, however, not served the needs of small-scale, resource-poor farmers in various African countries (Collinson, 1982; Eponou, 1996; Low, 1995). In the USA, many farmers, particularly farmers with limited resources, were not adopting technology such as high-input, high-productivity production systems developed for maize, wheat and rice by research centres (Robotham & McArthur, 2001). Thus the evolution of a farmer-orientated research programme is the prerequisite for successful small-scale, resource-poor development in the southern African context.

Numerous alternatives have been developed to address the failure of the "extension only" approach to reach the small-scale farmer. Approaches developed include: cropping systems research, farming systems research, farming systems research-extension, on-farm adaptive research, farmer-back-to-farmer, farmer-first-farmer-last, on-farm, client-orientated research and the Land Grant System (Harwood, 1979; Byerlee *et al.*, 1980; Gilbert *et al.*, 1980; Zandstra *et al.*, 1981; Rhoades & Booth, 1982; Merrill-Sands, 1986; Collinson, 1987; Ewell, 1988; Cornwall *et al.*, 1994; Norman *et al.*, 1994; Low, 1995 and Caldwell & Christian, 1996). Variations found among these approaches are associated with issues such as the intentions of the researcher, the extent to which farmers themselves are involved, the level of innovativeness and the extent to which researchers from disciplines beyond agriculture are involved (Bawden, 1995). A nine-country study by the International Service for National Agricultural Research (ISNAR) showed that national institutions have been able to respond more effectively to the needs of resource-poor farmers through an on-farm, client-orientated research approach, which raised scientists' understanding of clients' priority problems and technology needs (Merrill-Sands *et al.,* 1990). This approach has been part of national research programmes in Asia, Africa and Latin America, to bring beneficial technology to resource-poor farmers (Bembridge *et al.,* 1993).

1.1 Main characteristics and advantages of an on-farm research approach

Scientists of the KwaZulu-Natal Department of Agriculture and Environmental Affairs methodically evaluated the various approaches and, following consultation with experts in the field, decided that the most appropriate approach was an on-farm, client-orientated research approach. The strengths and advantages of the on-farm research approach lie in the systematic way in which the technical and human environments of farmers are evaluated, the identification and ranking of problems faced by farmers and the design, development, adaptation and evaluation of appropriate technologies to solve the problems, using criteria that are relevant to the farmer (Merrill-Sands, 1988 and Low, 1997). According to Collinson (1998), on-farm research is based on the rationale that it is necessary to understand to improve. Some of the characteristics of an on-farm research approach are that it:

- creates a link between research, extension, farmers and other development agencies (Low, 1997 and Matata *et al.*, 2001);
- allows for a basic understanding of the various farming systems in use and farmers' circumstances (Merrill-Sands, 1986; Low, 1995 and Lema & Meena, 1996);
- generates and tests technology relevant to the goals, needs and priorities of farmers (Merrill-Sands, 1986 and Norman *et al.*, 1994);
- allows for addressing specific components or sub-systems or any interaction (Merrill-Sands, 1986; Wilson *et al.*, 1986 and Asopa & Beye, 1997);
- complements and contributes to the relevance of on-station research (Merrill-Sands, 1986, Collinson, 1987 and Schiere *et al.*, 2000);
- involves teams consisting of representatives of a number of disciplines, which may include on-station commodity researchers (Merrill-Sands, 1986 and Asopa & Beye, 1997);
- offers a quick delivery rate of technology due to the participation of farmer and extension services (Stilwell *et al.*, 1996).

The success of any approach relates to the extent to which technology is adopted and the impact it has on the well-being of farmers and the people of a community. Farmers, as the clients and end-users of the information, are rational decision-makers and often pursue goals and employ criteria for evaluating technologies distinct from those used by agricultural scientists (Hildebrand, 1977 and Norman *et al.*, 1982).

1.2 Successes with on-farm research

Impact studies of on-farm agricultural research in Africa regularly demonstrate robust results (Gabre-Madhin & Haggblade, 2003). With median rates of return of over 35%, financial investments in African agricultural research widely surpass those of most other, more fashionable, investment opportunities (Oehmke & Crawford, 1992 and Masters *et al.,* 1998). The positive returns to research investment and increased food production, in regions where adoption of improved varieties of major food crops to farmers in Africa has occurred, are tangible evidence of potential successes of research in small-scale agriculture (Maredia *et al.*, 1998). The beneficial effects for on-farm research in Africa is consistent with the positive returns experienced in Asia and Latin America (Rukuni & Anandajayasekeram, 2001).

The non-adoption of research-developed technologies by small-scale farmers is a widespread phenomenon and is thought to be due largely to scientists assuming that they know and appreciate farmers' needs (Onyango *et al.*, 1998). Without the knowledge of farmers' priorities and agendas, there is a likelihood of addressing the wrong problems. Low (1993), therefore, held that the reason for failures is due to superficial interaction between researcher and farmer, the poor integration of field extension officers into the process, or input-supply problems for farmers when high-tech recommendations are made.

1.3 Establishment of the Farming Systems Research Section

Before the first democratic general elections in South Africa in 1994, the Directorate: Technology Development and Training (known as Research, Analytical Services and Training or RAST since 2004) served mainly the commercial farmer of the then Natal province, through its research programmes. Research was conducted at various research stations in the Province, under conditions that were vastly different from those of small-scale farmers. Research staff were far removed from the realities of small-scale farming, as well as from the Extension staff who worked in the rural communal areas. The White Paper on Agriculture for KwaZulu-Natal (1996) expressed an unequivocal commitment on the part of the Government to seriously address the needs of previously disadvantaged agriculturalists.

Poverty reduction and improved food security were viewed as major economic challenges for the region. Agricultural development, according to Van Rooyen & Sigwele (1998), should be the focal point for rural development in areas where the resource base favours agricultural activity and/or where large numbers of people depend on farming activities for household income and food. As a result, the Farming Systems Research Section (FSRS) was formed in 1995 and given the mandate to develop relevant technologies and/or recommendations for small-scale farmers in the Province. The FSRS is located in the Directorate: Research, Analytical Services and Training, based at the Cedara Research Station, approximately 20 km west of Pietermaritzburg. The intention was to use the on-farm, client-orientated research approach to close the gap that existed between research and extension and small-scale farmers.

1.4 Structures of the Extension Services

In contrast to the FSRS, the Extension Services of the KwaZulu-Natal Department of Agriculture and Environmental Affairs are decentralized into Regions, in order to allow the Department to be closer to its clients (Van Rooyen, 1999). From November 2000 to 2004, five Extension Regions, namely the Northern, North West, North East, South West and South East Regions have functioned as independent Directorates. Each Region is divided into a number of districts to provide frontline advisory and developmental services to clients, while Professional Services, and Engineering and Soil Conservation Services provide a supportive service to promote effective agricultural development. In 2004, the number of Regions was reduced to two, namely the Northern and Southern Regions.

During the late 1990s, Extension Services adopted a Project Planning and Implementation System under the control of a Regional Technical Working Group (RTWG) system, which was viewed to be a "bottom-up" approach. It operates at three levels (Van Rooyen, 1999):

- the Ward level, where community projects are initiated in co-operation with Agricultural Development Technicians;
- the District level, where the technical investigations and project proposals are finalised (District Task Team); and
- the Regional level, where projects are approved and finances provided and monitored.

The membership of the Regional Technical Working Group is open to all who would like to make a contribution to agricultural development, such as Universities, NGOs, other Provincial and National Departments and even Directorates within the Provincial Department of Agriculture. When co-operation and support are wanted from Extension staff for any non-Extension project, the Regional Technical Working Group is the level in a Region at which this needs to be discussed and agreed upon. At a level lower than the Regional Technical Working Group, the main function of the District Task Team is agricultural development in the district (Van Rooyen, 1999). The District Task Team ensures project planning, co-ordination and ownership of all Extension projects by the district community and is responsible for accountability of Extension staff to their clientele. Membership of this committee includes all role-players who are involved with the agricultural development programme in the district (*e.g.* the FSRS).

1.5 Involvement of the Farming Systems Research Section in an on-farm research programme

The on-farm research programme undertaken by the FSRS was initiated through the channels and procedures dictated by established Extension structures. Farm in this study is defined as the area where people normally practise agriculture such as communal cropping fields, communal vegetable gardens, homestead gardens, communal grazing areas or kraals. The Obonjaneni community (community defined as a group of people living in a rural area in which they practise agriculture), located in the Bergville District, was identified in a RTWG meeting of the North West Region in 1997 as the target area to initiate the first on-farm research conducted by the Directorate: RAST, in a rural communal area. The following objectives were identified for the FSRS programme:

- to study the small-scale farming system in Obonjaneni and to identify agricultural constraints experienced by the farmers;
- with the participation of extension, commodity researchers and farmers, to conduct on-farm research aimed at developing relevant technologies, which should be:
    - economically viable;
    - environmentally sustainable;
    - socially acceptable;

    - providing solutions to priority problems;
- to disseminate relevant technology.

The successes of this on-farm research programme needed to be critically evaluated, in terms of its potential to serve as a "role-model" for unlocking the agricultural potential of the rural communities in KwaZulu-Natal.

The outcome and impact of the programme followed by the FSRS was to be measured in terms of the following:

- linkages formed between farmers, extensionists and researchers (including the participation of on-station researchers);
- participation of the different role players in all the activities;
- identification of constraints and a relevant research and technology dissemination programme;
- technology adoption to improve agricultural production.

In the following chapters, an account of the on-farm research and technology dissemination programme will be given. This will be dealt with under the main topics:

- target area selection and collection of initial secondary information for conducting on-farm research in Obonjaneni;
- secondary information collected for an on-farm, client-orientated research programme;
- the diagnostic phase of a study of the small-scale farming systems and agricultural constraints in Obonjaneni;
- on-farm research and technology dissemination in Obonjaneni;
- the selection of a sample of homesteads and survey procedures followed to determine the impact of on-farm research and technology dissemination;
- impact evaluation of the on-farm research and technology dissemination programme conducted in the Obonjaneni community.

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CHAPTER 2

TARGET AREA SELECTION AND COLLECTION OF INITIAL SECONDARY INFORMATION FOR CONDUCTING ON-FARM RESEARCH IN A RURAL COMMUNITY OF KWAZULU-NATAL*

2.1 Introduction

Target area selection to conduct on-farm, client-orientated research for small-scale farmers KwaZulu-Natal is a challenging and daunting task, as the Province has a rural family population of between 360 000 and 400 000 (White Paper, 1996). For the purpose of the study described in this thesis, staff of the Farming Systems Research Section (FSRS) needed to identify a target area (community or communities of small-scale farmers) in a structured and well-planned manner.

The agricultural extension service is the most important link in the chain between development and servicing organizations on the one hand, and the farmers and villages on the other (Bembridge *et al.,* 1983). The extension service has the potential to play a key role in increasing the agricultural production of farmers. The creation of effective research-extension links and the breaking of barriers, such as poor communication, lack of co-operation and wide gaps in educational level, mentioned by Ewell (1989), are crucial for the efficient implementation of a farming systems approach (Anandajayasekeram & Stilwell, 1998).

Participatory approaches to diagnosis and experimentation can close the technology development and communication gaps between research, extension and small-scale farmers (Ewell, 1989 and Low, 1997). A small-scale farmer can loosely be defined as anyone who practises agriculture for subsistence or for commercial purposes in a rural communal area. Numerous methods for promoting the linkage between research, extension and the farmer have been developed. These include cropping systems research, farming systems research, on-farm adaptive research, farmer-to-farmer, farmer-first-farmer-last and on-farm, client-orientated research (Harwood, 1979; Byerlee *et al.*, 1980; Gilbert *et al.*, 1980; Zandstra *et al.*, 1981; Rhoades & Booth, 1982; Collinson, 1987 and Low, 1995). However, on-farm research alone cannot solve the linkage problem (Ewell, 1989). Low (1995) mentioned that

* The material presented in this thesis will be submitted to journals roughly on a Chapter-by-Chapter basis. That is why the lay-out between Chapters varies somewhat, and why some information is repeated between Chapters.

commitment, competence and communication from all role-players are the three key requirements for meeting the needs of small-scale farmers. This emerged from experiences in implementing research and extension approaches in southern African countries. According to Matata *et al.* (2001) a solid partnership amongst all the role-players in agricultural development is a vital ingredient for the process. The link or partnership between on-farm research and extension is likely to be more effective when it is developed at the early stages of an on-farm research effort, rather than when it is hastily and belatedly created (Ewell, 1989).

To enable research teams to conduct on-farm research, the selection of a target area is the first step (McIntosh, 1982; Shaner *et al.,* 1982 and Matata *et al.*, 2001). Key personnel responsible for the on-farm research must identify criteria to assist with the selection (Shaner *et al.,* 1982). The following criteria have been used by research teams in the past: the agricultural potential of an area, regions which government has identified as priority agricultural development zones, the need for greater domestic food production, regional food shortages, political stability, areas representative of a large agro-climatic zone where research results will have wide-spread applicability, areas in which intensification of cropping patterns is feasible, infrastructure (both existing and being developed); available markets, and farmers willing to adopt innovations (Bernsten, 1982; McIntosh, 1982; Shaner *et al.,* 1982 and Low, 1997). A target area might also be selected on the basis of specific physical limitations or problems such as erodible slopes, flooding, soil salinity, inadequate grazing, or animal diseases (Shaner *et al.*, 1982). Very specific reasons or objectives could direct research teams to a target area. For example, Mahanjana & Cronje (2000) based the selection of a survey study area in the Eastern Cape on a need expressed by the Department of Agriculture to increase goat numbers as a means of controlling patches of bush encroachment in the area.

Once research teams arrive in a target area and find that substantially different conditions and resources exist, the area can be sub-divided into smaller areas with similar physical, biological and socio-economic factors, and farming systems characteristics (Shaner *et al.*, 1982). Farmers in these areas are often referred to as a "Target Group" or "Recommendation Domain" (Matata *et al.*, 2001). A Recommendation Domain is defined as a group of farmers who might adopt the same recommendation given equal access to information, or a group of farmers whose circumstances are similar enough for the same recommendation to be applicable (Byerlee *et al.,* 1980 and Matata *et al.*, 2001). In a study by Bernsten (1982), where more than one sub-district had been chosen, visits were paid to the areas in order to collect information, which was transferred to a data matrix in order to assist in selecting the target area.

Following the selection of a target area, the step next recommended is to make contact with community leaders (*e.g.* the tribal authority) and farmers of the community or village. A community is composed of diverse groups of people with different levels of power, access to resources, and interest in participating in research programmes (Biggs, 1989). A major problem in most on-farm, client-orientated research programmes, once the target area has been selected, is the biased selection of farmers in the area (Biggs, 1989). Farmer selection, according to Merrill-Sands *et al.* (1990), is a very weak aspect in most on-farm research programmes and across all modes of farmer participation. Researchers often select farmers on an *ad hoc* basis, which biases samples toward wealthy, politically active, male farmers, and more influential, resource-rich or "progressive" farmers (Biggs, 1989 and Merrill-Sands *et al.*, 1990). It is therefore important that the selection for farmer collaboration takes place with research objectives in mind (Biggs, 1989 and Ashby, 1990), especially if feedback from farmers is to be used effectively as an input into research-priority setting and planning (Merrill-Sands *et al.*, 1989).

The steps taken by FSRS in target area selection and the first contacts made with Extension staff, community leaders and farmers, will be discussed under the following headings: (i) the Extension structures in KwaZulu-Natal, (ii) meeting with staff of the Extension Regions and identification of a target area, (iii) consultations with staff of the Bergville Extension District (iv) meeting with community leaders and visits to the community, (v) community meetings to introduce small-scale farmers to the on-farm, client-orientated research approach, and (vi) the progress and information gained at community meetings.

2.2 Extension structures in KwaZulu-Natal

The FSRS is a section located in a Sub-directorate of the Directorate: Research, Analytical Services and Training (former Technology Development and Training Directorate). It is completely detached from the Extension Services in the structure of the KwaZulu-Natal Department of Agriculture and Environmental Affairs. The FSRS is based at the Cedara Research Station, 20 km west of Pietermaritzburg (see Figure 2.1). The Extension Services are decentralised into Regions, to allow the Department to be nearer to its clients (Van

Rooyen, 1999). Five Extension Regions, namely the Northern, North West, North East, South West and South East Regions are functioning as independent Directorates. The basic structure of these Directorates consists of District Services, Professional Services, Engineering and Soil Conservation Services and the Administrative components (Van Rooyen, 1999). The Extension staff (which in this document refers to Agricultural Development Technicians), whom fall under the District Services, provide frontline advisory and development services to the clients, The Professional Services and Engineering and Soil Conservation Services, on the other hand, provide a support service to provide effective agricultural development (Van Rooyen, 1999). Districts are subdivided into wards, which in turn are subdivided into sub-wards.

During the 1990s, the Department, then known as the KwaZulu-Natal Department of Agriculture, adopted a project planning and implementation system under the control of the Regional Technical Working Group (RTWG) (Van Rooyen, 1999). The membership to the RTWG is open to all who would like to make a contribution to agricultural development, including Universities, NGOs and other Departments. When co-operation and support are needed from Extension staff for any non-Extension project, the RTWG is the level in a Region at which this needs to be discussed and agreed upon. This level of communication is significant, in the light of the fact that, according to Ewell (1989), the most successful cases of integration of on-farm research and extension are those in which links have been forged simultaneously at several levels of the hierarchy of the organizations involved: technicians in the field, scientists, and administrators at Regional level and high-level committees. The RTWG system, according to Van Rooyen (1999), is a bottom-up approach and operates at three levels:

a) the Ward and sub-ward level where community projects are initiated in co-operation with Agricultural Development Technicians from the District office;
b) the District level where the technical investigations and project proposals are finalised;
c) the Regional level where projects are approved and finances provided and monitored by the RTWG.

The main function of the District Task Team, which functions at a level lower than the Regional Technical Working Group, is agricultural development in the District (Van Rooyen, 1999). The Head of District chairs the meetings. The District Task Team ensures project planning, co-ordination and "ownership" of all extension projects by the district community and is responsible for accountability by Extension staff to their clientele. Membership of this committee includes all role-players who are involved with the agricultural development programme in the district, *e.g.* the FSRS, NGOs and rural farmers.

2.3 Meetings with staff of the Extension Regions and the identification of a target area

During 1996 and 1997, staff of the FSRS embarked on a campaign to introduce the on-farm, client-orientated research approach to Extension staff in the five Regions. It was emphasized that on-farm research cannot substitute for Extension (Ewell, 1989). The approach was explained to staff in terms of the following basic concepts, as mentioned by Low (1997):

a) a diagnostic phase, to understand the circumstances in which farmers operate, to understand system interactions and to identify agricultural constraints (these influence the selection of research priorities);
b) the implementation of on-farm research and development;
c) the evaluation of the proposed new technology in the context of the whole-farm system into which it is being introduced (including farmer assessments).

From the feedback and response received at the different meetings it was clear that the on-farm research approach was new to the majority of Extension staff. It was emphasized at the meetings that the approach would be complementary to Extension activities and not a substitute. In spite of the fact that the approach was a new concept to Extension staff, much interest was shown in the approach in all the regions.

2.3.1 Identification of the target area

Following the meetings with the Extension staff of the Regions, the FSRS was invited by the North West Region to test the on-farm research approach in the Region. At a follow-up RTWG meeting of the North West Region on 8 August 1997, the following issues were discussed between staff of the FSRS and Extension:

a) the possibility that, when a particular area (community) is selected, the rest of the District would take the view that they had been abandoned;
b) the difference between on-farm research and demonstrations, so as to avoid confusing the community;
c) the difference between on-station research and the envisaged on-farm research;
d) the function and the role of FSRS scientists in a Region *vis-à-vis* the role of scientists

in the Districts.

These issues were discussed in detail with Extension staff at meetings. It was recommended that when an on-farm research programme is being conducted in one community or area of a District, that the other Extension staff of the District should participate in all the major activities of the approach, such as planting and harvesting of trials, field days, planning of trials and feedback meetings. Through their participation it was felt they would gain the knowledge and experience which they, then, can apply in their own Extension Wards, *e.g.* by carrying out demonstrations. The role and purpose of a demonstration, according to Matata *et al.* (2001), are to persuade farmers to adopt an improved technology by showing the superiority of the improved technology over the one currently being used.

Both on-station and on-farm research is needed in the quest for new knowledge. The reason is that the two types focus on different, but complementary, aspects. On experiment stations, applied research, in which new technologies are created, is usually undertaken (CGIAR, 1981). On-farm research is a scientific method that concentrates mainly on adaptive research which involves helping to adjust technology to specific environmental conditions and to facilitate adoption of such technology. It provides a practical way of evaluating technology within a system context, using criteria that are relevant to the farmer (CGIAR, 1981 and Norman *et al.*, 1994). Some of the characteristics of the on-farm research system are that it generates and tests technology relevant to the goals, needs and priorities of farmers. It seeks to integrate farmers and extension staff into the research process and acts as a link to feed back information about future priorities for applied research to on-station staff (Merrill-Sands, 1986; Norman *et al.*, 1994; Low, 1997 and Collinson, 1998). In this way on-farm research aims to complement traditional on-station research by adapting the findings of such research to local conditions and providing Extension services with technical packages that are appropriate to the circumstances of small farmers operating in particular rural environments. It is important to bear in mind that the on-station researcher's environment is characterized by particular (often favourable) natural circumstances, availability of inputs, little concern with cost or risk and generally a single objective: to increase output per unit of land (Low, 1986). What may work well under "ideal" conditions on research stations may not work so well for farmers in the field. For this reason, on-farm trials are commonly used to ensure that a new technology is appropriate for farmers and provides good results in a more "realistic" environment. In Panama the research area selected for on-farm research was chosen because its generally small- and medium-sized farms produced commodities that were priorities in the National Agricultural Development Plan and seemed to offer potential for technological development (Martinez *et al.*, 1991). On-station researchers need to investigate specific aspects of crop or livestock production, as the backbone of technological advances in agriculture (Low, 1995). It is important to note that on-farm research complements and depends upon experiment station research (Merrill-Sands, 1988). The essence of the approach is that it responds to the farmers' felt needs and compliments the traditional flow of information from researcher to extension to farmer by making the farmer and extension active research partners.

The ultimate objective of an on-farm research, according to Norman *et al.* (1994), is to produce new or adapted technology options that will be used by farmers to increase their productivity and incomes. Through the correct level of communication, Management of the Region requested the Head of District, Bergville at a RTWG meeting in August 1997 to assist in testing the on-farm research approach. Once this had been agreed upon, the Obonjaneni Community was identified as the target area (see Figure 2.1 for location). The only selection criterion used by Extension staff was that "agriculture in the community was in a poor state and that very few agricultural activities were taking place, compared to how it had been in the past". Reasons for this poor state were (i) problems with uncontrolled movement of livestock which resulted in a lack of interest in cropping by people in Obonjaneni, (ii) poor performance of the previous Agricultural Development Technician, and (iii) people had lost interest because of the low yields of crops due to excessive soil acidity (ZV Nkosi, 2002, personal communication). These aspects were communicated to, and discussed with, the community at meetings during the diagnostic phase.

There is some statistical support for the idea that the "worst" can be the "best" place to start an on-farm research programme. A quantified analysis and evaluation of 150 cases of local organizations in Asia, Africa and Latin America found that a number of environmental variables, such as topography, resource endowment, infrastructure, economic diversification, income distribution, settlement patterns and literacy, had negative or zero correlations, all insignificant, with overall scores of local organizations' contributions to rural development (Esman & Uphoff, 1984). A hypothesis that more "favourable" environmental conditions would be correlated with greater success of local organizations was not supported by the data. This suggests that plausible arguments can be made for beginning almost anywhere except, presumably, in areas that are especially violent and affected by conflict (Uphoff *et al.*, 1998). The physical conditions of an area are probably considerably less important than the capabilities and disposition of the people in an area: are they ready, willing and able to take responsibility for improving their lives in one or more respects? This often cannot be known in advance. It was also mentioned by Uphoff *et al.* (1998) that *how* a programme is initiated is more important than *where* it is initiated.

Selecting Obonjaneni as the target area could be seen as a top-down approach, which was made at a RTWG meeting without the presence of farmers. The important aspect is that Extension staff, through contact with farmers in the identified area, realized that agriculture was in a poor state and assistance was needed to address the problem. The role of Extension staff and the link with farmers were evident in this selection process, which could thus be deemed as a bottom-up approach. It is absolutely essential for the success of the on-farm research that Extension is an active partner in the programme (De Lange, 1997). The involvement of Extension staff members in the target area selection could be seen as the first step towards their becoming a partner in the on-farm research approach. Many case studies concluded that links with Extension had been regarded as a secondary priority, with the result that their active involvement had been a weakness in the implementation of on-farm research (Ewell, 1989).

The FSRS assumed membership of the Bergville District Task Team in 1997, following the selection of the Obonjaneni community as the target area. At this level contact was made with the Agricultural Development Technician, Mr F S Nkosi, whose main function was to serve the community and give advice to small-scale farmers. The Bergville District, one of six Districts of the North West Region, covers approximately 348 000 ha (R G Bennett, 2003, personal communication) and is subdivided into six Extension Wards, namely: Amangwane Central, Amangwane East, Amazizi, Eleven Settlement, Ngaba and Reserve (Z V Nkosi, 2002, personal communication). The wards were identified and demarcated in terms of geographical and tribal boundaries (Z V Nkosi, 2002, personal communication). The target area is one of the sub-wards within the Amazizi Ward. It is located 44 km west of the town of Bergville and approximately 220 km north-west of Cedara (see Figure 2.1 and Figure 3.2).

In spite of the distance (approximately 220 km) between the Obonjaneni community and the offices of the FSRS, involvement was seen as an opportunity and a challenge to enhance food security and to uplift small-scale farmers. The progress of the on-farm research approach followed in Obonjaneni was to be closely monitored and evaluated in the hope that it could serve as a model for implementation in the rest of KwaZulu-Natal.

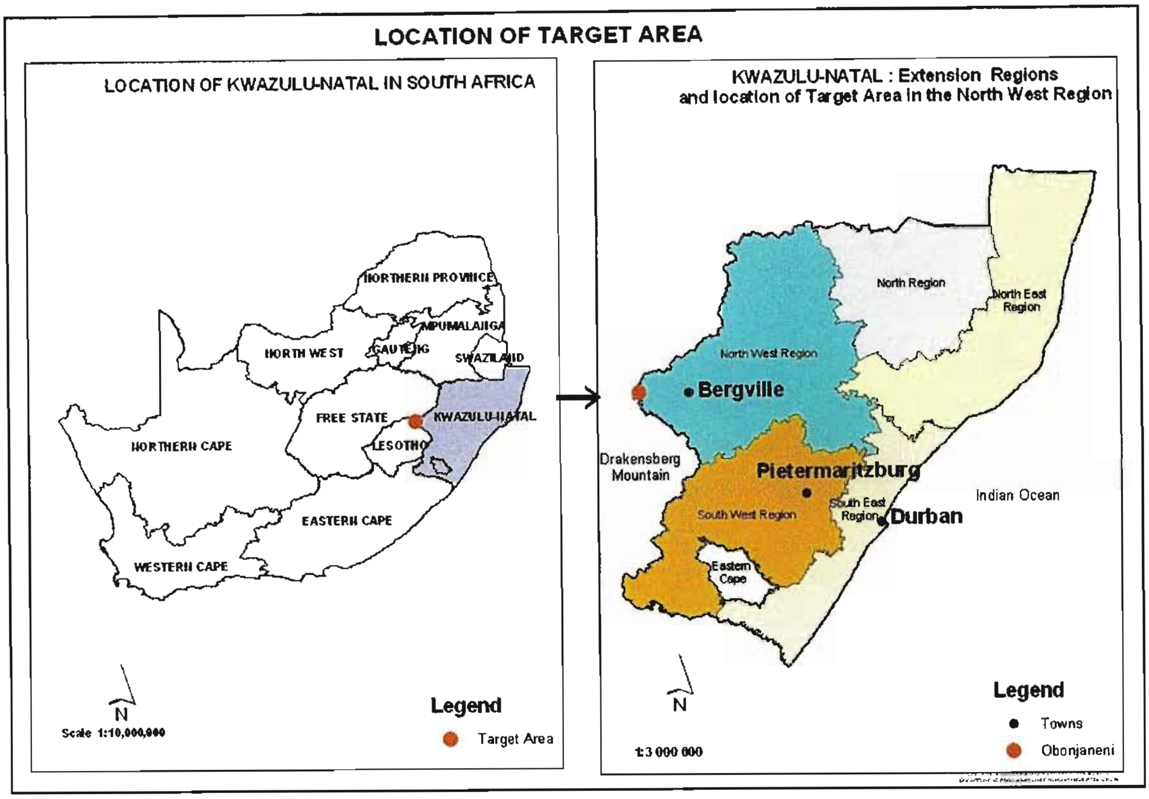

Figure 2.1 Location of target area

2.4 Consultations with staff of the Bergville District

The selection of the Obonjaneni community brought together researchers and Extension staff at District level, in a multi-disciplinary team. The first two meetings took place during September and October 1997, at the Bergville Extension office. The Bergville Extension staff (Head of District, Head of Extension, Home Economist and Amazizi Ward Agricultural Development Technician), staff from the Region's Head Office near Ladysmith, staff from the Natural Resource Section based at Cedara and FSRS staff attended the first meeting. As new colleagues at the time (one could even describe them as total strangers to each other), it was important, for the success of the on-farm research approach, to build friendship and trust among participants as quickly as possible, To facilitate this important aspect, the agendas for meetings were decided upon and finalized at the meeting or communicated before the meetings, via telephone calls or faxes. This encouraged transparency in the process.

The main objectives of the meetings were to explain and discuss the proposed on-farm, client-orientated research programme, to study the natural resource information of the area, as supplied by the Natural Resource Section, Cedara, and for Extension staff to outline the different farming systems then practised in the area. The steps to be followed in the approach were discussed and agreed upon by FSRS and Extension staff. The steps and actions planned are summarised in Table 2.1.

Table 2.1 Summary of the strategy to be implemented in the Obonjaneni target area, as decided upon between the staff of the Farming Systems Research Section and Extension

Steps identified to be followed in the on-farm, client-orientated research approach			
Approach community	**Diagnosis**	**Intervention**	**Evaluation**
* Extension staff to approach Inkosi (Chief), Councillors and Indunas (Headmen) to explain the on-farm research approach and the need for their future co-operation. * FSRS and Extension staff to visit the community to obtain general impressions of the area. * After obtaining the Inkosi's approval, visit area and organise a general meeting as soon as possible. * Announce open invitation to community to attend a general meeting (Extension staff to make contact with leader farmers in the community to advertise the meeting) * At the community meeting, community members were requested to identify farmers to participate in the approach. * Farmers, associations and projects to be visited by a multi-disciplinary team[1], after the community meeting. * Collect all possible available secondary information of the identified target area.	* Collect primary information through formal structured interviews. * Train staff on how to use the questionnaire survey. * Interview farmers who volunteered at meeting to participate. * Analyse the survey results. * Hold brainstorming sessions with Extension to discuss findings of survey. * Define possible strategies and solutions to identified constraints. *Compile a report on findings of the survey.	* Team to prepare survey results for feedback meetings with community and to discuss possible solutions and research interventions. * Ensure that experimental interventions can be implemented without undue risk to the environment, farmer, farm operation or the community. * Members of team to include intervention strategies in their work programmes. * Community was requested to identify participants for on-farm research. * Discuss research needs, treatments and sites with participants. * Identify and visit research sites. *Compile research protocol. * On-farm research conducted by FSR Team. * Demonstrations conducted by Extension / FSRS staff. * Organise farmers' / field days, field visits and feedback meetings to transfer technology.	* Researchers, Extension and farmers will evaluate all research results jointly. * Meetings between farmers, extension and researchers to be held to discuss trial implementation, progress, results of trials and future research. * Annual evaluation of the results will be followed by a decision on further on-farm research. * Assessments and reactions of farmers will be taken into account in the evaluation and planning process. * Continuous monitoring, evaluation and impact assessment to take place to determine value of the approach to the community. * Results of research and other interventions to be reflected in annual reports and other publications.

[1] Multi-disciplinary team = FSRS staff, Extension staff and other co-workers, including commodity researchers

An important contribution of Extension to the on-farm research approach was to facilitate the process of gaining access to, and the co-operation of, the community through establishing linkages with the Tribal Authorities. The Head of District was tasked to approach the Inkosi (Chief) of the Amazizi Tribal area to request permission for researchers to work in the Obonjaneni community. Bembridge *et al.* (1983) stressed that the involvement of Tribal Authorities is essential for long-term agricultural and rural development programmes aimed at bringing about desirable change.

The contribution by staff from the Natural Resources Section to the first meeting concerned the information available about the area. The target area falls within a large agro-climatic area of approximately 147 611 ha, indicating that research results would have widespread applicability. Information was also imparted that the maize grain production potential of the area varies between approximately 2 and 7 t/ha, depending on the soil type and management level. The variation in yield potential shows, among other things, the effect of soil type on maize yield and underlines the importance of obtaining soil information when discussing constraints and solutions with the farmers of the area.

2.5 Meeting with community leaders and visit to Obonjaneni

After gaining the approval of the Tribal Authority, the first visit to the target area by the FSR team took place during early October 1997. The aims of the visit were for the FSR team to become familiar with the area and for Extension staff to provide information on existing agricultural projects in the community. Unfortunately, farmers and community members were not present during the visit, as the Extension staff member was relatively new and unknown in the Extension Ward. The number of households and *bona fide* farmers in the community was unknown. Extension staff mentioned that most of the community members claimed to be farmers, because many of them grew small areas of crops, vegetables and/or fruit, or kept livestock.

The Amazizi Maize Association, Phuthumani Community Garden and one sewing club were reported to be active in the community. Information such as the area of arable land in the communal cropping fields and the number of animals was not available at the time of the visit. Extension staff indicated that the highly successful commercial farmers of *e.g.* maize, soyabeans and livestock, situated between the community and the town of Bergville, influence the people of Obonjaneni, to purchase inputs, such as fertilizers, in an attempt to emulate the yields obtained by the commercial farmers.

Observations made during the first visit showed that agriculture in the community was in a poor state. It was also noticed that no cropping activities were taking place in the large communal fields. The crops were produced only in small gardens adjacent to homesteads. Fences were not in place to protect communal fields from livestock damage. During the visit, animals were present in the fields, which were lying fallow. It appeared that, for several years, no maize had been planted in the area earmarked for crop production, apparently due to theft of fencing and the presence of stray animals. The quality and quantity of the vegetables, seen during the visit to the Community Garden, reflected poor management practices. The Agricultural Development Technician mentioned the following constraints in terms of agricultural activities:

a) theft of fences,
b) stray livestock, which prevented cropping of the communal fields,
c) lack of credit facilities,
d) incorrect use of land.

The Thandanani Craft Centre, situated next to the main tarred road which leads to popular tourist attractions, sold crafts to tourists and visitors to the area. LIMA was mentioned as the only Non-Governmental Organization (NGO) involved in the community.

2.6 Community meetings to introduce small-scale farmers to the on-farm research approach

It was concluded after the first visit that the initiative should continue and that a general community meeting should be organised, to which the entire community would be invited. This would give the opportunity to all interested people to be informed of the on-farm research approach to be followed in the community. The date (12 November 1997), time and venue of the meeting were set by FSRS and Extension staff and communicated to the community through the Extension staff. The then Natal Parks Board and Nature Conservation (now Ezemvelo KwaZulu-Natal Wildlife), with land neighbouring the community, and organizations such as LIMA, were invited to the meeting. The agenda for the general meeting, drawn-up by the FSRS staff, in co-operation with the Extension staff, took into account the following objectives:

a) to meet the people from the community,

b) to inform the community about the on-farm, client-orientated research approach,

c) to allow participation at the meeting from the community members, to provide information on agricultural activities in the area and to mention constraints they are experiencing,

d) to identify volunteers to be interviewed individually at their homesteads,

e) to obtain approval from the community for FSRS staff to address agricultural constraints, using the on-farm research approach.

2.7 Progress and information gained at community meetings

2.7.1 Discussion points for community meeting

At the outset of this and later meetings it was emphasized that agriculture is the core business of the Department and that it is important for the people to realize that (i) the General Community Meeting is not a "handout" meeting (*e.g.* handing out of money or inputs such as fertilizer or seed) and (ii) the FSRS are not donors or funders. The on-farm research approach (as summarized in Table 2.1) was explained, using the following discussion points:

a) FSRS staff is from the KwaZulu-Natal Department of Agriculture. The Section is in the Directorate: Technology Development and Training, based at Cedara, close to Pietermaritzburg

b) FSRS and Extension staff want to learn from, and assist, farmers to overcome their constraints and to improve their efficiency

c) the meaning and objectives of "on-farm research"

d) for the on-farm research approach to work, researchers, farmers and Extension staff need to co-operate and work together as a team – to be called the FSR team

e) the FSR team does not have answers to all the constraints and problems identified, but working together with the farmers as a team it will try to assist as much as possible

f) before on-farm research can be conducted, it is important to

   i. learn from the farmers, who have a vast amount of knowledge and experience

   ii. find out what is happening in the community in terms of activities such as associations and interest groups

   iii. develop an understanding of the existing farming systems, including the production practices in the community, and the nature of the farming households and the environment in which they operate

g) the sharing of knowledge and experience and new ideas

h) a survey would have to be conducted to gather information and to identify constraints experienced by farmers

i) volunteers to be interviewed need to be identified

j) results of survey findings will be utilized to benefit the community
   i. agricultural issues will be addressed through research or extension
   ii. non-agricultural problems will be taken to the people who can help to solve/address them

k) survey results and findings will be presented at feedback meetings in order to plan future actions

l) if required, more surveys will have to be conducted to gain additional information on certain specific constraints or production practices

m) farmer participants are required to enable the FSR team to conduct on-farm research and must be identified

n) the FSR team to design and conduct the on-farm research by
   i. ranking identified constraints in order of importance
   ii. identifying possible solutions or actions
   iii. planning the on-farm research, together with farmers
   iv. identifying sites for the on-farm research activities

o) Farmers' days and field days will be organised. *All the people* in the community must be given the opportunity to learn and benefit from the approach followed at Obonjaneni.

2.7.2 Attendance and outcomes of meetings

The first general community meeting was held on 12 November 1997. As a result of the relatively poor attendance, two further meetings, each with an agenda similar to that of the November 1997 meeting, were held, one in December 1997 and another in February 1998. Attendance lists were not kept at the meetings, but new people were present at each of the meetings. In total, approximately 60 people attended the three meetings. Chairmanship of the meetings was shared between FSRS and Extension staff, and agendas were decided upon at the meetings and translations from English to Zulu and Zulu to English carried out by FSRS and Extension staff.

2.7.2.1 First meeting

The first community meeting on 12 November 1997 took place at the Thandanani Craft Centre and was attended by 32 people.

There was an initial reluctance on the part of the community members to ask questions and to participate in the meeting. Extension staff commented that farmers believe that they should listen and absorb knowledge rather than contribute to the meeting. Only after the Head of Extension re-emphasized that the meeting is a two-way process, did farmers start to participate in the meetings. This behaviour confirmed findings elsewhere. In southern Ethiopia it was found that farmers were sceptical during the initial stage of a meeting where the objectives were to discuss a farmer-participatory research programme (Tesfaye *et al.,* 1998). However, after long discussions, the Ethiopian farmers became convinced and expressed their interest and willingness to participate in the implementation of the project. In farming systems approach work in Botswana, resource-poor farmers were immediately eager and willing to take an active part in the agricultural process (Worman *et al.,* 1990).

It was felt by FSRS and Extension staff that the attendance was poor and that a second meeting needed to be organised. The date, time and venue for the second meeting were decided in conjunction with the community.

2.7.2.2 Second meeting

The second meeting took place on 10 December 1997, during the summer holidays. Notification of the second meeting was made the responsibility of the Extension staff, the community members who had attended the first meeting and the chairman of the Amazizi Maize Association. Attendance was poorer than at the first meeting, with only six farmers present at the start of the meeting. The chairman of the local Maize Association expressed his disappointment at the poor turnout. Reasons given at the meeting for the poor attendance were that the notifications were received late (poor communication) and that the meeting was held during the December holidays.

2.7.2.3 Third meeting and selection of people for interviews

As a result of the poor attendance at the first two meetings, the following actions were taken:

a) notices and posters (A3 size) were made with the following information: the logo of the Department, an open invitation to attend a community meeting, the date and objectives of the meeting, time and venue. FSRS staff prepared the notices and posters. *(A comment had been made by community members to FSRS staff that people will not attend a meeting if they do not know the purpose of the meeting);*

b) notices and posters were delivered to the District Extension office for distribution and placement of posters (Thandanani Craft Centre, local shops);

c) children from the Secondary School were used to deliver notices to their homes.

Approximately 20 community members attended the third meeting on Wednesday, 11 February 1998, in the Obonjaneni Methodist Church. One of the objectives of these meetings was to select a sample of people to be interviewed for the collection of primary information. FSR and Extension staff concluded that people attending the meetings were the ones with an interest in agriculture and it was necessary to continue the process, even though they were few in number. Feedback meetings, as planned and indicated in Table 2.1, would therefore play an important role in evaluating the survey results obtained from such a small sample.

At the conclusion of the third meeting, 20 community members volunteered to be interviewed for the diagnostic phase of the approach. The small number of people at the meeting left no room for participants in the survey to be selected according to the principle of statistical randomness, but by the principle of convenience (Van Vuuren & Maree, 1999). It is also important to note that at the time of the meetings, information regarding the status, level of power, knowledge and access to resources of participants was unknown. Background information of people was unavailable to the FSR team. Of importance, however, was that they showed an interest in the meeting by attending it. According to Van Vuuren & Maree (1999), the non-randomness of a sample has two negative implications. Firstly, statistical theories of probability do not apply to non-random samples, making it impossible to know the degree of accuracy with which properties of the sample can be used to describe properties of the population. Secondly, since the researcher plays an active role in deciding who should and should not be in the sample, bias can easily be introduced. The sample, however, would provide researchers with a feeling about the population, which is, at times, sufficient justification for using the method of non-random selection (Shaner *et al.*, 1982).

2.7.3 Information collected at meetings

The information gathered at the meeting was part of the process of obtaining an insight into the small-scale farming community and to provide background information necessary for the diagnostic survey. People at the meetings mentioned that farmers in Obonjaneni were labeled as "bad farmers", compared to those of the neighbouring communities, and that the community needed help and assistance from the Department of Agriculture.

2.7.3.1 Constraints raised by farmers at meetings

a) Crop production

   i. Information was needed on:
      - fertilizer and liming practices,
      - which dry bean and cowpea cultivars were available,
      - soil preparation on different soil types.

   ii. Stray livestock had resulted in the termination of crop production activities in the communal fields (there was a total lack of fences around the communal cropping fields).

   iii. Storage of grain crops posed a problem due to a decline in quality during storage.

b) Livestock

   i. Stray livestock was a problem due to a general lack of discipline in the community.

   ii. Livestock was supposed to graze in the mountain areas for the summer months to enable people to plant crops in the communal fields. However, people who did not use the cropping land disobeyed this rule. Initially, herders were employed by the Inkosi to control the movement of cattle. In the early 1990s control on the movement of animals was rejected by the community (no reasons were given). At the time of the meetings there was no herding or control over the movement of cattle. Approximately 50% of the community members had cattle, but the problem lay with the minority, who had cattle but did not plant crops. There was no system in place to charge livestock owners for damages.

   iii. Theft of livestock was a major problem. For this reason livestock owners were unwilling to allow their cattle to graze on the mountain. Strategies had been designed by the community to combat stock theft. Four men were put in the mountains at night, for two weeks at a time, to guard the cattle. Money was, however, needed from the community members to pay them. People were sceptical of this arrangement and it was stopped.

c) Vegetable production

i. The community vegetable garden could not be irrigated due to a broken pump.

ii. The vegetable garden was not properly fenced.

iii. Members of the garden lack knowledge on the choice of vegetable crops to be grown in the area.

iv. Members need guidance and knowledge on the correct use of herbicides.

d) Socio-economic aspects

i. After the completion of the Woodstock dam in the area during 1981, some of the households were moved to their present location. (This dam forms part of the Drakensberg Pumped Storage Scheme situated in the Northern Drakensberg).

ii. People had left the community for a better living elsewhere.

iii. There was a lack of co-operation and motivation in the community.

iv. The theft problem, in particular theft of livestock, resulted in a spirit of de-motivation in the community.

v. Poor communication seemed to be a problem when events were organised.

vi. Members of the community described agriculture as *"dead and not sick"* in their area and thanked the Department for offering assistance with on-farm research.

2.8 Conclusions

a) The selection of the Obonjaneni target area by the Regional Technical Working Group was based on the fact that agriculture was in a poor state and that very few agricultural activities were taking place in the community. Although the selection of Obonjaneni as target the study area can be deemed successful, there is a need to use more encompassing, critical criteria for the selection of target areas in future. These are presented under 2.9.

b) The poor initial contact with leader farmers, led to communication problems which resulted in the need for three community meetings to be arranged in an attempt to explain the on-farm research approach and intended programme to the people of Obonjaneni.

c) The poor attendance of community meetings prevented the selection of a truly representative sample of community members for the diagnostic survey and it also caused a delay in the programme of a few months. However, the willingness of the FSRS staff to return to the community for three community meetings perhaps demonstrated to people in the community, and to the Extension staff, the commitment and seriousness of the FSRS staff about getting involved in an on-farm research programme.

d) The lack of basic information on the target community (such as the number of homesteads and small-scale farmers, the availability of resources, area available for agriculture and the number of livestock) hampered the efforts to gain an initial understanding of the community. It was also not known whether this target area was mainly a residential area or a small-scale farming community. This kind of information ideally needs to be available when a research team moves into an area or community to conduct an on-farm research programme. Extension staff can assist in providing this kind information and, by doing so, will contribute to the speedy commencement of a programme.

2.9 Recommendations

a) Based on this part of the study I recommend that the criteria for the selection of a target community at Regional Technical Working Group or District level in KwaZulu-Natal for on-farm research should include some or all of the following:

   i. Agricultural potential

      - the area must have the potential for agriculture generally practiced in the area;
      - the area must be representative of a large agro-climatic zone, so that the research results can have widespread applicability;
      - the area should have a critical agricultural problem which limits production resulting in poverty and hunger;

- the area should have the potential for better use of its resources. A target area could be selected on the basis of specific physical limitations, or problems such as erodible slopes, flooding, soil acidity, inadequate grazing, or animal disease.

ii. Socio-cultural aspects

- the area should have a strong leadership structure (Inkosi, Indunas and Councillors). Political stability and the safety of researchers are essential;
- for an agricultural appraisal, the area should be predominantly agricultural and not residential;
- the potential of the area should not only be evaluated in terms of natural resources, but also in terms of the human potential, *e.g.* willingness of farmers to participate;
- availability of markets and infrastructure could contribute to the potential to raise the income of farmers from agriculture.

iii. General aspects

- involvement is likely to be for at least five years and the local and relevant Extension staff should be committed for the total period;
- distance between research stations and the target area: if the area is close to a research station, FSRS staff can get more co-operation from research station staff;
- easy access to all parts of the on-farm research area enhances co-operation and support among the researchers, Extension staff and farmers;
- if needed, the area should be scaled down to a sub-ward, according to criteria such as the accessibility, uniformity, size of the ward, number of people that will benefit, constraints and/or potential of area, secondary information available and farmers' willingness to participate in the approach.

b) Leaders and leader farmers in the community need to be approached by Extension staff and should be involved in the programme from the start. Extension staff need to play a significant role in achieving farmer participation.

c) Meetings should be planned together with farmers and extension staff and adequately publicised, by using the following communication methods (as suggested by the community):

i. the Inkosi should assist in calling meetings;

ii. an elected publicity officer could play an important role;

iii. the Induna(s) should be used to disperse the message;

iv. the principal of the local secondary school should be approached, with a view to the children delivering notices of meetings or events, to households;

v. the message should be distributed through associations and local structures (such as the Development Committee and churches);

vi. pamphlets should be distributed in the community;

vii. a loudspeaker on a vehicle could be used to announce and to advertise meetings (extension officers should use loudspeakers on their vehicles and a reminder could be given over the loudspeaker on the morning of the meeting);

viii. the use of Ukhosi FM (Zulu Radio station) was suggested (it was the opinion of the research staff that the radio would broadcast FSR messages to other non-target areas and use up much airtime inefficiently; farmers, however, favoured the use of radio);

ix. Saturday meetings had been suggested as a means of involving people who were away, working during the week. However, the meeting of farmers, FSRS and Extension staff decided against Saturday meetings and felt that the focus group should be the people actively involved in agriculture during the week. Community members commented that even during the week a good turnout at the meetings was possible.

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CHAPTER 3

SECONDARY INFORMATION COLLECTED FOR AN ON-FARM CLIENT-ORIENTATED RESEARCH PROGRAMME

3.1 Introduction

The collection and study of relevant background information concerning an area and its people earmarked for an on-farm research programme, or for that matter any other action, is a crucial and purposeful activity before the onset of an intervention programme. According to Pinheiro *et al.* (1994), such studies arise from the need for researchers to know how the farmers organise and manage their farming systems and to better understand the environment in which the farmers interact. This information is called secondary information and is defined by McCracken *et al.* (1988) as published or unpublished data that are relevant to the topic or to an agro-ecosystem and which were previously acquired by other people. The best starting point, according to Dillon & Hardaker (1993), is to review available secondary data, that is, additional information already collected by others.

In an on-farm research approach, the collection, analysis, synthesis and interpretation of secondary information needs to take place and needs to form part of the diagnostic studies, following the identification of the target area and farmers (Matata *et al.*, 2001). This, though, needs to take place before the main diagnostic study, during which primary information is collected (Byerlee & Collinson, cited by Collinson, 1987). Secondary information was used in Bangladesh, where the information from participatory poverty assessments provided the basic criteria for classifying households according to poverty or wealth status and was used to select participants for focus groups (Nabi *et al.*, 1999). In Kenya previous and subsequent studies provided additional information on related technologies, asset portfolios, gender issues, cultural issues in adoption, and social networks in an agricultural research programme (Adato & Meinzen-Dick, 2002). In the latter study, many sources were tapped and valuable information was obtained which contributed to a better understanding of the target area.

The important advantage of time spent reviewing and summarizing secondary information is that it may be valuable in identifying farmers' current circumstances and in clarifying later diagnostic studies (McCracken *et al.*, 1988 and Matata *et al.*, 2001). In particular, it can assist in avoiding duplicating studies and, by revealing gaps or biases in existing data, it can also stimulate ideas and suggest paths of investigation for the researchers (McCracken *et al.*, 1988). The term 'farmer circumstances' in a diagnostic study, according to Matata *et al.*, (2001), refers to all those factors that influence farmers' decisions. These circumstances may be grouped into five categories, namely natural (physical and biological), institutional, economic and social and cultural circumstances. Reasons for their importance include the following:

- to provide an initial understanding of the system;
- to identify the management challenges that farmers face;
- to determine the current production practices and the farmers' likely responses concerning a change in these practices;
- to define or redefine the target group;
- to define or redefine potential improvements in livelihoods.

The collection of secondary information can usually be conducted rapidly, inexpensively and simply (Bernsten, 1982 and Shaner *et al.*, 1982). However, according to McCracken *et al.* (1988), in collecting this information it is, important not to expend valuable time which could rather have better been spent in the field. Numerous sources of secondary information are available (Shaner *et al.*, 1982; McCracken *et al.*, 1988 and Matata *et al.*, 2001):

- weather data;
- regional reports;
- topographical, soil and other surveys and maps;
- aerial and other photographs (natural vegetation);
- travel books;
- newspaper and other articles;
- data found in government agencies (*e.g.* Extension offices), at universities, research centres, marketing bodies and other similar institutions;
- project documents;
- research papers;
- annual reports;
- diagnostic survey results;
- satellite images and
- national census statistics.

While using the different sources, it is important that the accuracy, reliability (checked by comparing data from different secondary sources) and the scale of data (*e.g.* rainfall data - daily, weekly, monthly, annually) be assessed to ensure that the data are the most recent available (Bernsten, 1982 and Matata *et al.*, 2001). Socio-economic information, in particular, according to Matata *et al.* (2001) should be recent, with data more than five years old requiring verification.

The value of natural resource information as secondary information is that it determines the agricultural potential of a target area or region (Guy & Smith, 1995). Production potential is influenced by natural resource factors that include climate, topography, soil and vegetation patterns, and additional factors such as management, markets, labour and capital (Smith, 2001). Assessment of these physical resources is necessary, prior to any intervention being considered, in order to facilitate correct land-use planning and to promote appropriate and sustainable resource utilization. Any land use will be affected by the complex interrelationships of the above-mentioned factors. To illustrate this complexity, Matata *et al.* (2001) described the possible effects of, for example, rainfall, on the agronomic and socio-economic aspects of the system. The agronomic implications of the amount of rainfall and the rainfall pattern influence:

i. length of growing season;
ii. crop/livestock combinations produced in the system;
iii. timing of operations and the amount of time spent on farm operations, including land preparation, planting, weeding and harvesting;
iv. pest and disease incidence;
v. incidence and control of weeds – spectrum of weeds;
vi. crop spacing;
vii. crop husbandry techniques, *e.g.* tillage.

The socio-economic implications of variation in rainfall include:

i. quantity and quality of produce and the risk and level of management required;
ii. input requirements and marketing of products.

Soil type and topography could affect the choice of land for cropping by virtue of the following:

i. drainage, soil water availability and retention and erosion risk;
ii. soil fertility;

iii. crop selection and cropping combinations, livestock number and livestock species;

iv. cultivation practices (*e.g.* tilling method and timing).

According to Matata *et al.* (2001), soils and rainfall together can influence:

i. the wetting depth – plant moisture availability;

ii. erosion;

iii. loss of nutrients.

All these factors can influence the production system and the practices followed by farmers. Each of the factors affecting land use would need to be studied and taken into consideration when planning any intervention strategy.

This chapter discusses the secondary information available for the target area, which is located approximately 44 kilometres west of the town of Bergville (28^0 41' 00"S and 28^0 59' 50"E), in the foothills of the Drakensberg range, with Lesotho as the neighbouring country. Sources for secondary information found for the target area included:

a) natural resource data supplied by the Natural Resources Section of the KwaZulu-Natal Department of Agriculture and Environmental Affairs;

b) information supplied by Extension staff during FSR Section staff visits to the community;

c) animal numbers in the community from the Animal Health Technician;

d) information obtained from the farmers themselves;

e) aerial photographs;

f) miscellaneous reports;

g) articles found in the literature.

3.2 Secondary information relating to the target community

3.2.1 Information derived from the KwaZulu-Natal Bioresource Programme

3.2.1.1 The KwaZulu-Natal Bioresource Programme

The diversity of natural resources in KwaZulu-Natal is enormous, resulting in large variations in agricultural production potential and thus, farming enterprises, throughout the Province

(Camp, 1999a). While this diversity offers great opportunities in terms of the choice of enterprises, it is also very challenging in terms of land management and long-term sustainability of resources (Camp & Liengme, 2001). To achieve the necessary sound matching of agricultural production and other forms of land use with the diverse natural resources of the Province, detailed land use planning information is vital. To meet this need, the Department developed a computer-based natural resource classification system unique to KwaZulu-Natal, which is known as the Bioresource Programme. The programme classifies the natural resources of the Province (climate, vegetation, soils and topography) into 590 ecological zones of reasonable homogeneity (Camp *et al.*, 2001) and is available from the Natural Resources Section of the KwaZulu-Natal Department of Agriculture and Environmental Affairs. In the work done by Camp (1999a), the many ecological and agro-ecological studies that were undertaken in KwaZulu-Natal were recognised.

3.2.1.2 Classification of the natural resource information

The natural resource information for the target area is classified at three levels (from the largest to the smallest unit) (Camp, 1999a):

a) Bioresource Groups (BRG) – vegetation pattern;
b) Bioresource Units (BRU) – agro-ecological zones;
c) Ecotopes – soil associations.

a) Bioresource Groups

A Bioresource Group is defined as a specific vegetation pattern controlled by an interplay of climatic and biotic factors namely soil, climate and altitude. The land of the Obonjaneni community falls within Bioresource Groups 10 (Montane Veld) and 11 (Moist Transitional Tall Grassveld) (Camp, 1999b, c). The locality and description, total area of each Bioresource Group in hectares (ha), climate and vegetation of the two Bioresource Groups are summarised in Table 3.1. It is clear from the locality and description information regarding the Obonjaneni site that the results from an on-farm research programme there would be applicable to a larger area and thus for many other small-scale farmers within the Bioresource Groups.

Table 3.1 Description of the two Bioresource Groups regarding the Obonjaneni site (Camp, 1999a)

Information	BRG 10 Montane Veld	BRG11 Moist Transitional Tall Grassveld
Locality and description:	The total area is 289 480 ha in extent and includes the entire high Drakensberg range along the border between KwaZulu-Natal and Lesotho. It extends over a distance of approximately 180 km.	The total area is 775 203 ha and extends down the western border of KwaZulu-Natal.
Climate:		
Mean annual rainfall	1 198 - 1 389 mm	800 - 1 116 mm
Mean annual temperature (MAT)	13.2 °C	16.0 °C
• MAT – July	6.9 °C	8.8 °C
• MAT – Jan	19.6 °C	23.2 °C
Mist	Frequent (October to March)	Frequent in spring and early summer
Frost incidence	Severe	Moderate, occasionally severe
Vegetation:	Plant indicator species are: **Trees** - *Buddleja salviifolia* (Sagewood), *Cyathea dregei* (Common tree fern), *Podocarpus* spp. (Yellowwood family); **Shrubs** – *Protea* spp., *Leucosidea sericea* (Ouhout); **Grasses** - *Festuca* spp., *Monocymbium ceresiiforme* (Wild oatgrass), *Stiburus alopecuroides* (Blackpatch lovegrass); **Forbs** - *Pteridium acquilinum* (Bracken fern)	The most extensive plant type is *Themeda-Hyparrhenia* grassland, with *Hyparrhenia hirta* (Common thatching grass) dominating much of the veld, particularly disturbed veld.
Invasive alien species	Occasional *Acacia* spp (e.g. Black wattle) stand in watercourses	*Acacia mearnsii* (Black wattle), *Lantana camara*, *Rubis cuneifolia* (American bramble), *Solanum mauritianum* (Bugweed)

b) Bioresource Units found in Obonjaneni

A Bioresource Unit is a class of land within which the environmental factors such as soil type, climate (rainfall, temperature and evaporation), vegetation and terrain form, display a sufficient degree of homogeneity, is such that uniform land-use practices and production techniques can be defined (Camp, 1999a). A Bioresource Group may consist of a number of Bioresource Units. However, only one Bioresource Unit occurs in each of the two Bioresource Groups found in the target area (namely Ze1 and Yc6).

c) Ecotopes

An ecotope is a class of land defined in terms of soil (form, texture and depth) and soil surface characteristics (rockiness and slope), within which agricultural yields and production techniques are uniform (Camp, 1999a). The value of identified ecotopes is, among other things, to select and describe research sites, assess land and yield potential and interpret research results in relation to soil characteristics. Ecotopes can also be used to indicate where norms need to be collected, or where research is lacking. There may be a wide range of soils within a Bioresource Unit and hence site-specific production can vary considerably. The soils information is available only as a percentage of the Bioresource Unit due to the scale of mapping (1:250 000), *i.e.* the spatial distribution at local level is not available. Thus, soils information must be collected from on-site surveys. As a result, ecotopes found within each Bioresource Unit are identified but cannot be locally mapped without a field survey.

3.2.1.3 Bioresource Unit information

Obonjaneni falls within two Bioresource Units: Yc6 - Rugged Glen and Ze1 - Little Berg. A description of each Bioresource Unit as defined by Camp (1995) follows.

It is important to bear in mind that this description is representative of the *entire* BRU, which is for a far greater area than that occupied by the Obonjaneni site. Thus, the data may not be fully representative of the smaller target area, indicating a need for further ground-truthing (*e.g.* soil survey).

The majority of the cropping fields falls within the BRU Yc6 (Satellite image, Figure 3.1). The position of the community's cropping fields, residential area and the communal grazing area can be seen.

a) Bioresource Unit Yc6 - Rugged Glen (Bioresource Group 11 – Moist Transitional Tall Grassveld)

The total area of this BRU is 16 219 ha and consists primarily of rolling and broken terrain. The altitude range of the total, of which Obonjaneni is one community, lies between 1 197 and 1 574 metres above sea level, with moderate to steep slopes. The area is highly valued as a water conservation area. There are numerous permanent streams traversing this Bioresource Unit.

i) Climate

While the relatively high rainfall, 971mm per annum, would indicate a high potential for intensification, the limited sunshine hours of 6.1 hours per day during the growing season, dry and bitterly cold winters and a severe frost hazard, limit production and the choice of crops suitable to the area. The January mean temperature is 20.9 degrees Celsius, while the July mean is 9.8 degrees Celsius. Mists and cloud cover are frequent in spring and early summer. The climate capability class indicates a slightly restricted growing season due to the occurrence of low temperatures and frosts. Eighty percent of rainfall falls between September and March each year. Winters are dry and cold, providing little opportunity for production other than wheat and pasture production under irrigation.

ii) Vegetation

The most extensive plant association in the Bioresource Group is *Themeda-Hyparrhenia* grassland, with *Hyparrhenia hirta* dominating, particularly on disturbed areas. Long-term overgrazing is indicated by the presence of *Eragrostis* and *Sporobolus* species. Where selective overgrazing has occurred and where soils are particularly leached (south-facing aspects), tall sour grasses are found and palatability is low. The extended winter also results in poor quality grazing. The nutrient value of veld makes it suitable for grazing only from October to March. The grazing capacity norm is 1.7 ha/animal unit (AU) with a grazing production of 250 days. This means that for the remaining 100 days, additional fodder and/or supplementation is required to maintain livestock. Detailed veld assessments are required to determine current grazing capacity.

iii) Soils and Land Potential

Soils are primarily deep red apedal (no visible macro-structure) loams of the Hutton soil form, with clay contents ranging from 35 to 45% in the topsoil (MacVicar *et al.*, 1977). The soils are generally deep, well-drained, highly leached and acidic, with a high soluble aluminium content. Soils require high levels of fertilizers and lime to produce good crops. The erosion hazard is high. Agricultural potential is generally high, with limitations including low temperatures, severe frosts and steepness of some lands.

The indicated potential land use in this Bioresource Unit include the production of crops such as cabbages, carrots, lucerne, oats, potatoes, soyabeans, tomatoes, dry beans and maize on arable lands below a 12% slope, as well as timber (*Pinus patula* and *Pinus taeda*) and extensive livestock farming.

b) Bioresource Unit Ze1 – Little Berg (Bioresource Group 10 – Montane Veld)

Bioresource Unit Ze1 is an ecological sensitive area and has been identified as a water conservation area. The total area of the BRU is 131 392 ha. The terrain is mountainous and broken, with steep slopes, and an altitude range of between 1 402 and 2 743 metres above mean sea level. As a water production area, in a country subject to droughts and water shortages, it has immense value. Annual snowfalls provide water to downstream ecosystems and land users. Development could cause irreparable harm to the area and planning must thus take this valuable function into consideration.

i) Climate

The area receives a high rainfall of 1 198 mm per annum and has fairly low mean annual sunshine hours of 6.1 hours per day, dropping to 5.8 hours per day during the crop growing season, of October to March. This is due to the extent of cloud cover and mist, which is frequent in the rainy season. The frost hazard is severe restricting crop production. The climate capability class indicates that the area has a restricted growing season due to low temperatures and frost. Snow is experienced on a regular basis in winter.

ii) Vegetation

The vegetation is highly sensitive to mismanagement. This Bioresource Group has particular sensitive resources and the humic soils are highly erodible. Overgrazing can lead to erosion of topsoil. Veld has limited value for grazing, with a very restricted growing season, from October to February. The grazing capacity is estimated to be 5.0 ha/AU (Camp, 1997). Where grass production is under-utilized, it tends to become moribund and deteriorates in both species composition and basal cover. Fire is an important management tool, but veld should be burnt only between 1 August and 30 September, following rain (Camp, 1995).

iii) Soils and Land Potential

Soils are humic, highly acidic and highly erodible when exposed. High levels of leaching result in fairly nutrient-poor soils, due to their well-drained character. Available nutrients are confined to the topsoil as a result of organic matter decomposition and recycling under grassland. Dominant soil forms are Hutton, Inanda and Glenrosa, with weathering parent material close to the surface (MacVicar *et al.*, 1977). Soils become shallower on the steeper slopes. Land potential is very restricted, owing to the severe limitations of low temperature, excessive slopes, shallow soil and snow. Landslips are common after prolonged rain. North-facing slopes have a tendency to become overgrazed when farmed. Footpaths are a common sight and are the precursor to erosion.

The potential crops to grow in this environment where soil depth is sufficient and slope permits are cabbages, carrots, maize, oats, potatoes, lucerne, kikuyu and pine trees.

3.2.1.4 Yields of suitable crops for the area

a) Crop production models

The climatic data such as rainfall, temperature and evaporation, as well as the soils information, were used to model the potential yields for 40 agronomic crops under both dryland and irrigated conditions (Smith, 1997). MacVicar (1974) described the meaning of the term "potential" in agriculture at several levels, including experimental, best-farmer and specific-farmer potential. He defined specific-farmer potential as the adviser's estimate of what the individual farmer being advised could achieve. For the purpose of the Bioresource Programme it was decided, for "farmer potential", to use an estimate of 70% of experimental potential.

The crop Bioresource model showed that possible alternative crops such as cowpeas, groundnuts, barley, camphor, cherry and chicory could be grown in the area.

b) Potential yields for crops suited to the target area

Some of the potential yields of suitable crops, for the high potential ecotopes (humic, well-drained and alluvial ecotopes) in the two Bioresource Units found in Obonjaneni, at a 70% management factor, are shown in Table 3.2.

The yield information shows that the target area has good agricultural potential and that relatively high-yields could be achieved. The yields, however, are linked to a management factor that is perhaps not achievable by the majority of small-scale farmers in rural communities in KwaZulu-Natal, due mainly to a lack of available resources, *e.g.* cash for inputs such as lime and fertilizers, fences, equipment for land preparation and planters.

Table 3.2 The potential crop yields on flat or gently sloping non-rocky ground (slope not exceeding 12%) in BRU Yc6 and Ze1 at a management factor of 70% (Smith, 1997)

Suitable crops	Yc6 - Rugged Glen	Ze1 - Little Berg
Maize: dry land, planted in October	5.2 to 7.1 t/ha	1.8 to 4.1 t/ha
Potatoes: dry land		
September	23.8 to 28.0 t/ha	*
January - April	23.5 to 27.7 t/ha	*
October – February	25.0 to 29.4 t/ha	*
Potatoes: irrigated		
January - April	31.5 to 37.0 t/ha	*
Cabbage: transplant October or November	44.7 to 74.5 t/ha	31.9 to 63.8 t/ha
Carrots: sow September or December	24.8 to 41.4 t/ha	24.1 to 34.4 t/ha
Tomato: transplant October	34.1 to 56.9 t/ha	*
Dry beans	1.3 to 1.8 t/ha	*
Kikuyu	7.1 to 11.8 t/ha	5.9 to 9.1 t/ha

*: cropping not advisable in the majority of this BRU – thus no crop models developed

3.2.1.5 Satellite imagery of the target area

Information obtained by the Natural Resources Section from satellite imagery in August 2002 (Satellite imagery of the target area shown in Figure 3.1 and the location of the target area in relation to the province of KwaZulu-Natal shown in Figure 3.2) showed that the area under communal cropping fields was approximately 40 ha and no potential to enlarge (BRU Yc6), the residential area was approximately 358 ha (falls within BRU Yc6 and BRU Ze1) and the communal grazing area behind the residential area measured approximately 1200 ha (BRU Ze1). The total area available to the Obonjaneni community for farming activities was approximately 1598 ha.

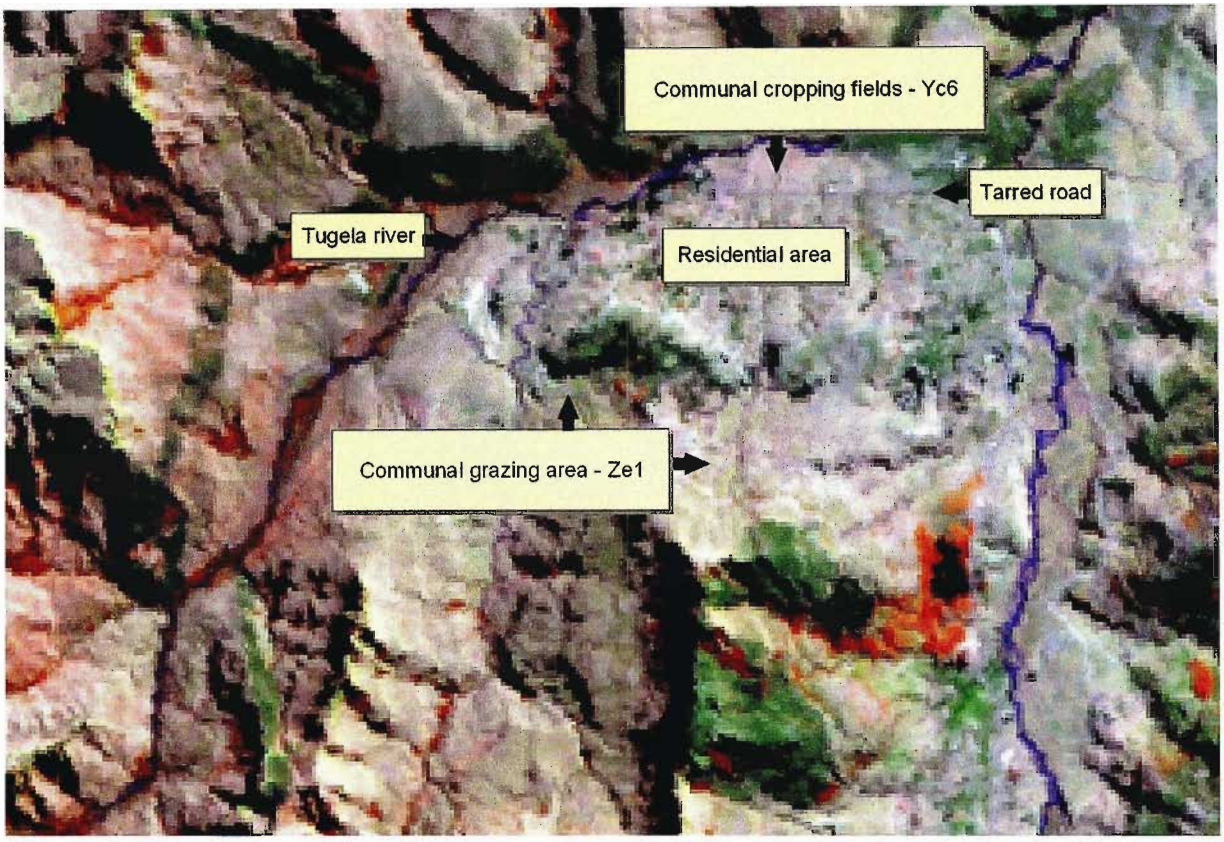

Figure 3.1 Satellite imagery of the target area (scale 1: 32 000)

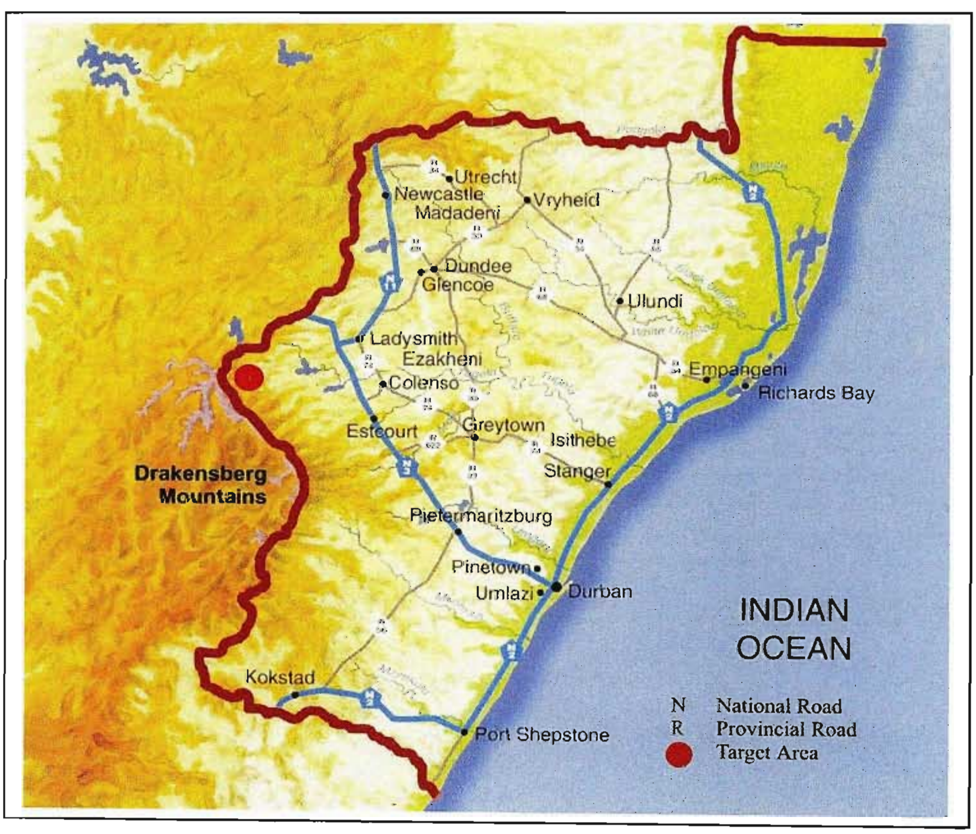

Figure 3.2 The target area in relation to the province of KwaZulu-Natal

3.2.2 Information from Extension staff during visits to Obonjaneni

The first visit to the community by Extension and FSR Section staff took place in October 1997, after the Tribal Authorities had given their approval for the initiative in Obonjaneni. During the visit, Extension staff found that the number of *bona fide* farmers was unknown, with most community members claiming to be farmers. Many of the households were found to have mixed-farming enterprises including maize, vegetables, potatoes, dry beans, fruit trees and livestock (cattle, goats, sheep and poultry). Two crop farmers' associations and one sewing club were operating in the community.

According to the local Agricultural Development Technician (ADT), the farmers in the community were experiencing problems such as theft of fences, uncontrolled livestock on cropping lands and lack of credit facilities, while the communal cropping fields were totally unutilised and continuously grazed by animals. The community garden, communal cropping fields and lands where livestock was allowed to graze during summer and winter, were identified. It was also mentioned that no maize had been planted in the cropping fields for several years due to the uncontrolled movement of livestock, resulting from the theft of fences and poor discipline in the community.

Apart from the agricultural activities, the community had the potential to exploit the tourism industry, which was already well established in the greater area. In this respect, crafts were being sold from the Thandanani Craft Centre, which is located next to the main road leading to the Royal Natal Park, bordering Obonjaneni.

3.2.3 Information obtained from Veterinary Services, KwaZulu-Natal Department of Agriculture and Environmental Affairs

The 1999 livestock numbers obtained from livestock owners at the local dip tank which serves Obonjaneni, as supplied by the Animal Health Technician (Veterinary Services, KwaZulu-Natal Department of Agriculture and Environmental Affairs), Bergville District, are summarised in Table 3.3.

Table 3.3 The 1999 livestock numbers obtained from livestock owners at the Nyosana dip tank

Cattle	Sheep	Goats	Horses	Donkeys	Pigs	Poultry
1427	383	528	79	13	16	722

To assist in establishing the additional feed requirements during winter, when livestock in communal areas is dependent mainly on crop residues, the approximate daily fodder requirement (kg dry matter (DM)) of the ruminants only in Obonjaneni was calculated. This calculation is based on the relationship between the metabolic mass (mass to the power of 0.75 *i.e.* $W^{0.75}$) and feed intake (Boeke, 1992). The fodder intake per day (kg DM) for a 450 kg dry animal, for example, is:

$0.1 \times W^{0.75}$

$= 0.1 \times 450^{0.75}$

$= 9.77$ kg DM

Therefore, the approximate total kg DM/day requirement of the cattle, goats and sheep, given in Table 3.3, can be calculated:

1427 head of cattle = 13 941 kg DM/day (450 kg @ 9.77 kg DM/head)

528 head of goats = 760 kg DM/day (35 kg goats @ 1.44 kg DM/goat)

383 head of sheep = 720 kg DM/day (50 kg sheep @ 1.88 kg DM/sheep)

The estimated total DM needed for the ruminants (dry animals) in Obonjaneni was 15 421 kg DM/day.

3.2.4 Information obtained from farmers

As far back as one of the farmers could remember, black people had been farming at Obonjaneni. The area where people are housed at present used to be cropping fields many years ago and the people were living on the slopes of the mountain. Cropping land was situated on both sides of the road that passes through the community. Farmers said that the "Betterment Planned" system was introduced by government during 1945 – 1946 and resulted in people moving down from the slopes of the mountain to the present "residential" area because of improved infrastructure and roads.

Davenport (1987) reported that "Betterment Planning" was a government programme that commenced in 1936. It included fencing pastures, promoting contour ploughing, planting forests, culling cattle, restructuring of housing patterns and appointing and forcibly removed farmers due to mismanagement of farm (sacking farmers). The underlying concept of the "Betterment Planning" schemes was to consolidate residential, arable and grazing areas at an administrative area level with two main objectives: to select the best land for the various land uses and to introduce better land husbandry practices (Anon., 1992). Betterment planning of the black rural areas was South Africa's attempt at villagization, *i.e.* planned village land use. According to De Wet (1987), the new land use system was inflexible; people found themselves with smaller fields and gardens than before, and had to walk greater distances to fetch fuel, water and thatching grass. This was accompanied by very unpopular stock-culling measures triggering peasant resistance to "betterment" in the 1940s and 1950s throughout the homelands (Cross, 1990).

The "Betterment Planning", according to the Obonjaneni farmers, resulted in the reduction of the communal cropping area, which today consists only of the fields which lie between the road and the Tugela River. People, however, had also stopped planting in the present cropping fields over the past few years due to poor control of the movement of livestock. Some farmers previously planted up to four fields in the communal cropping area. Discussions with some of the leading farmers revealed that more and more people were moving into the community, effectively reducing the area available for crop production (see 6.2.2 in Chapter 6).

3.2.5 Aerial photographs

Black and white contact aerial photographs that cover the target area were obtained from the Surveyor-General's Office, Department of Land Affairs, Pietermaritzburg. Aerial photographs of the area were taken on March 1996 and August 2000. Enlargements (x6) of the area, as identified on the contact aerial photograph, were obtained from the Chief Directorate: Surveys and Mapping, Mowbray, in Cape Town. Homesteads, schools, communal cropping fields, grazing areas, the community garden and other well-known landmarks are clearly visible in the enlarged photographs (see Figures 6.1 and 6.2 in Chapter 6).

3.2.6 Miscellaneous reports

A few reports of studies previously conducted in the area were found. A report "Strategic Plan for the KwaZulu Department of Agriculture" (Anon., 1992) highlighted the following information of interest for KwaZulu, a Bantustan area of South Africa before the General Elections in 1994, of which the community of Obonjaneni was part.

a) The absence of able-bodied men was one of the major reasons why the communal areas have a relatively unproductive rural economy. Remittances sent home by migrants acted as an economic cushion and militated against farming productivity and efficiency. The high rate of illiteracy among adults further compounded the problems of a relative lack of progress in agriculture.

b) Infant and child mortality rates were high among the rural population and the main factor was poor nutrition.

c) KwaZulu's most precious resources of soil, water and vegetation were being threatened by population pressure, socio-economic factors and misuse.

d) A particular weakness in the present structure of the KwaZulu Department of Agriculture and Forestry was the lack of experienced, professionally trained Subject Matter Specialists. The role of these specialists, according to the report, was to train and develop field staff, carry out adaptive research and provide back-up expert advice.

e) The majority of households had a housing allotment of approximately 0.2 ha.

In the report "An Evaluation of the KwaZulu Extension Services", Bembridge *et al.* (1983) reported extremely low maize yields, which were a fraction of the potential, in the rural communal areas of KwaZulu-Natal (in the previous KwaZulu). The poor yields were a direct reflection of the low rate of adoption of improved technology. Livestock reproduction and off-take rates were low and mortalities high. Available evidence, according to the authors, suggested that the average rural family in KwaZulu produced less than 50% of its food requirement and was therefore more of a consumer than a producer of food. A very interesting recommendation in the report was the proposal of a Regional Technical Working Group structure for Extension to improve communication and liaison between research and extension. Another aspect of concern was the finding that the productivity and efficiency of extension workers had been depressed by neglecting in-service training in both technology and extension methods. Consequently, the majority of extension workers lacked the necessary skills and ability to supply practical advice to farmers and fulfil the objectives of the Department.

A report by Muller *et al.* (1987) documented the results of a socio-economic survey of the Upper Tugela location, covering the Amazizi tribe in which the community of Obonjaneni falls. This report mentioned that the area was under the jurisdiction of the KwaZulu

Government. Land in the area was held under different types of tenure: the largest part (94.4%) was held under traditional tribal tenure, 5% was controlled by the South African Development Trust according to the 1936 Land Act, while a negligible 0.5% was private freehold land. The report contains valuable information on the agricultural activities of the area *e.g.* a majority of households were unable to fulfil basic subsistence requirements, monoculture of maize predominated, milk production was inadequate, stock management was poor and the mean size of arable holdings per household allocated was 1.16 ha per holder in the Amazizi tribe.

The report "Towards a plan for the Bergville Magisterial District" by Hicks *et al.* (1990), arose from the need to respond to environmental degradation and gross poverty within the catchment of the Upper Tugela. It is interesting to note that agriculture was identified as the economic base of the district and its development was of primary concern. It was recommended that a multidisciplinary specialist team prepare a comprehensive agricultural development strategy. The report indicated that the principles that should guide agricultural development were the interaction and co-operation between all farming communities within the district and the elimination of constraints restricting the development of the agricultural sector. To achieve this it would be necessary to introduce a comprehensive farmer support programme which would have the following components: supply of inputs, marketing services, extension and education services, the development of agricultural infrastructure and the promotion of a crop mix which would reduce risk, maintain and, if possible, increase, levels of employment. It was also mentioned that assistance to small-scale farmers in Black Freehold Areas was an important consideration.

Anthropometric findings on the nutritional status of pre-school children in South Africa in 1994, indicated that one in four children were stunted and one in ten was underweight (Steyn *et al.*, 1999). In practical terms, this means that about 660 000 preschool children were underweight and 1.5 million were stunted due to chronic under-nutrition. The same study revealed that malnutrition was most prevalent in the Eastern Cape, Northern Province (Limpopo) and in KwaZulu-Natal. The nutritional assessment of children between 0 and 60 months in rural households in KwaZulu-Natal by Kirsten *et al.* (1998), revealed that 35 percent of households had stunted children. Inadequate dietary intake was considered to be one of the primary immediate determinants of malnutrition. The authors regarded the underlying determinants of adequate dietary intake to be household food security as well as adequate and appropriate care for women and children.

Steyn *et al.* (1999) in affirming that access to food is dependent on an adequate, stable local food supply believed the latter to be influenced by many interacting factors, which play a role in determining the extent of food security. They stated that the most frequently cited factors include:

a) access to land,
b) livestock ownership,
c) availability of food gardens,
d) safe, accessible water supply,
e) stable climatic conditions,
f) access to food shops,
g) access to alternate food supplies,
h) cash (income) to buy food.

The situation in South Africa is that a large proportion of the African (black) population lives in the former "homelands" which are too small and degraded to support an active subsistence sector (Steyn *et al.*, 1999). The result is that subsistence farming accounts for only 6% of the total income of non-urban families (Anon., cited by Steyn *et al.*, 1999) and is not a major source of food according to the National Food Consumption Survey (1999). The majority of food (even maize) is purchased. A study by Kirsten *et al.* (1998) carried out in developing areas found that agricultural activities have positive and significant nutritional benefits only for households which are 'seriously' involved in these activities. Subsistence agriculture and communal vegetable gardening may have benefits by slightly improving the macro- and micronutrient status of beneficiaries, but do not yield sufficient produce to improve the energy intake of household members. The findings of a national survey on the impact of agricultural deregulation (Ebony Consulting International, 2002) showed that income remains the single most important determinant of a household's ability to meet its food security needs. Even where agriculture produces additional income or income replacements, there is no guarantee that increases in income would automatically be spent on the acquisition of more food, a wider variety of foods and/or foods of greater energy density.

3.2.7 Published articles

During the 1940s, the area in which Obonjaneni falls was identified as an area with very poor soil fertility. Farmers could not rely entirely on veld for livestock production (Pentz, 1945), and a need was identified to supplement veld by the intensification of certain portions of the land (crop residues or pastures). As early as the 1940s, Pentz (1945) commented that the cropping of arable land in these areas was possible, provided that soil fertility constraints were addressed.

Thomson & Lyne (1995) reported that the communal area found in the Upper Tugela Catchment, bordering the Drakensberg mountain range between the towns of Winterton and Bergville (this region includes the Obonjaneni area), had a high agricultural potential. They questioned the view that tenure, as defined by the breadth, duration and assurance of property rights to arable land, is secure in the communal areas of KwaZulu-Natal. Information obtained in their study suggested that households did not have secure tenure and that technical change had not induced a shift towards more exclusive land rights. Consequently, emerging farmers had little incentive to farm in communal areas. They also found that 50% of households in the Amazizi ward had problems with stray animals and 91% of them had problems with crops damaged by livestock.

In the neighbouring Okhombe community, Von Maltitz (1998) found that only a small percentage of households had access to communal cropping fields, with the average size of home allotments being 1.2 ha. These fields were used for dryland farming, and maize was by far the most favoured crop. Crops were grown only during summer as the fields formed part of the communal grazing area during winter. The commonage was available for all stockowners to use as the exclusive summer grazing area, and the livestock was moved to the fields during winter (Von Maltitz, 1998).

Finally, a point of relevance to the entire province is that Miles (1996), from the KwaZulu-Natal Department of Agriculture and Environmental Affairs, reported that surveys based on soil tests in KwaZulu-Natal indicated that field crops were often severely restricted by excessive soil acidity and/or nutrient deficiencies and that this had major sociological effects on rural communities.

3.3 Discussion

A large proportion of the African population in South Africa lives in the former "homelands", which in the view of Steyn *et al.* (1999) are "too small and degraded to support an active subsistence sector". Kirsten *et al.* (1998) commented that the low agricultural productivity, under-development, unemployment and a high rate of illiteracy in these areas result in extreme poverty and a high dependency on remittances. This serious and complex situation in small-scale agriculture, arose over decades due to many reasons and continues to pose a huge challenge to Government and the private sector. The situation needs to be addressed with a well planned and co-ordinated programme to unlock the potential of the rural communal areas. Technology development and training through the farming systems research approach could contribute to alleviating this problem (see 1.1 in Chapter 1). As indicated in this Chapter, secondary information is available and could assist in the preliminary assessments of a target area.

3.3.1 Land tenure

The issue concerning the lack of secure land tenure in communal areas is not unique to the province of KwaZulu-Natal. A report on "Strategic Plan for the KwaZulu Department of Agriculture" (Anon., 1992) mentioned that it is clear that the present traditional tenure system in KwaZulu militates against general progress and the development of a viable agricultural sector. It was also mentioned that those people who want to farm are unable to acquire sufficient control of land rights, while traditional tenure systems offer little long-term security. In a comprehensive survey on African development literature, Eicher & Baker (1982) have overwhelmingly shown that rigid and legalised adherence to communal tenure can be a severe stumbling block to agriculture in Africa. For both growth and consolidation in agriculture Groenewald (1998) indicated that security of tenure is a prerequisite. The opinion of Leseme *et al.* (1980) was that the powerful position of chiefs and headmen precludes security of tenure, inhibits the use of new technology and limits private decision-making and hence also investment on the part of small farmers in these circumstances. Rutman (1976) pointed out that overcrowding and poor production inevitably became the result of such tenure. In this environment, farmers clearly cannot enforce exclusive rights to their arable land. Studies have shown inefficiency in land use in the former homelands (Groenewald, 1998). Arable land is under-utilised, with authors such as Groenewald (1998) estimating that between 20 and 28% of arable land is not ploughed every year, while crop yields are low because of low inputs of variable production goods and technology. Grazing land is simultaneously over-utilized (Thomson & Lyne, 1991).

It is important to note that within the communal land tenure system, one can distinguish between three classes of land-use right holders (Groenewald, 1998):

a) people who receive good remuneration from occupations outside agriculture for whom the costs of spending more time and effort on their arable land are too high to render them worthwhile;

b) people without the necessary means (for example aged or single-female household heads) who find it difficult, if not impossible, to cultivate all their arable land;

c) people with the ability and desire to be full-time farmers.

Lyne (1989) felt that if an effective rental market existed, all abovementioned groups could be better off if those with the ability and the desire to be full-time farmers leased land from the other two groups. The potential farmers could improve their livelihood by operating more land, while the other two groups could obtain rental revenues for land otherwise left idle or used inefficiently (Lyne, 1989). According to Jodha (1992), communal property ownership regimes often constitute very important social insurance mechanisms for the old and the poor. There is a need to be mindful of this when adding up costs and benefits of moving to private property rights. Thus, common property regimes can provide important insurance functions. But they can also be used to exclude people, especially those who are politically incorrect or not "real" members of the community, for instance women, widows and outsiders (Van der Bank, 2003).

In parts of South Africa, according to Groenewald (1998), smallholder farmers are ready for tenurial change. But, land tenure is not a magical concept that will put agriculture on the way to development (Groenewald, 1998). It is but one factor that will influence the future of agriculture. While it will probably take many years to find solutions to this issue, attention needs to be given urgently to small-scale farmers in terms of technology development and training. Thus, the challenge for an on-farm research approach is to be as effective as possible in addressing the agricultural constraints of small-scale farmers, within the scenario of no, or limited, land tenure in the majority of communal areas in KwaZulu-Natal.

3.3.2 Potential for crop production

From the Bioresource Programme, the potential yields of various crops, assuming a 70% management factor, indicate that the Obonjaneni community area has high agricultural potential. This confirms the opinions of the authors as presented in 3.2.1.4 concerning the target area. The ecotopes which occur in the Bioresource Units in which Obonjaneni falls, are suited to growing crops such as maize, dry beans, soyabeans, cabbage, carrots and tomatoes.

A management level of 70% (inputs and techniques), a potential dryland maize yield of between 5.2 and 7.1 tons/ha/annum (Table 3.2) is possible in Obonjaneni. However, if the management level is reduced to 50%, the potential production on these soils can drop to 3.7 tons/ha/annum. Should yields of 1.86 t/ha/annum or 0.74 ton/ha/annum be attained, it would indicate management levels of 25% and 10%, respectively. Potential cabbage yields at 70% management level are between 44 and 74 t/ha. Potato yields at 70% management level could vary from 23 to 29 t/ha and dry bean yields from 1.3 to 1.8 t/ha. According to the information obtained during the diagnostic survey (see Chapter 4) these are the three main crops produced in Obonjaneni. They are included in the on-farm research programme as discussed in Chapter 5.

These yield potentials of different crops will serve as a benchmark in later Chapters of this thesis to (i) evaluate the level of production attained and (ii) to assist research, extension and farmers to diagnose possible production constraints in the community. Poor yields obtained by small-scale farmers may indicate poor management practices relating to liming, fertilizing, seed source, planting dates, weeding, plant population, fencing and problems relating to uncontrolled movement of livestock.

3.3.3 Limitations to livestock production

3.3.3.1 Crop residues

Information from the Bioresource Programme indicates that farmers cannot rely entirely on veld for livestock production, due to the forage quality and quantity produced by the veld type found in the area. The communal cropping fields form part of the grazing area for the overwintering of livestock. In Obonjaneni approximately 40 ha of communal cropping fields are available for winter grazing. Assuming that the yield of maize produced can be improved to 5 t/ha/annum, the residues would amount to 60% of the yield (*i.e.* 3 t/ha, of which only 40% is utilized), thus effectively only 1.2 tons/ha of residue would be available to the animals (Smith, 1998). Assuming that 40 ha were under maize, then at a yield of 5 tons/ha, the residues available to livestock will be approximately 48 000 kg. However, with the requirement of 13 941 kg DM/day for the 1 427 head of cattle in the Obonjaneni area (see

3.2.3 for calculations), these residues will be sufficient to feed the animals for only 3.5 days (without even taking the small stock into consideration). It is therefore clear that the crop residues in the community would need to be supplemented with additional systems of fodder production.

3.3.3.2 Grazing capacity of the area

The potential grazing capacities under controlled management system, with a veld condition score of 75%, as supplied by the inventories of Bioresource Units Yc6 (Rugged Glen) and Ze1 (Little Berg), are 1.7 and 1.4 ha per animal unit, respectively. However, it must be questioned whether the grazing capacity information in the Bioresource Programme is applicable under communally managed veld conditions. This information needs to be adapted for the type of veld management practised on communal areas and adjusted for degraded veld where applicable. Camp (1995) is of the view that if the actual veld condition is known, the following formula could be used to calculate the grazing capacity:

*Grazing capacity = Annual DM consumed/(MAP*0.8*X*Veld condition score*0.5)*

Where veld condition is expressed as a fraction, MAP = mean annual precipitation,

X = kg/mm/ha.

To use this formula, grassland scientists should determine the veld condition of a specific area. At 75% of benchmark, the carrying capacity of the area available is 880 AU (1 AU = 450 kg steer). Even without knowing the weights of the animals and the type of animals mentioned in the number in Table 3.3, it is clear that the recommended carrying capacity for the area available in Obonjaneni is being exceeded. A follow-up veld assessment study in Obonjaneni showed that Yc6 (Rugged Glen; Bioresource Group 11 – Moist Transitional Tall Grassveld) is degraded from surface erosion along footpaths and has shown a change in species composition to unpalatable species such as *Eragrostis plana* (Nees) and *Sporobolus africanus* (Poir.) due to overgrazing (Letty *et al.*, 2003). The grazing capacity should be downgraded to 2.7 ha/AU to account for this degradation (B Forbes, 2004, personal communication). This means that the current grazing situation is even worse than the secondary information suggests.

The Bioresource Programme supports a grazing season from October to February/March. In a communal system, such as the target community, animals stay on the veld for the whole year without supplementation. Many do survive, although production, health and reproduction rates could be severely compromised. The grazing capacity information supplied for the different Bioresource Units is thus not directly applicable as secondary information to Obonjaneni, and is more applicable to commercial farms, where veld management techniques are being implemented. Rural communal grazing strategies need to be studied to allow for adjustments, or improved management techniques, to be implemented. Furthermore, the grazing capacity data provided by the Bioresource Programme inventories need to be re-evaluated in terms of their applicability to communal systems.

3.3.3.3 Kikuyu as a possible supplement to veld grazing

Information from the Bioresource Programme shows that kikuyu (*Pennisetum clandestinum* Chiov) is a possible option for the community to consider for summer grazing or as a foggage (standing hay) for winter (Smith, 1997). This grass, when well managed, is most certainly one of the best soil conditioner and rehabilitator species available. Due to the ability of kikuyu to tolerate heavy grazing and trampling, extreme temperatures and high levels of soil acidity, it should be considered in areas where soil erosion is apparent, cover is poor and where indigenous grass species have no opportunity for recovery. The established kikuyu areas could then be grazed in the summer months to reduce grazing pressure on the natural rangeland. Kikuyu could even be utilized as a foggage during winter (Stewart, 2003).

3.3.4 Summary of information found in reports, literature and other sources relevant to the target area

The reports, literature and other sources of information provided valuable secondary information concerning the area in which Obonjaneni falls. The information obtained as secondary information could be summarised as follows:

a) the number of *bona fide* farmers is unknown and, according to Extension staff, most community members claim they are farmers;
b) the production potential of the area is high and provides an opportunity for food security to be addressed in Obonjaneni;
c) mixed farming enterprises are found, with agricultural activities involving maize, cattle, goats, sheep, poultry, vegetables, potatoes, dry beans and fruit trees;
d) livestock numbers obtained at the Nyosana dip tank in 1999 (last official count) show that there are approximately 1427 cattle, 528 goats and 383 sheep in the community, as well as poultry, pigs, horses and donkeys;
e) farmers cannot rely entirely on veld for livestock production;
f) the presence of farmers' associations show that the crop farmers in the community

function in some kind of a structure;

g) agricultural problems identified by Extension staff include theft of fences, uncontrolled livestock, lack of credit facilities and the incorrect use of land;

h) due to the uncontrolled movement of livestock, theft of fences and poor discipline in the community, no maize had been planted in the cropping fields for several years;

i) the community has the opportunity to tap into the tourism industry;

j) more and more people are moving into the area – with bigger demands on the available natural resources;

k) aerial photographs are available and could be used to study migration into the community, the development of infrastructure, the change in the number of homesteads and the change in natural resource status, over time;

l) information that is needed to be verified is the mean communal field size per land holder. In the Amazizi tribe, of which the Obonjaneni community is part, sizes are approximately 1 ha;

m) production from cropping fields could be severely restricted by excessive soil acidity and/or nutrient deficiencies and poor production practices;

n) Extension staff, due to many reasons and factors, appear to have neglected the farmers in the community and contribute to the poor status of agriculture;

o) households in the area do not have secure tenure and small-scale farmers appear to have little incentive to farm in communal areas;

p) Poverty and unemployment in the area are problems that need to be addressed.

The collection of secondary information showed the huge range of valuable information available for the identified target area. This information could be used very purposefully to plan further steps in the on-farm research approach, including meeting with leaders and farmers of the community and preparations for the diagnostic survey. The information for the specific target area was not easily obtainable and needed hard work. Dillon & Hardaker (1993) recognized the fact that to collect and assimilate all levels of information would be a large and difficult task. It was nevertheless important to review the relevant secondary information available, in order to make best use of what is already known and to see what gaps in knowledge remain to be filled by the collection of primary data. A diagnostic study, however, is needed to verify outdated information and to fill in where gaps occur in the information.

3.4 Conclusions

a) Valuable secondary information, emanating from various sources, was identified for use in the envisaged on-farm research and technology dissemination approach to be followed in Obonjaneni. However, the collection of the information provided to be a large and difficult task. Information was not available in the normal journals and articles found in libraries, and some reports were obtained by pure coincidence.

b) The Bioresource Programme is clearly an invaluable tool in a study of this nature. In the case of the Obonjaneni community, information gleaned from this Programme indicated that there is considerable potential for improved crop and vegetable production. Information showed that livestock in the community is destructive and prevents any crop production activities in the communal cropping fields. The number of livestock in 1999 suggests that animals in the community are a major resource factor and have a valuable role to play in the economy and agricultural activities of households. The current veld data, in terms of veld condition score and grazing capacity, as given by the Bioresource Programme, are applicable to areas where controlled grazing management occurs and thus cannot be used directly as secondary information for the Obonjaneni community. They do, however, give an indication of the grazing capacity of the area. The parameters provided in the Bioresource Programme need to be adapted, to take into account the complexities and alternate interventions suited to the communal grazing system.

c) Other secondary information sources revealed many negative factors that restrain the progress and prosperity of small-scale farmers and agriculture and which could contribute to a poor interest in agriculture in the area. The information however needs to be verified in a diagnostic study to enable a relevant intervention programme to be developed.

d) Agriculture is a potentially important activity to address poverty, hunger and unemployment in rural communal areas. With more and more people moving into the community, it is extremely important that the ecotopes of arable land and high potential soil types be identified and mapped. These high potential agricultural areas need to be retained as primary food-producing areas and should not be used for housing or the establishment of any other infrastructure. This important aspect is valid in many other communities throughout the province.

3.5 Recommendations

a) In all on-farm client-orientated research programmes it is of paramount importance that the research staff make a special effort to collect, study and summarise all available secondary information for an identified target area before primary data collection commences. The information could be useful in preparing a diagnostic study as the first step in the on-farm research and technology dissemination approach.

b) The Bioresource Programme information should be used in on-farm research, advice and land-planning activities. However, the following important additional information of the target area is needed (*e.g.* if one cannot gather a soil survey):

   i. a soil survey to map ecotope boundaries, including aspects of rockiness, wetness and drainage at the local level;
   ii. soil analysis to determine soil fertility status and thus fertilizer and lime requirements;
   iii. slope mapping to determine arable land and erosion risk;
   iv. a veld assessment to determine the current condition of the veld and to compare this to the BRG benchmark to determine grazing capacity – this is crucial, especially for communally managed, degraded veld conditions;
   v. a land degradation assessment to ascertain the extent of erosion (by direct measurement or by visual observation), and the modification of the cropping and grazing potential, if necessary.

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CHAPTER 4

THE DIAGNOSTIC PHASE OF A STUDY OF SMALL-SCALE FARMING SYSTEMS AND AGRICULTURAL CONSTRAINTS IN OBONJANENI

4.1 Introduction

To cater for the needs of the many small-scale farmers in KwaZulu-Natal, the Farming Systems Research Section (FSRS) of the former KwaZulu-Natal Department of Agriculture (now the KwaZulu-Natal Department of Agriculture and Environmental Affairs) was mandated in the mid-1990s to conduct on-farm, client-orientated research in rural communal areas. In the KwaZulu-Natal province, approximately 39% of the population lives in rural households, depending wholly or partly on agriculture (Anon., 1995).

Until the mid-1980s, agricultural research and extension had not had the expected beneficial impact on the millions of small-scale farmers in Africa (Spencer, 1986). In recent times it has been said that agriculture has failed to feed the people of eastern and southern Africa adequately and that most countries in the region have become net importers of food (FAO, cited by Torkelsson & Anandajayasekeram, 2002). Food insecurity affected mostly the small and subsistence farmers and other rural people in developing areas (Von Braun *et al.*, cited by Kirsten *et al.*, 1996). A nutritional assessment of children between birth and 60 months in two districts of the former KwaZulu revealed that 35% of households had stunted children (shorter than what is normal for their age) (Kirsten *et al.*, 1998). The prevalence of underweight children was lower (10% of households), but they were from the same households as the stunted children. Both these indicators are determinants of the nutritional status of the children and a link to the agricultural production by the household and even of the area. The low energy and macronutrient intake for non-urban African children in South Africa between two and six years old, as was found in a national food consumption survey, was most probably the result of a low fat intake, partially explaining the high prevalence of stunting in this group (Vorster *et al.*, 1995). Cash flow and production of crops and livestock were the most important variables classifying rural households as either nutritionally adequate or nutritionally deficient (Kirsten *et al.*, cited by Van Rooyen & Njobe-Mbuli, 1998). An important and noteworthy finding was that households with access to seeds and fertilizer, and strong family involvement in agriculture, seemed less likely to have stunted children and were therefore considered to be better nourished (Kirsten *et al.*, 1998).

Subsistence agriculture in KwaZulu-Natal has been characterized by overpopulation, land degradation, low agricultural productivity, underdevelopment, unemployment, a high rate of illiteracy and poverty (Makhanya, 1998), with people who seek employment in towns and cities creating strong urban linkages and dependencies for the majority of households. In South Africa, the poverty share (percentage of poor individuals defined as the poorest 40% of households in terms of consumption expenditure) was 71.6% in rural areas (May & Vaughan, 1999).

People in rural areas for many years relied on agriculture to survive and to try to build a future for themselves. Reasons for the lack of progress in agriculture in the developing world were generally ascribed to factors such as lack of information due to poor communications and poor extension, poor support services, lack of resources (land, production inputs and credit), lack of infrastructure (roads, dams and telecommunications) and a lack of marketing facilities (Harwood, 1982 and Rukuni & Anandajayasekeram, 2001). In the South African context, the rural communal areas have high human population densities, up to and exceeding 300/km^2, settlements are often large and sprawling, infrastructure is frequently non-existent, arable land is scarce and one is often struck by environmental impoverishment rather than greenness (Shackleton *et al.*, 1999). A study during the late 1980s in the Upper Tugela area, in which the community of Obonjaneni falls, found that agricultural production was inadequate in relation to most households' subsistence requirements, as 18.8% of the households had no arable fields, and even those with arable land had a mean holding size of 1.4 ha (Muller *et al.*, 1987). This hardly provides a sound base for economic existence (Van Rooyen & Njobe-Mbuli, 1998). The situation in most of the developing countries is that the majority of farmers are small-holders, with land holdings of 2 to 3 ha or less (Anon., 1997). A further "problem" area for farmers and potential farmers in rural areas is land tenure. In KwaZulu-Natal the right to use land is given by the Inkosi (Chief) and his councillors, which could be another limiting factor, according to Thomson & Lyne (1995), to the prosperity of rural communal areas, in that emerging farmers have little incentive to farm because they do not have secure land tenure.

Small-scale farmers, with the constraints they live under, need relevant and applicable technology. There is a lack of relevant information on what crops, livestock, agro-forestry and alternative energy sources to recommend on areas as small as 2 ha as found in these areas and on how these agricultural components should be integrated. It is felt that much of the technology developed on research stations has limited appropriateness for many small-scale farmers' priorities or constraints and fails to serve their needs well, whether it is in South Africa or in other developing countries (Kirkby *et al.*, 1981; Collinson, 1982; Low, 1995 and Eponou, 1996). The lack of both relevance and impact of research findings is partly due to the poor linkages between research and its clients, the farmer and the extension staff (Ewell, 1988 and Eponou, 1996). Schiere (1996) positioned on-farm research as an intermediary and linking phase between on-station trials and extension. Linkage implies that farmers must be more directly involved in the description of the farming system, the identification of the problems experienced, the formulation of strategies to solve such problems and in technology dissemination (Ashby *et al.*, 1995; Singini & Van Rooyen, 1995 and Mafuru & Heemskerk, 1997). In addition, it has been emphasized that on-farm research complements, depends on, and contributes to the relevance of on-station research (Collinson, 1987 and Schiere *et al.*, 2000).

An improved linkage between the role-players in rural agriculture should result in a demand-driven service, which should include a research programme that is more relevant to farmers. The decision on the type of research, which should be done, is a critical step in a systems-orientated research programme (generally referred to as farming systems research or FSR) (Hawkins, 1994). The result will be appropriate extension messages (Low, 1995), tailored towards the small-scale farmers' diverse circumstances, such as household objectives, managerial capacity and resource endowments. The research programme should be based on a diagnostic study which aims to describe and understand the farmers' production systems, the circumstances under which the farmers manage their farming operations, the activities they pursue, the resource base they use, the overall environment in which they operate and the identification of key farmer problems and ideas on how to solve these problems (Okigbo, 1986; Collinson, 1987 and Matata *et al.*, 2001). This process of studying the farming system and involving all the role-players could be brought about by using many different techniques, some of which are discussed below.

The opportunities for researchers to learn from farmers include meetings, field days, on-farm trials (Ewell, 1988 and Biggs, 1989) and specific diagnostic and information-gathering tools, which include exploratory surveys (Byerlee *et al.*, 1980 and Collinson, 1982), informal agricultural surveys (Rhoades, 1982), reconnaissance surveys (Shaner *et al.*, 1982) and rapid rural appraisals (Chambers, 1980 and Schiere, 1996). Studies based on surveys are used to provide a better understanding of farmers' goals, as well as the motivations that may affect their efforts to improve the farming system (Norman *et al.,* 1994). These studies allow an understanding of family priorities, the farmers' decision-making processes, the resource allocations and the management strategies employed in the face of local uncertainties and a limited resource endowment (Collinson, 1987). Formal surveys provide a systematic, ordered way of obtaining information from respondents and enable precise and statistically analysable data to be obtained (Norman *et al.*, 1994). Concerning the use of interviews, Murphy *et al.* (1998) said, "if you want to understand what people do, believe and think, ask them". Structured and in-depth interviews in the former Venda "homeland" in South Africa helped D'Haese *et al.* (1998) to develop social profiles, to establish the economic position of households, to identify constraints and problems and to establish crop budgets.

The collection of information enables experimentation to be focused on those aspects for which solutions offer most impact on the productivity of a system (Collinson, 1987). Without a proper understanding of the situation prevailing at the time, it is unlikely that the solutions that are developed to help farmers overcome their constraints will be attractive and/or relevant to them (Norman *et al.,* 1994). The term 'constraint' in the agricultural development literature is generally applied to any condition that limits agricultural production (Erbaugh *et al.*, 1999). Most commonly, constraints are identified as physical, biological or socio-economic factors (Shaner *et al.*, 1982). Research opportunities or direction will be determined by the problems contributing most to the gap between present and potential production (De Datta *et al.*, cited by Collinson, 1987). The planning of on-farm research needs to include the identification of possible solutions to well-defined production problems, the causes of which have been properly identified (Tripp & Wooley, 1989; Schiere, 1996 and Matata *et al.*, 2001). For on-farm research teams, which would include the farmer and extension staff, to identify potential solutions to constraints, a good knowledge of the technical possibilities, as well as a clear understanding of the nature of the production problem will be required (Schiere, 1996). Possible solutions may be obtained from farmers, from the literature, or from unpublished or published results of research centres and even from new, incisive thinking. With the identification of a tentative solution, the work proceeds to on-farm testing (Schiere, 1996). If no solution is found, however, the problem is referred back to the research station, with or without farmers' participation, depending on the problem and local conditions. Another opinion is that a survey leads to an awareness that some aspects are so complicated (*e.g.* integration of crops with livestock via compost/manure) that the complexity compels one to go to on-station research for answers for components to be later tested "on-farm". Farming systems research, therefore, is complementary to commodity and disciplinary research and does not replace it.

The possibility of a biased selection of farmers is a major problem when work proceeds to on-farm and is identified as a very weak area in many on-farm research programmes and across all modes of farmer participation (Biggs, 1989 and Merrill-Sands *et al.*, 1990). Farmers have often being selected on an *ad hoc* basis, which biases samples towards wealthy, politically active, male farmers and more influential, resource-rich or "progressive" farmers (Biggs, 1989 and Merrill-Sands *et al.*, 1990). Another challenge facing researchers is the identification of smallholders who are "farmers" and for whom farming is of significant interest (Stillwell *et al.*, 1988), as opposed to those who simply eke out an existence on the land available to them. In South Africa, in the former Ciskei, it was found that most landholders are only passively interested in agriculture. Stillwell *et al.* (1988) have therefore argued that research should be concentrated on "committed" farmers with a definite interest in agriculture. This may involve only 15 to 20% of rural households (Eckert *et al.*, 1988). The present author believes that it is, however, quite likely that those eking out an existence do so because they believe that agriculture cannot provide them adequately with food. The challenge therefore is to involve them and to convince them that they are wrong. The only way forward to achieve rural progress in South Africa is to involve the approximately 80% households who are not active in agriculture. For people who, as an only resource have some land or access to land, improving their agriculture must be a first step in their upliftment. Agriculture remains a major economic activity in the southern Africa region and will have to be supported if it is to contribute to poverty abatement and food security (Van Rooyen & Sigwele, 1998). These authors felt that, in doing so, agricultural development should be the focal point for rural development in areas where the resource base favours agricultural activity, and/or where large numbers of people depend on farming activities for household income and food.

In spite of the many factors inhibiting progress and prosperity, Mukhala (1999) commented that most rural small-scale farmers in African countries wish to improve their standard of living. If so, an on-farm research programme with new technologies, knowledge and improved management techniques should have positive outcomes in less-developed areas. To address and ameliorate the living standards through improved agricultural production, the challenge posed to agricultural researchers, extension workers and developers is to develop improved technology that would be adopted by rural communal small-scale farmers. It has been emphasized that unless the technology package is relevant and suits the conditions of such farmers, the vast majority of the farming community will not adopt it and it will be ineffective (Anon., 1997). The challenge is therefore to develop new, or adapt existing, technology options that will be used by farmers to increase their productivity and incomes (Norman *et al.*, 1994). These need to be sustainable. The selection of collaborative farmers needs to take place with the research objectives in mind (Biggs, 1989 and Ashby, 1990), especially if inputs from farmers are to be used for research priority-setting and planning (Merrill-Sands *et al.*, 1989). Farmers who are truly interested in participating in collaborative research can be separated from those who wish only to be part of a development activity (Harrison, 1995). Important criteria for choosing farmers are similar enterprise patterns, production patterns and resource bases, and those who could be a particular recommendation domain or target group (Norman *et al.*, 1994 and Matata *et al.*, 2001).

The present chapter describes the diagnostic study, conducted in the community of Obonjaneni. It had the following objectives:

a) to study and develop a basic understanding of the farming systems practised, and
b) to identify agricultural, economical and sociological constraints experienced by the farmers.

Subsequent to the diagnostic survey, an on-farm, client-orientated technology research and dissemination programme, based on the identified constraints, would be launched.

4.2 Methodology used in the diagnostic survey

The main events that took place during the diagnostic stage are summarized in Table 4.1.

4.2.1 Identification of respondents

At the third community meeting, held in February 1998 to discuss the methodology of on-farm research, all those (n = 20) present volunteered to be interviewed. Not one of those present had completed a questionnaire before. It was agreed at the meeting that the FSRS staff, Extension staff and the farmer co-workers would be referred to in future as the FSR team. At the meeting it was felt by the researchers (the FSRS staff) and Extension staff that the information to be obtained from the 20 people should give an overview of the prevailing farming systems and the constraints experienced by people in the community. Although the sample was small, it was felt by the present author that the 20 people who volunteered to participate in the diagnostic study were the ones who showed interest in the process that was communicated to them and to which the larger community was invited. On its results the on-farm research and technology dissemination was to be based (Chapter 5). A name list was compiled, interview dates were discussed and appointments made.

Table 4.1 Main events that took place in Obonjaneni during the diagnostic stage

Date of event	Event	Purpose of events
February 1998	Community meeting	To identify the respondents for interviews
March 1998	Interviews	To conduct the diagnostic survey
April 1998	Community meeting	To present and discuss information gained from diagnostic survey
May 1998	Meeting between Extension and FSRS staff	To discuss findings of survey and future programme
17 June 1998	Meeting with the tribal authority	To discuss findings of survey and the control of livestock movement
August 1998	Meeting with the tribal authority	To give feedback of diagnostic survey to the tribal authority
September 1998	Community meeting	To discuss solutions or alternatives and the on-farm research programme with farmers
Early 2000	Interviews with community garden members	To conduct a diagnostic survey in the Phuthumani Community Garden

The non-random sample used in this study has two negative implications (Van Vuuren & Maree, 1999). Firstly, statistical theories of probability do not apply to non-random samples, making it impossible to know the degree of accuracy to which properties of the sample can be used to describe properties of the population. Secondly, since the researcher plays a role in the sample selection, bias can easily be introduced. However, this non-random sampling of respondents does provide researchers with a feeling about the population, which is, at times, sufficient justification for using the method (Shaner *et al.*, 1982).

4.2.2 Structured questionnaire survey

Staff of the FSRS developed a formal (or 'structured') questionnaire survey to be used in diagnostic studies (Appendix A). The questionnaire consisted of the following sections: (i) general information about the farmer, (ii) a listing of farming enterprises practised by the household and (iii) sections on specific information on farming enterprises: cattle - beef, cattle – dairy, sheep, goats, chickens, pigs, vegetables and fruit, crop production, and medicinal and craft plants.

The questionnaire was drafted by staff members of the FSRS, with the following people also contributing to its development: Prof J van der Ploeg (Wageningen University, The Netherlands), Prof P Lubout (University of Zululand), Regional Directors of the Department of Agriculture, Research and Extension staff from the Department, and eight small-scale farmers from the Memela and Nxamalala Wards in KwaZulu-Natal.

4.2.3 Interview process

Interviews took place over two days during March 1998, five months after the initial introduction of the FSRS to the community. During the two days, 17 of the 20 people (nine women and eight men) were individually interviewed at their homesteads. Extension staff or the co-worker farmers who assisted in finding the homesteads were not able to locate the remaining three people who, therefore, were not interviewed.

Staff of the FSRS, the Head of the District, the Head of Extension and the Agricultural Development Technician of the sub-ward attended the first interview. This was held with the Chairman of the Amazizi Maize Association and was used as a training session to clarify possibly unclear aspects of the questionnaire for the teams involved. After the first interview, the group formed three teams, which were made up of FSRS staff (each team led by either one of the two Animal Scientists or by an FSR Crop Scientist) and an Extension staff member, to conduct the interviews (see Plate 4.1). In addition to conducting the interviews during the visits to the homesteads, observations were made to establish the infrastructure of the community. The scientist led the interview by asking the questions in English and the Extension staff translated the question into Zulu. The answer or response was translated back into English and written on the questionnaire survey form by the scientist. An interview took on average 90 minutes, with the range being from 60 to 125 minutes.

4.2.4 Analysis of survey results

The survey data were captured on Quattro Pro and MS Excel spreadsheet programmes. The data were subjected to descriptive analyses of simple percentages and proportions. Due to the small number of respondents and the non-random nature of the sample, the information was not subjected to any statistical analysis, although mean, median and standard deviation calculations were done on some of the data. The information obtained from the male and female respondents was analysed separately, to establish any gender differences.

4.2.5 Involvement in the Phuthumani Community Garden

At the time of the diagnostic study, despondent garden members invited FSRS and Extension staff to the garden to assist in solving constraints such as poor growth of crops, poor yields, pests and diseases and the poor quality of seedlings which they purchased (see Plate 4.2). Problems and possible solutions were discussed at a follow-up meeting between FSRS staff, Extension staff and garden members.

A follow-up to the lime demonstration was an informal survey conducted during February 2000 among the members of the community garden (Mpanza, 2000). The 17 respondents interviewed during the diagnostic survey (mentioned under 4.2.3) did not include any members of the community garden. The objectives of this study were to describe and understand the way in which the members of this community garden operate, to identify production problems and constraints or missed opportunities and to address them through research and demonstration programmes. Six of the 10 members were interviewed.

4.3 Results

The farming systems, agricultural constraints and the visions of the people, obtained from the diagnostic study, are summarised in Figure 1.

The survey showed that the rural households could be described as complex and dynamic systems. They were based on a wide range of activities and strategies attempting to address household income, food security, education for children, social networking and community activities, and relationships with kin, friends and neighbours.

Of the 17 respondents interviewed, 10 (59%) were involved with both crops and livestock, six (35%) were planting crops alone and one (6%) had livestock only. Most of the agricultural products were retained to satisfy household food requirements, with a very small proportion of products being marketed in the community.

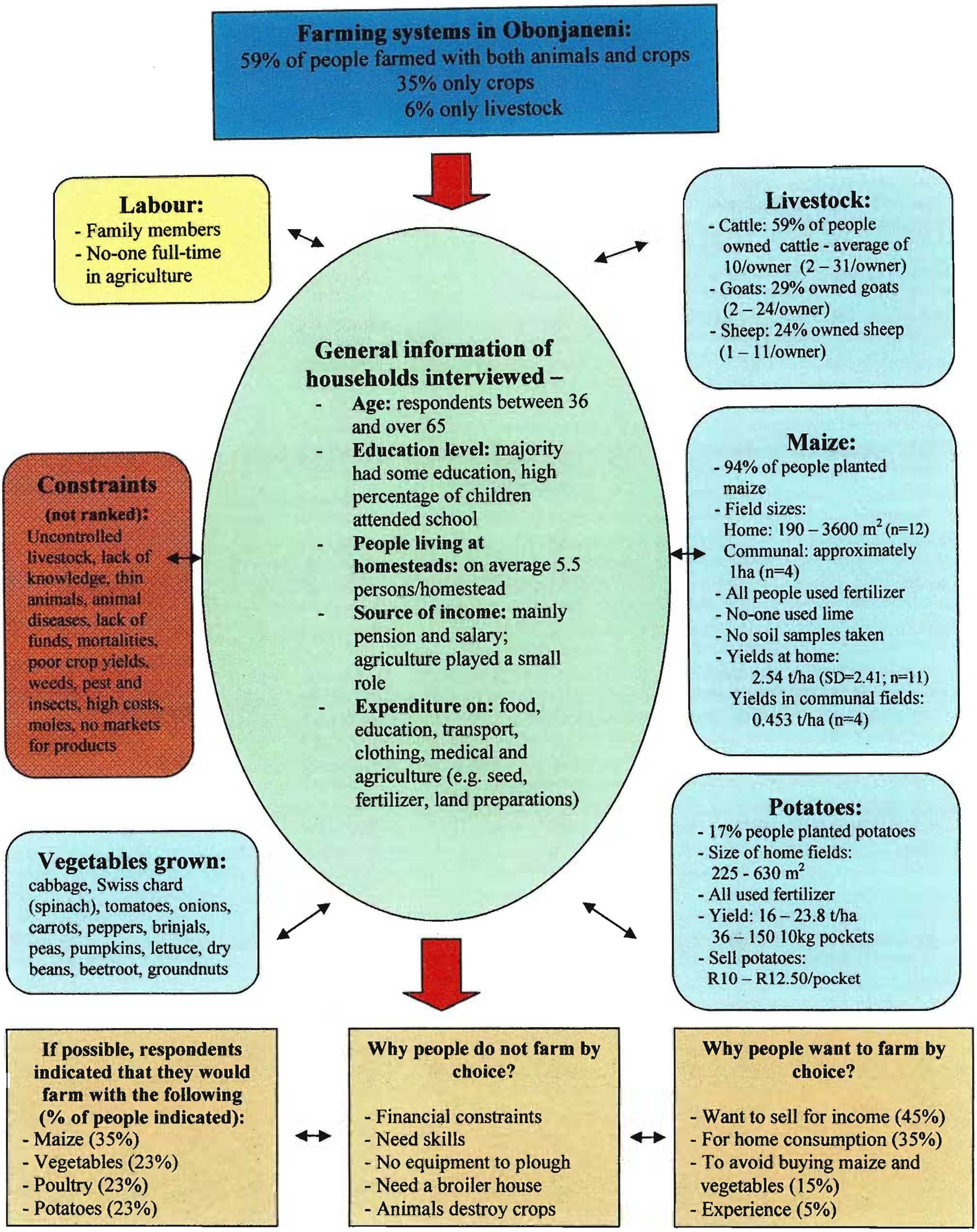

Figure 4.1 Summary of the main findings of the diagnostic survey conducted in Obonjaneni in 1998

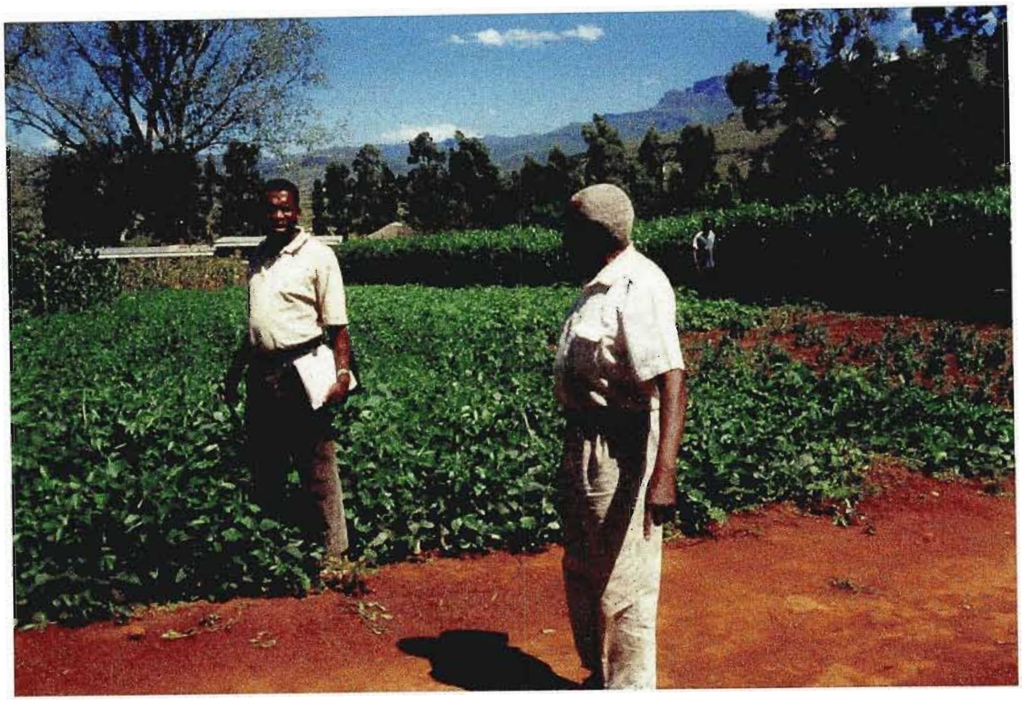

Plate 4.1 A farmer working in his homestead fields (garden) being interviewed by the Head of the Bergville District (left)

Plate 4.2 This community garden was found to be in a bad state, with members ready to abandon the garden. Soil fertility, high soil acidity levels and a lack of knowledge were negatively affecting the production of vegetables in this garden

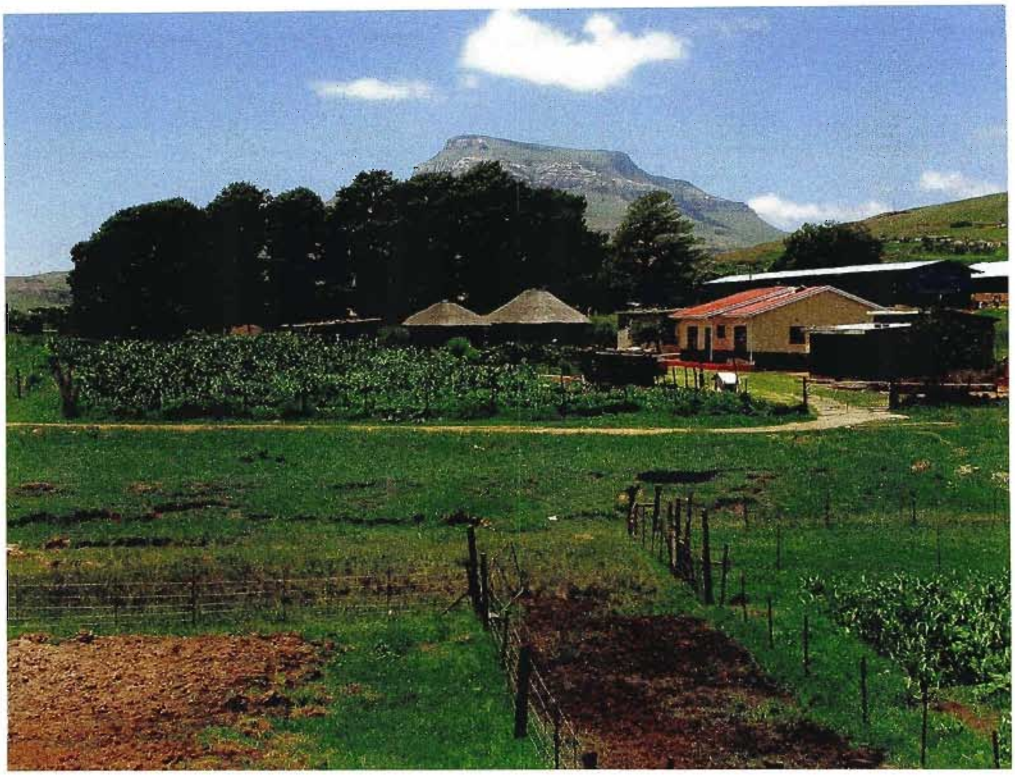

Plate 4.3 A homestead (buildings or cluster of buildings on one plot, where a family resides) in Obonjaneni

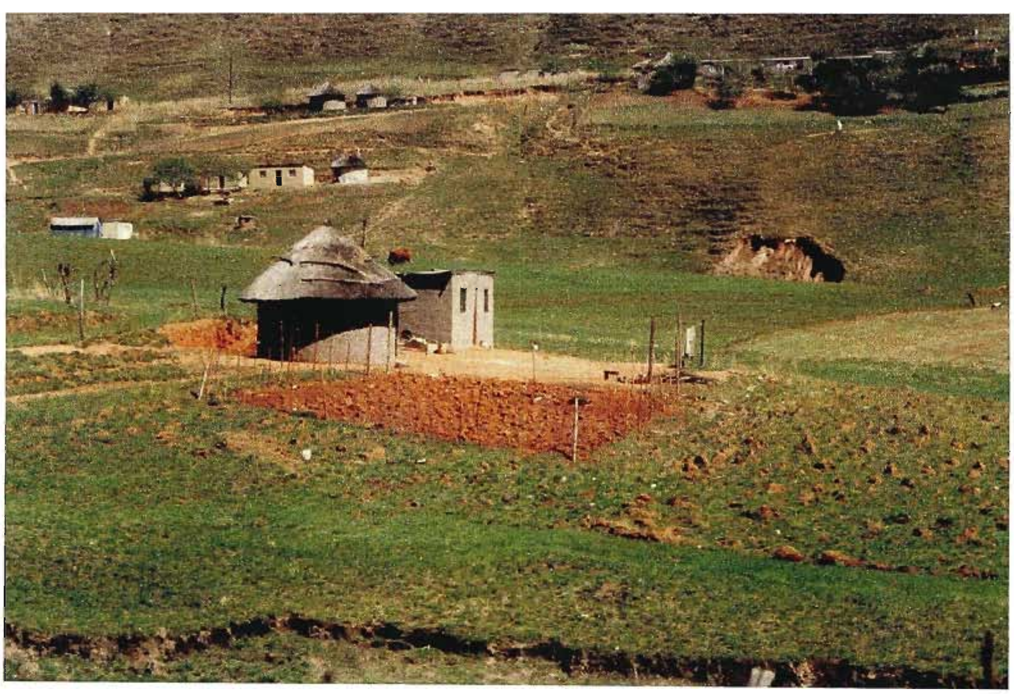

Plate 4.4 In general, agriculture plays a limited role in household incomes

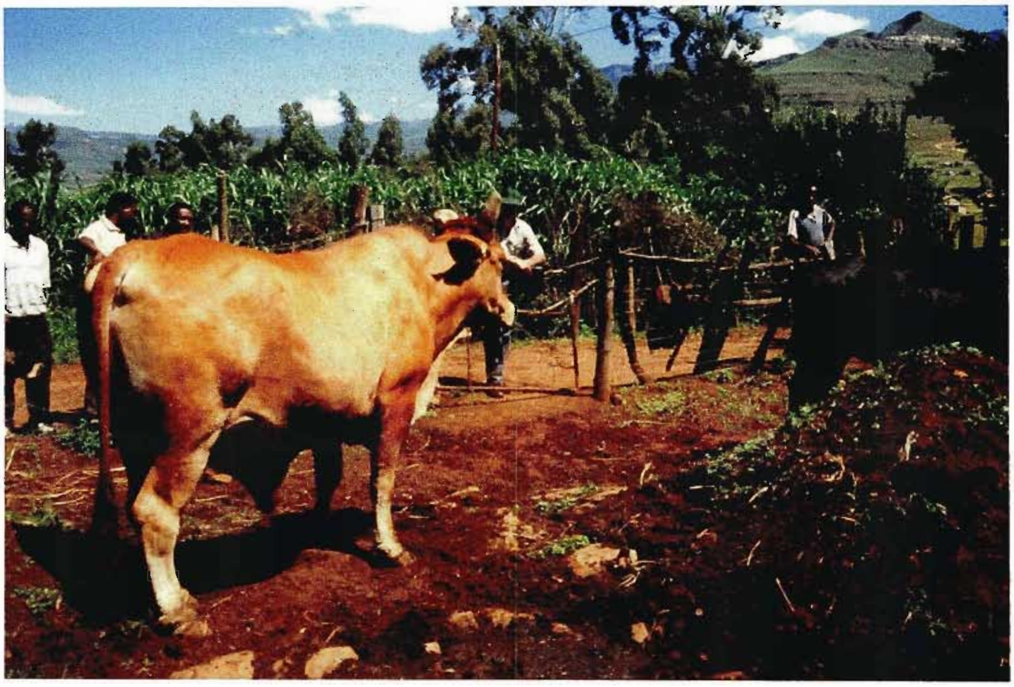

Plate 4.5 The main farming system practised is a combination of cropping and keeping livestock, mainly cattle

Plate 4.6 FSRS staff discussing problems with a small-scale farmer who is experiencing problems growing cabbage in her homestead garden

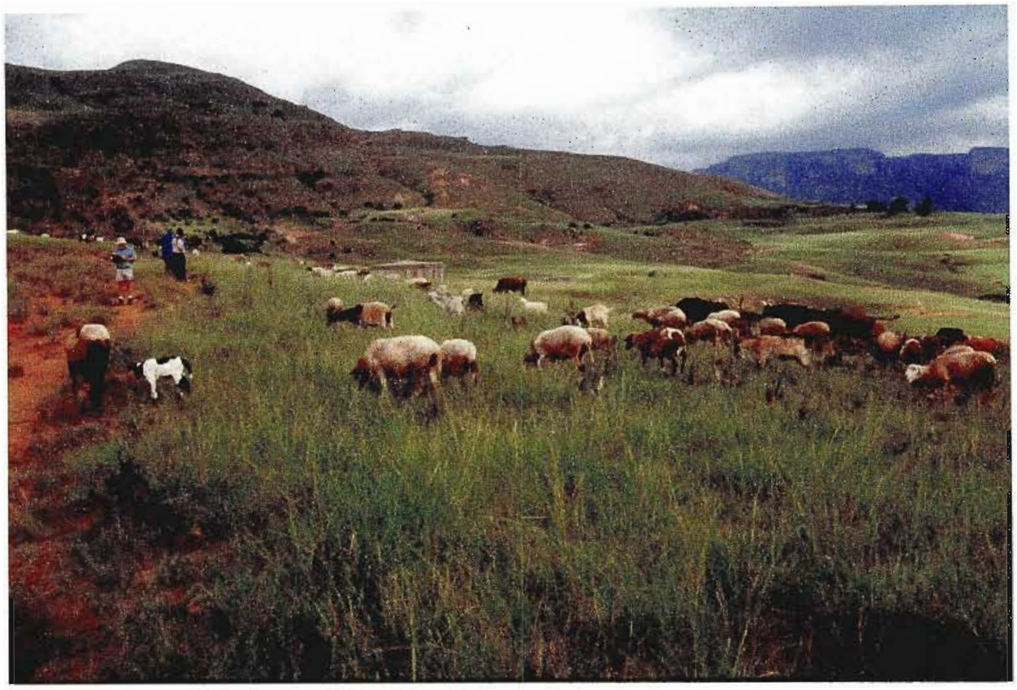

Plate 4.7 Livestock grazing communal veld during summer

Plate 4.8 Land preparation takes place from September to November and is done mainly by contractors

Plate 4.9 Theft of fences is an important cause of uncontrolled movement of livestock and a reason for communal cropping fields being left unplanted

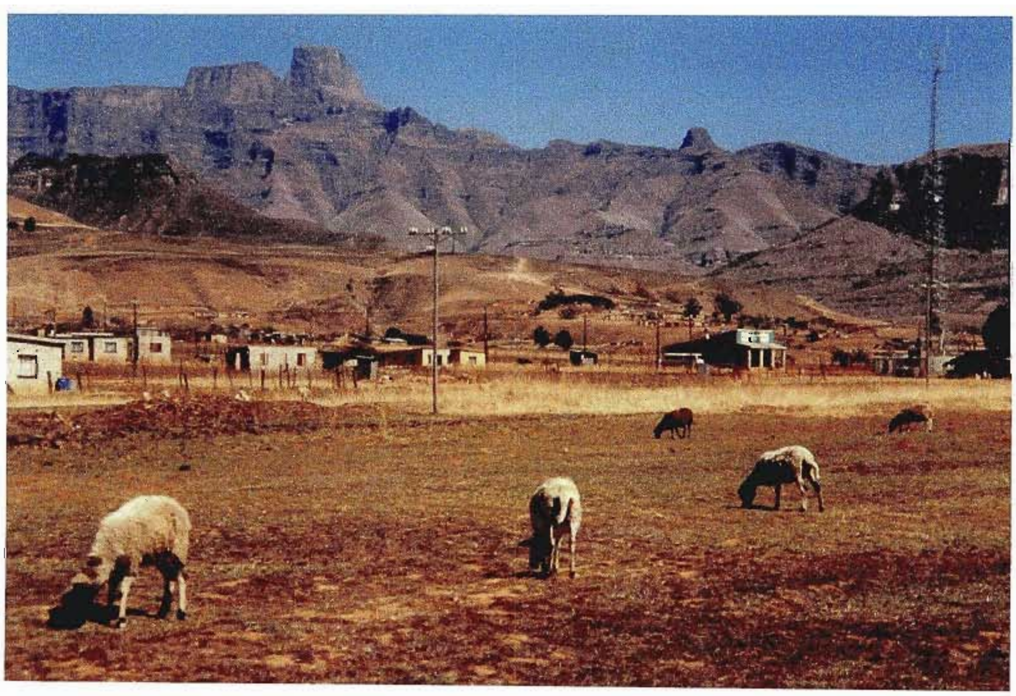

Plate 4.10 At the time of the interviews, communal fields had not been cropped for five to seven years due to stray animals

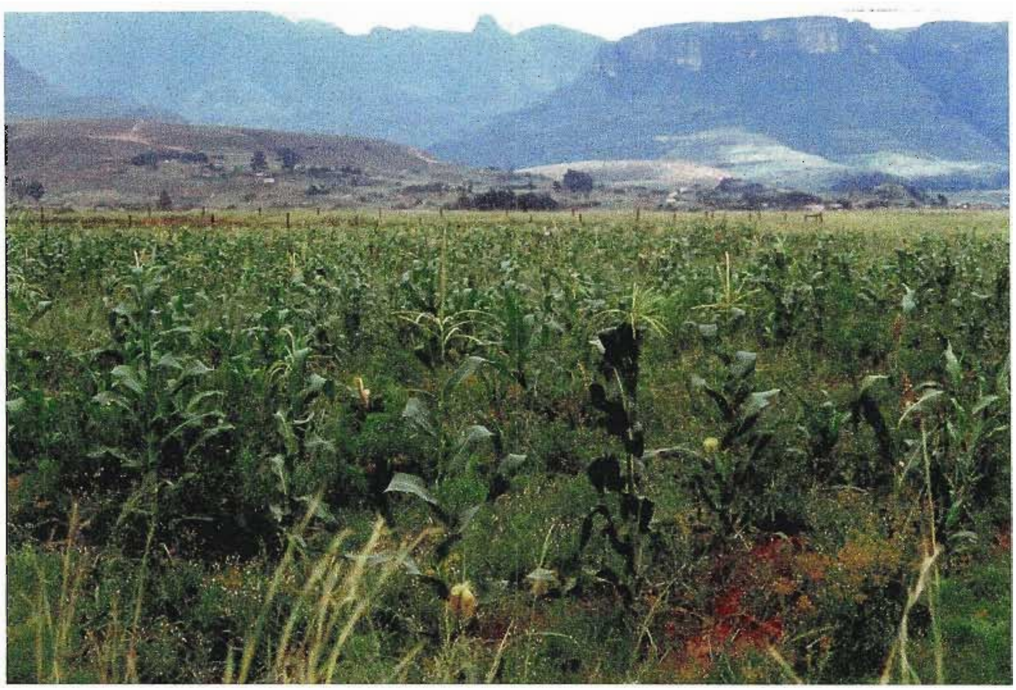

Plate 4.11 A common trend was the late planting of maize and inadequate weeding, resulting in poor yields of the staple food in the community

Plate 4.12 Soil tests indicated that crop yields are often restricted by excessive soil acidity and/or nutrient deficiencies

4.3.1 Household demographics

4.3.1.1 Age

The age distribution of the respondents is summarised in Table 4.2. The mean age of respondents interviewed was 58 (SD 12.7) years. The women interviewed tended to be younger than the men. The people interviewed tended towards being the older members of the community. On numerous occasions the people from the community commented that the youth needed to be brought back into agriculture.

Table 4.2 Age distribution of men and women interviewed in Obonjaneni

	Frequency				Total
	36 – 45	46 – 55	56 – 64	> 65	
Men	-	2	1	5	8
Women	3	2	3	1	9
Total	3	4	4	6	17

4.3.1.2 Educational level

The literacy level was relatively low, with 18% of the respondents interviewed having no education, 47% having an education less than grade 7 and 35% having passed grade 7 (Table 4.3). The majority of the respondents only had a primary school education. In the South African education system, secondary school ends at grade 12, while primary schooling covers grades 1 to 7. From the information summarised in Table 4.5, it was encouraging to see that 16 of the 17 respondents indicated that money is spent on education.

Table 4.3 The educational level of respondents interviewed in Obonjaneni

	Frequency		
	No schooling	Grade 1 – 7	Grade 8 – 12
Men	2	3	3
Women	1	5	3

4.3.1.3 Language

All the respondents interviewed spoke Zulu, but only 65% of them were capable of reading it. English was spoken by 35% and 24% could read it. A small percentage of respondents could speak Afrikaans and Sotho and an even smaller percentage could read these languages.

4.3.1.4 Respondents living at the homesteads

The term "homestead" in this study was used for the buildings or cluster of buildings (units) on one plot, where a family resides (see Plate 4.3). The total number of people living at a homestead varied from 1 to 11. The average number of people per homestead was 5.5. On average, four children were found per homestead visited. Of the 17 respondents interviewed, 16 indicated that they were, or had been, married. Five were widows and one was a widower. Respondents indicated that 93% of children living in the households assisted in the agricultural activities of the family.

4.3.1.5 Household income

Not one of the respondents was permanently involved in agriculture. Agriculture played a limited role in household income (see Plate 4.4), with a once-off income through selling potatoes, maize or cattle indicated by five respondents, or 29% of the 17 interviewed (Table 4.4).

Table 4.4 Source of income, as indicated by 17 respondents interviewed at Obonjaneni

Source of income	No of households	Pension	Monthly salaries	Annual income from agriculture	Home industry[1] (annual income)	Boarders
Salary – only	4		Ns,R1600,R3500,R1500			
Pension – only	2	R940 R940				
Pension & Agriculture	2	R940 R940		R700 – potatoes R160 – maize		
Salary & Home Industry	2		R570 Ns		R1000 Ns	
Agriculture & Savings	2			R450 – potatoes R1500 – potatoes		
Pension & Salaries	1	R450	R150			
Pension & Boarder	1	R940				Ns
Salary & Boarder	1		R2400 (from daughters)			R100
Agriculture & Home Industry	1			R1200 – cattle	R450	
Home Industry & Boarders	1				Ns	R400

Ns = respondent interviewed not sure of the amount
[1] Home industry = school uniforms and crafts for local craft centre

From the information summarised in Table 4.4, it was clear that annual income from agriculture played a small role in household income. Even though agriculture accounted for a low contribution towards household income, it was clear that nearly all the households were involved in some kind of agricultural activity. The minority of households was able to produce an agricultural surplus and engage in marketing activities. Household income was derived mostly from non-farm sources such as pensions and monthly salaries from family members employed outside the community. Six (or 35%) of the respondents interviewed received an old-age pension, which is an important source of income for black people in rural areas (Christiansen, 1996).

4.3.1.6 Expenditure in households

The information summarised in Table 4.5 gives an idea of the money spent monthly and annually in the households. The expenditures on agricultural items, and in particular for planting maize, are summarised in Table 4.7.

Table 4.5 The minimum, maximum and mean monthly and annual expenditures in the households interviewed

Item	n	Minimum	Maximum	Median
Monthly:				
Food	13	R200	R1 500	R400
Education	4	R120	R450	R232
Transport	13	R10	R1 800	R100
Annual:				
Education	12	R15	R14 000	R142
Clothing	6	R150	R2 000	R850
Medical	5	R50	R600	R80

The median monthly expenditure in 13 households on food was R400, with a minimum of R200 and a maximum of R1 500. Two of the households paid for children's post-school studies at tertiary institutions (R10 800 and R14 000/annum). Money spent on clothing included school clothes for children. Education was an item on which nearly all the households spent money.

More than 75% of the respondents purchased their fresh produce, maize meal and other foodstuffs, not produced by them, from Bergville, approximately 40 km from the community. The remaining 25% of respondents purchased goods from the local store. The transport used by the community was mainly taxis, while five respondents (27%) indicated that they used their own transport.

4.3.2 Other organisations active in the community

Two NGOs (LIMA and Aquamanzi) were working in the community at the time of the diagnostic study.

4.3.3 Agriculture

4.3.3.1 Farming systems in Obonjaneni

The main farming system practised in the community was found to be a combination of cropping and the keeping of livestock (see Plate 4.5). Maize was the main crop produced in Obonjaneni (Figure 4.2), with 16 (94%) of the respondents interviewed planting it. Potatoes were planted by 6 (35%) of the respondents interviewed.

In 25% of home gardens cabbage, Swiss chard (locally called spinach) and tomatoes were grown, while onions and carrots were planted in 19% of gardens (see Plate 4.6). It was disturbing to find that fewer than half of the respondents indicated that they grow vegetables in homestead gardens.

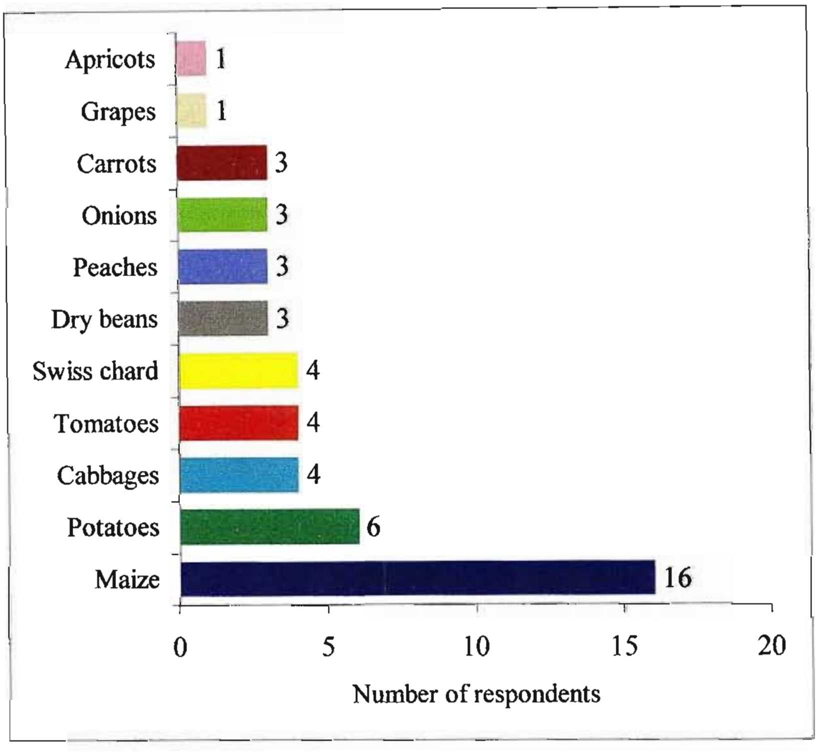

Figure 4.2 The number of respondent growing different crops

Although people were growing different crops in their homestead fields, they indicated, when asked with what they would like to farm if given a choice, six respondents (35%) mentioned maize, four (23%) said vegetables, poultry or potatoes, and three (18%) said dry beans. The response to the question shows that the respondents did not consider household production in homestead fields as farming. In terms of crop production they saw farming as an extensive production on fields 1 to 2 ha in area. The reasons why they did not farm with their choice were:

a) financial restrictions (4 respondents);
b) lack of skills (3 respondents);
c) lack of implements with which to plough (1 respondent);
d) facility needed for broilers (1 respondent);
e) animals destroy crops in the communal fields (1 respondent).

When asked why they wanted to farm with the enterprise of their choice, the following responses were given:

a) want to sell and generate income (9 or 53% of the respondents);
b) for home consumption (7 or 41% of the respondents);
c) has the required experience from working on a commercial farm (one respondent).

4.3.3.2 Land tenure

All the people living in Obonjaneni are part of the traditional communal land tenure system. The majority of respondents worked in their homestead gardens only, and not in the communal cropping fields.

4.3.3.3 Labour for agricultural activities

The participation of the spouse in agricultural activities was as follows:

a) 88% of males indicated that their spouses participated, and
b) 22% of the women indicated that their spouses participated.

Not one respondent was permanently involved in agriculture (*i.e.* a full-time farmer).

4.3.4 Livestock

The number of households owning livestock, and the types of livestock owned, are illustrated in Figure 4.3.

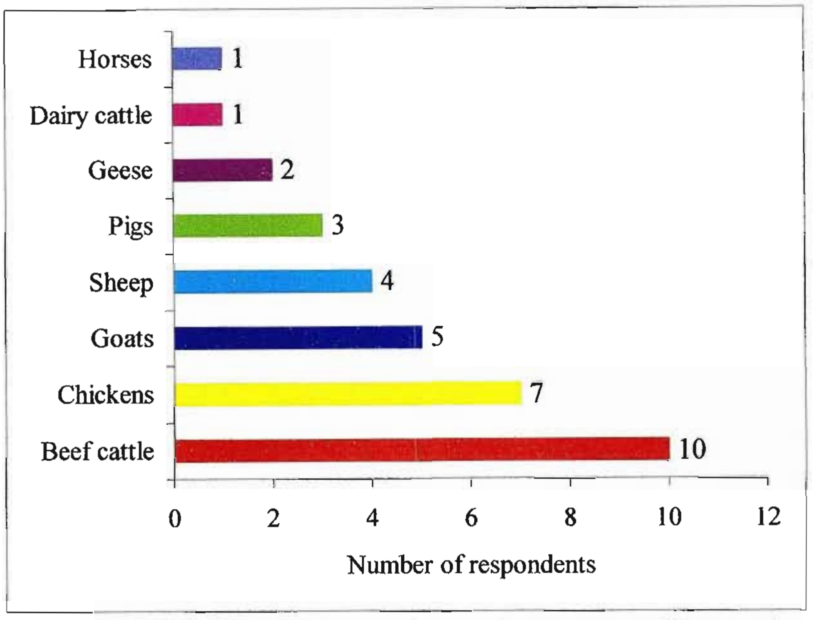

Figure 4.3 The number of respondents owning various types of livestock

Turkeys were observed at some of the homesteads, but respondents did not mention them during the interviews.

4.3.4.1 Cattle

a) Cattle numbers

Ten, or 59% (5 male and 5 female respondents) of the 17 respondents interviewed indicated that they owned cattle. The owners collectively had 99 head of cattle, all run under a communal grazing system. The cattle numbers varied from 2 to 31 per owner, with a median of 8 cattle/owner. The number, age and sex of cattle owned by the respondents are summarised in Table 4.6.

Table 4.6 The numbers, ages and sexes of cattle owned by 10 respondents

Animal type	N (owners)	Minimum animals/owner	Maximum animals/owner	Median
Total number	10	2	31	8
Cows	9	1	8	4
Calves	3	1	4	3
Steers	3	1	3	2
Heifers	3	1	2	2
Oxen	5	1	6	2
Bulls	2	1	1	1

Cattle owners found it difficult to give a breakdown of the sex and age categories of the cattle they possessed. However, according to the information in Table 4.6, female animals made up the majority of the cattle and there were lower numbers of oxen/steers. The majority of the cattle were crossbred animals and since they were run together there was very little control over the choice of bull used.

b) Reasons for keeping cattle

Cattle were kept mainly for cultural purposes and for milk, as illustrated in Figure 4.4.

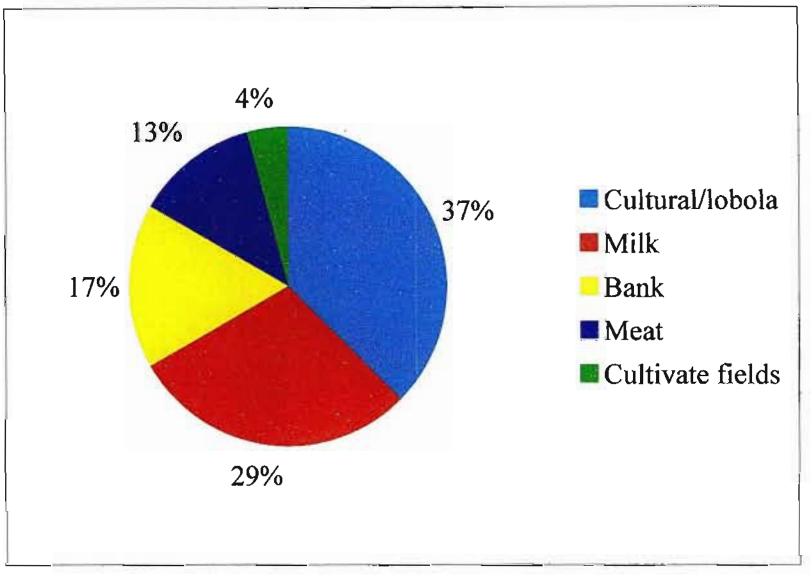

Figure 4.4 Reasons given for keeping cattle in Obonjaneni

At the time of the survey, only a total of 12 cows were milked for household purposes and this by seven out of 10 cattle owners. Owners milked their cows in the open. Four of the seven respondents met their household milk requirements, while two never met their requirements, and one sometimes did. The average milk requirement per household was indicated to be 4½ ℓ per day. It was found that a significant amount of milk is purchased from commercial producers selling milk in the area.

Animals used for lobola (cattle paid for a bride) and slaughtered during ceremonies were said to be purchased from commercial farmers and from neighbours (included in the 37% shown in Figure 4.4). When animals are slaughtered three respondents indicated that they sell hides, one discarded the hides and others indicated that they kept them for their own use. Where hides were sold, incomes mentioned were R8 and R50 per hide, depending on the buyer.

c) Nutrition

All the animals grazed communal veld during summer, whereas during winter the following occurred (frequency indicated in brackets): animals grazed on communal maize residues (small fields surrounding the homesteads) (7), diet supplemented with hay (5), animals grazed communal veld (4), animals grazed grass around the homesteads (4), animals fed crop residues at home (4) and animals grazed pastures in the communal area (1).

It would appear that the cattle owners' knowledge of stockmanship made them aware of the winter-feeding problem since:

i. 9 out of 10 purchased some kind of lick (varying from salt to a molasses meal lick);
ii. 4 out of 10 purchased hay;
iii. 1 out of 10 cut grass herself, for hay;
iv. 1 grew forage sorghum for his animals (a cut-and-carry system).

d) Reproduction and mortalities

Calving occurred mainly during the summer (indicated by five respondents), while one respondent indicated that all-year-round calving occurred. One said spring and three did not know when their animals calved. It would appear that over the 12-month period prior to the interviews, just fewer than half of the cows produced calves, with 24 calves being born. When weaning was discussed, eight out of 10 farmers did not wean calves.

Calf losses were 16% over the 12 months due to worms, diarrhoea and a blocked gut (respondent mentioned the possible intake of plastic that caused the death). Five adult animal deaths, caused by Black Quarter and Red Water, were reported by two owners over the same period.

e) Health management

The frequency of dipping was reported to vary from never, to weekly, to every 2 - 3 months. Many mentioned that the dip tank had not been working, so people had not dipped as frequently as desired. Cattle-owners seemed aware of the need to dip. The following information relates to tick control over the 12-month period (1997/1998):

i. 2 owners purchased and used "Deadline" (own cost);
ii. 2 did not dip their cattle at all;
iii. 2 dipped weekly;
iv. 4 dipped once/twice monthly.

Six stated that they follow a vaccination and dosing programme. Nine of the respondents interviewed had contact with the local Animal Health Technician (Veterinary Services, KwaZulu-Natal Department of Agriculture and Environmental Affairs).

f) Stock theft and security

Over a period of 12 months, 13 head of cattle were stolen in the community. At an average price of R1500/animal, the loss of cattle in monetary terms was R19 500. No one appeared to be employed by the community to herd the cattle. Cattle were herded by (number of respondents in brackets): the owners themselves (3), children (2), a herdsman (1) and a nephew (1), while one owner indicated that animals were only visited on a weekly basis.

g) Constraints

The following cattle constraints were identified by the respondents (frequency indicated in brackets):

i. thin animals due to poor winter feeding of cows and calves (4);
ii. theft (3);
iii. Redwater (2);
iv. ticks (2);
v. mastitis (1);
vi. diarrhoea (1);
vii. worms (1);
viii. litter problems (plastic kills cattle);
ix. no money to fatten animals for market – as a result, animals fetch poor prices.

4.3.4.2 Goats

The goats in the community were of a local indigenous type. Five (29%) of the 17 respondents interviewed indicated that they were goat owners, with a total of 56 goats between them. The goat numbers per owner were as follows: 2, 3, 5, 22 and 24. The reasons for keeping goats were (frequency indicated in brackets): cultural purposes (4), cash sales (1) and meat (1). The owners were uncertain of the composition of the flocks.

Goats grazed mostly on communal veld, in both summer and winter. One owner mentioned that goats grazed maize stalks in the communal fields during winter. Hay was purchased by one owner, one allowed goats to graze around the homesteads where kikuyu (*Pennisetum* *clandestinum* Chiov.) grass is growing, and three owners supplemented the grazing with a lick (no detail given) during the winter. Lick blocks and crushed yellow maize were mentioned as supplements.

Kidding was said to take place all year round. Owners found it difficult to recall the number of kids born over the 12 months prior to the interview. The owner of 22 goats mentioned seven kids, while the owner with 24 goats was uncertain of the number of kids. Only three kids died over the period of 12 months. The main reasons given for kid mortalities were injuries and that they did not get fat. Among four of the owners, eight goats were slaughtered during the 12-month period.

Three owners had no dosing programme for their goats, while the farmer with the 22 goats implemented a dosing and inoculation programme. Two owners had never dipped their goats before, while one owner dipped the animals once a year. The other two owners did not mention anything about disease control. The only goat constraint identified was that "goats do not get fat".

4.3.4.3 Sheep

Four (24%) of the 17 respondents owned sheep, with a total of 25 sheep among them. The sheep numbers were 1, 6, 7 and 11 per owner. Ewes made up approximately 56% of the sheep and 16% were rams, 16% wethers and 12% lambs. The breeds found varied from wool (cross-breed) to mutton (Dorper) types. Rams were purchased from neighbours, or from commercial farmers or they used their own. It would seem that the turnover of sheep was relatively high, with sheep being slaughtered and sold. Five sheep were slaughtered over the 12-month period and one owner sold two sheep, at an average price of R300 each.

Sheep grazed communal natural grazing (veld) during summer and winter (see Plate 4.7). Two owners indicated that sheep also grazed maize stalks in communal fields and one owner fed hay during winter. Two respondents supplied supplements: one supplied crushed yellow maize during winter and one put out lick all year round.

Lambing was said to take place throughout the year. All ram lambs were castrated (using a burdizo). One owner mentioned that his animals were dosed against internal parasites during August. One owner used the dip tank when cattle were dipped. No vaccination took place.

Both adult and lamb mortalities were reported during the previous 12-month period. Three lambs were killed, one by worms, one by dogs and one by people ("hooligans"). Five mature sheep succumbed to diarrhoea. Theft of sheep occurs in the community. No mention was made of shearing or the selling of wool. One respondent indicated that the reason for throwing wool away is that it was too dirty. One owner used the skins. Sheep constraints identified by respondents were:

i. diarrhoea;
ii. worms;
iii. mortalities due to disease.

4.3.4.4 Chickens

Seven (41%) of the respondents interviewed had Zulu fowls, some had geese and ducks but only one farmer had broilers and a few layers. Chicken constraints identified were:

i. the low quality of chickens sold by suppliers;
ii. managerial problems;
iii. high cost of feed and transport problems for broilers;
iv. inability to market broilers.

4.3.4.5 Pigs

One respondent had two Landrace pigs for his own use. Feed was purchased from the co-operative in Bergville at R69/50kg bag. The pig constraints identified were:

i. lack of knowledge, *e.g.* what medicine to use;
ii. high cost of feed.

4.3.5 Maize, potatoes, vegetables and fruit production

4.3.5.1 Maize

The size of the fields, the type of seed used, the use of fertilizer and manure, the cost of ploughing and the maize yields are summarised in Table 4.7.

a) Field sizes

The size of the fields around the homesteads varied from 190 to 3 600 m^2 and the communal fields from 8 230 to 10 000 m^2 (1 ha). A common problem was that respondents did not know the sizes of their fields. The interview teams measured the fields of nine homesteads.

What was evident from the information (summarised in Table 4.7) was the huge cost, and cost discrepancies, to plough the small fields, when calculated in R/ha. Costs varied from farmer to farmer.

Table 4.7 Field sizes, production practices and maize yields in Obonjaneni

Size of fields	Type of seed used	Fertilizer or manure used (fertilizer cost/area)	Ploughing cost (R/ha)	Adjusted maize yield[1]	Yield (t/ha)
8230 m^2 8230 m^2	Certified 20 kg: R352	R210 R210	R80 R80 (R97)	108 kg (3x80) 108 kg (3x80)	0.13 0.13
3600 m^2	Certified 5kg: R55 + Own	R500 + Manure: 7 tons	R600	180 kg (8x50)	0.50
*1290 m^2	Certified 2 kg	R140: 2 bags + Manure	R70 (R542)	432 kg (12x80)	3.35
*650 m^2	Certified + Own	Fertilizer Manure	R50 (R1076)	72 kg (2x80)	1.11
*480 m^2	Certified: R80	R148: 2 x R74	R100 (R2083)	Green maize	-
*190 m^2	Own seed	R70 + Manure		72 kg (2 x 80) + Green maize	3.79
1200 m^2	Own seed	R65 + Manure	R60 (R500)	126 kg (3.5x80)	1.05
10 000 m^2 (1ha)	Own seed	R80 + CM: 50kg	R300 (R300)	675 kg (30x50)	0.68
*768 m^2	Own seed	R420 + Manure: 10t	R50 (R651)	72 kg (2x80)	0.94
8230 m^2	Certified	R225	R100 (R122)	Not measured	-
2990 m^2	Own seed	R148 (2 x R74)	R100 (R334)	90 kg (4x50) + 264 kg (16x16.5)	1.18
8230 m^2	Own seed	R156 (2 x R78)	R120 (R146)	720 kg (20x80)	0.87
*480 m^2	Own seed	R78 (1 bag)		16.5kg	0.34
968 m^2	Certified R55	R210 (3 bags)		504 kg (14x80)	5.207
*1218 m^2	Certified + Own	Fertilizer + Manure	R140 (R1148)	990 kg (60x16.5)	8.13
*1218 m^2	Own seed	R95 + CM: 1 wool bag	R120 (R985)	288 kg (8x80)	2.36
N: 17 **Mean: 3410** **SD: 3567**		**N: 15** **Mean: R183.67** **SD: 125.8**	**N: 14** **Mean:** **R140.71** **SD: 146.3**	**N: 15** **Mean: 314.6** **SD: 293.6**	**N: 15** **Mean: 1.09** **SD: 2.25**

[1] 80 = 80kg bags; 50 = 50kg bags; gogogo (20ℓ paraffin tin) = 16.5kg - adjusted yield: the maize in bags was unshelled. Grain yield was determined by multiplying the quantity in bags by 0.5 (ratio of 2:1 between unshelled and shelled maize in bags). The calculated yield was adjusted by 10% for worm damage, seed size and other unknown variables (Lawrence, 2003. Personal communication).
* Field size measured by interviewer
CM = chicken manure

b) Land preparation

Land preparation in the community was said to take place from September to November (82% of the respondents) and mainly by contractors using tractors (see Plate 4.8). Three respondents indicated that they did land preparation by hand and one used oxen. All respondents ploughed fields at least once for land preparation, while 10 (59%) ploughed fields twice and five (29%) disced their fields after ploughing it once.

c) Intercropping practices

Eight respondents in their homestead fields practised intercropping, mainly with maize, pumpkin and dry beans. Three respondents mentioned that their fields were too small to practise intercropping. The most widely adopted intercropping system, according to Lea (1991), is maize and pumpkins.

d) Maize planting time

Planting of maize was said to take place over the following three periods and reasons given for why they plant at these times were:

i. 1 – 15 November (33% of the respondents). To allow livestock to be removed from fields; minimize stalkborer problems at this time; have had good yields in the past;

ii. 16 – 30 November (54% of the respondents). To allow livestock to be removed from fields; to minimize stalk borer; have had good yields in the past; waiting for summer heat;

iii. December (13% of the respondents). Cattle removed too late, which delayed planting.

e) Soil fertility

i. Soil sampling

Thirteen (or 87%) of 15 respondents who responded to the question had never taken soil samples. Two respondents indicated that soil samples had been taken by the Extension Officer and by staff of an NGO. One of the two farmers who had a soil sample taken had not received the results and/or recommendations.

ii. Fertilizer

All the maize growers interviewed purchased fertilizer, but none utilized a soil sample analysis. From the information summarised in Table 4.7, respondents spent between R50 and R500, annually, on fertilizer. Five of the 16 respondents growing maize mentioned that they used 3:2:1 as fertilizer, while the rest were not able to give the name of the fertilizer they used. Fifteen respondents purchased fertilizer from the co-operative in Bergville (approximately 40 km from Obonjaneni) and two bought their fertilizer at a local shop. The fertilizer was transported to the community by (frequency indicated in brackets): taxi (8), pick-up truck (3), contractor (3) and own transport (2).

iii. Lime

Fifteen (94%) of the 16 maize growers had never used lime before. The respondent who had applied lime did so a few years before the interview and employed a contractor to transport and apply it. The reasons given for not using lime were (frequency indicated in brackets):

- lack of knowledge (6);
- not necessary (3);
- shortage of finance (3);
- received no soil sample results (1);
- too difficult to transport (1);
- not sure how to apply lime on a small scale (1);
- not sure if it is available in small quantities (1);
- not sure where to buy it (1).

iv. Kraal manure

Eight maize growers used kraal manure. The majority applied kraal manure just before or at planting by broadcasting it by hand, or manually placing it in the furrow or by means of a planter, or as a mixture with fertilizer in the furrow. The exact quantities of manure used were not known. One respondent used chicken manure (R20 for one "wool bag"). The reasons given when kraal manure was not used were:

- it causes a weed problem;
- labour-consuming.

f) Seed used

Eleven (or 69%) of the respondents were using their own open-pollinated seed, while eight (50%) indicated that they used certified seed (some used both) (See Table 4.7). Certified seed was purchased from the co-operative in Bergville. Reasons given for not using certified seed were (frequency indicated in brackets):

- unaware of it (lack of knowledge) (4);
- did not see the need for it (1);
- bad experience (1);
- did not trust anything else but own seed (1).

g) Plant spacing and population

The distance between plant rows was 100 cm and the distance between plants within the row varied from 10 to 30 cm. The calculated plant population varied, therefore, from approximately 33 000 to 100 000 plants/ha. Respondents also mentioned that they planted maize at the higher populations in order to minimize the extent of cutworm damage.

Planting in the community was done in diverse ways (one person often made use of a number of different methods):

i. hand hoe (nine respondents), with the assistance of the family;
ii. oxen (six respondents), with the assistance of the family;
iii. tractor and planter operated by a contractor (six respondents).

h) Crop rotation

Two farmers rotated maize and potatoes and mentioned that it was important for disease control.

i) Weeding

Weed control was carried out by household members, while two respondents used hired labour. Eight (50%) respondents indicated that they weeded only once, while seven (44%) weeded twice and one (6%) respondent weeded three times during the season. The majority of the respondents (69%) practised weeding when the weeds were small. One respondent weeded when the weed was "half-size" and four respondents weeded before the weeds "covered the crop". No chemicals were used for weed control and respondents did not have the knowledge to use chemicals. A comparison of the frequency of weeding between the genders showed that all women respondents weeded only once, while men weeded twice and even three times.

j) Insect and disease control

Very little insect control took place. One respondent mentioned that seed was soaked in salt water and in another instance turkeys were used to control insects. Two respondents used commercial cutworm bait. Respondents indicated that they wanted to control stalkborer, cutworms and a black-yellow beetle (spotted maize beetle or Astylus beetle – *Astylus atromaculatus* Blanchard). Nobody had tried to control maize diseases.

k) Maize yields

Yield was indicated by 14 of the 16 respondents and recorded in one of the following measurements:

i. Gogogos – 3 respondents (gogogo = 20ℓ paraffin tin with a capacity of 16.5 kg of maize grain);

ii. 50 kg bags – 3 respondents (unshelled maize);

iii. 80 kg bags – 9 respondents (unshelled maize);

iv. 200ℓ drum – 1 respondent (unknown whether it was shelled or unshelled).

Maize was grown in fields that ranged in size from 190 m^2 to 1 ha, with a mean size of 3 410 m^2 (SD = 3 567). The maize yields obtained and the yield, converted to t/ha, are summarized in Table 4.7.

Shelled yields from the areas planted varied from 16.5 to 990 kg (See Table 4.7). The mean yield obtained by 14 respondents was 314.6 kg (SD = 293.6). The mean converted yield (t/ha) for all the fields was 1.095 t/ha (SD = 2.259), 2.54 t/ha (SD = 2.41) for the home fields and 0.4531 t/ha (SD = 0.3805) for the communal fields (location of fields was not indicated). The large standard deviation found in yields at the homesteads could be an indication of the differences in production systems used in the community. All the maize produced was consumed by the households and only one respondent sold maize, to the value of R160. Only three of the seven men (43%) and two of the nine women (22%) indicated that they produced enough white maize for their own consumption (people use only white maize for own consumption).

l) Processing of maize and other usage

Seven respondents milled their own maize, while nine used a contractor or the local mill to process their maize. Other uses of maize mentioned were green maize (7 respondents) (green maize is defined as maize on the cob prepared by boiling or roasting, at the soft-dough stage), and yellow maize for livestock (3 respondents).

m) Constraints

The following constraints were identified (frequency indicated in brackets):

i. hail and storms (7);

ii. cattle and goats getting into the fields: no control over animal movement (6);

iii. poor yields (5);

iv. weeds (2);
v. cutworms (2);
vi. other insect damage (2);
vii. lack of technical knowledge (2);
viii. bad germination (2);
ix. drought (2);
x. rats during storage of grain (2);
xi. stalkborer (1);
xii. high input costs (1);
xiii. lack of fertilizer (1);
xiv. lack of implements (1).

4.3.5.2 Potatoes

Information obtained from the survey concerning field sizes, an approximate cost to plant the potatoes, fertilizer and manure used and costs and the number of pockets sold, is summarised in Table 4.8.

Table 4.8 The field size, cost of land preparation, seed and fertilizer costs, usage of manure, yield and income from potatoes produced by three growers in Obonjaneni

Field size	Cost of land preparation	Seed cost	Fertilizer cost	Use of manure	Harvest (10 kg pockets) & Yield/ha	Pockets sold
480 m^2	R100	R62 (R31/bag)	R89	No manure	70 14.58t	70 pockets @ R10/pocket
630 m^2	R60	R30/30kg	R70	Four bags kraal manure	150 23.81t	150 pockets
225 m^2	Not mentioned	R32/30 kg	R40 (25 kg fertilizer)	Two wheelbarrows of kraal manure mixed with chicken manure	36 20t	36 pockets @ R12.50/pocket

Potatoes were grown at the homesteads on areas varying from 225 to 630 m^2 in size (Table 4.8). Planting was said to take place over three periods: July, August and during the second half of October. A July planting enabled people to plant maize in November in the same field. The costs of land preparation ranged from R60 to R100/area (Table 4.8). The three potato growers used fertilizer (one mentioned 2:3:4), but no soil samples had been taken. They spent R40 (transported by taxi), R70 (transported by light delivery vehicle) and R89 (supplied by contractor) on fertilizer. One of the potato growers mentioned that taxi-owners charged R20 per bag to transport the fertilizer from Bergville. Two growers used relatively small quantities of kraal and chicken manure. Lime was not used, because they did not know how to apply it on a small scale and they were not sure of its availability in small quantities.

The source of seed was their own crops and the co-operatives. The distance between the rows varied from 100 to 120 cm and distance between plants within the rows varied from 20 to 30 cm. Two respondents practised crop rotation with maize. They weeded when the potatoes emerged and it was mentioned that ridging also removes weeds. Nothing was mentioned concerning insect control and no chemicals were used to control disease. Yields, when converted to t/ha, were 20 ton/ha on 225 m^2, 14.58 on 480 m^2 and 23.81 t/ha on 630 m^2 (Table 4.8).

Constraints identified were:

i. moles destroy crops (2);
ii. blight (1);
iii. larvae in potatoes (1);
iv. need advice from extension services;
v. CMR beetles (also known as blister beetles, with black and yellow stripes).

4.3.5.3 Vegetables and fruit

From the 17 respondents interviewed, six indicated that they grew vegetables and had fruit trees for their own use. The following vegetables and fruit trees were found in the home gardens (frequency indicated in brackets): cabbage (4), Swiss chard (spinach) (4), tomatoes (4), peaches (3), onions (3), carrots (3), chilli peppers (2), brinjals (eggfruit) (2), while the following were only mentioned once: peas, joko beans, groundnuts, pumpkins, beetroot, lettuce, dry beans, apples, plums, apricots, oranges, lemons, bananas, grapes, guavas and granadillas. Vegetable seedlings were purchased from as far away as Weenen, approximately 145 km from the community.

Constraints identified were:

i. cutworms;

ii. lack of knowledge;
iii. the lack of know-how to market surplus produce;
iv. CMR beetles;
v. aphids;
vi. caterpillars;
vii. hail;
viii. carrots do not grow properly;
ix. rotten peaches.

4.3.6 Phuthumani Community Garden

During 1998, a lime demonstration was laid out in plots following the analysis of soil samples taken in the garden. The four soil samples taken from plots, during 1998, from different members in the community garden showed an average acid saturation of 65.25% (SD = 12.84) and pH (KCl) of 4.02 (SD = 0.014). To produce vegetables, the permissible acid saturation of the soil should be between 1 and 5% (Manson *et al.*, 2000). After discussions with garden members and on the result of the soil analysis, it was decided to conduct a demonstration in the community garden, to show the effect of lime and best management practices on cabbage production (see 5.3.10 in Chapter 5 for further detail).

4.3.6.1 Membership and objectives

"The community garden is a well fenced-off area of land, to be used by a group of people to produce vegetables. It could also supplement the vegetables produced at the homesteads. This land is within the jurisdiction of a tribal authority. The objectives of community gardens are (a) to improve the diet of rural people, by making a variety of fruit and vegetables available within communities and to promote household food security, (b) to enable people to produce their own vegetables, instead of buying them, (c) to enable people to acquire the knowledge and skills to do this, (d) to provide a focus for work within a community and (e) to teach business skills for the successful running of the community garden" (Policy on Community Gardens, 1999). Furthermore, the impression conveyed to FSRS staff was that gardening is viewed as a job for women.

The garden is managed by a committee which has a constitution and a bank account. There is a recognised agreement or arrangement that grants them security of tenure to the land for a minimum period of five years. The ten members of Phuthumani Community Garden consisted of eight women and two men. The reason for the gender imbalance was that men were working in jobs not related to agriculture and others were involved in maize production in the larger, communal fields.

4.3.6.2 Plots worked and vegetables planted

Each member had six plots, with plot sizes ranging from 40 to 65 m^2. Vegetables grown in the garden were tomatoes, cabbage, chilli, green pepper, brinjal, onions, beetroot, carrot, Swiss chard (spinach) and green peas. Only one vegetable type was planted per plot. The type of vegetables planted was based on a group decision, because seedlings were purchased jointly. The vegetables grown were for home consumption and for sale.

4.3.6.3 Problems encountered by the garden members

a) Pests and diseases

Cutworms and aphids were the pests mentioned. They were controlled using chemicals. Garden members had a problem with bacterial wilt of potatoes and presumed early and/or late blight of tomatoes. Weather conditions in the area (too much rain) were identified as the main cause of the problem. The garden members undertook no measures to control diseases.

b) Tillering of cabbage plants

The cabbage seedlings purchased in Bergville were said to grow well until the stage of head formation, when the plants developed more than one head (tillering). This could be caused by insects. Smaller heads also resulted from the tillering and this affected the marketability of the cabbages. The garden members were trying to solve the problem by producing their own seedlings in their own seedbeds.

c) High input costs

Input costs were high as commodities were transported from Bergville, approximately 40 km from the garden.

4.3.6.4 Ranking problem crops

Tomatoes were ranked first, followed by cabbage, as the most problematic crops in the garden. Besides the high soil acidity affecting crops in the area (see Section 4.3.6), members of the garden identified early and/or late blight in tomatoes and tillering of cabbages as major problems.

4.4. Interaction with the community and Extension staff

4.4.1 Community meeting to discuss the findings of the diagnostic survey

The objectives of the feedback meeting with the community in April 1998 were to present and discuss the information gained from the diagnostic study. Present at the meeting were staff members from the KwaZulu-Natal Department of Agriculture and Environmental Affairs, the Head of District, the Head of Extension (the chairman of the meeting) the Agricultural Development Technician, FSRS staff (4 members), 18 people from the community (farmers) and two Technikon students. The meeting was advertised through the members of the Amazizi Maize Association, posters were placed at strategic places in the community and notices were given to school-children. The reasons given by farmers for the poor attendance were the following:

a) some people will come later (it did not happen);
b) notices were not received by people;
c) a funeral in the area.

FSRS scientists presented the crop and livestock results of the diagnostic survey. Not all the respondents who were interviewed were present, but people agreed that the information was a true reflection of the situation in the community. The people again mentioned the problem of stray animals destroying crops and commented that this problem was not found on commercial farms (see Plates 4.9 and 4.10).

The following issues were raised and discussed at the meeting:

a) a lecture on maize production, covering the main production practices, was presented;
b) natural resources need to be assessed in order to understand some of the livestock constraints identified;
c) livestock owners need to get together to form an association. One of the benefits could be the buying of inputs in larger quantities, at lower prices;
d) cattle owners need to spend money if they want to have productive animals. The basic inputs for improved animal productivity and reduced mortalities include supplements to improve nutrition, dips/doses – to control ticks and parasites, vaccines to prevent disease and veterinary products to treat diseases and infections;

e) livestock owners were advised to keep certain drugs on hand, to treat animals quickly and effectively (names of drugs were mentioned);

f) to control tick-borne diseases, livestock owners were advised to consider knapsack sprayers, pour-ons and injectables, as alternatives to dips.

4.4.2 Meeting with Extension to discuss the findings of the survey and the feedback meeting

Four Extension and four FSRS staff attended a meeting that was held in May 1998 at the Cedara Research Station. The aims of the meeting were to strengthen further the newly formed relationship with Extension colleagues from the Bergville District and the head office of the North West Region and to discuss the findings of the diagnostic survey. At the start of the meeting the FSRS staff presented a slide show dealing with the survey.

The two main issues affecting agricultural activities in Obonjaneni were stray animals and a lack of knowledge (expertise). It was agreed that the control of stray livestock was a major issue and should be addressed first, before any other of the identified constraints. The livestock issue prompted the following questions:

a) how influential were the cattle owners in the community?

b) what were the people's objectives with maize and vegetable production?

c) why did they allow livestock to be a problem?

At the meeting, an appointment with the Nkosi (Chief) and the tribal authority to give feedback on the survey results, and to re-emphasise the negative effect of stray animals on crop production and thus agriculture in general in the community, was seen as an essential first step, before any other intervention could take place. The Agricultural Development Technician responsible for the Obonjaneni community was tasked to arrange a meeting with the Nkosi and the tribal authorities in June 1998.

4.4.3 Meeting with tribal authorities

The meeting with the tribal authorities was held in June 1998, at the Amazizi Tribal Court. Present at the meeting were: the Induna (Headman) of Obonjaneni, representing the Nkosi (Chief), 12 members of the Amazizi tribal authority, the Amazizi Maize Association chairman, the KWANALU (KwaZulu-Natal Agricultural Union - organised agriculture) representative for the area, officials from the KwaZulu-Natal Department of Agriculture and Environmental Affairs, who included FSRS staff, the Control Agricultural Development

Technician of the Extension Region, the Head of the Bergville District Extension office, the Head of Extension (Bergville office), the Assistant Director Professional Services, the Agricultural Development Technician for the sub-ward of Obonjaneni and the North West Region Subject Matter Specialist for Crops.

The FSRS staff gave a report-back on the findings of the diagnostic survey. A suggestion was made to the tribal authorities that 1 November should be set as the deadline for livestock to be removed from the communal cropping fields. It was conveyed that this date needed to be enforced and strictly monitored. The local leaders were informed that officials of the Department of Agriculture and the farmers of Obonjaneni felt that the community, in conjunction with the tribal authority, needed to solve the livestock problem. It was made explicit during the discussions that without a solution to this problem it would be meaningless to address the other constraints identified by the people of Obonjaneni.

The community and tribal authority members raised the following important issues after the FSRS presentation:

a) "Many years ago there was a fence dividing the grazing camps and the maize fields. A date for removal of stock each year was announced when the cattle were all moved to the mountains and the lands were closed. As the fence wire has deteriorated and parts of the fence were removed (from the 1950s) so the cattle problem has returned."

b) "We need money to divide the grazing camps from the maize fields by fencing and so solve the problem."

c) "Our community is responsible for causing the problem; the fence existed, but the people removed it and brought their cattle to the fields. If we are serious about farming and committed to it, we can look after the fence and keep the livestock out. The community likes keeping livestock, but also likes food from the fields and we must decide what we want."

d) "We need to decide on the penalty for cattle grazing in the cropping fields, when they should be in the grazing camps. The Nkosi's council and Indunas can help us."

e) "This meeting needs to propose a solution, because the problem has already been discussed at a community meeting, at which the Nkosi was present."

f) "A problem in the community (tribe) is that the people are difficult to control and no longer respect each other."

g) "We can conclude by saying that the cattle must go to the mountains, but the problem *with stock theft there also needs to be addressed."*

h) *"The Nkosi should issue an edict to say that by a certain date the cattle must be removed from the fields and if the cattle are found in the fields after this date, a penalty will have to be paid. This is our responsibility as a community."*

i) *"We need a decision today from the Induna."*

The Induna said that the tribal authority does not decide unilaterally, but should go out to the wards to discuss these issues with the people. The communities must agree and bind themselves to the solutions that have been decided upon. It was requested that the councillors of the different wards should select dates for meetings in their areas. The Induna adjourned the meeting to enable the tribal authority to discuss and decide on how it could support the community and co-operate with the FSRS concerning on-farm research programmes and concerning addressing the constraints of the people of Obonjaneni.

At the conclusion of the meeting, the FSRS and the Extension staff thanked the Induna and councillors for their positive approach and requested a date on which the Departmental Officials could return for their report-back.

4.4.3.1 Report-back meeting by the tribal authority

The Induna, eight members of the Amazizi tribal authority and the FSRS and Extension staff attended the report-back meeting held in August 1998. The Induna gave the following positive feedback:

a) *"Animals need to be moved away from the fields at the end of September."*

b) *"In close co-operation with farmers, people will be identified next to the road opposite the cropping fields to chase animals away."*

c) *"The following punishment will be put into action:*

    i. *R200 for people who deliberately put their animals on the fields after the set date.*

    ii. *R100 for owners whose animals wander into fields accidentally."*

d) *"The Nkosi and his councillors are fully behind the effort of the KwaZulu-Natal Department of Agriculture to assist the people of Obonjaneni to solve the agricultural constraints."*

Staff from the FSRS and Extension staff thanked the Induna and councillors for the meeting, for the positive report and for their future co-operation. Farmers who attended the meeting were requested by the Extension staff to start preparing immediately for the planting season.

The communal cropping fields had been unplanted for five to seven years at the time of the interviews, largely due to the major problem of stray animals (no fences were in place to keep animals away from crops planted). The meeting with the tribal authorities was encouraging and resulted in a positive outcome in favour of the people of the community who wanted to plant crops and for the FSR team's on-farm, client-orientated research programme.

4.4.4 Meeting with farmers to discuss the solutions and the research interventions

The meeting to plan the first season's on-farm research programme took place in the community in September 1998. It was attended by 20 farmers, FSR staff, the Head of the Bergville Extension District, the Agricultural Development Technician responsible for the community (sub-ward), the Assistant Director: Extension, the Head of Extension in the District, the Subject Matter Specialist for Crops and the local Induna. A trend observed at the meetings was that a small core of people regularly attended meetings, with some new faces appearing at each meeting. At the start of the meeting the Agricultural Development Technician summarised the process from September 1997. A further input by Extension staff was a crop production lecture by the Subject Matter Specialist for Crops of the North West Extension Region. He discussed land preparation, control of stalkborer, planting dates, moisture-saving practices, soil compaction and its effects, land preparation for good seed germination, calibration of planters, value and use of manure, effective use of fertilizers, maize cultivars and where to buy seed. The farmers were also requested to use the on-farm trials and demonstrations as learning opportunities, similar to a school class.

During the meeting the following comments of interest were made by farmers:

a) *"We are very enthusiastic to use the fields after many years and people must use their fields that were not used for more than 5 to 7 years."*

b) *"The Extension Officer needs to be used by people in the community and Extension staff need to visit them."*

c) *"I am happy to be part of the meeting and for the opportunity to gain knowledge."* (comment from a farmer from the neighbouring community)

d) *"Is the planned on-farm research for all the people?"*

e) *"People can listen and learn during the demonstration."*

f) *"I am not familiar with farming and want to be taught."*

g) *"Parents need to invite children back to the farm."*

h) *"The Department is thanked for their involvement."*

4.4.5 Addressing the agricultural constraints

In any given production system one may identify a number of constraints, but due to circumstances, as described by Matata *et al.* (2001), it is not always possible to handle all of these problems simultaneously. In Obonjaneni, people who attended the feedback and planning meeting were very clear about what they wanted from the on-farm trials. However, the poor attendance at the meetings was perhaps an indication of the paucity of people in the community really interested in making progress with agriculture.

The FSRS staff was not sure how to interpret the small numbers of people who attended the meetings and participated in the diagnostic survey. The Extension staff assured the FSRS staff that the low level of community participation was a common problem and was the reason why extension workers concentrate on interest groups or farmers' associations. They also commented that as soon as the research results were demonstrated and people benefited from them, others would join (Nelson Siteto, 1998 – personal communication – Assistant Director: District Services). In a community or location it is, according to Okali *et al.* (1994), not everyone who wishes to, or will be able to, participate in research activities. In these authors' opinion, the question of who participates in the research process has ramifications for the wider concerns of many projects - equity, social development, empowerment and sustainability - and can be expected to have a direct impact on the immediate research activities.

4.4.6 Link between the Farming Systems Research Section, Extension staff and participants

The diagnostic study was characterised by a good spirit of co-operation between the FSRS, Extension staff and the people in Obonjaneni. The diagnostic stage of the on-farm research programme contributed to the much-needed link between Extension staff, farmers and researchers. It allowed both researchers and extension staff to learn more about the farmer, by literally "walking in the farmers' footsteps".

4.5 Discussion

Farmers usually base their decisions at farm level on their objectives, strategic plans and available resources (land, labour, equipment and funds). Farming systems research and extension (FSR&E) methodology initiatives in India made partners join in a variety of field visits which promoted useful discussions with farmers (Schiere *et al.*, 2000). This helped scientists and extension workers appreciate the complexities of farming and the fact that a new technology often requires, or triggers, a series of other changes. The present diagnostic survey, which used a structured questionnaire, provided an opportunity to gain a good understanding of the farming operation regarding household demographics, choice of activities, agricultural practices and constraints affecting production. However, the meetings at which respondents for the diagnostic studies were identified, were advertised as agricultural meetings and it is therefore likely that the non-farmers stayed away. Respondents could therefore have been biased in terms of the absence of non-farmers in the sample. It would have been useful to include non-farmers, to assess their attitudes towards agriculture and other aspects concerning the functioning and the well-being of people in Obonjaneni. Nevertheless, the diagnostic survey gave researchers and extension staff an informed basis for the planning of an on-farm research and a technology dissemination programme with people who showed an interest in this approach.

4.5.1 Household demographics

The Obonjaneni community falls within the Upper Tugela catchment area, which is a communal area with high agricultural potential (Thomson & Lyne, 1995). It is made up of two tribal wards: the "Betterment Planned" Amazizi ward and the unplanned Amangwane ward (Thomson & Lyne, 1995). Obonjaneni is part of the Amazizi ward. Betterment Planning was a government programme in the 1940s and 1950s (Cross, 1999), which resulted in three distinct areas in such communities, namely the homestead area, the agricultural fields and the communal rangeland (Von Maltitz, 1998). Being a "Betterment Planned" community, all households in Obonjaneni have access to a homestead area, on average 1.2 ha in size (Von Maltitz, 1998). This homestead area (part assigned to buildings and part to a small field) is one of the most important agricultural resources to most households. The agricultural fields are allocated to individual households when applied for, traditionally by the Nkosi (Chief) and only a small percentage of households have access to these areas.

In communal tenure systems, households have individual usufruct to arable land and communal usufruct to grazing land (Thomson & Lyne, 1995). Any arable land not under cultivation becomes communal grazing land. In winter, all land becomes communal and livestock owners are entitled to use the stover on cropping lands for grazing. This limited breadth of rights not only prevents farmers from internalising the benefits of their investment, but also restricts their freedom to make decisions regarding land use. The Nkosi (Chief) announces dates when farmers are allowed to start ploughing their lands and planting and harvesting their crops. To attempt any of these operations before the specified dates could result in a fine of up to R1000 (Thomson & Lyne, 1995). Land tenure is thus a mixture of private tenure of the homesteads and the communal cropping fields for grazing during summer, and permanent grazing rights for the rangeland areas and the use of the cropping fields during winter. Problems related to land rights and tenure are common across Sub-Saharan Africa (Dixon & Gulliver, 2001). In addition to expanding access to credit, developing effective tenure systems can have a profound impact on the ability of communities to enter into productive partnerships arrangements and to intensify production. In India, land tenure influences farmers' decisions for increased investment (Nataraju & Nagaraja, 1998). Tenure is expected to be positively related to adoption of new or alternative technology (Abd-Ella *et al.*, 1981).

The mean age of the respondents in Obonjaneni was 58. This showed that the sample tended towards the elderly and was poorly representative of the younger generation. A study of a rural community growing cassava/maize in Nigeria showed that the mean age of farmers was 48, indicating that the older people were generally involved in agriculture, while younger people (below 30 years) were less involved in, or totally out of, agriculture (Apantaku *et al.*, 2003).

Educational attainment has been known to influence the adoption behaviour of small-scale farmers (Abd-Ella *et al.*, 1988 and Igodan & Adekoya, 1987). It is therefore encouraging to see that a high percentage of children attend school in Obonjaneni. Botha & Lombard (1992) showed that people who were willing to be trained are more successful than those who are not. Although the volunteers in the FSR programme made up a small group, they were perhaps the people who were willing to be trained and who could make a difference in the community. Community members showed no signs of conflict which could be ascribed to the open and volunteered approach followed.

The finding that all the people spoke Zulu, 65% of them could read it and 23.5% could read English, was an important observation from a communication perspective. It needs to be taken into consideration when notices or information leaflets are prepared for distribution in the community. Documented information needs to be easy to understand and simply written.

Hedden-Dunkhorst & Mollel (1998) reported that the South African smallholder farming system is characterised by a relatively large off-farm income component. This was also found in Obonjaneni. A study by Kirsten *et al.* (1996) in the former KwaZulu showed that sources of income varied widely and depended on the socio-economic status of the household. The ultra-poor derive most of their income from pensions, while formal jobs are the important source for the more affluent. For middle-income earners, agriculture plays a fairly consistent role, with a relatively constant contribution to income of about 15%. The authors did not indicate whether this included the value of consumed food produced on-farm, which could play an important role in the economy of such households. The monetary value of own produce consumed, be it crops, vegetables or animal products, could be a substantial sum, which would then allow people in rural areas to use scarce resources, such as cash, for other needs. Well-practised agriculture could therefore play a crucial role in rural areas in improving the livelihood of people.

Eckert (1988) commented that when off-farm work provides a risk-free daily wage of perhaps 5 -10 times the income obtained from farming, it is little wonder that most households are not interested in agriculture. An important fact is that a regular source of income enabled households to expand their livelihood base and pursue more and alternative options because of the ability to use cash for a range of informal activities, such as herd building, agriculture and the establishment of small businesses (Shackleton *et al.*, cited by Shackleton *et al.*, 1999). More than 70% of household income on small farms (less than 5 ha in size) in rural Honduras was derived from off-farm activities, mainly female wage labour for coffee picking (Ruben & Van den Berg, 1997). In Latin America, a new systems-orientated approach has to consider that agriculture is only one of many sources of income for most peasant households and that off-farm and non-agricultural activities are increasingly important leverages for reducing rural poverty (Berdegué, 2001).

While many households benefit from agriculture in terms of meeting households needs, it seems that they do not recognise it as a "source of income". It must however be remembered that agricultural produce serves as a substitute for goods that would otherw. purchased. A positive fact that should be noted is that more than half (nearly 5ɔ. respondents in Obonjaneni indicated that if the opportunity arose they would like to gen. cash income from agriculture. This is an indication of the interest in, and possible future of, agriculture in the area. The reasons why they did not farm with the particular enterprise of choice were financial constraints, need of skills, lack of equipment (*e.g.* ploughs and planters), need for facilities (*e.g.* a broiler house) and the destruction of crops by uncontrolled animals. Of interest was that respondents throughout the diagnostic study did not mention land as a restriction, whereas Kirsten *et al.* (1996), in a study in the former KwaZulu, found that if households were to have been able to obtain more land, the majority of respondents indicated that they would plant vegetables (24%) or maize (43%). Elsewhere in KwaZulu-Natal, 60% of respondents indicated that they felt they needed more land and that they felt they did not have enough land to grow agricultural produce to feed their families (Kirsten *et al.*, 1996).

In Obonjaneni it was clear that gender could be a critical issue in diagnostic studies, as demonstrated by the difference in weeding frequencies between men and women (see 4.3.5.1 i). The importance of a balance in gender is necessary for an understanding of women's and men's roles and for a richer and more complete picture of a production system (Feldstein & Jiggins, 1994). In India, time allocation studies showed that in developing economies rural women work an average of 12 – 18 hours/day, compared to 8 – 12 hours in the case of men (Rao, 1997). Women in India, in addition to their domestic responsibilities, constitute half of the rural workforce for agriculture and other rural productive activities (Nataraju & Nagaraja, 1998). Food security at household level in Tanzania is limited due to the heavy workload of women, for example the dominant use of the hand hoe aggravating the situation in terms of badly timed weeding, and resulting in low agricultural productivity (Lazaro, 1996). In Bangladesh, women are involved in all phases of agriculture where they have a great bearing on the production system used, because of their valuable knowledge of production using minimal resource facilities (Chowdhury & Hoque, 1996).

4.5.2 Livestock

At the time of the diagnostic study, cattle were the most important form of livestock in Obonjaneni, with goats being the second most important. In other parts of KwaZulu-Natal, Kirsten *et al.* (1996) found that roughly half of the respondents (51%) had cattle, while one third (31%) had goats. According to Bembridge (1984) each livestock species has a specific role in communal livestock systems, which is not necessarily related to the generation of cash income. This was confirmed by the work of Tapson (1990), with regard to cattle sales in the former homeland of KwaZulu. The off-take was 1% per annum, while from the commercial farming sector it was 25% per annum.

The socio-economic importance of livestock is illustrated by the list of diverse reasons for keeping cattle and goats. The findings of this study agree with Paterson (1994), who found that cattle are kept for milk, traction, lobola and ceremonies and not for commercial purposes. The constraints identified and the level of productivity of the livestock found in the diagnostic study is a clear reflection of the poor nutritional and management status. To address the constraints purposefully, the respondents need to decide whether they are able and prepared to spend money on inputs.

The livestock constraints identified in Obonjaneni were not unique to the area, with similar problems identified in other countries. In Colombia, livestock problems identified, in order of priority, by women respondents were: parasite control, providing supplementary fodder, improving natural pasture quality, seed selection and storage and adequate planting densities of crops (Fernandez, 1991). Singh *et al.* (1994) reported that in the villages of the Karnal District, Haryana, India, low productivity of the local cows and buffaloes was a common problem mainly due to poor genetic potential, a low plane of nutrition, a lack of a systematic breeding policy, the inadequate availability of proven bulls and a lack of awareness of proper management practices. Admassu & Bekele (2002) reported that in two areas in Ethiopia the major livestock production constraints identified by pastoralists were predators, drought and shortage of pasture, livestock diseases, and theft in the Afar area, while in the Kobo area shortage of grazing land, livestock diseases, drought and water shortage were limiting (Ngega *et al.*, 2002). Animal numbers in small-scale systems are in line with those reported from other parts of the world. In Afghanistan, sedentary (as opposed to semi-nomadic) farmers keep an average of five heads of cattle for draft power and household milk supplies, young stock for replacements and sales, and generally own three to 10 sheep and goats (Ward *et al.*, 1998). In the Northern Communal Areas of Namibia, Düvel & Stephanus (2000) reported that 55% of respondents mentioned livestock disease as the main constraint.

For a livestock owner in Obonjaneni it is important to know that the annual decline in grass quality in this area usually begins in February and that good-quality licks (protein-mineral licks) need to be supplied to livestock from this time of the year, to ensure continued animal mass gains (Hardy & Camp, 1999). They also need to know that, when rains occur in early spring (thus ensuring early-season grass growth), this type of grassveld provides grazing for about nine to 11 months of the year. Most classes of animals are able to maintain mass with the supplementation of a good-quality lick during the winter months, provided that enough roughage is available (Hardy & Camp, 1999).

The livestock owners interviewed in Obonjaneni used different kinds of strategies to overwinter their animals. Information showed that livestock owners spent money on supplementation, but many of the supplements, varying from salt to molasses meal, still did not supply the nutrients deficient in the veld during the winter period. Cattle management was difficult, since fences in the area have been stolen or have disintegrated. Herding of cattle was a problem, because young boys, traditionally used for herding, were in school. The absence of an organized livestock owner structure was evident and the owners were encouraged by FSRS staff to form a livestock association. Advantages of an association could be the following:

a) to organize the herding of livestock;
b) to address the constraints relatively easily with an extension or research intervention programme;
c) to address livestock theft more effectively – collectively they have a far better chance to obtain the assistance of the Stock Theft Unit of the SA Police Service;
d) to purchase inputs (licks and remedies) together and share costs.

4.5.3 Crop production

As the staple, maize was found to be the preferred and most important crop in Obonjaneni, with 94% of the people interviewed planting it mainly in homestead gardens. Although four people mentioned making use of communal fields, the approximately 40 ha of communal fields (measured by satellite imaging, Natural Resource Section, KwaZulu-Natal Department of Agriculture and Environmental Affairs) had not been cropped for 5 to 7 years, at the time of the interviews. The finding that people rely on maize as their main staple food crop is typical of the rest of Africa. In Kenya, although coffee and livestock dominate the farming systems, food self-sufficiency is considered to be an important factor and all farmers grow maize, beans, potatoes and bananas. In the Central and Eastern Highlands of Kenya it is said "a family without maize is dying of hunger" (Micheni, 1998). In Zambia, maize is the first crop to be grown by Zambian smallholders (Drinkwater & McEwan, 1994). The present diagnostic study showed that maize production in Obonjaneni was in a poor state and this shortcoming needed to be solved (see Plate 4.11).

It would appear that the majority of people in the area planted maize too late. Maize was planted towards the end of November, or in December, by 63% of the farmers. Lea (1991) advised a maize planting date not later than early November. This area is classified by Lea (1991) as an area with a very short growing season and cold spells in this high-altitude area may cause considerable damage to late-planted maize. The possible advantage of the correct planting date on yield needs to be measured against solving the reasons given for planting late, which included trespassing livestock, unreliable contractors and stalkborer problems.

Inadequate weeding was a common feature and this could affect the yields of maize and other crops (see Plate 4.11). Early weeding has been shown to almost double the grain yield of maize and should take place not later than two to three weeks after emergence. In most cases, a second weeding will be required two to three weeks later. In order to obtain top yields, a third weeding might be beneficial, particularly if persistent, perennial weeds are troublesome (Lea, 1991).

The main reason, according to Lyne & Niewoudt (1990), for low crop yields is that many growers provide only minimal inputs and often very little labour input for hand weeding. The net effect was that in 1990 only 10% of land holders in KwaZulu could be regarded as progressive farmers, adopting recommended practices to a reasonable degree. Many of these were participating in Farmer Support Programmes. In Zimbabwe, Swaziland and Zambia, late and inadequate weeding is widely recognized as a common feature of smallholder production. Factors which contribute to this problem include the priority given to expanding the area planted, the time needed for hoe weeding and the shortage of draught oxen. A World Bank (1987) report mentioned that poor weed management, late planting and low plant populations combine to constrain potential increases in arable productivity on small farms. In most rural areas in southern Africa, due to limited household labour and the current risk management strategy of planting as large an area as possible, most crops are weeded once only, typically 4 to 6 weeks after emergence (Twomlow & O'Neill, 2003). The practice of weeding only once can rob the household of up to 40% of its potential crop yield, compared to a crop that has been weeded once at 2 to 3 weeks and again 6 weeks after emergence, regardless of crop establishment practices. In Uganda, men and women identified weeding as an arduous job and men considered weeding as being particularly difficult for women, especially with the heavy hoes available for weeding (Lubwama, 1998).

The reasons for the huge range in plant populations for maize in Obonjaneni were not examined. The recommended plant population for the Obonjaneni area, according to Lea (1991), is 25 000 for low and 35 000 for good soil fertility conditions. Surveys and observations on small farms in Zimbabwe, Swaziland and Zambia indicated that densities of 15 000 – 20 000 maize plants/ha are common when farmers are aiming at the recommended 35 000 – 44 000 plants/ha (Low *et al.*, 1991). These authors mentioned that poor-quality seedbeds, insect attacks, dry spells, soil capping and inappropriate equipment and methods are among the reasons for the low plant population. The tendency towards late planting in Obonjaneni is also evident in other countries. Low *et al.* (1991) reported that maize is planted 30 – 60 days after the recommended planting dates in Zimbabwe, Swaziland and Zambia.

Cragg (cited by Muller, 1987) found that an estimated household subsistence requirement for maize was 700 kg per annum. Kirsten *et al.* (1998) found in a survey in two districts in the former KwaZulu that crop production is largely of a subsistence nature and only a relatively small proportion of households sells some of their harvest. Subsistence farmer maize yields of lower than 1 t/ha were the norm for the area in which the Obonjaneni community falls (Von Maltitz, 1998). The maize yield potential for the area is, however, between 5 and 7 t/ha (Camp, 1995). In the early 1980s Bembridge *et al.* (1983) commented that the extremely low maize yield levels found in KwaZulu (Obonjaneni falls within the former KwaZulu), which are a fraction of the potential, are a direct reflection of the low rate of adoption of modern technology by farmers. The authors indicated that this clearly showed a need for a diagnostic investigation into the reasons for the poor adoption of technologies.

The majority of people interviewed in Obonjaneni (41%) harvested between 100 kg and 1000 kg of shelled maize, while the total maize yield averaged approximately 300 kg per household. The fact that only one respondent in Obonjaneni sold a small amount of maize showed that yields is produced mainly in an attempt to satisfy subsistence needs. Only two households out of 16 produced more than 700 kg of maize in their fields, showing that people in Obonjaneni produced maize yields below the subsistence level. The mean yield of 314 kg showed that the maize yield fell short, by more than half, of the subsistence requirements per year. Differences in maize yield between the households illustrated the variation in maize production systems, which could complicate the selection of a target group for maize research.

On an average field size of 3 410 m^2 (Table 4.7), and assuming a mean yield of 5 t/ha, production could be, on average, 1 705 kg of maize per annum, at a 70% management factor (see 3.2.1.4 b). It is thus possible, in the absence of hail, to produce enough maize for subsistence on the relatively small areas in Obonjaneni, provided that management practices such as planting dates, soil fertility aspects and the correct plant population are addressed.

Stray animals, poor yields and a lack of knowledge were given as the most important factors affecting the production of crops and vegetables. The main reason given by people in Obonjaneni for the trend towards the late planting of maize was that animals were kept as long as possible on the crop residues and grass in the communal cropping area before they are moved to the mountains. Cattle owners were unwilling to withdraw their livestock to the highlands due to stock theft. What was found in Obonjaneni in 1998 was not a new problem. Thomson & Lyne (1995) reported that 50% of households in the Amazizi ward, of which Obonjaneni is a subward, were having problems with stray animals and 91% of them had problems with crops being damaged by livestock. Where neighbouring commercial farms had almost completed their field operations in October, very few communal farmers had commenced ploughing and livestock was still grazing the arable land (Thomson & Lyne, 1995).

4.5.4 Soil fertility

People in the community did not use lime when growing crops and vegetables. The results of the soil sample taken in the community garden showed that lime could have a significant impact on the garden, and also on agriculture in general, in Obonjaneni. Another important finding was that all the people interviewed bought fertilizer, but 94% of the farmers interviewed had never had a soil sample tested (see Plate 4.12). Thus crop and vegetable growers did not purchase fertilizer according to soil sample analysis and applied the products without this information and without knowing their field sizes. Even though the quantities applied were probably entirely inadequate, this implies inefficient use of scarce capital, while resultant poor maize and vegetable yields contribute to the poor state of agriculture in the community. The level of fertilizer use in Africa is very low, approximately 8 kg/ha (Fofana *et* *al*., 2003). The use of mineral fertilizers in eastern Africa is not a traditional practice and, as such, is still viewed as *nouvelle* in some areas (Mati & de Lange, 2003). In Ethiopia, 78% of farmers interviewed in 1995 used mineral fertilizers and virtually all the non-users were poorer farmers (Eyasu, 2002). Fofana *et al.* (2003) believed that the use of fertilizers could be part of a solution to correct environmental degradation and to address rising food demands properly. With the agronomic and, in particular, soil fertility technology currently available, there are enormous opportunities for increasing the yields and thereby the sustainability of small-scale farming (Miles, 1996).

In KwaZulu-Natal, surveys based on soil tests indicated that crop yields are often severely restricted by excessive soil acidity and/or nutrient deficiencies (Miles, 1996 and Beukes, 1997). Factors contributing to this state of affairs, according to Miles (1996) and Beukes (1997), are (i) soils are often inherently infertile, (ii) capital for correcting infertility problems is in short supply and (iii) where capital, albeit limited, is available, corrective treatments often do not address the specific, most-limiting soil factors on particular fields. Miles (1996) commented that, indirectly, soil infertility might have major sociological effects on rural communities. Where fertility problems are not addressed, low yields and/or frequent crop failures contribute to poor stewardship of the land resource. According to Miles (1996), a small soil fertility improvement could result in large, very obvious and very profitable yield increases.

It was found that relatively small amounts of kraal or chicken manure were used, except in one case, where the farmer used 7 tons of kraal manure on 3600 m^2. The actual quantities of manure applied, as indicated by the respondents, may not be reliable, because the manure was not weighed before application. According to Lea (1991), a small quantity of manure is better than none, but, to obtain good results, 5 to 10 tons/ha of kraal manure or between 3 to 5 tons/ha of poultry manure are needed.

Many African agricultural experts consider soil fertility depletion to be the fundamental root cause of declining food security across the continent (Borlaug, 1996 and Sanchez, 1997). In a survey conducted in Zambia, farmers described their soils as exhausted and finished and linked the problem to the decline in yields and their deteriorating food security situation (Drinkwater & McEwan, 1994). In Kenya Onyango *et al.* (1998) stated that low soil fertility was one of the problems affecting crop and livestock production which required urgent attention. A wide array of ideas, including compost making, better methods of conserving farmyard manures, the use of green manure legumes and combinations of organic and inorganic fertilizers for maize, vegetables and pasture production, were studied in Kenya as a means of addressing the soil fertility problem. Field trials in Malawi demonstrated that local maize varieties grown on organically rich soils gave double the yield of hybrid varieties grown on poor soils, suggesting that the overriding constraint on maize production there is not germplasm but soil fertility (Carr, 1994).

4.5.5 Community garden

At the time of the diagnostic study, the community garden in Obonjaneni was in a poor state and was benefiting neither the members nor the community. Soil samples showed that soil fertility, and particularly the high soil acidity levels, were negatively affecting the production of vegetables in the garden. The comment by Schmidt & Vorster (1995), that participation in a communal garden does not guarantee better nutritional status for households, needs further investigation. However, the advantage for households who grew vegetables, according to Schmidt & Vorster (1995), was that they did not purchase vegetables, but used the money to purchase other foods, such as oil and fat. The present author believes that home gardens and the community garden in Obonjaneni could play a considerable role in providing households with fresh vegetables, to supplement the often poor diets of people in rural communal areas. The marketing of produce from this garden also has great potential. Besides the local demand for fresh vegetables, the produce could be sold to tourists, as this garden is located in an area of KwaZulu-Natal that attracts many tourists. An important factor to ensure productive homestead gardens will be the provision of sufficient water. Water harvesting needs to be investigated in these areas. The optimum management and utilization of the small areas available around the homesteads needs to be researched, with the co-operation of interested participants.

4.5.6 Constraints and solutions

Low *et al.* (1991) reported that, in general, the diagnostic part of on-farm research programmes in Kenya, Zimbabwe, Malawi and Swaziland had no difficulty in identifying clear sets of research opportunities from initial diagnostic studies based on formal and informal surveys. The value of a proper diagnostic study was shown in workshops in Ghana and Tanzania, where on-station researchers, extensionists and NGOs ranked soil fertility as a high priority problem, after it had been ranked low during the farmer workshops. The reason for the adjustment in ranking was that soil tests showed low fertility levels and development workers reasoned that soil fertility was likely to be a key factor limiting the sustainability of production systems in the face of population growth and a shorter fallow period (Hawkins, 1994).

Table 4.9 shows that the constraints found in Obonjaneni are similar to those experienced by many small-scale farmers in numerous other countries.

Table 4.9 Agricultural production constraints identified by small-scale farmers in other developing countries

Country	Problems	Literature
Zimbabwe	Low crop yield associated with poor management, a lack of draft power, low soil fertility, pests and diseases, inadequate labour at critical periods (leading to poor timelines of planting and weeding) and low plant populations.	Chavunduka, 1982
Panama	Control of weeds in maize fields.	Martinez *et al.*, 1991
Tanzania, Arumeru district	Lack of water for livestock, crop water stress, livestock diseases, crop pests and diseases, lack of grazing areas and fodder, low soil fertility, lack of firewood, weeds and lack of credit.	Hawkins, 1994
Ghana, northern villages	*Crop production:* pests and diseases, low soil fertility, weeds, lack of irrigation, delayed planting, availability/cost of tractor, availability and cost of implements. *Animal production:* animal disease, animal feed, animal theft, water for animals, marketing of animals and herding. *Economic:* lack of credit, difference in grain sale/purchase price, underemployment and insufficient cash in lean seasons. *Labour:* land preparation, planting, weeding, harvesting and processing.	Hawkins, 1994
India	Limited size of farm holdings, poor land and soil fertility, poor quality seeds, lack of cash and credit, inadequate irrigation and drainage arrangements, lack of timely access to inputs.	Nataraju & Nagaraja, 1998
Kenya	Non-use of organic or inorganic fertilizers, non-certified seeds, low-yielding varieties, poor weed control, lack of technical knowledge and continuous cropping and soil problems (soil erosion, waterlogging, low soil fertility, leaching and soil compaction).	Onyango *et al.*, 1998
Nepal	Low crop productivity resulting from the low yield of the different species and cultivars, incidence of pests and diseases, soil erosion, low soil fertility and a lack of information on improved technology.	Timsina, 2001
San Salvador, Altavista	Cause for a 25% yield decrease in corn and rice was declining soil fertility and drought.	Gabunada & Barker, 1996

The causes and solutions for constraints identified in Obonjaneni could, however, differ, to accommodate local socio-economic factors. The constraints identified by the respondents highlighted a lack of expertise and management skills in all aspects of agricultural production. Although poor contact and linkages with Departmental officials were not raised by the respondents in Obonjaneni, the constraints listed by them in the study clearly indicate the poor, or even absence of, communication with officials who have to assist in solving the problems. Similarly, in Afghanistan, a fundamental problem, which perhaps applies to many countries, and which caused a poor animal health and production delivery system, was the poor interaction and relationship between veterinarians and livestock owners (Mehraban *et al.*, cited by Ward *et al.*, 1998).

Solutions to some constraints of small-scale farmers will not easily be found. A green revolution in southern Africa is unlikely to spring from a single technology breakthrough. It is more likely to come from a series of incremental gains in productivity which derive from a number of carefully focused research thrusts. According to Blackie (1989), it will need the development of a research agenda in which farmer income, stability of production and job creation are the primary criteria for evaluation. An on-farm research and technology dissemination programme, to address the most important constraints and opportunities, could only take place after an in-depth study of all aspects linked to the constraints and through a series of meetings and discussions with a well-represented group of community people, as was done in the study in Obonjaneni. An issue that needs close monitoring is whether or not there are hidden constraints that are not apparent to the community or even to the interviewer. A diagnostic stage needs patience and it needs to guarantee that discussions take place with a wide cross-section of the community, to ensure that the planned on-farm research programme covers all possible alternatives which benefit the target group.

What emerged from the current study was that not one of the households was totally dependent on agriculture for a living. This is quite different from many other developing countries in the world. Some small-scale farmers are incorporating high-value crops into their farming systems (*e.g.* vegetable production by Indian communities in the highlands of Guatemala and organic coffee by small farmers in southern Mexico), in an effort to better their well-being and reduce rural poverty (Berdegué, 2001). Most of the households in Obonjaneni relied on non-agricultural sources of income. If this survey had been conducted at a different location, where the community was more reliant on agriculture, the outcomes of the survey may well have been different in terms of the constraints and solutions. Future questionnaires will therefore have to take this into consideration, to measure the real interest of people in agriculture and their commitment to use agriculture to improve their lives. With an increase in the size of the rural population, *e.g.* as a result of unemployment and, consequently, an influx of people to these areas, production land for farming becomes smaller and smaller. This creates a challenge to all rural development practitioners, in collaboration with voluntary participants from communities, to research and establish the best use of the relatively small areas available for farming. It is a concern that fields or gardens are used for a few months and then left non-utilized for many months. The improved use of available, limited land could certainly contribute to the mitigation of rural poverty, hunger and other social problems found in communities. Constraints identified in this study show the need for a well-planned on-farm research and technology dissemination programme, to address the poor state of agriculture in a sustainable manner.

4.6 Conclusion

a) The structured diagnostic survey used in this study provided critical information on the farmers' production systems, the circumstances under which the farmers operated, the farming activities pursued by the farmers and the resource-base of the target area. It provided an idea of the overall environment in which the farmers operated. It made possible the identification of key constraints and some of the needs and aspirations of the farmers.

b) The community's poverty and low agricultural production justified the focus on an on-farm research programme. The diagnostic study showed that the small-scale farmers in the community, and perhaps in the area, have been excluded from the mainstream agricultural sector and that agricultural development and technology dissemination programmes had had very little success in addressing the constraints experienced by farmers in this community.

c) The two main issues which had a negative impact on the agricultural activities in Obonjaneni were identified as stray animals and a lack of agricultural expertise.

d) The diagnostic survey, and discussions with members of the community, revealed that agriculture was in a poor state. The maize yields obtained from the small areas at homesteads in general did not meet the requirements of households. Very little activity was taking place in the 40 ha communal cropping fields. The community garden was in a poor state, with low vegetable yields and despondent garden members.

e) It appeared as if no-one in the community was permanently involved in agriculture and no-one seemed to rely on agriculture as a source of income. It was clear from feedback, however, that Obonjaneni is an area with high agricultural potential and that, in the past, the community was actively involved in agriculture.

f) At the meetings attended by staff of the KwaZulu-Natal Department of Agriculture and Environmental Affairs it was apparent that the community welcomed their participation and they were requested to address the agricultural problems experienced by the community. This was important and encouraging for the subsequent on-farm research approach.

g) The people who participated in the diagnostic studies had a good understanding of their problems, but were unable to find appropriate solutions to the constraints they had identified by themselves. From the start, the people welcomed support from outside the community. It was concluded that addressing the constraints identified in this study with on-farm, client-orientated research and a technology dissemination initiative could contribute to a revival of agriculture in Obonjaneni.

h) It was promising to note that approximately half of the respondents indicated that they wanted to sell produce and generate income from agriculture. These people needed to be supported with technology and knowledge. They could also be the real farmers in the community, who could make a difference to food security in such a rural community.

i) The literacy level and the language skills of the people need to be considered when notices or invitations are prepared for distribution in the community, or when technology is disseminated. Communication with the community, in whatever form it takes, needs to be in Zulu. It needs to be very clear and easy to read when a written format is used.

j) The non-involvement of youth in agricultural activities was raised as a concern during meetings. The poor state of agriculture in the community and the precarious existence of people in rural communal areas could contribute to the lack of interest shown by the youth and by others in the community. Young people would rather look for work in the towns and cities and urbanisation is thus a more attractive alternative. Addressing the constraints successfully and changing the face of agriculture could bring some of the youth back to agriculture.

k) The relatively poor attendance at the meetings was perhaps an indication of the low percentage of people in the community who were really interested in making progress with agriculture or an indication of the level of disenchantment with agriculture. The FSR team was not sure how to interpret the small number of people who attended the meetings and participated in the diagnostic survey. The Extension staff assured the FSRS staff that the low level of community participation was a common problem and was the reason why extension workers concentrate on interest groups or farmers' associations. They also commented that, as soon as research results were forthcoming and some people seemed to be benefiting from the results, other people would join.

l) All the activities that took place during the diagnostic stage contributed to the much-needed link between Extension staff, farmers and the staff of the FSRS. These activities were time-consuming and required a commitment and a process of continuous communication among the different partners.

4.7 Recommendations

a) Training sessions on how to use questionnaires before entering a community are recommended. This allows for the standardization of the way answers are presented and the inclusion of additional relevant information where explanations need to be given.

b) It is recommended that the interview team meet before and after the first session of interviews, to discuss the process, the progress made, to compare responses and to discuss and solve possible problems and uncertainties. This contributes to the collection of quality information.

c) A list of the names of people attending the meetings should be kept. The observation is that many "new" people show up at each meeting, but that only a core group attends all the meetings.

d) As a team (researchers, farmers, Extension), time frames should be set to monitor the progress of the process.

e) The role and the responsibility of each partner throughout the process should be defined. This allows partners (including farmers) to include the activities of an on-farm research programme in their daily activities or work programmes. This would ensure commitment and a clear understanding of each partner's role in the programme.

f) There is a need to persevere with the people who regularly attend meetings and who participate in the activities - they are the people who are interested in agriculture and who are trendsetters.

g) There should be discussions and agreement, at the start of the process, about what is expected from Extension staff, including such issues as:
   i. their use as a key informant in the provision of a description of the farming systems practiced in an area and to provide other technical information required;
   ii. their assistance identifying leading farmers and farmer groups;
   iii. their link between the research team and the small-scale farmers for setting up meetings, aspects such as dates, venues and time should be borne in mind.

h) The tribal authority should be involved from day one in the diagnostic phase. They should be informed about the findings of the diagnostic study and involved in all the programmes and actions taken to address the constraints identified by the people of a community, *e.g.* they need to be invited to feedback meetings, field and farmers' days and to be sent the minutes of meetings.

i) The Extension staff should conduct diagnostic studies, not only for the sake of calling in research scientists to conduct on-farm research, but also for their own use in a demand-driven technology dissemination programme.

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CHAPTER 5

ON-FARM RESEARCH AND TECHNOLOGY DISSEMINATION IN OBONJANENI

Knowledge is the most precious of all resources and it should be spread as far and wide as possible (Blight, 1998)

5.1 Introduction

The generally poor state of agriculture, which in many instances is accompanied by socio-economic problems such as hunger, poverty, unemployment and poor health, is threatening millions of people in developing countries. Agricultural technology, according to Bembridge *et al.* (1993), has an important role to play in improving food security in South Africa by augmenting food supplies, as well as household purchasing power. Thousands of small-scale farmers with agricultural constraints are situated at considerable distances from research stations, while on-station researchers are often far removed from the reality of small-scale farmer agriculture. A need among agricultural researchers to better understand small-scale farmers, and the circumstances under which they operate, has led to the emergence of a farmer-orientated approach to technology development (Robotham & McArthur, 2001). The adoption of an on-farm research approach implies moving away from packaged recipes towards providing farmers with options and advice on how to improve production (Low *et al.*, 1991) or to modify their practices. However, an important prerequisite for research to be relevant and effective, is a strong link between researchers, farmers and extension staff (Merrill-Sands & Kamowitz, 1990; Röling, 1990 and Norman *et al.*, 1994). The reason for the partnership in an on-farm research programme is that the system in which a small-scale farmer operates demands research that is applicable, practical and problem-orientated (Timsina, 2001); this should hold good for small-scale and for commercial farmers. A result of improved linkages sees farmers participating in meetings, diagnostic studies, problem identification, implementation of on-farm trials, the assessment of technology, the application of the technology and the training of others (a composite of results from various authors) (Ashby *et al.*, 1995; McArthur, 1996 and Onyango *et al.*, 1998).

On-farm trials have for many years been part of national research programmes in Asia, Africa and Latin America, with beneficial results in bringing technology to resource-poor farmers (Bembridge *et al.,* 1993). The research objectives, experimental design and methods used, types of data to be collected, methods of analysis and evaluation criteria which would appeal to the different role-players in the agricultural development process will dictate the type of on-farm trial to be used (Norman *et al.*, 1994). Trial types found in this approach vary from researcher-led to farmer-led (Collinson, 1987; Biggs, 1989; Norman *et al.*, 1994; Schiere, 1996; Pound *et al.*, 1998 and Snapp, 1999). Further, on-farm testing and/or adjustment of technologies to specific environmental and farmers' conditions are mainly addressed through an adaptive research approach (Norman *et al.*, 1995; Schiere, 1996 and Low, 1997).

In spite of the fact that on-farm research is aimed at specific environmental and farmers conditions, it is found that communities are composed of diverse groups of farmers with different levels of power, access to resources, and some will even have the wish or the interest to be involved in the research programme (Biggs, 1989 and Okali *et al.*, 1994). All these elements or factors contribute to the weakness of a possible biased selection of farmers as participants in a research programme (Ewell, 1988; Biggs, 1989 and Merrill-Sands & Kamowitz, 1990). An important selection criterion for farmer participation in on-farm trials is that farmers should be interested, willing and able to co-operate (Norman *et al.*, 1994). Other factors such as gender, wealth, the type of draught used, or specific characteristics of the type of land farmed or animals owned, need to be included to stratify participants in a sample to ensure that there is representation by both male and female, wealthy and poor farmers (Norman *et al.*, 1994). Adato & Meinzen-Dick (2002), for example, illustrated the importance of a gender balance in Zimbabwe, where men were found to prefer improved varieties, while women preferred open-pollinated varieties because they had less access to credit required for certified seed and fertilizer and to formal maize markets where improved maize is sold.

After the initiation of an on-farm research programme, a challenge to the approach is to keep the interest of the farmer participants. The expectations and the curiosity of farmers when something is done on their farms must, according to Hildebrand & Poey (1985), be satisfied as quickly as possible if their support and assistance is to continue. If at all possible, treatment effects must be observable and it must be ensured that as little time as possible lapses between the completion of trials and the communication of results in ways that farmers understand (Fernandez, 1991; Norman *et al.*, 1994 and Pannell, cited by Smith *et al.*, 2001). Bembridge *et al.* (1993) said that for research to be effective for farmers, a continuous flow of technology suitable for agricultural and rural development is needed. The dissemination of technology through an on-farm research programme, with all its different phases, addresses the criticism of the traditional indirect way of information flow which is from researchers to subject-matter specialists to extension workers to farmers. It is felt that such information is often not relevant to many farmers' priorities or constraints and fails to have an impact on the resource-poor farmer (Collinson, 1982; Cox *et al.*, 1998 and Van de Fliert, 2003). Appropriate messages need to be tailored and translated into practical applications for the diverse circumstances in which farmers operate or find themselves in a particular target area. Factors such as production systems, economic realities, household objectives, managerial capacity, resource endowments and farmers' priorities and constraints contribute to the most relevant message for a target area (Kirkby *et al.,* 1981; Collinson, 1982; Low, 1995; Eponou, 1996 and Van de Fliert, 2003). Once the technology options are released for dissemination, it is up to the farmers to decide whether or not to adopt them (Norman *et al.*, 1994).

One must not think that only on-farm research has been responsible for major changes in Africa. According to Maredia *et al.* (1998) there is growing evidence that the impact of agricultural research in Africa has increased productivity on farms. The generation and diffusion of improved, higher-yielding maize, open-pollinated varieties in western Africa and hybrids in eastern and southern Africa, higher-yielding wheat in eastern and southern Africa, hybrid sorghum in Sudan, semi-dwarf rice for irrigated regions in western Africa, early-maturing cowpeas in western Africa and disease-resistant potatoes in the eastern and central African highlands are cited as outstanding success stories of technological change in food crop production in parts of Africa (Maredia *et al.,* 1998). There is sufficient evidence, according to Rukuni & Anandajayasekeram (2001), that the pay-off of agricultural research in Africa is consistent with the positive returns experienced in Asia and Latin America (Oehmke & Crawford, 1996). The benefits of research are considerable and returns on investment of 20 to 90% have been reported in various countries (Gamble, 1984).

The measure of value of any technology development or new knowledge will be the degree of adoption. Superficial diagnosis of problems and causes, poor implementation of trials, inadequate analysis and interpretation of trial results in relation to the implications for farmers, improper planning of the next cycle of trials, lack of genuine farmer participation and a high turnover of staff, are some of the main contributory factors of non- or poor adoption of technologies (Low, 1995). For example, excellent farmer interest and participation in a combination of experiments and demonstrations led to significant changes in maize production practices in Panama (Martinez *et al.*, 1991). Farmer participation and improved technology adoption has been shown to be successful in Kenya in connection with use of locally available agricultural products and cropping systems that enrich soils (Onyango *et al.*, 1998). In Malawi soil fertility technologies adopted by farmers also improved maize production (Snapp *et al.*, 2002).

Researcher, farmer and extension staff need to thoroughly study the small-scale farming system and the identified constraints before the initiation of a research programme (Tripp & Woolley, 1989 and Harrington, 1995). Such a study would simultaneously include the identification of possible solutions (Norman & Douglas, 1994), which is determined by the availability of skills and scientific information (Baur & Kradi, 2001). It is also important to realize that for many farmers, experimentation is a way of life in order to ensure survival (Schiere, 1996). Thus the knowledge and skills of rural people that have allowed them to survive over many years need to be included as possible solutions for any intervention programme. The final stage therefore in planning on-farm trials is to prioritize new technology options and possible solutions to be used by farmers to enable them to better their current situation through the modification of current production practices which will result in an increase in agricultural productivity and incomes.

To address the agricultural constraints identified by the people of Obonjaneni during the diagnostic study and for research to have an impact in a rural community, a demand-driven on-farm research and technology dissemination programme was applied by the Farming Systems Research Section (FSRS) of the KwaZulu-Natal Department of Agriculture and Environmental Affairs. An overview of the following activities followed between 1998 and 2002 will be presented:

- procedures and methods followed in the on-farm research programme;
- results of the on-farm research programmes;
- interaction with and feedback from farmers.

5.2 Procedures and methods followed in the on-farm research programme

5.2.1 Location and participants

Obonjaneni is situated in the Bergville District in KwaZulu-Natal (See Figure 2.1 in Chapter 2) (28°41'00"S and 28°59'50"E), approximately 40 km from the nearest town, Bergville, and 220 km (a four-hour return trip) north-west of the Cedara Research Station, where the FSRS is based. It is at an altitude ranging from 1197 to 2743 m (flat to mountainous) and with a rolling broken terrain of moderate to steep slopes (Camp, 1995). The Tugela river, one of the main rivers in KwaZulu-Natal, runs through Obonjaneni, with the communal cropping fields situated between the river and the residential area.

Two distinct groups in Obonjaneni, namely the Amazizi Maize Association and the Phuthumani Community Garden, were the main partners in the on-farm research and technology dissemination programme. They were the farmers who mainly attended meetings and volunteered to participate in the research programme in terms of making fields or plots available and assisting in the planting, management and harvesting of trials and in organising the technology dissemination events.

To strengthen the technology-development component of the FSRS, scientists and technicians from the Soil Fertility Section, based at Cedara, became permanently involved in the research programme. Scientists and technicians from the Natural Resources, Agronomy, Crop Protection (Weed Control), Pastures, Horticulture and Animal Science Sections, all based at Cedara, were co-opted to the programme when their inputs were needed. The involvement of the on-station scientists and technicians was an ideal opportunity to link on-station research programmes with small-scale farmer agriculture, as well as with Extension staff.

Twenty small-scale farmers, the Induna (Headman), Extension and FSRS staff attended the first research planning meeting on 22 September 1998. The Amazizi Maize Association allocated approximately 1.5 ha in the middle of the unutilised 40 ha communal cropping fields for the trials. The identified site was found suitable, for the following reasons, it was:

a) located close to the main tarred road passing through Obonjaneni;
b) visible to the majority of people in the community;
c) relatively easy to reach for the majority of the community;
d) representative (in terms of soil type and fertility) of the communal fields available to the small-scale farmers for growing crops.

Because the trials were conducted in the communal fields and due to the representativeness of the site, it was decided that the one field was sufficient for the trials. However, when working with individual farmers, it was the view of Asopa & Beye (1997) that on-farm research should be conducted on an adequate number of farmers' fields. This could allow for representativeness of the production situation and for different socio-economic conditions within an area and would increase the statistical reliability of the results.

5.2.2 Research protocols

The principal objective of the on-farm research approach was to revive agriculture in Obonjaneni. To achieve this, farmers requested several research trials, each with its specific objective. For each research trial conducted, a responsible officer and co-workers compiled a research protocol, which included objectives and the methodology to be followed. Annually, the responsible officer compiled a progress report of each trial, covering the data collected for the particular season. The author of this thesis, who led the team in the approach followed in Obonjaneni, quoted, where indicated, the research conducted by scientists and technicians from a completeness point of view to point out the extent and type of work that was carried out to adhere to the demands of farmers and to address constraints identified by them.

5.2.3 Crop trials conducted over four seasons

The constraints identified during the diagnostic phase (see Chapter 4) were used as the basis for planning the on-farm crop research programme with inputs from farmers and Extension staff. The cropping trials and demonstrations conducted over four seasons (1998/1999 to 2001/2002) are summarised in Table 5.1.

Table 5.1 Summary of the on-farm research trials conducted in the communal cropping fields over four seasons (1998/1999 to 2001/2002) in Obonjaneni

Season 1 1998/1999	**Season 2 1999/2000**	**Season 3 2000/2001**	**Season 4 2001/2002**
Maize: lime x cultivar	Maize: lime x cultivar	Maize: lime x cultivar	Maize: lime x fertilizer x cultivar
Dry bean: lime x cultivar	Dry bean: lime x cultivar	Dry bean: lime x cultivar	Dry bean: lime x cultivar
	Evaluation of maize cultivars for green maize	Maize: effect of planting date on yield	Maize: effect of planting date on yield
	Vegetable soyabean and cowpeas as alternative crops	Potatoes: cultivar and cultural practices	Maize: planting without ploughing demonstration
			Potatoes: cultivar and cultural practices
			Vegetable soyabean as alternative crop

Planning meetings that were open to the entire community, but were attended mainly by members of the Amazizi Maize Association and Phuthumani Community Garden, were held annually prior to the start of the cropping season (see Plate 5.1). The purpose of the meetings was to discuss results from the previous season's trials, constraints and possible solutions to be tested in the on-farm trials. The annual feedback meetings of research results are summarized and presented in Table 5.7. The poor state of agriculture and the apparent absence of leader farmers when the FSRS arrived in Obonjaneni in 1997, and the farmers own programme and involvement in their fields, contributed to the decision to use researcher-designed and researcher-managed trials, as classified by Biggs (1989). It was requested during the meetings that the farmers and Extension staff assist during the planting, management and harvesting of trials.

During the planning meetings an *ex ante* evaluation (Norman *et al.*, 1994) showed that people interested in participating in the on-farm trials wanted to produce enough crops for their own consumption first and then to sell the surplus, mainly to people in the community. It was anticipated that surplus maize could also be sent to a maize mill run by the Upper Tugela Farmers' Association, approximately 15 km from Obonjaneni.

The objectives and a summary of the treatments of the maize, dry bean, vegetable soyabean and cowpeas and potato trials are summarised in Tables 5.2. Information of the trials conducted will be discussed per season.

5.2.3.1 Season 1 (1998/1999)

At the first planning meeting, farmers requested maize (*Zea mays* L.) and dry bean (*Phaseolus vulgaris* L.) trials to identify suitable cultivars for the community, with high yields as an important criterion (see Plates 5.2 and 5.3). It was suggested by scientists, in view of the soil acidity constraints in the area (as identified by soil samples taken during the first visit to the community), that lime needed to be included as a treatment. According to the soil analysis, a lime application level of 10 t/ha was required for optimum maize yield in the communal cropping fields (see Plate 5.4). The cost to a farmer to apply 10t lime/ha was calculated to be R3800/ha (taken at R19.50/50kg bag, as paid by the Amazizi Maize Association members in the 2002/2003 season and disregarding transport difficulties and transport costs). The high cost of lime would be unaffordable to the majority of small-scale farmers in the area. However, it was important in the first season to demonstrate the effect of lime on acidic soil and thereby to determine the potential for maize production in the area. It must be taken into consideration that farmers develop high expectations when something is done on their farms and their curiosity should be satisfied as quickly as possible if their support and assistance are to be maintained (Fernandez, 1991).

Plate 5.1 Planning and feedback meetings were held annually, prior to the new cropping season

Plate 5.2 Lime x fertilizer x cultivar maize trial in communal cropping area

Plate 5.3 Dry bean trial to test the response of different cultivars to lime on acid soils

Plate 5.4 Soil analysis indicated that a lime level of 10 t/ha was required for optimum maize yield in communal cropping fields (maize grown under 0 lime in the foreground and 10 t/ha in the background)

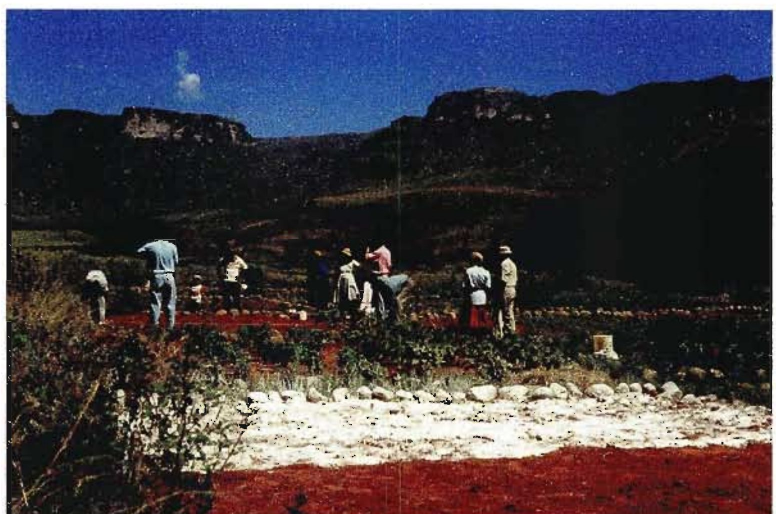

Plate 5.5 FSR Section staff demonstrate the effect of lime compared with no lime on yield performance of vegetables in the community garden

Plate 5.6 Farmers participated in planting maize trials in the communal cropping fields

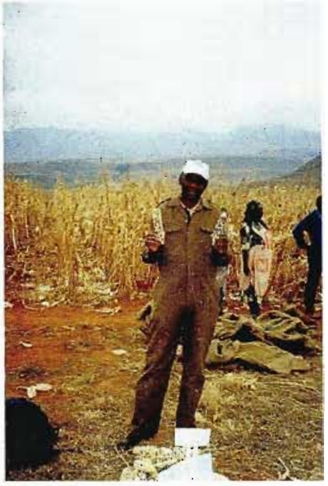

Plate 5.7 Farmers realized that Obonjaneni has the potential for good maize production

Plate 5.8 In the absence of lime it could be more profitable for farmers to plant their own seed (Mr Mbongwa, a farmer, supplied his own acidity-resistant maize seed for the trials)

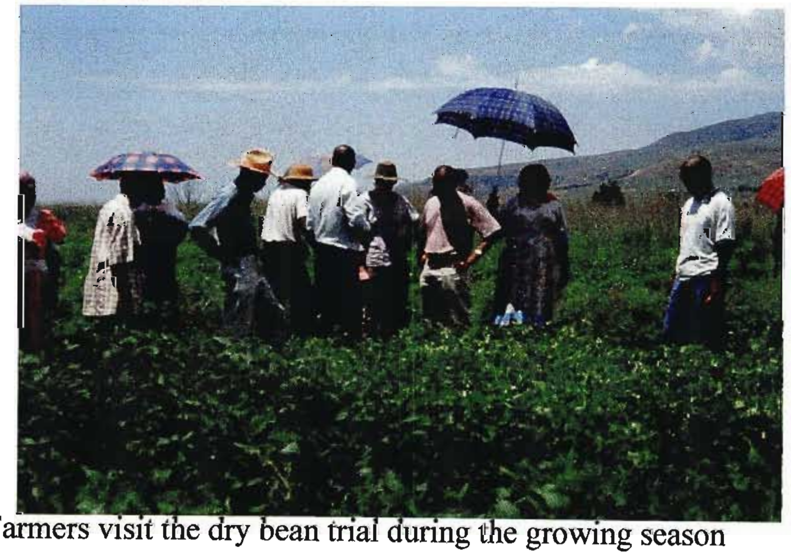

Plate 5.9 Farmers visit the dry bean trial during the growing season

Plate 5.10 A trial to compare the yield of cabbages grown where only lime was applied and where lime and fertilizer were applied

Plate 5.11 On-farm research showed that cabbages could be produced successfully and profitably in the community garden

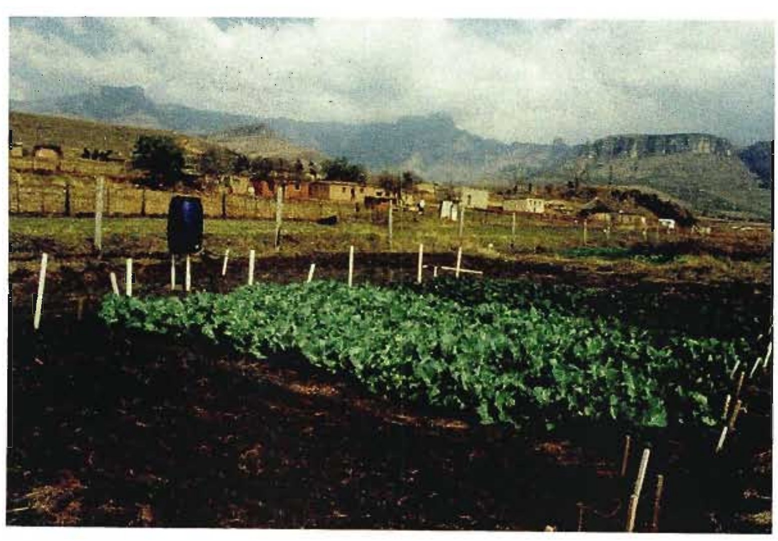

Plate 5.12 A "Family Drip Irrigation System" tested in the community garden

Plate 5.13 Fence erected by the community to re-establish a camping system to implement a veld management system

Plate 5.14 Livestock owners discussing practical aspects of animal health care

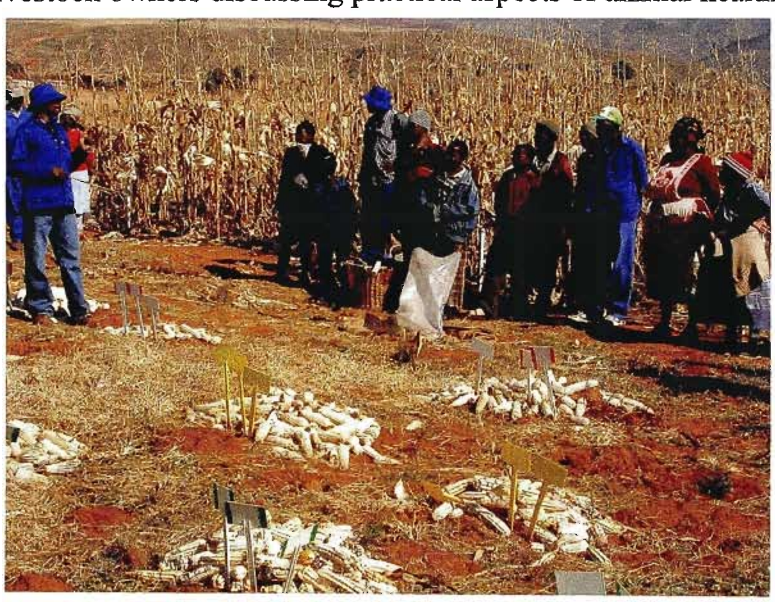

Plate 5.15 Technology transfer during trial activities, such as harvesting

Plate 5.16 Farmers and researchers discussing good cultivation practices in maize

Plate 5.17 Feedback of trial results to community members

Plate 5.18 Illustrations or practical demonstrations had a high impact in terms of interest shown and questions asked by the farmers

Plate 5.19 Female farmer participates as speaker during a farmers' field day

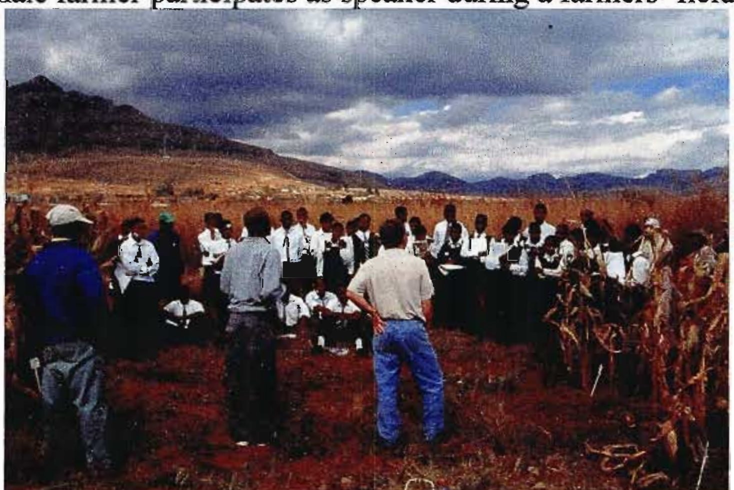

Plate 5.20 Pupils from the local secondary school attended the farmers' field days

Plate 5.21 The Amazizi Maize Association used their initiative, their own money and spent time erecting a fence to protect the communal cropping fields from livestock

Table 5.2 Summary of the objectives and treatments of the crop trials conducted in Obonjaneni between 1998 and 2002

Crop trials	Objectives	Treatments
Maize trials:		
Season 1	To assess various maize cultivars and to demonstrate the use of fertilizers, lime and good cultivation practices to local farmers (Roberts, 1998/1999).	Sixteen cultivars included a local variety ("Zulu" seed). Lime levels: 0 & 10 t/ha. Split plot design and two replications. Same fertilizer applied to all treatments according to recommendations based on soil analysis. AgMag[1] applied to the zero lime plots to avoid a Mg deficiency limiting yield (Seasons 1 to 4). Statistical analysis of trial data (Seasons 1 to 4) was conducted using analysis of variance (ANOVA) and mean separations were based on the LSD at the 5 and 1% level of probability using Genstat 5.2.
Season 2	To assess various maize cultivars and to demonstrate the use of fertilizers, lime and good cultivation practices to local farmers (Roberts, 1999/2000a).	Four cultivars included a local variety ("Zulu" seed). Lime levels: 0 & 10 t/ha. Split plot design and eight replications.
Season 3	To assess various maize cultivars and to demonstrate the use of fertilizers, lime and good cultivation practices to local farmers (Roberts, 2000/2001).	Eight cultivars included two local varieties ("Zulu" seed). Lime levels: 0, 3, 6 and 9 t/ha. Split plot design with three replications.
Season 4	To assess various maize cultivars and to demonstrate the use of fertilizers, lime and good cultivation practices to local farmers (Roberts, 2001/2002).	Six cultivars, included an acid-resistant, and a local variety ("Zulu" seed). A further treatment of a cultivar planted without any N fertilizer. Lime levels: 0, 3, 6 and 9 t/ha. Three replications.
Effect of planting date on maize yield:		
Season 3	To determine the optimum time of planting local farmer seed and to determine grain yield when planted very early, early, late and very late (Metho, 2000/2001a).	Cultivar: farmer's own seed. Planting dates: 15 Nov, 30 Nov, 5 Dec and 15 Jan. Cultivation practices were the same (lime and fertilizer applied according to recommendations) for all treatments (Seasons 3 & 4).
Season 4	To determine the optimum time of planting own seed and to determine the grain yield of own seed when planted at different planting dates (Madiba & de Villiers, 2001/2002).	Cultivar - farmers' own seed. Planting dates: 15 Nov, 30 Nov, 14 Dec and 28 Dec 2001. Two replications per planting date.
Dry beans trials:		
Season 1	To determine response of dry bean cultivars to lime on acid soils (Thibaud, 1998/1999).	Eight cultivars. Lime levels: 0, 7 & 14 t/ha. Replicated split-plot design. Same fertilizer applied to all treatments according to recommendations based on soil analysis, in addition all zero lime plots were treated with AgMag[1]at an equivalent rate to avoid Mg deficiency (Seasons 1, 3 & 4). Yield data were subjected to an ANOVA analysis using Genstat 5 (Seasons 1and 3).
Season 3	To determine response of dry bean cultivars to lime on acid soils (Thibaud, 2000/2001).	Six cultivars of which two cultivars contained either "high" (10 mg/kg) or "low" (0.4 mg/kg) Mo seed reserves. Lime levels: 0, 5, 7 and 10 t/ha. Split-plot design with two replications.
Season 4	To evaluate and quantify the yield of dry bean cultivars and to demonstrate and recommend economic lime rates and suitable production practices (Khubone & Metho, 2001/2002).	Four cultivars. Lime levels: 0, 5, 7 and 10 tons/ha. Four replications. After planting it was discovered that the treatment plots were not exactly where they were from the original layout, as used during the previous season. The problem was communicated to the farmers. No statistical analysis was conducted.
Vegetable soyabean and cowpeas:		
Season 2	To evaluate the performance of vegetable soyabean, as a new alternative crop, and cowpeas, under two soil acidity situations at an early and late planting date (Metho, 1999/2000).	One vegetable soyabean cultivar and one cowpea cultivar. Lime rates: 0 and 10 t/ha. Early planting: on 28 Dec 1999 and late planting on 20 Jan 2000. Fertilizer applied according to recommended rates. Treatments in a simple split-plot arrangement and in un-replicated blocks. No statistical analysis was conducted.
Season 4	To introduce an alternative crop which is protein-rich to small-scale farmers and to test and evaluate the performance of vegetable soyabean planted at different lime rates (Madiba & Metho 2001/2002a).	One vegetable soyabean cultivar planted. Lime levels: 0, 1, 2 and 3 t/ha. Four replications. Fertilizer applied according to recommended rates.
Potatoes:		
Season 3	To evaluate the yield potential of 10 potato cultivars and to establish good cultivation practices (Metho, 2000/2001b).	Ten cultivars. Three replications. Lime was applied at 4.5 t/ha and fertilizer according to recommendation. Spraying of recommended fungicides when necessary. Not statistical analysed (Seasons 3 & 4)
Season 4	To evaluate the yield potential of 10 potato cultivars and to demonstrate good cultivation practices (Madiba & Metho 2001/2002b).	Ten cultivars. Three replications. Same plots used as in Season 3. Fertilizer according to recommendation. Spraying of recommended fungicides when necessary.

Season 1 = 1998/1999; Season 2 = 1999/2000; Season 3 = 2000/2001; Season 4 = 2001/2002

[1]AgMag = Magnesium Oxide (One of the cheapest forms of Mg fertilizer and also has a slight liming action)

As part of the evaluation of the dry bean trial the five different cultivars were not only evaluated in terms of yield but also taste. The Home Economist of the Bergville Extension office assisted and prepared the dry bean cultivars, numbered from A to E, with only salt added. Paper plates and spoons were available to the taste panel of 30 community members. The voting sheet (in Zulu) enabled farmers to rank the beans from 1 to 5, where 1 was best and 5 worst. The cultivar with the lowest score was thus the preferred one.

FSRS, Extension staff and farmers, agreed upon the following arrangements for the first seasons trials:

i. that the FSRS supply all the inputs *i.e.* seed, fertilizer, lime and pegs;
ii. that the Extension office supply the tractor and be responsible for the land preparation;
iii. that the Amazizi Maize Association members contribute their own seed (local variety or "Zulu" seed) for inclusion in the trials and organise a back-up tractor if needed;
iv. that the local Agricultural Development Technician determine the planting dates, in collaboration with the farmers;

5.2.3.2 Season 2 (1999/2000)

The number of maize cultivars was reduced from 16 to four, with high yields and high acid resistance, as measured during Season 1 (Table 5.2), as selection criteria. The same site was used and lime was not applied during Season 2. A separate area was made available by the farmers to screen seven maize cultivars (local variety included) for green maize. A maize tasting event was held just before livestock destroyed the trial.

The dry bean trial did not take place due to the area being sprayed by mistake with the herbicide Atrazine, which is toxic to dry bean production for up to an 18-month period.

The ARC, Summer Grain Institute in Potchefstroom, requested the staff from the FSRS to evaluate the performance of vegetable soyabean (*Glycine max.* L.) as a potential alternative food crop to supplement the diet of people in rural communities. Vegetable soyabean is a very large-seeded soyabean that is eaten like green peas from freshly harvested green vegetable soyabean pods. They are nutritious and an exceptionally good source of protein. The green beans can be consumed (as done with groundnuts and other nuts) directly after the pods were boiled in water or could be added to many foods (Birch, 2002). After discussions with farmers in a planning meeting, vegetable soyabean and cowpeas (*Vignia unguiculata* L.) where included in the trials for Season 2.

5.2.3.3 Season 3 (2000/2001)

The family, and also members of the Amazizi Maize Association, whose fields were used during the first two seasons, indicated that they required the field for their own use. The Amazizi Maize Association allocated a new site, approximately 500 m from the previous site and located within a newly fenced-off irrigation scheme of 2.29 ha. Six farmers, who were also members of the Amazizi Maize Association, used the scheme. However, due to a broken pump the area could not be irrigated during this season. Moving the on-farm trials inside a fenced area was perhaps beneficial in terms of protection from possible livestock damage, but could unintentionally have excluded many people of the community from the trials.

Due to the change in trial site, it was important to repeat the maize and dry bean trials conducted during the previous seasons. An important change in the maize trial, as was envisaged and discussed with farmers, was the inclusion and application of different lime levels. A summary of the treatments is given in Table 5.2.

Farmers in the community requested a follow-up trial on vegetable soyabeans, but this was not possible due to the unavailability of seed.

It was learnt during the diagnostic study and also observed over the first two seasons that people in the community use various planting dates for maize. Through discussions, and an informal survey, farmers gave the following reasons for planting maize at different times:

i. their unawareness of the negative effect of late planting on yield;
ii. the avoidance of stalk-borer infestation;
iii. the fact that contractors come late to prepare fields.

The effect of planting date on maize yield was an aspect that needed attention. The objectives and treatments of the trials are summarized in Table 5.2.

At the planning meeting for Season 3, eight farmers and members of the Amazizi Maize Association showed interest in testing some of the technology used in the trials. Researcher-designed and farmer-managed trials (Biggs, 1989) were laid out in eight farmers' fields. The

FSRS supplied the inputs. The following maize treatments were laid out in 10 x 10 m areas in fields of the individual farmers (Metho, 2000/2001a):

1) lime x own seed (1 farmer participated);
2) recommended fertilizer rate x own seed (5 farmers participated);
3) lime x recommended fertilizer rate x own seed (1 farmer participated);
4) acid-resistant cultivar (5 farmers participated);
5) acid-resistant cultivar x recommended fertilizer rate (5 farmers participated);
6) acid-resistant cultivar x recommended fertilizer x lime (6 farmers participated);
7) 3x hoeing for weed control compared with own practice (6 farmers participated);
8) cutworm and stalkborer control (8 farmers participated).

The areas were measured out in the middle of the farmers' fields. The treatment(s) and the instructions were given to the participants orally and in writing in Zulu (farmers' home language).

Maize yields were determined in the communal cropping fields of some members of the Amazizi Maize Association.

Farmers requested a cultivar trial to identify the most suitable potato cultivar for the community. Other than yield, no evaluation criteria to identify the most suitable cultivar were discussed at the planning meeting. The objectives and summary of treatments are summarized in Table 5.2.

5.2.3.4 Season 4 (2001/2002)

Farmers showed interest in the no-till practice (called planting-without-ploughing or PWP) and requested a demonstration. A farmer made an area in the middle of his field available for the demonstration. The demonstration was planted late due to very dry conditions, but served the purpose of showing the farmers the PWP technique and principles.

The farmers requested a weed control trial, in which the use of herbicide, as a treatment, was requested. They mentioned that hand-hoeing for weed control was too labour intensive, which is a problem to them. An on-station weed scientist, based at Cedara, became involved in the discussions and the planning of demonstrations on the use of herbicides and knapsack sprayers.

An informal survey was used to study the maize production practices and to evaluate and monitor the progress made with the on-farm trials. Ten small-scale farmers (nine were members of the Amazizi Maize Association) were individually interviewed. As part of the survey, maize yields were determined on seven fields belonging to association members located in the communal fields.

A soil scientist studied the soil fertilty status of homestead fields. The hypothesis was that the homestead fields differed in nutrient status relative to the communal cropping fields, due to different cultivation practices (Roberts, 1999/2000a). Volunteers were identified at a community meeting and 58 people participated. Topsoil samples (0 - 15cm) were taken during March 1999. Each topsoil sample consisted of 20 sub-samples that were mixed together to form a composite sample. Geographic Positioning Systems (GPS) technology was used to record the position and the field sizes at the homesteads.

5.2.4 Intervention programme in the Phuthumani Community Garden

The Phuthumani Community Garden in Obonjaneni was run by 10 members on a 1.01 ha area. The garden is located next to the Tugela river, from which water is pumped for irrigation. A general description of a community garden and the results of a diagnostic study conducted with the garden members are presented in Chapter 4.

Members of the garden asked the FSRS for assistance in improving vegetable production in the garden. Unsatisfactory yields, poor crop stands and "sick-looking" vegetables were the main factors that contributed to the despondency of the garden members when FSRS staff met them in 1998. The involvement of the FSRS in the garden was through researcher-designed and farmer/researcher-managed trials. This gave the garden members an opportunity for hands-on experience, through which they gained knowledge about many aspects of vegetable production.

5.2.4.1 Demonstrations of improved vegetable production practices

Garden members and the FSRS staff decided to demonstrate the effect of lime compared with no lime, and improved vegetable production practices, on the yields of vegetables (Van Rensburg, 1997/1998) (see Plate 5.5). Soil samples were taken from four plots in the garden (Lady1, Lady2, Man1 and Man2). At Lady1 a $48m^2$ plot was planted to cabbage, at Lady2 a $48m^2$ plot was planted to spinach (Swiss chard), at Man1 $36m^2$ were planted to beetroot and at

Man2 a $36m^2$ were planted to carrots. Approximately seven weeks before the crops were planted, half of each plot was limed according to recommendations for the specific crops, while correct production practices were applied over the whole plot.

5.2.4.2 The role of lime and fertilizer in cabbage production

A perception among garden members was that there is no need to apply fertilizers when the cabbage yield increased from no yield to approximately 30 t/ha after lime application. A trial was conducted to compare the yield of cabbages grown where only lime was applied and where lime and fertilizer were applied (Mpanza, 2000/2001).

5.2.4.3 Evaluation of cabbage and tomato cultivars

Garden members ranked cabbage and tomatoes as the two most problematic crops in the garden (Mpanza, 2001/2002a). Cabbage problems mentioned were: cutworms and aphids and the formation of small, multi-headed (tillering) plants. Poor seedlings and over-application of herbicides were mentioned as possible causes for the tillering problem. Three cabbage cultivars, namely Hercules, Tropicana and Green Coronet, were planted in a trial, with three replications) to identify the most suitable cultivar for the garden. Lime and fertilizers were applied according to recommendations.

A cultivar trial was requested to address the poor performance of tomatoes in the garden. The two cultivars planted were Hytech 36 and a no-name farmers' choice under correct production practices (Mpanza, 2001/2002b). Tomatoes in all treatments were treated against insects but not against diseases. The objective was also to see which cultivar was susceptible to disease in an effort to identify the ideal cultivar under a low input management strategy.

5.2.4.4 Production of vegetable seedlings

The poor quality of seedlings used in the garden was identified as a constraint, which according to garden members, resulted in poor vegetable crops (Mpanza *et al*., 2001 and Mpanza, 2001/2002a). Garden members used mainly two sources of seedlings:

a) commercial nurseries as far as 300 km from the community
b) seedlings produced in garden plots.

The seedling suppliers were suspected by garden members of providing poor-quality seedlings. During discussions with the responsible researcher it was indicated that the

Extension staff often assisted in the purchasing and transporting of the seedlings. The seedlings were then kept at the Extension office for a few days before delivery or collection by the garden members. This could have been a stressful period for seedlings, due to possible heat and drought stress and rough handling which would have contributed to the poor performance when transplanted. The seedlings produced in the garden plots were of poor quality. A solution agreed upon was to embark on a programme of improving the quality of seedlings produced in the garden.

At a cost of R7 500, a small nursery (3 x 6m, with a capacity of 5 000 seedlings) was erected by a contractor (commissioned by the FSRS) in the garden during October 2000. The garden members contributed by building a germination room, using locally available materials such as mud bricks, wooden poles and corrugated iron.

Cabbage seedlings produced in the garden nursery were compared with seedlings obtained from a commercial nursery approximately 300 km from Obonjaneni (see 5.3.13.for discussion).

5.2.4.5 Testing of a "Family Drip Irrigation System"

An alternative method to improve the efficiency of water use in the community garden was discussed with the garden members after a Cape Town irrigation company donated three sets of a "Family Drip Irrigation System" to be tested in a rural community. The system has a 150 litre water tank that is installed on blocks, a valve, a filter, a main line to a distribution line branching to dripperlines. The water for the garden is pumped (electricity) from the Tugela river to a reservoir located in the middle of the garden, from where the drum is filled. The three sets were installed in garden plots planted with cabbage, Swiss chard and onions. The same crops were planted under the irrigation system in the garden that had been previously installed, which comprised sprinklers and a hosepipe. Farmers were responsible for the day-to-day management of crops and for the irrigation. Yield and the visual evaluation by garden members were collected to establish the differences in crop performance between the two irrigation systems (Mpanza, 2001/2002c).

5.2.5 Data collection

The maize (lime x cultivar) and dry bean (lime x cultivar) trials were statistically designed and analysed. The effect of planting date on maize yield, potato cultivars, vegetable soyabean and trials conducted in the community garden were not analysed statistically due to the design and relative small area used. During the harvesting of the maize trials an effort was made to stack maize cobs from the different treatments in heaps to allow a visual evaluation of yield and also to compare the cob sizes between the treatments. The financial implications of the data collected were discussed during the planning meetings and at the technology dissemination events (*e.g.* feedback meetings and farmers' field days) (information not presented in this study).

5.2.6 Livestock activities

The FSRS staff found it extremely difficult to initiate a programme to address the livestock constraints (indicated in Chapter 4). The main reason for this failure was the absence of an organised livestock management structure in Obonjaneni. The different reasons given during the diagnostic survey concerning why people keep cattle (see Chapter 4.3.4.1) could possibly have contributed to an apparent absence of an organised livestock structure in the community.

Several times it was communicated to the livestock owners that the formation of a livestock association was necessary before any animal-related work could begin. The Livestock Agricultural Development Technician in the Bergville District and the Animal Health Technician, Veterinary Services, of the KwaZulu-Natal Department of Agriculture and Environmental Affairs, were made responsible for assisting the livestock owners with the formation of an association. When an impact evaluation study was conducted in September and October 2002, no livestock association had been formed, and from general observations this did not appear to be a concern to livestock owners.

The need to pay attention to veld management was highlighted at a meeting between livestock owners and Departmental staff in May 2000. The communal grazing area behind the residential area, and which extends into the mountains, is about 1200 ha (Letty *et al.*, 2002). The livestock owners felt that without a camp system it would be impossible to manage the veld correctly and to maintain or improve its condition. The grazing area of Obonjaneni was originally divided into five camps (Letty *et al.*, 2003), but fences were no longer in place. The livestock owners wished to re-establish the camping system.

To address livestock constraints and other issues raised by livestock owners, staff in the FSRS initiated a concept of Livestock Care Centres (Letty, 2001/2002), with the following objectives:

a) to provide veterinary services to livestock owners in the rural communities where the FSRS is active;

b) to build the capacity of rural livestock owners in terms of health-care, management and the feeding of livestock;

c) to facilitate links between rural livestock owners and feed and drug companies;

d) to identify research needs.

While waiting for the formation of a livestock association in Obonjaneni, the Livestock Care Centre concept was discussed with livestock owners, a State Veterinarian of the North West Extension Region and the local Animal Health Technician of the District.

5.2.7 Interaction with farmers

Over the five year period (1998 – 2002) a continuous process of technology dissemination took place using information obtained from trials, while other topics were raised by farmers. The main events to disseminate technology were farmers' field days, feedback meetings on trials results and monthly meetings.

An on-going process of monitoring and evaluation took place through informal surveys, planning and feedback meetings and from farmer comments received during field visits and farmers' field days. Information gained through interaction with the farmers since the involvement in Obonjaneni with the on-farm trials and technology dissemination will be covered in three sections. Firstly, farmers' comments on the on-farm research programme, secondly the response by farmers in terms of tangible benefits and actions taken by them and thirdly the problems and frustrations they experienced.

5.3 Results

Farmers and Extension staff were involved in the management of the trials when their time allowed. Active farmer involvement during the first two seasons was experienced when very little agricultural activity took place in the communal fields (see Plate 5.6). However, during the third and fourth seasons, farmer involvement in trial management became limited as they increased their own agricultural activities. Their main involvement in the trials was at the planning meetings, visits and discussions at the trial sites, monthly meetings and farmers' field days.

The involvement of the local Agricultural Development Technician was prominent during the first two seasons, but decreased during the third and fourth season due to a very busy programme, which included many other development projects, involvement of NGOs in his ward and many meetings.

5.3.1 Soil acidity of the communal cropping fields

Soil samples of 32 unlimed plots in the communal cropping fields had an average acid saturation of 55% (SD = 16.7%), which varied from 12 to 75% (Roberts, 1998/1999). The acid saturation levels found underlined the problem small-scale farmers face in terms of soil acidity effects on crop production (acid saturation values of > 20% are considered harmful to the growth of maize). Variation in the acidity found within the same field emphasises the importance of soil sampling, especially in resource-poor farming systems.

5.3.2 Maize trials

Suitable cultivars for the area were identified (PAN6479 and PAN6243 with or without lime; SC709 with lime). Results showed that with correct agronomic practices (correct use of fertilizer and cultural practices, such as the correct plant population density, weeding and spacing) and the amelioration of the soil with lime, there is potential for good maize yields in Obonjaneni (Table 5.3) (see Plate 5.7). Soil analysis to determine lime requirement is critical, as no other option exists. The quantity of the lime required will be determined from this analysis. The ideal practice is to apply all the required lime as soon as possible for a particular season. However, if finance or any other constraint limits the amount of lime to be applied it is suggested that the lime be applied over a five-year period. It needs to be stressed that every application of lime, even sub-optimal quantities, will help.

Of particular note was the yield of the local variety ("Zulu" seed) under acidic conditions (see Plate 5.8). A clear message emerged that resource-poor farmers may plant commercial hybrids to obtain better yields under correct agronomic practices. In the absence of liming, it could be more profitable for farmers to plant their own seed, which, as a result of selection in the community over many years, has developed acid tolerance.

5.3.3 Dry bean trial

Data showed that dry beans could be successfully grown in Obonjaneni (see Plate 5.9).

Table 5.3 Summary of the main findings of the crop trials conducted in Obonjaneni between 1998 and 2002

	Main findings of the crop trials
Maize trials:	
Season 1	Average yield of all cultivars were 3.08 and 4.40 t/ha for the 0 and 10 t lime/ha treatments respectively (43% response to lime). The local variety ("Zulu seed") had yields of 3.88 and 4.62 t/ha for the 0 and the 10 t/ha lime respectively (19% response to lime). Considerable variation was observed across the trial. No statistical analysis of data was performed.
Season 2	Average yield over all cultivars increased (P = 0.01) from 1.62 to 4.45 t/ha from the unlimed to lime treatments, respectively (175% response to lime). "Zulu" maize had the least response to lime with a yield increase from 3.02 to 4.38 t/ha (45% response to lime). The performance of the "Zulu" maize under extremely acid conditions was noteworthy.
Season 3	The average yield over all cultivars increased (P = 0.05) in response to the first lime increment (no response with further lime additions): 3.85 (0 lime), 4.68 (3 t lime/ha) (21% response to lime), 4.52 (6 t lime/ha) (17% response to lime) and 4.68 t/ha (9 t lime/ha) (21% response to lime). The "Zulu" maize, from two sources, did not show a significant response to lime: 3.61 & 3.50 t/ha at 0 lime and 3.85 and 4.24 t/ha at 9 t lime/ha.
Season 4	Significant yield response (P=0.01) to lime up to 6 t/ha. Average yield over cultivars was 5.51 (0 lime), 6.61 (3 t lime/ha) (20% response to lime), 7.35 (6 t lime/ha) (33% response to lime) and 7.77 (9 t lime/ha) (41% response to lime) respectively. The "Zulu" maize did not show a significant response to lime, indicating its potential under acidic conditions: 5.73 t/ha at 0 lime and 6.15 t/ha at 9 t lime/ha (7.3% response to lime).
Effect of planting date on maize yields:	
Season 3	Yield was 6.76; 6.68; 3.36 and 0 t/ha for the 15 Nov, 30 Nov, 5 Dec and 15 Jan planting dates, respectively.
Season 4	Yields were 3.55, 5.41, 4.52 and 1.27 t/ha for the 15 Nov, end-November, 14 Dec and 28 Dec planting dates, respectively. Observations showed infestation of stalk-borer in maize planted mid-November. The other planting dates did not show any signs of infestation.
Dry bean trials:	
Season 1	Average yields over cultivars were 1 468, 2 446 (66% response to lime) and 2 589 kg/ha (76% response to lime) for the 0, 7 and 14 t lime/ha. It was also found that the permissible acid saturation for dry beans could be increased from 5 to 20% as a reduced input option for small-scale farmers. Dry bean tasting took place, and the preference list differed from yield (see Table 5.4).
Season 3	Acid saturation was 67, 43, 36 and 19% for the 0, 5, 7 and 10 t lime/ha. Average dry bean yields were 2 150, 2 648 (23% response to lime), 3 111 (45% response to lime) and 3 181 kg/ha (48% response to lime) for the 0, 5, 7 and 10 t lime/ha respectively.
Season 4	Over cultivars, the average yield was 1 173, 1 512 (29% response to lime), 1 694 (44% response to lime) and 1 721 kg/ha (47% response to lime) for the 0, 5, 7 and 10 t lime/ha treatments respectively indicating that all cultivars chosen are relatively suitable for the area.
Vegetable soyabean and cowpeas:	
Season 2	Both crops could be grown successfully. Vegetable soyabean yield was not assessed due to small plots. Four out of five people enjoyed the taste of cooked vegetable soyabean. Cowpea yield was not assessed due to severe attack by CMR beetles, thus little interest was shown in cowpeas as an alternative crop.
Season 4	The vegetable soyabeans (beans) yielded 0.7, 1.7 (142% response), 1.8 (157% response) and 2.4 t/ha (243% response) for the 0, 1, 2 and 3 t/ha lime levels respectively.
Potatoes (cultivar and production practices):	
Season 3	Under rainfed conditions yields varied from 34 to 59 t/ha among cultivars. Some cultivars were not considered suitable by farmers due to their yellow flesh. The average yield of cultivar BP1 (the more preferred by small-scale farmers because of its white flesh colour) was 47 t/ha.
Season 4	Average yield of potatoes under rainfed conditions was 31.6 t/ha. The highest yield was 43.6 t/ha and the lowest was 17.8 t/ha. BP1 was the cultivar preferred by the community because of the white flesh, and it yielded 23.7 t/ha.

Season 1 = 1998/1999; Season 2 = 1999/2000; Season 3 = 2000/2001; Season 4 = 2001/2002

Yields of more than 3 t/ha were obtained when best management practices were followed (including time of planting, varietal choice and recommended lime application) (Table 5.3). A further important finding was that among the commercial dry bean cultivars, differences existed in tolerances to soil acidity. The most significant finding in the trials was that the permissible acid saturation for dry beans could be increased from 5 to 20%. This implies a considerably reduced lime requirement for resource-poor farmers who want to grow dry beans in acid soils (Thibaud, 1998/1999).

Results from the taste session showed that the panel preferred the taste of Mngeni, the second lowest in terms of yield, whereas Mkuzi, the least tasty cultivar, gave the second highest yield (Table 5.4).

Table 5.4 Results of the "taste panel" evaluation by community members and the yield (kg/ha) of five different dry bean cultivars

Cultivar	**Dry bean tasting**		**Yield**
	Total score given	**Order of best taste**	**(kg/ha)**
Mngeni	58	1st	1 982
Star	72	2nd	1 731
PAN 146	105	3rd	2 184
Zambezi	109	4th	2 590
Mkuzi	121	5th	2 353

An important message that emanated from the taste panel result was that caution needs to be exercised in recommending technology based on only one criterion. This finding emphasises the importance of farmers in the evaluation process of on-farm trials.

5.3.4 Vegetable soyabeans and cowpeas

The production of vegetable soyabeans showed potential as an alternative high-protein food crop for Obonjaneni on the basis of good yields (Table 5.3), as well as the fact that people enjoyed the taste of the cooked product (Metho, 1999/2000). However, the unavailability of vegetable soyabean seed forced the termination of the trials. This highlights the importance of determining whether inputs, such as seed are available, not only for research purposes, but also for farmers, before embarking on research with new cultivars or crops. Seed and, for that matter, all inputs used in on-farm trials must be available at the nearest town to enable farmers to purchase them relatively easily. This factor certainly must play a critical role in the adoption of new technology.

Due to a severe attack by insects (CMR beetles) on the cowpeas, yield was not determined. This resulted in farmers showing no interest in the crop.

5.3.5 Potatoes

The trials showed that potatoes could be successfully produced in the community under rain-fed conditions (Table 5.3). High-yielding cultivars were identified for the area. Important feedback from the farmers was that they preferred the white-fleshed cultivars with the better cooking qualities and not some of the high-yielding, yellow-fleshed cultivars. This is unfortunate, since yellow-fleshed cultivars such as Mnandi have greater resistance to disease and are possibly more nutritious. Researchers, farmers and extension staff did not discuss the criterion of flesh colour during the planning meetings when cultivars were identified.

5.3.6 Effect of planting date on maize yield

A late planting date, as the only variable, negatively affected maize yield (Table 5.3). Results showed that planting should ideally take place from mid-November to the end of November in Obonjaneni. It would appear that planting later up to the first week of December would still be in order. Stalkborer infestation in the early plantings negatively affected the yield. However, technology is available for effective and affordable control of stalkborer.

5.3.7 Researcher-designed and farmer-managed trials

No data were collected due to poor communication between FSRS staff and the participants. Farmers started to harvest their fields earlier, due to a livestock damage threat, and in the process also harvested the various 10 x 10 m treatments. However, valuable discussions and observations on the trials took place during the growing season. Farmers shared their observations at a farmers' field day.

5.3.8 Soil fertility survey conducted in homestead fields

The mean size of the homestead fields measured was 0.1416 ha (n = 55), which ranged from 0.01 to 0.53 ha. The acid saturation varied from 3 to 78%, with an average of 41%. Acid saturations in excess of 50% occurred in 45% of homestead fields, and 20% of the homestead gardens in Obonjaneni did not require lime (Roberts, 1999/2000b). Ironically, results from the survey showed that 95% of respondents (42 of 44 people interviewed) purchased fertilizer. However, the more important need to conduct a soil test to correct soil acidity by investing in lime has not been addressed in the community. Soil samples also showed that the P and K status of homestead fields was better than that of the communal cropping fields. A conclusion that could be drawn is that people would rather invest in their own homestead fields than in the more distant communal cropping areas, or where farmers have to re-apply for use of the land every 3 to 10 years (personal communication – Amazizi Maize Association member).

5.3.9 Maize yields produced in the communal cropping fields

The FSRS staff measured the maize yields of members of the Amazizi Maize Association over three seasons. These are summarised in Table 5.5.

Table 5.5 Maize yields obtained in the communal cropping fields of some of the members of the Amazizi Maize Association

Season	Average rainfall for period Sept to May (mm)	Number of fields used in study	Yield (t/ha)	
			Average	Range
2000/2001[1]	135.4	7	2.98	1.09 – 4.63
2001/2002[2]	152.2	6	2.36	1.10 – 3.94
2002/2003[3]	102.9	5	3.46	1.55 – 5.51

[1] Metho, 2000/2001a
[2] Madiba & De Villiers, 2001/2002
[3] Madiba *et al.*, 2002/2003

The yield data in Table 5.5 showed that maize yields varied among the different farmers. Plant population/ha between the farmers and over seasons varied between 16 000 and 41 000. The variation in plant population and yield showed that farmers followed different production practices. However, all the farmers indicated that their yields were much higher than in previous years, before the intervention of the on-farm research programme (see results of impact study in Chapter 7). Yields were relatively good considering the fact that no maize was grown in the cropping fields for 5 to 7 years prior to the intervention of FSRS during late 1997. The yields of the Amazizi Maize Association, shown in Table 5.5, compare favourably with the African average of 1.32 t/ha for maize, reported by Maredia *et al.* (1998).

5.3.10 Demonstration of improved vegetable production

The permissible acid saturation of soil for vegetable production is between 1 and 5% (Manson *et al.*, 2000). The soil analysis taken from four plots, as summarised in Table 5.6, indicated that acidity was a major limitation and should receive priority in addressing the problems in the Garden.

Table 5.6 Analysis of soil samples taken in March 1998 from four plots in the Phuthumani Community Garden (Van Rensburg, 1997/1998)

Sample	P	K	Ca	Mg	Exch. Acidity	Total cations	Acid sat.	pH (KCL)	Zn	Mn
	----------mg/L----------				------cmol/L------		%		mg/L	
Lady1	7	119	187	46	2.84	4.46	64	4.02	2.6	7
Lady2	11	129	300	75	2.26	4.70	48	4.04	3.3	6
Man1	7	61	99	23	2.99	3.83	78	4.01	1.9	7
Man2	9	85	131	40	2.94	4.14	71	4.01	1.9	7

In general, the nutrient status of all four soils (Table 5.6) was poor for the production of vegetables. Although lime was a priority, the other deficiencies such as P and K would have to be addressed in order to produce reasonable yields. The analysis clearly pointed to a lack of extension in terms of realizing the true potential and objectives of this garden (potential yields of some crops are summarised in Table 3.2).

No data were collected from the four plots planted with cabbage, Swiss chard, beetroot and carrots, due to the fact that the responsible scientist left the FSRS before harvesting and data collection. However, garden members had the opportunity to see the positive effect of lime on the performance of the crops and were trained in different aspects of proper production practices (spacing, fertilization, weeding) on four of the main vegetable types grown in the garden.

A copy of "Basic guidelines for vegetable production", compiled by a FSRS staff member, was presented to and discussed with the garden members. It was also given to the local Agricultural Development Technician for use in the rest of the Extension ward.

5.3.11 The role of lime and fertilizer in cabbage production

The Hercules and Tropicana cultivars respectively yielded 90 and 65 t/ha in the limed and fertilized plots compared to the 40 and 30 t/ha in the lime-only plots (Mpanza & Khubone, 2003). FSRS staff used the trial to explain the roles and the differences between lime and fertilizer to community garden members (see Plate 5.10).

5.3.12 Evaluation of cabbage and tomato cultivars

5.3.12.1 Cabbage cultivars, production costs and profits

The yields obtained for the Green Coronet, Tropicana and Hercules cultivars were 62, 65 and 75 t/ha, respectively. Tropicana was found to be more prone to cracking when left in the field unharvested. This was seen as a disadvantage to the garden members who do not have storage facilities. Green Coronet gave more rejects (small, unusable heads) compared to the other two cultivars. Hercules was found to be the best cultivar in terms of yield; it lasted longer in the field and showed the least number of rejects (see Plate 5.11).

From the results obtained in the Phuthumani Community Garden it was calculated that a net profit of R250/member/100m^2 was possible (Mpanza & Khubone, 2003), with the following assumptions:

i. that community garden members share the costs of inputs such as fertilizers (*e.g.* the latter is only available in 50 kg bags);
ii. that the cost of lime be spread over 3 to 4 years;
iii. that 425 seedlings be planted on 100m^2;
iv. that cabbages be sold at a minimum price of R2.50/cabbage.

A concern raised by Adey *et al.* (1998) was that the initial capital for inputs such as lime and inorganic fertilizer for a hectare is not available to members. Here, therefore, the area has been reduced to 1/100th ha, rendering input management expenses manageable to a farmer, and expecting him/her to increase the area from year to year as more income is generated.

To produce cabbages successfully and profitably, the on-farm research in the community garden emphasized the following:

i. the importance of a soil sample analysis;
ii. the role and importance of lime;
iii. the correct use of fertilizer;
iv. the use of healthy and strong seedlings;
v. the importance of correct plant population;
vi. the importance for members to share inputs, especially when these are only available in large quantities.

5.3.12.2 Tomatoes

Very dry conditions early in the growing season, followed by high rainfall caused leaf diseases and fruit to rot. No yield was measured and it was decided, with the garden members, to repeat the trial, without any changes to the treatments, before any final decision on the suitability of tomatoes for the area could be made (Mpanza, 2001/2002c).

5.3.13 Production of cabbage seedlings

The commercial nursery seedlings yielded 71 t/ha, compared to 75 t/ha for the seedlings grown in the garden nursery. The conclusion was that garden members could produce their own seedlings, save on transportation costs and obtain good yields (Mpanza, 2001/2002a and Mpanza *et al.*, 2001). However, the costs of a small nursery could be unaffordable to many community gardens, except if garden members see a business opportunity to sell seedlings in the community.

A positive outcome from the seedling nursery was that members were trained in nursery sanitation, treatment of trays, use of growing media, use of certified seeds, planting of the seeds, use of the germination room, fertigation and the control of diseases and pests in the nursery. This training will equip them to supply seedlings from the garden to the rest of the community.

5.3.14 Testing of a "Family Drip Irrigation System"

The "Family Drip Irrigation System" was found to be ideal for use in a community garden, with easily accessible water from the river, and it was subsequently taken to homestead gardens where availability of water could be a constraint to the proper use of such as system (Mpanza, 2001/2002b) (see Plate 5.12).

5.3.15 Management of the natural resources

Funds for the initial fence-line erected that divided the winter camp (the eroded area closest to the houses) from the mountain camps were obtained from the KwaZulu-Natal Wildlife Community Levy Fund in September 2001, which supports activities such as the on-farm research programme, in communities adjacent to KwaZulu-Natal Wildlife parks (see Plate 5.13). The funds obtained covered the costs of the fencing material, while the community agreed to make a contribution of R10.00 per household to pay those community members who erected the fence (Letty *et al.*, 2002). However, the collection of money from community residents was not a mutual decision and failed to materialise. People who erected the fence were compensated from the funds for materials obtained from KwaZulu-Natal Wildlife. As a result, less fencing material could be purchased to erect fences dividing the mountain camps designed in co-operation with a group of elected community livestock members. A second Business Plan was submitted in 2003 for the application of additional funds from the KZN Wildlife Community Levy Fund, for the completion of the fencing project. The impact of this action will not be covered in this study, but needs to be monitored closely.

Grassland Scientists from the Department of Agriculture and Environmental Affairs conducted a veld condition assessment of the envisaged grazing camps in February 2002. The objective was to obtain some baseline information regarding basal cover and species composition, to enable the monitoring of changes that would take place as a result of implementing a grazing programme (Letty *et al.*, 2003). The veld assessment study showed that livestock was concentrated on the areas in closest proximity to the residential area, and that this had resulted in a negative species composition change, a reduction in veld condition and an increased incidence of gully erosion due to footpaths. This was because many animals were brought home every night to combat the major problem of theft. It was concluded from the study that the most severely grazed camp, in close proximity to the residential area, needed to be managed more carefully.

A process of training farmers in veld management principles took place concurrently with the erection of the fence, in order to involve the community in designing a grazing system which would meet sound veld management principles.

5.3.16 Livestock Care Centres

The livestock owners accepted the concept of the Livestock Care Centres (LCC) with enthusiasm. The first LCC meeting was held in March 2002 and covered the following: a branding demonstration (FSRS staff), branding legislation and laws (South African Police Service) and a talk on the control of internal parasites (a representative of a veterinary company) (see Plate 5.14). Livestock owners from a neighbouring community (Okhombe) who attended the meeting at Obonjaneni requested a similar meeting to be held within their community. Approximately 60 farmers attended it, in May 2002 (Letty, 2001/2002).

5.4 Interaction with, and feedback from, farmers

5.4.1 Technology dissemination programme

The research team, over the five years of involvement, was regularly asked to provide information on a wide variety of topics and subjects. This was to be expected, as Timsina (1998) mentioned that farmers perceive researchers to be well educated and hence able to provide some alternative solutions whenever they visit their fields.

The aims of the dissemination events were to transfer technology and to raise awareness of best practices to all the people who attended. Technology dissemination events included the following:

a) individual contact with farmers;
b) meetings with the Amazizi Maize Association, Phuthumani Community Garden members and livestock owners;
c) during trial activities such as planting, management (*e.g.* weeding and pest and disease control) and harvesting of trials (see Plate 5.15);
d) field visits (see Plate 5.16);
e) farmers' field days (four events);
f) feedback meetings (with the main aim to give feedback on trial results (four meetings) (see Plate 5.17);
g) livestock care centre meeting.

Information concerning the large number of subjects that was covered during the farmers' field days, feedback meetings and monthly meetings is given in Table 5.7, with maize and dry bean production, soil fertility, maize planting date and potato production receiving particular attention. The programmes for all the events were planned and discussed in collaboration with Extension staff and farmers. The roles of the members of the Amazizi Maize Association and the Phuthumani Community Garden in the organisation of these events were huge, *e.g.* they determined the dates, time and venues, content of the programmes, contributed as speakers and advertised the events in the community.

Table 5.7 The variety of topics covered and the number of presentations at farmers' field days, feedback meetings and monthly meetings during the period 1998 to 2002

Topics	Dates when topic was presented	Number of presentations
Maize production (lime, fertilizer, cultivar, cultural practices)	14 Jun '99; 11 May '00; 21 Jul '00; 14 Mar '01; 23 May '01; 12 Sep '01; 28 Sep '01; 24 Apr '02; 1 Aug '02; 5 Sep '02	10
Dry bean production (lime, fertilizer, cultivar, cultural practices)	14 Jun '99; 11 May '00; 21 Jul '00; 14 Mar '01; 23 May '01; 12 Sep '01; 28 Sep '01; 24 Apr '02; 1 Aug '02; 5 Sep '02	10
Soil fertility (soil sampling, liming methods)	24 Mar '99; 18 Mar '00; 11 May '00; 21 Jul '00; 23 May '01; 12 Sep '01	6
Effect of planting date on maize yield	11 May '00; 14 Mar '01; 12 Sep '01; 24 Apr '02; 1 Aug '02	5
Potato production (cultivar, cultural practices)	21 Jul '00; 14 Mar '01; 23 May '01; 12 Sep '01; 24 Apr '02	5
Vegetable soyabean production	11 May '00; 21 Jul '00; 14 Mar '01; 24 Apr '02	4
Farmer-managed trials	14 Mar '01; 23 May '01; 1 Aug '02	3
Planting-without-Ploughing	12 Sep '01; 24 Apr '02; 1 Aug '02	3
Vegetables – general	23 May '01; 24 Apr '02; 1 Aug '02	3
Weed control (use of herbicides and knapsack calibration)	23 May '01; 28 Feb '02	2
Cabbage production	12 Sep '01; 1 Aug '02	2
Pumpkin production	28 Sep '01; 24 Apr '02	2
Sweet potato production	24 Apr '02	1
Groundnut production	24 Apr '02	1
Utilization of crop residues	11 May '00	1
General livestock issues	14 June '99	1
Feedback on veld assessment results	14 June 99	1
Branding	20 March '02	1
Internal parasite control	20 March '02	1

Blue = farmers' field days; Red = feedback meetings; Black = monthly meetings

The farmers' field days drew participation from across all sectors of the community, including community leaders, participating and non-participating farmers (including some farmers from neighbouring communities) and pupils with agriculture as a subject from the local secondary school. The four farmers' field days were purposely held in the communal cropping fields, to give farmers and visitors the opportunity to see and discuss the on-farm trials. All the events, with the exception of one, were held during weekdays (approximately 30 people attended the farmers' day that was held on a Saturday).

The average attendance at the 11 technology dissemination events held on weekdays (field days and feedback meetings), excluding the scholars, was 38 people. The average attendance of 38 people who attended the dissemination events represented 4% of the 937 households counted on an aerial Plate (technique described in Chapter 6). Assuming that only one person per household attended the dissemination events, it could be concluded that approximately

4% of the people in Obonjaneni showed interest in the agricultural activities by attending the technology dissemination events over the period. The Amazizi Maize Association members commented that the attendance of farmers' field days and the feedback meetings was good, because people saw things happening in the cropping fields and wanted to see and learn. The monthly meetings (at which the main objectives were to keep formal contact with farmers and with technology dissemination, as one of the main items on the agenda) were not as well attended as the farmers' field days or the feedback meetings.

Except for a small core group of people, a concern was that "different" people were seen at each meeting, which resulted in a lack of continuity from meeting to meeting and event to event. Among the reasons mentioned by farmers as to why people did not attend meetings, or did not attend regularly, were that people complained about the empty promises that they heard during political meetings and which therefore changed their attitude towards meetings in general. On the other hand, it is likely that others would prefer to attend political rather than agricultural meetings.

Where lunches were served during any one of the technology dissemination events, it was not advertised on the programme or agenda. The FSRS, Extension staff and farmers (mainly members of the Amazizi Maize Association) felt that an advertised lunch would attract people to such events for the wrong reason.

Many of the technology dissemination presentations were translated from English into Zulu by Departmental staff (local Agricultural Development Technicians from the Bergville District and/or Research Technicians). Feedback received was that some of the information was lost through the translation process, which is a serious aspect and the manner in which translations are conducted needs further attention.

Scientists and technicians at the different technology dissemination events used various formats for their presentations, such as:

a) talks without any visual aids;
b) demonstrations (*e.g.* herbicides to control weeds by showing the use of a knapsack sprayer);
c) posters with text and results of trials (histograms, tables and figures);
d) photographs to show the treatments;

e) marked-out area to show a specific message *e.g.* the quantity of lime needed per area (see Plate 5.18);

f) putting cobs in front of sign boards indicating different treatments to allow farmers to evaluate technology in terms of cob size and pip size.

Members of the Amazizi Maize Association shared their knowledge and experiences at the farmers' field days and at the monthly meetings.

The points covered by four farmers in their presentations and at their own maize fields, at a farmers' field day held in May 2001, are summarized in Table 5.8. Of interest is that three of the presentations were from female farmers (see Plate 5.19). Although speakers were members of the maize association, it was evident from the information in Table 5.8 that the speakers represented a wide spectrum of small-scale farmers in Obonjaneni. The information showed some elements of technology adoption.

Table 5.8 Summary of the information covered by members of the Amazizi Maize Association in their talks at a farmers' field day held in May 2001 in Obonjaneni

Farmer 1 (female) Planted maize on 1 December Did not use fertilizer recommendations or soil tests Lime recommendation – could not apply the required amount – too expensive Maize worse than the previous season Must buy certified seed – but expensive	**Farmer 2 (female)** Ploughed with oxen Limed only a small area of the field Used 3:2:1 as fertilizer Used own seed 1x weeding Maize was better the previous season
Farmer 3 (female) Maize cultivar used: PAN 6480 Two bags of Diammonium Phosphate (DAP) applied with planter Applied one bag of Limestone Ammonium Nitrate (LAN) Hoeing 3x showed no difference in yield Stalkborer, cutworm control and topdressing showed difference in maize Field with lime and recommended fertilizer gave big cobs compared to small cobs of the fertilizer-only field Maize in the area with four bags of lime better than in the unlimed area	**Farmer 4 (male)** *Field 1* Newly planted area not well disked - uneven preparation of field Field required lime, applied non-recommended rates because soil sample was not taken - 38 bags added 3 weeks instead of 6 weeks before planting Applied one bag of DAP Hired people for weeding 3x weeding gave no difference in cob size Good to hoe 2x at least – reduced and prevented weeds Yield was better than the previous year *Field 2* Not enough DAP applied No liming resulted in short and small cobs

At a monthly meeting in August 2002, six farmers gave feedback on the maize production practices they followed during the 2001/2002 season (Table 5.9).

Table 5.9 Information provided by six farmers on their maize production practices followed during the 2001/2002 season

Farmer 1 Gained a lot of knowledge from the on-farm trials Each season we see an increase in yield Noticed increased yields from previous season - two reasons were given: (i) 2000/2001 applied lime and saw the effect in 2001/2002 (ii) Weed control Where weeded once, weeds grow up into maize Weeded twice, small weeds in maize Weeded 3x, improved maize yield Yield*: Field 1 = 1.29 t/ha Field 2 = 1.81 t/ha	***Farmer 2*** Thanked extension and researchers for their inputs into the community Previously he used 9 bags of fertilizer and harvested 37 bags of maize After soil sample applied only 2 bags of fertilizer and 52 bags of lime for the 2001/2002 season and harvested 58 bags of maize (size of field unknown) **Previously:** 9 bags of fertilizer @ R300/bag = R2700 **2001/2002 season:** 2 bags of fertilizer @ R300/bag and 58 bags of lime @ R18.60/50 kg bag = R1567 Farmer harvested 21 bags more maize and paid R1133 less on inputs
Farmer 3 2000/2001 season was his first season involved in agriculture (assisting father and mother) *Fields at home:* Maize yield was good, but not happy with it Serious attack of stalkborer, treated too late Want to control stalkborer properly in new season and need to be taught to detect stalkborer early for proper treatment Hand-hoe weeds *Irrigation scheme* (although not irrigated due to broken pump was still called this)– planted potatoes and vegetables: Members of scheme received good profits on potatoes (profits are confidential) Planted tomatoes, pumpkins, green peppers with good yields Cabbage planted in December but wilted Scheme non-operational because of broken pump *Dry land maize in communal cropping fields:* 2001/2002 was a better season compared to 2000/2001 - reason was that lime was applied in fields. Yields*: Field 1 = 3.94 t/ha Field 2 = 3.68 t/ha	***Farmer 4*** Planted 19 November 2001 Applied no lime and used own seed Drought was a problem during planting Control of weeds too late Planted the same time as other members of association 2001/2002 was a better season than the previous seasons Yield*: 1.10 t/ha ***Farmer 5*** Better maize season than the previous year ***Farmer 6*** A farmer from neighbouring community asked the following questions: "What is the effect of fertilizer on soil acidity?" "For how many years is lime effective?"

* Yields measured by FSRS staff

The feedback given by Farmers 1 to 5 and the questions asked by Farmer 6, who was from a neighbouring community, were encouraging and showed that some farmers were benefiting from the on-farm trials. Farmer 2, as shown in the shaded area in Table 5.9, reduced the quantity of fertilizer that he normally applied and addressed the soil acidity problem with 52 bags of lime. The benefit was a significant reduction in input costs compared with the previous season and an increase in yield of 21 bags of maize. The people in the meeting received the feedback of Farmer 2 with great excitement. It is of significance that Farmer 2 paid R10 for soil sample analyses, paid less than R1 133 for inputs (excluding the cost of analysing the soil sample) and harvested approximately R1 000 of maize more than in the previous season.

The farmers' field days were well supported by Extension staff from the Bergville District. Although the events were not Extension-driven, Extension officers acted on many occasions as chairman, master of ceremonies and as speakers at meetings and at the farmers' field days. The feedback received from the Extension staff of the Bergville District office on the farmers' field days was encouraging and mentioned that both staff and farmers benefited from attending.

Pupils from the local secondary school who attended the farmers' field days showed interest in the subjects covered and were even prepared to assist in the management of the trials (see Plate 5.20). The teachers enquired whether they could take pupils with agriculture as a subject to the on-farm trials, as part of their practicals. Staff from the KwaZulu-Natal Department of Agriculture and Environmental Affairs was asked to assist with lectures on specific subjects during school time. Teachers were requested to specifically invite the Departmental staff. To date the FSRS or the on-station researchers involved in the programme have received no requests. Important, however, is that teachers and scholars attended the farmers' field days.

5.4.2 Feedback from farmers

5.4.2.1 Farmer comments on the on-farm trials

The following conclusions can be made from the comments made by farmers, as shown in Table 5.10:

i. farmers realised (for the first time) that Obonjaneni has the potential for good maize yields;
ii. the on-farm trials were a learning process to them and they needed time to implement the findings;
iii. farmers recognised the value of the on-farm trials and were prepared to test the technology themselves;

iv. some farmers were ready and prepared to share the knowledge they had gained from the trials and the technology dissemination events with other people in the community.

From the feedback it was clear that the on-farm research approach was starting to have an impact in Obonjaneni, especially on activities in the communal cropping fields where the Amazizi Maize Association was active.

Table 5.10 Comments, response and feedback from farmers during meetings and other interaction events held with farmers on the on-farm research programme followed in Obonjaneni

Season 1 (1998/1999)	Season 2 (1999/2000)	Season 3 (2000/2001)	Season 4 (2001/2002)
The Chairman of the Amazizi Maize Association commented that he would rather plant a small area with high inputs than a big area with low inputs. Will apply more lime and plant bigger area the following season. (18 February 1999)	The Amazizi Maize Association Chairman thanked the Agricultural Development Technician and the FSR & Soil Fertility/Analytical Services Sections for the maize, dry bean and the potato trials. (18 March 2000)	The problem of low maize yields was addressed through the on-farm research programme: liming rates, cultivars, fertilization and planting dates. (10 April 2001)	One of the younger members of the Amazizi Maize Association started to keep rainfall data in the communal cropping field.
A farmer mentioned that the herbicide he used in the maize field at home worked effectively and he will continue to use it. (18 February 1999)	Farmers said that they have seen the results from the 1998/1999 trials and were satisfied with the progress. (18 March 2000)	Weed control was getting attention through the cultural practices in the researcher-managed and farmer-implemented trials. (10 April 2001)	Farmers learned the following from on-farm trials: ▪ the use of lime; ▪ cultivars that one could buy; ▪ the correct time of planting; ▪ taking of soil samples before liming or planting; ▪ to follow soil test recommendations; ▪ correct farming practices. (1 August 2002)
Farmers commented that the surplus maize after applying the knowledge they gained from the on-farm trials, could be sent to a maize mill run by the Upper Tugela Farmers' Association. (20 October 1999) Farmers saw how to grow maize and witnessed higher yields with correct cultural practices. They applied what was learnt. (October 1999) Farmers commented that the perception they had that the area has a low agricultural potential was proven wrong by the trials. It was the first year that the people in the community saw high yields on their fields. (20 October 1999)	The Chairman of the Amazizi Maize Association felt there was potential for the members to improve, but time was needed because they were still learning. (30 June 2000)	A "monthly meeting" idea was accepted and given a name by the community as "nQolobane", which means "storage tank for good years". (4 May 2001 & 15 August 2001) A notice board to advertise events in the community was erected on the premises of the community hall in September 2001.	Chairman of the Amazizi Maize Association commented that he could teach other people should FSR withdraw from the community. (1 August 2002)

5.4.2.2 Tangible benefits gained from the on-farm research programme

The tangible benefits gained by farmers and their actions are summarized in Table 5.11.

Encouraging feedback during the first season was that better control of livestock resulted in increased cropping activities in the communal fields. The Amazizi Maize Association used their own initiative and own funds, after discussions with the local authorities, to erect a fence along the main road dividing the cropping fields from the residential area, in an effort to control the movement of livestock (see Plate 5.21). A further major impact of the newly instituted control of livestock, in addition to the benefit to crop production, was that women were able to harvest thatch in the communal cropping areas for their own use and for sale. The support and trust shown by farmers for the on-farm research programme were clearly demonstrated when the Amazizi Maize Association members voluntarily contributed R270 towards the costs of the first farmers' field day ever held in Obonjaneni on 24 March 1999.

During Season 2, the Amazizi Maize Association, in their separate Association meeting, formulated their vision, which displayed a positive attitude towards agriculture and a strong desire to become commercial small-scale farmers. A significant development was that six of the leader farmers, with the assistance of and through the Extension Service, compiled a successful business plan for a 2.29 ha irrigation system.

A very strong sign of the growing interest in agriculture was the increase in the number of fields being cultivated and planted in the communal cropping area since the arrival of the FSRS in 1997. In 1997 not one field was planted, during 1998/1999 (Season 1) eight fields were planted with maize, 16 fields during 2001/2002 (Season 4) and 44 fields in January 2003 (41 fields with maize and 3 with potatoes). The impact over the seasons is clear. The increase in the use of fields to 41 in the 2002/2003 season and an increase from no maize grown in the communal fields to an average yield to 1.55 t/ha (the lowest yield given in Table 5.6 for the 2002/2003 season) resulted in a total maize production from the communal cropping fields (with an average size of 0.578 ha) of approximately 36.7 tons, at a value of R36 731 (taken at R1000/ton). This increase in maize yields would certainly have a positive impact on food security in Obonjaneni and would further save people money because they did not have to buy maize in Bergville, located approximately 40 km from the community. Records kept by two farmers showed net profits during the 2001/2002 season of R3 572 and R2 443 from the maize they produced. Both farmers based fertilizer applications on soil analyses. They employed labour for weeding, at a cost of R15/person/day. Of importance was that the farmers said that the maize they had available to sell was finished early in December, while there was still a very good market in Obonjaneni. A further positive development was that members of the Amazizi Maize Association started to sell potatoes and maize grown in the communal cropping fields locally.

Table 5.11 Tangible benefits and actions taken by farmers in Obonjaneni since the intervention with the on-farm research programme

Season 1 (1998/1999)	Season 2 (1999/2000)	Season 3 (2000/2001)	Season 4 (2001/2002)
People had been keen to plant maize in the communal cropping fields after a period of 5 to 7 years of no agricultural activity. (18 February 1999) Eight fields had been planted with maize in the communal cropping fields. (18 February 1999)	Members of the Amazizi Maize Association shared their vision with Departmental staff (18 March 2000): ▪ To cultivate or utilized all the fields in Obonjaneni . ▪ More than half of the members to be commercial small-scale farmers in ten years' time. ▪ To create jobs in Obonjaneni rather than to look for jobs elsewhere. ▪ To be engaged in proper cultivation of crops.	A member of the Amazizi Maize Association reported maize sales exceeding R2000. Other farmers and members of the Amazizi Maize Association reported that they produced enough maize for family use and to store.	Sixteen people planted communal fields of which 15 were Amazizi Maize Association members. 20 fields (13 ha) in production with an average size of 0.578 ha, ranging from 0.01 to 1.53 ha) as measured in September 2001. Seven fields ploughed for the following season with an average size of 0.468 ha (ranging from 0.14 to 0.84 ha) in September 2001.
The absence of cattle in the fields had showed good animal control. (18 February 1999)		Farmers asked for assistance on the correct storage of maize. (4 May 2001)	Members of the irrigation scheme kept detailed records of input costs, payments, income and balance.
With the animals back on the mountain during summer, grass in the cropping fields was long and available to cut for thatch grass for own use and to sell.		A farmer and member of the Amazizi Maize Association reported that he produced enough potatoes in 2001 for home consumption, to keep for seed and to sell. He realized more than R3000 in cash from potato sales and also sold more than 20 bags (60kg bags) of maize.	Advice was requested on the following: ▪ sweet potato cultivars, ▪ sorghum cultivation, ▪ short and long term maize cultivars ▪ control of CMR beetles on dry beans. (5 September 2002)
The Amazizi Maize Association had used initiative, own money and time to erect a fence along the main road to protect the communal cropping fields from livestock. (20 October 1999)		The farmers requested training in ▪ Soil Conservation, and ▪ Record and Bookkeeping. (10 April and 4 May 2001)	Two farmers were able to supply records of their own expenditures, income and profits on maize sold to the community. (22 January 2002)
Amazizi Maize Association contributed R270 (R30/member) towards the first Farmers' Field Day. (18 February 1999)		Requested that no-till technology be included in the Farmers' Day programme. (10 April 2001)	Chairman of the Amazizi Maize Association encouraged the people from the community to participate in the land rental scheme. In other words, people who are not using their fields to hand them over to those who want to work on them. (1 August 2002)
Farmers decided to obtain their own seed potatoes as they saw the need to do things for themselves.		Livestock owners requested information on different pastures for cattle and advice on how to control livestock diseases. (4 May 2001)	

Farmers planted dry beans in a crop rotation system with potatoes during the 2002/2003 cropping season. The fact that they planted cultivars that were used in the trials showed adoption of the technology developed for the community. They harvested 6 x 80 kg bags (480 kg) from 0.23 ha (2 086 kg/ha) from the mid-January planting and 7 x 50 kg (350 kg) from

0.28 ha (1 250 kg/ha) from the mid-February planting. The gross income for the two areas was approximately R4 000.

In one of the meetings during 2002 the Chairman of the Amazizi Maize Association mentioned that 200 bags of lime were purchased for the fields, but assistance was required from Government to transport lime to Obonjaneni due to a lack of funds. This request was an indication of both poor planning and a lack of insight to use the advantage of the Association's collective bargaining to their benefit. A well-trained association committee could have requested the suppliers to deliver such a big order, or, if need be, to purchase only a portion of the lime and use some of the funds to pay for the delivery. A need for training farmers, especially organized groups such as associations, to plan and to be self-reliant was identified by the on-farm research team.

5.4.2.3 Concerns and problems raised by farmers

The farmers continuously complained about the high input costs, especially those of hybrid seed. High costs could have a negative effect on the adoption of technology developed in the communal areas. Possible solutions need to be measured against the affordability and availability of inputs during planning sessions involving researchers, farmers and Extension staff.

Farmers expressed their frustrations with the local ploughing contractors and mentioned the high costs, their unreliability and the poor quality of work performed. Although some farmers use local labour to control weeds at between R10 and R20/person/day, they complained about the unavailability of suitable implements to control weeds. Farmers mentioned the unavailability of seed and fertilizer in Obonjaneni as a problem, which forced them to obtain these in Bergville (40 km from Obonjaneni). Farmers suggested that seed and fertilizer companies open a depot closer to them. The broken electric pump in the irrigation scheme was a cause for frustration. The frustration and despondency caused by the broken pump in the irrigation scheme, as well as the broken pump in the community garden, referred to in Chapter 2, (see 2.7.3.1 (ci)), pose a serious challenge to the sustainability of such infrastructural interventions in communities. In spite of the on-farm research programme and the many tangible benefits mentioned, it was evident that farmers occasionally lost heart from the many challenges and frustrations that beset them. This needs to be studied and considered by the researchers, farmers and Extension staff in the planning of new trials, and even the re-planning of existing on-farm trials to ensure the ongoing adoption of technology. The impression was never left, however, that the frustration and despondency was used as a ruse to solicit more assistance in kind from researchers, but rather an honest expression of their feelings of the situation in which they found themselves.

During the period of on-farm trials, researchers and technicians often had to work with little assistance from farmers, especially when farmers were very active in managing their own fields. Feedback from the farmers was that activities in their own fields (weeding in particular) and other programmes kept them too busy and prevented them from assisting and participating in the management of the trials. This could perhaps be seen to partially invalidate the on-farm research concept. It is not a new phenomenon, as Norman *et al.* (1988) mentioned that during the busy times of the year, the competing demands for farmers' time can lead to poor co-operation from them.

5.4.2.4 Farmer assessment on cropping trials

The informal survey conducted during Season 4 (2001/2002) with 10 farmers (seven males and three females) showed that some degree of technology adoption took place. Seven of the farmers purchased some certified seed, but indicated that "own seed" still played an important role. Five of the farmers applied lime to their fields. The ones who had not applied lime indicated that they still wanted to use it, but that insufficient money prevented them from doing so. All the farmers interviewed purchased and used fertilizer according to a soil analysis. Six farmers mentioned that the maize crop looked better compared with the previous season. Six farmers indicated that maize was planted for own home consumption (to eat), while six farmers indicated that they wanted to sell maize. The good maize crop benefited farmers in that enough was available for their families to eat but also to feed livestock and thus, with no need to buy maize in Bergville, money was saved. Farmers said they wanted to continue planting maize in the future, but needed more equipment (*e.g.* ploughs and planters). In spite of the positive comments and the advantages of the good crops obtained, the following problems were given (frequency mentioned in brackets): weeds (5); insufficient funds for inputs (4); livestock in fields (2); stalkborer (2); no profit (1); no or costly tractors (1) and cutworms (1).

The feedback suggested that some farmers were using knowledge they obtained from the on-farm trials. It was also observed that although farmers worked alongside each other in the same communal cropping area, there were large differences between the levels of technology applied. A particular concern was that, whilst farmers were prepared to spend money on inputs such as lime and fertilizer, they had no idea of the size of their fields.

5.4.2.5 General feedback and impact in community garden

Feedback received from a community garden member was that, as a result of the FSRS staff involvement, he could teach other people in Obonjaneni how to grow vegetables. The involvement of FSRS staff in the garden resulted in the following outcomes:

a) garden members improved their constitution and new members joined;
b) a generally improved maintenance of the garden;
c) an improved layout and re-allocation of plots;
d) garden members set their sights on selling produce from the garden.

5.5 Discussion

What implicit criteria define "success" in African agriculture is a question often found in the literature. In a study by Gabre-Madhin & Haggblade (2003), their respondents overwhelmingly focused on growth in production and approximately 40% of the cases cited involved significant increases in agricultural output, while another 20% cited corollary efficiency concerns about increased farmer incomes and foreign exchange earnings. Sustainability of production was also listed as an important criterion for success. Semana (1999), working in Uganda, reported that farm output was among the indicators of impact of on-farm trials and demonstrations.

Although the objectives of the FSRS were discussed and agreed upon in community meetings, and research projects had their own objectives, no specific indicators were discussed between researcher, farmers and Extension for the different trials. The improved crop yields, the increased usage of lime and certified seed, the growth in the usage of communal cropping fields, the selling of products and the positive opinion of participants from the community could be seen as indicators directing towards impact. According to Bayer & Waters-Bayer (2002), for each situation participants have to identify and agree on indicators and prepare a checklist that can serve to give some idea of how certain changes could be measured. Essential components of a monitoring and evaluation system thus include the selection of indicators (qualitative and quantitative) for each activity and desired impact (Hardi & Pinter, 1995 and MacGillivray & Zadek, 1995). The warning is repeatedly given that partners in participatory monitoring and evaluation should choose and test only a small number of indictors which give them the essential information and can be interpreted locally and quickly (Bayer & Waters-Bayer, 2002).

The information collected in Obonjaneni supplied the FSRS staff with qualitative information which reflected the feeling of how farmers perceive progress. Bayer & Waters-Bayer (2002) mentioned that monitoring and evaluation, in development parlance, is a continuous process of collecting information about the performance of a project. The on-going monitoring and evaluation process was an important source of information in the present study.

The many meetings held between FSRS staff, farmers and Extension staff over the period played an important role in the programme and activities followed in Obonjaneni. Through the meetings held in Obonjaneni the attempt was made to include all the stakeholders – farmers, extensionists, researchers - within the process, in order to work together towards common objectives. As identified by Biggs (1989), the main objectives of meetings are (i) a means of organizing and managing farmer participation more efficiently and effectively and (ii) a research tool for assembling, analysing and giving information. In Botswana, regular group meetings contributed towards solidarity of groups, it created familiarity between group members and researchers, and it provided unique insights into farmers' priorities and perceptions (Norman *et al.*, 1988). The meetings ensured that two main characteristics necessary in any procedure in farming systems research are adhered to, namely "Inclusion" and "Transparency" (Hawkins, 1994). The result of poor communication and a lack of participation was evident in Burkino Faso, where farmers reported that they had visited the local trials without being clearly informed of the reasons why these visits were organised, while in Ghana farmers reported that they thought that the trials conducted on their fields were "academic exercises" (Eponou, 1996).

The distance between Cedara and the Extension staff, on the one hand, and farmers on the other, was often a source of frustration for all parties, especially for the researchers. Distance contributed to communication problems in organizing meetings and other events, as well as to problems arising in the management of trials and the collection of data. Experience with Asian farmers, according to Timsina (2001), showed that they sometimes are negligent and thus fail to manage the trials, especially under variable weather conditions, during social events and when they have other priorities. If the researcher is stationed at or near the research site, the farmers could more easily make contact. However, the researchers are usually stationed at the research station or university, far from the Farming Systems Research and Extension site and do not visit the trials for periods of days or weeks. In that case, on-farm trials may fail, due to negligence on the part of the farmers and researchers.

In Obonjaneni, the on-farm research activities relied heavily on the organised groups such as the Amazizi Maize Association and the Phuthumani Community Garden. A similar arrangement has been reported in several countries with good reasons and results. In Botswana, the experience showed that the group format provided a forum for improving dialogue with, and among, farmers (Norman *et al.*, 1988). Organized farm groups and associations in Sri Lanka played an enormous role in enhancing farmers' participation in developing programmes (Doemampo, 1996). Collective action by farmers in African agriculture improved agricultural opportunities as follows: infrastructure provision, technology development and dissemination, irrigation development and management, natural resource and common property management and policy change (Gabre-Madhin & Haggblade, 2003). In the Casamance region of Senegal, groups assisted researchers in a technology development and dissemination programme that focused on critical issues and thereby accelerated the solution of farmer problems (Béavogui *et al.*, 2000). The farmer groups eventually can evolve towards farmer field schools, with some members becoming farmer-trainers (Béavogui *et al.*, 2000).

A problem experienced in the researcher-designed and farmer-managed trials was that visual comparisons between farmer practices and the new technology, as well as the accessibility of the trials, especially with big groups, were extremely difficult during the season, due to the location of the treatments in the middle of the farmers' fields. The lesson learnt was that trials and treatments within trials need to be demarcated, marked properly with a clear description and be visible, to allow visual comparisons. The trials must be easily accessible. A further problem identified was that more than two on-farm treatments per field confused participants and complicated the management of the treatments. This experience is in agreement with the observation of Asopa & Beye (1997), that farmer-managed trials should have fewer treatments than researcher-managed trials.

The on-farm crop and vegetable research programme and the livestock activities in Obonjaneni were not unique when compared with work conducted in other parts of the world.

In Tanzania, on-farm trials concentrated on (in order of the most trials conducted) were: improved varieties/breeds, surveys, soil fertility, improved husbandry of crops and livestock, integrated pest management (including weed control), livestock-feeding strategies and pest and disease control (Lema & Meena, 1998). In the Caribbean, technologies were developed on-farm for over forty crops, covering areas such as sourcing and characterization of germplasm, flower induction, spacing, fertilizer regime, land preparation, pest and disease management, weed control, tissue culture production, plant breeding, irrigation systems, storage and ripening, livestock feed development, breed selection and livestock feeding systems (Blades, 1998). In Panama (Martinez *et al.*, 1991), on-farm experimentation to determine adequate weed control and plant spacing offered the possibility of developing recommendations in one season. Questions of fertilizer requirements (nitrogen and phosphorus requirements) and suitable maize varieties (short maize varieties) involved a number of years of research.

A very important aspect of the approach followed in Obonjaneni was that the FSRS staff, as well as the on-station researchers from Cedara honoured decisions and promises made. When it was not possible to adhere to, or to deliver, as discussed and agreed, it was communicated back to farmers as soon as possible. A further aspect of the involvement was that times set (in agreement with farmers and Extension staff) for appointments and meetings and other events were respected and adhered to by the researchers. This was highly appreciated and commended by many of the small-scale farmers and contributed to a very healthy and trusting working relationship between the researchers, the farmers and extension staff. In Afghanistan it has been reported that regular contact, making friends with farmers and working through solutions in a participatory manner was revolutionary to the livestock farmers and resulted in trust and a spirit of co-operation (Ward *et al.*, 1998). Timsina (2001) also commented that farmers are willing to participate in research if the researchers are honest and helpful.

With the experience and knowledge gained in Obonjaneni over four seasons, one tends to disagree with Drinkwater & McEwan (1994), who commented that in the past a handicap in the generation of short-term research interventions was the four to five seasons needed before FSR teams are satisfied with their on-farm research results. They concluded that there is a need for FSR teams to use methods that would reduce this time. It is found that when control over the management and evaluation of on-farm variety trials is handed over to farmer groups, that it is quite feasible for them to produce a consensus on their conclusions in one or two seasons (Drinkwater & McEwan, 1994). Farmers are then likely to turn their attention to the rather more important question of how the new varieties and other technologies can be made more widely available. The experience in Obonjaneni shows that trials do not always go according to plan and are influenced by many factors, *e.g.* the move to a new site after an initial two years of experimentation at another, turnover of and inexperience of staff, livestock damage, poor service of contractors in field preparation, requests from farmers to repeat trials because they are learning and new farmers continually joining the approach.

A huge concern identified in the work in Obonjaneni was that the local contractors used for setting up the trials were found to be exorbitantly expensive and did a very poor and unsatisfactory job in incorporating the lime. This could greatly have reduced the effectiveness of the lime in the first season, which could have affected the performance of maize. Farmers, and even the contractors, need to be made aware of this problem.

5.5.1 Solutions to identified constraints

Although farmers in Obonjaneni played a significant role in identifying possible solutions to constraints, the impression during planning meetings was that they, especially at the first two seasons, did not think beyond new varieties to address the constraints identified in Obonjaneni. However, during the annual research planning meetings for Seasons 3 and 4, farmers requested trials and demonstrations on weed control and an alternative production practice such as minimum tillage procedures. Farmers, and even the young, inexperienced researchers and technicians, did not consider solutions beyond the "normal" variety and management practices. Possible reasons for the lack of identification of more solutions could have been that farmers were not involved with crop farming for many years in Obonjaneni and that the farmers in KwaZulu-Natal have been deprived of technology and a proper service for decades, which could possibly contribute to the fact that they did not think outside their "box of limited technology". It was found in Zambia that when farmers were asked directly to give their priorities for research, replies often reflected insufficient understanding of the range of technological options available for testing (Kean, 1988). One of the obvious benefits of working with farmers, according to Timsina (2001), is that the indigenous knowledge and innovations found in communities could be included and used in research programmes. It needs to be recognized that farmers are capable of developing innovative and valuable agro-ecological technology that needs to be included or recognized as solutions to constraints identified by them. In Cameroon, farmers used night paddocking of cattle to improve soil fertility (Tchawa *et al.,* 2002) and in Western Sudan farmers developed special ploughs suitable for local conditions (Fidiel, 2002). In Nepal, farmers brought germ plasm of rice, banana and onion from other districts and even from India, on their own initiative, and tested and adopted these in their own environments (Timsina, 2001). With all the indigenous knowledge farmers have, Gupta (1991) commented that there is no term more inappropriate than 'resource-poor', when talking about knowledge-rich peasants. Disadvantaged, yes; but resource-poor, no.

5.5.2 Maize

The emphasis on maize in this study corresponds with the fact that maize is the most important and staple food crop in eastern and southern Africa and grown on 40% of the cropped area in Africa (Maredia *et al.*, 1998 and Rukuni & Anandajayasekeram, 2001). This figure is comparable to that established for Asia and Latin America (Byerlee & Eicher, 1997). Due to improved food crop production technologies, with the emphasis on higher-yielding varieties, the average maize yield has increased from 1.2 t/ha in 1961 – 1963 to 2.6 t/ha in 1995 – 1997 in developing countries (Dixon & Gulliver, 2001). The average maize yield in Sub-Saharan Africa in 2000 was 1.5 t/ha (Dixon & Gulliver, 2001), so the Obonjaneni average yield of between 1.55 and 5.51 in the 2002/2003 compares favourably with this average.

The message that it could be more profitable for farmers to plant their own seed in the absence of lime needs to be adopted by Extension staff, which would perhaps require an adjustment of the standard "best practice" knowledge with which they are familiar and which is used by them. Low (1995) found that new, "away from the normal practice" results seem to be difficult for Extension to digest. An example of this is a case study in Zambia, where an open-pollinated improved variety was found to be superior to hybrids when no fertilizer was applied, though the Extension messages concerning maize varieties and fertilizer rates related only to hybrids receiving 60 kg N/ha (Waterworth & Muwamba, 1989). The option of using no fertilizer and non-hybrids was not included in the extension message. This illustrated the problem that Extension staff had with handling on-farm research findings that do not conform to accepted technical ideals (Low, 1995).

5.5.3 Dry beans

The request by farmers in Obonjaneni for work on dry beans is indicative of the fact that the common bean is an important crop in Africa and is grown on more than 3.5 million hectares. They are cultivated for subsistence and increasingly used as a cash crop by many farmers, of whom most are women (Maredia *et al.*, 1998). For many rural and urban consumers in Africa, beans provide the least expensive source of energy and protein (Maredia *et al.*, 1998). The full realization of this crop's potential to combat hunger and poverty requires a major research effort aimed at overcoming key constraints (Maredia *et al.*, 1998). Grain yields of released varieties evaluated in the Obonjaneni fields ranged from 1.1 to 1.9 t/ha, substantially above the average yields of 0.5 to 0.7 t/ha of bean varieties released in Tanzania for production and evaluated in farmers' fields (Madata *et al.*, 1998). In Uganda, an estimated 45 to 88% of farmers surveyed reported using improved bean varieties (Hoogendijk & David, 1997). Dry beans in the Obonjaneni community could play a significant role in homestead food security and as a source of income for farmers.

5.5.4 Soil fertility survey conducted in homestead fields

The Department's Fertilizer Advisory Service recommends a maximum permissible acid saturation of 20% for maize production and 5% to produce vegetables (Manson *et al.*, 2000). Lime is required to decrease the acidity of the fields and the quantities needed range from 5 to 16 t/ha. The resultant cost to correct the soil acidity in homestead fields is summarised in Table 5.12.

Table 5.12 Lime required and the cost to correct the soil acidity in homestead fields (based on a lime cost of R19.50 per bag)

Different sizes of homestead fields	**Levels of lime requirement**	
	5 t/ha	**16 t/ha**
Lime required for 1 ha:		
No of 50 kg bags	100	320
Cost/ha	R1 900	R6 240
Lime required for the average size field of 0.1416 ha:		
No of 50 kg bags	14	45
Cost/field	R266	R877
Lime required for the smallest field of 0.01 ha:		
No of 50 kg bags	1	3
Cost/field	R19	R57
Lime required for largest field of 0.53 ha:		
No of 50 kg bags	53	170
Cost/field	R1007	R3230

The information presented in Table 5.12 suggests that lime could possibly be an affordable item for small areas, more especially because most households spend fertilizers each season. However, the handling and transportation of the l of 50 kg) of lime required could be a problem to people (the majority rural communities such as Obonjaneni, which is approximately 40 km from the n To overcome the large quantity needed, a solution suggested to farmers was that they co apply lime over a number of seasons on small areas of a field until the whole area was covered, thus spreading the financial outlay and the effort of getting lime to homestead gardens or cropping fields. The cost-effective control of soil acidity, in particular, should receive attention in future research programmes. In addition, acid-tolerant crops (such as sweet potatoes and cowpeas and "Zulu" maize) could play a significant role in rural communities for people who cannot afford inputs and who do not have transport to purchase inputs.

In Season 4, when the farmers had seen some of the beneficial effects of lime, participants in the soil fertility study, whose homestead gardens had an acidity problem, were supplied with two bags of lime, to incorporate. Instructions were given to apply the lime to a specific area in the field. Participants were requested to manage their fields as normal and to compare the maize planted in the limed and unlimed areas. In follow-up visits it was learnt that the participants spread the lime over the whole field, proving that even on-farm demonstrations require close supervision. Yields were not measured but comments and feedback from participants were:

a) lime worked well and made a difference; maize yield was good;
b) need to apply more lime;
c) need a cheaper place to buy lime;
d) no money to buy lime.

5.5.5 Livestock

The difficulty experienced in initiating a livestock research programme in Obonjaneni did not come as a surprise. In spite of the vital role livestock plays in many farming systems in the southern Africa region, Blackie (1989) felt that livestock problems are commonly ill-defined by researchers and appropriate technology is scarce. Dolberg (1993) said that livestock research, with few exceptions, has not contributed so far in any substantial, positive way in developing countries, but livestock production for rural development remains a priority. It is, however, possible to address the livestock problems; for example, Afghani farmers benefited from ongoing farming systems research projects such as adapted legume forage trials for winter feeding, the value of molasses-urea-mineral blocks for supplementary feeding, the financial benefits from strategic deworming for internal parasites in sheep and goats, the value of improved genetics through artificial insemination (Ward *et al.*, 1998) and straw-feeding in small-scale farming systems in India (Schiere, 1995).

5.5.6 Technology dissemination

The continuous flow of information derived from the research programme, and other relevant information for farmers, created ample opportunity for discussions and contributed to the awareness of best practices, for all people to adopt for their own use. The success of the technology dissemination events, in terms of attendance, relevancy of topics dealt with in programmes and other administrative matters could largely be attributed to the contribution of the members of the maize association and the community garden. The themes of technology disseminated in Obonjaneni were similar to those in Nigeria (Apantaku *et al.*, 2003): planting of improved varieties of maize, use of herbicides, use of fertilizer to improve soil fertility and use of pesticides on the fields and in the stores. It is important to note that work in Guatemala showed that on-farm research programmes alone could not disseminate technology adequately among resource-poor farmers, in spite of having already generated technology relevant to these farmers (Ortiz *et al.,* 1991). The involvement of Extension staff was encouraging and conducive for the approach, in light of their function to disseminate relevant information to other areas in which they are also involved. As was shown in Guatemala, where the potential of extension teams was realized in disseminating new technology faster and on a much wider scale when they became partners with on-farm adaptive research, while the quality of on-farm research and the transfer of technology improved with the involvement of rural leaders and farmers (Ortiz *et al.,* 1991). In similar vein to Obonjaneni, farmer field days in Panama were also held at experimental and demonstration sites and farmers' associations proved to be an effective means of organizing these events (Marinez *et al.*, 1991).

During all the different dissemination events it was very clear that illustrations or practical demonstrations had a high impact in terms of interest shown and questions asked by the farmers. The role of women in on-farm research programmes is of particular importance, as was stressed by Fresco (1989), who said that any attempt to develop agricultural technology aimed at increasing food production in Third World countries will need to involve women farmers as participants and partners.

5.6 Conclusions

a) A continuous process of communication among all the role players throughout the on-farm research programme was the key to what has been achieved in the community of Obonjaneni over the period 1997 to 2002. The distance of 220 km between the Cedara Research Station, where the FSRS is based, and Obonjaneni, added to the challenge of conducting on-farm research. Communication between the FSRS staff, Extension staff and small-scale farmers was often extremely difficult and a source of frustration to all. Distance for future on-farm research programmes requires better planning, very clear instructions, a continuous process of communication among participants (the possession of telephones by farmers and facilities such as fax machines and e-mail in the Extension office could be seen as important) and the need for clearly defined responsibilities of all participants. These are critical for the success of an on-farm research programme.

b) The presence of organised groups such as the Amazizi Maize Association and the Phutumani Community Garden facilitated the on-farm research programme.

c) The treatments in the research programmes to address the constraints were limited to basic solutions and should increasingly include more options, such as indigenous knowledge, or farmer innovations used in the community, to overcome problems.

d) The intervention in Obonjaneni with the on-farm research programme resulted in a definite revival of and a new interest in agriculture, as reflected by the following:

   i. the successful intervention in the controlled movement of livestock;
   ii. an annual increase of fields planted with maize, potatoes and dry beans;
   iii. a newly defined vision of the Maize Association members;
   iv. the employment of casual labour to assist in planting, weeding and harvesting;
   v. the adoption of new technology (*e.g.* use of new varieties and of lime);
   vi. the selling of produce from the communal fields and the community garden;

vii. the successful technology dissemination events, with contributions from farmers as speakers.

d) Working with the existing organised structures in the community had advantages and disadvantages. The advantages were that:

i. there was easy contact and communication with members and/or small-scale farmers through a contact person or the chairman;

ii. the allocation of the research sites was quick and based on a group decision;

iii. one worked with a target group of people who showed similar interests and who were prepared to collaborate;

iv. it made the organization of meetings, field days, field visits or any other action relatively easy;

v. the leader farmers who developed over the period were members of the Maize Association.

Disadvantages were that:

i. a perception could have been that the on-farm research programme was only for the members of the Amazizi Maize Association and the Phutumani Community Garden; this could have resulted in a weakened link between the FSRS team and the rest of the community or other small-scale farmers;

ii. farmers were busy in their own fields and were not always available to assist with the management of the trials; many of the trial activities clashed with farmers' own work programmes and with their other activities, which often resulted in poor participation in managing the trials.

e) The on-farm trials showed that the Obonjaneni area has considerable agricultural potential. However, soil acidity is a major constraint affecting the production of crops and has a negative effect on household food security, not only in Obonjaneni but in all the small-scale areas with the same problem in KwaZulu-Natal. Addressing the problem presents considerable challenges. Firstly, the quantities of lime needed to reduce acidity to tolerable levels often exceed 5 t/ha, which, for example, would be 14 x 50 kg bags for a homestead field of 1500 m^2.

With the nearest supplier approximately 40 km away, this presents a major problem to people relying on public transport such as taxis. Secondly, people would rather invest in their own homestead fields than in the communal cropping fields, over which they have little direct control (they need to re-apply for tenure every 3 to 10 years). Thirdly, the poor and expensive service of local contractors negatively affects the use of lime.

f) The local maize variety ("Zulu" seed) has a role to play in small-scale agriculture. The "Zulu" seed supplied by the farmers not only performed well, but also significantly out-yielded some commercial hybrids under highly acid soil conditions. Small-scale farmers who are prepared to apply lime could plant commercial hybrids to obtain better yields, but, in the absence of liming, it may be more profitable for them to plant their own seed, which has been selected over a number of years for the local acid soil conditions. Extension staff must build this into the "best practice" package of maize knowledge.

g) Researchers need to take responsibility for the management of on-farm trials. This aspect needs to be discussed during the planning stages, when all the role players are present, so that the responsibilities of each partner, including those of the extension staff, can be defined. The research-designed and research-managed trials successfully resulted in the collection of data that showed the potential of agriculture in the community.

h) Although no data were collected in the researcher-designed but farmer-managed trials, the enthusiasm with which the farmers participated proved that this research method has potential in an on-farm research programme in an area such as Obonjaneni. However, when farmers are involved in trials, it is initially important not to use more than one treatment per field and to train farmers progressively in the basic aspects of trial layout and management.

i) The placements and positions of on-farm trials are important to allow visits and visual evaluations. Treatments should not be located in the middle of farmers' fields, due to accessibility problems.

j) The crop production trials in the communal fields showed that a minimum of four seasons was needed to enable scientists to make responsible and sound recommendations. Factors such as the variation in soil fertility among the different treatment plots, a change in the experimental site, and the poor service of the contractors, emphasized the importance of medium-to-long-term, properly planned, on-farm trials. The "hit-and-run" approach, where organizations are involved in communities for only one or two seasons, makes their recommendations unreliable.

k) The Amazizi Maize Association committee was not functioning at its full potential and to the benefit of its members and to the rest of the farmers. They could play a leading role in obtaining inputs at a reduced price. Furthermore, they could initiate farmers' days and similar events and play an important role in obtaining services.

l) The average attendance of 38 people, or 4% of the households in the community, showed clearly that not all the residents in Obonjaneni were farmers or interested in agriculture. It is also possible that many have become disenchanted with agriculture.

m) Leader farmers, who are quickly identifiable in an on-farm research programme, have the potential to assist in the dissemination of technology.

n) The focused attention, training, demonstrations and the hands-on experience received by the members of the community garden changed it from a once doomed garden to a productive and relatively well-managed one.

o) The lack of a formal livestock organization was largely responsible for the long timeframe needed to realize action in addressing the livestock constraints.

p) Theft of livestock and the resultant kraaling of animals at night resulted in a daily movement of animals up and down the mountain. This caused a reduction in veld condition and an increase in the incidence of gully erosion, due to the formation of footpaths in proximity to the village.

q) The sincere and enthusiastic manner in which the FSRS and other team members were received in Obonjaneni by the small-scale farmers who participated in the on-farm research programme, as well as by the rest of the community, and the positive response to the on-farm research effort, left a very strong impression that community members were "hungry" for knowledge, assistance and guidance. The on-farm research and technology dissemination programme contributed to a renewed interest in agriculture.

r) For the first time in KwaZulu-Natal, FSRS staff, on-station researchers, Extension staff and farmers have worked together to address the constraints of small-scale farmers in a rural community. Although room for improvement exists, the approach created successful and effective links among the three groups.

s) As emphasized by Low (1995), these investigations show that commitment, competence and communication are essential ingredients for success in an on-farm research programme.

t) This type of project provides an effective means of bringing about change.

u) The hands-on experience of researchers and extension staff in a project such as this provides them with new and appropriate technical ability, empowers them to become increasingly effective in their advice given in the on-farm situation, and boosts their morale and self-confidence.

5.7 Recommendations

a) The on-farm researchers need to consult with specialists in the relevant field. This could include on-station researchers, statisticians and economists, as dictated by the type of trial to be implemented, to identify possible solutions to constraints encountered by farmers. Farmers' knowledge and experience, where applicable, need to be more prominent in problem-solving.

b) Monitoring and evaluation are critical elements in the approach and it is recommended that researchers, farmers and Extension staff plan these together and in a structured manner. Logframe has the potential to organize a considerable amount of information in a coherent and concise manner. The logframe has a distinct advantage of focusing project planners and subsequently its implementers and evaluators (Coleman, 1987 and Sartorius, 1996). As an example, the main headings for a logframe for the involvement in Obonjaneni, could have been as follows:

Goal	Objectives	Outcomes
To unlock the agricultural potential of Obonjaneni.	• To study and understand the small-scale system. • Identify the agricultural constraints experienced by farmers. • To conduct on-farm research to address the constraints and to develop relevant technologies. • To train and to disseminate relevant technology.	• Create successful linkages between research, extension and farmers. • Successful intervention to control movement of livestock. • Increased number of fields planted under crops. • Adoption of technologies by maize association members. • Revival of activities in community garden through improved vegetable production. • Selling of produce from the communal fields and the community garden. • To organize successful farmers' field days, and use farmers as speakers on technology learnt and adopted from on-farm trials

(Each of these main headings in a logframe will need to be subdivided further into sub- and sub-sub headings in future planning sessions)

c) Introduce various best-practice technologies to farmers through farmer-implemented and farmer-managed trials, where they could be compared with farmers' normal practices. These trials need to be an essential and integral part of the on-farm research and technology dissemination process. The objective is for farmers to recognise a solution that is relevant, practical and applicable to the individual's situation. These trials need to be extremely simple in design so that, after training and information-sharing session with farmers, the technology can be implemented without any further guidance from researchers. Leader farmers, who will most probably be members of an association or other organised groups, should be used to establish these trials, which could be co-ordinated and facilitated by research and Extension technicians. These trials need to support the development and diffusion of appropriate technology through farmer-to-farmer training and the monitoring and evaluation process. Farmers need to be provided with the necessary inputs, accompanied with training on how to use them. Inputs supplied to the farmers need to be correctly labeled, preferably in Zulu, and if they are dangerous or toxic (herbicides or insecticides) must be labeled as such. Regular visits need to be carried out by researchers and technicians to motivate and to monitor progress. The idea is that these leader farmers, after experiencing the benefit of the best practice, will expand the knowledge to the rest of their fields and to neighbours and other community members.

d) It is essential to include farmers' evaluation criteria in formulating recommendations for farmers.

e) Regular meetings (need-driven) should be held between the FSRS staff, on-station scientists, Subject Matter Specialists, Extension staff and farmers, to discuss the on-farm research programme (trial results, problems, possible solutions, relevancy of trials and research to be conducted on research stations).

f) The layout of on-farm research trials with the different treatments in farmers' fields needs to be visible, to allow farmers and other visitors to make a visual evaluation between new technologies and farmer practice.

g) The minimum period of involvement in a community with on-farm trials should not be shorter than five years. The variation in variables such as soil fertility and the slow process of getting livestock farmers involved in any programme could demand this. Recommendations made to small-scale farmers must be technically sound and risk-free.

h) A field book should be opened for each on-farm project, to enable a systematic and diligent record keeping of every piece of additional information emanating from the on-farm trials, e.g. comments from farmers and visitors, climatic conditions, observations and any other relevant information. This would allow a detailed and proper analysis of the data collected, report writing and could contribute to the formulation of usable recommendations.

i) Associations, organised groups and community garden committee members should be trained to fulfil roles properly in communities. Training could be on how to organize events, bookkeeping, how to negotiate with input suppliers, to mention a few. In this regard the Department of Agriculture and Environmental Affairs needs to play an important role, to ensure that these organised groups in communities operate to their full potential.

j) A support system to allow farmers to obtain inputs more easily is needed for households in communities, of which the majority rely on women for agricultural activities. This would enable them to make use of new technologies to enhance agricultural production. For example, the value and the importance of lime in Obonjaneni for crop production has identified the need for such a support programme. Assistance could be in the following ways:

   i. the KwaZulu-Natal Department of Agriculture and Environmental Affairs to subsidize transport of bulk quantities of lime to distribution points in communities, especially for use in homestead gardens;
   ii. the placement of containers in communities as a possible depot for inputs such as seed, lime and fertilizer. This could be a joint venture between Government and the private sector;
   iii. Government to assist and support local shop-owners to become suppliers of production inputs

k) The KwaZulu-Natal Department of Agriculture and Environmental Affairs needs to consider the training of contractors operating in the rural communal areas. Training could include the maintenance of tractors and equipment, the calibration of planters, seedbed preparation, lime incorporation and even the setting of realistic and affordable tariffs. Properly trained contractors could contribute to technology adoption in rural communities.

l) The KwaZulu-Natal Department of Agriculture and Environmental Affairs needs to take the initiative to protect, conserve and even to improve the gene pool of the local maize variety (open-pollinated) and other important genetic material in the possession of small-scale farmers.

m) Technology dissemination events should be composed of short, concise and relevant messages to people. The techniques used need to be practical and innovative, for example:

   i. the use of photos or pictures;
   ii. yield data in units that farmers will relate to, *e.g.* 50 kg bags per known area rather than tons/ha;
   iii. marked out area, *e.g.* 10 x 10m area to illustrate the quantity of lime needed for a given area;
   iv. show the differences in the size of maize cobs obtained from different treatments, by putting them in front of sign-boards indicating the treatments.

n) Handouts of talks and presentations must be available at technology dissemination events, with a concise but complete summary of the recommendations and/or main findings in the most preferred language.

o) When translators are used during technology dissemination events, the interpreter should be knowledgeable on the subject. If possible, the talk should be made available to the interpreter in advance, to allow him/her to study it before the presentation. Translation should involve short sentences only. The translation should be planned with the interpreter (briefing and de-briefing sessions).

p) The KwaZulu-Natal Department of Agriculture and Environmental Affairs needs to use the on-farm research and technology dissemination approaches throughout the Province, in an effort to reach many thousands of small-scale farmers in rural areas.

q) For this approach to be used successfully in KwaZulu-Natal, scientists, technicians, Extension staff and farmers involved in on-farm research and technology dissemination need to be committed, competent and must have the ability to communicate effectively.

r) Conduct a preliminary study of agricultural production, yields, people involved and other relevant information, before final decisions and designs are made for on-farm research programmes.

s) Develop a local variety seed industry with a maize association, under the guidance of the Department of Agriculture.

t) Look at plant populations and techniques to monitor population.

u) On-farm demonstration trials in the most important line of farming, *e.g.* maize or cabbage, should be mandatory for all Extension staff, to equip them with technical skills and self-confidence.

5.8 References

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CHAPTER 6

THE SELECTION OF A SAMPLE OF HOMESTEADS AND SURVEY PROCEDURES FOLLOWED TO DETERMINE THE IMPACT OF ON-FARM RESEARCH AND TECHNOLOGY DISSEMINATION

6.1 Introduction

The Farming Systems Research Section (FSRS), in conjunction with commodity researchers and Extension Staff of the KwaZulu-Natal Department of Agriculture and Environmental Affairs, launched an on-farm client-orientated research and technology dissemination initiative in the Obonjaneni rural community of the Bergville District in September 1997. The main objective of this programme was to address agricultural constraints identified by community members, with the aim of enhancing food security and uplifting the small-scale farmers by improving their livelihoods. This programme was outlined in detail in Chapter 5. After this intervention, it was necessary to determine the impact of the programme over the period October 1997 to October 2002. The impact evaluation was conducted in October 2002, five years after the initiation of the programme. Community participants in the programme were mainly members of the Amazizi Maize Association, the Phuthumani Community Garden and the livestock owners. Technology dissemination took place at farmers' days, field days, meetings for feedback of research data and community meetings that were open to the entire community.

A major problem in most on-farm, client-orientated research programmes has been a bias in the selection of participatory farmers (Biggs, 1989). In many cases it has been found that the more influential, resource-rich or progressive farmers in the community are likely to dominate a programme, unless care is taken to organize and manage the selection of people in the programme (Biggs, 1989). Another problem faced by researchers is to identify smallholders who are "farmers" and for whom farming is of significant interest (Stilwell *et al.*, 1988). In a study conducted by Eckert *et al.* (1988) it was found that, in South Africa, this might embrace only 15 to 20% of rural households.

A farming community is heterogeneous, being composed of diverse groups of farmers with different levels of power, of access to resources and of interest in participating in research programmes (Biggs, 1989). To conduct an impact assessment requires the selection of a sample of homesteads (farmers) to be interviewed. According to Van Vuuren & Maree (1999), the best way to select, from a heterogeneous population, a sample which is representative of that population, is to use a sampling technique known as random or probability sampling. The sample selected needs to be a true representation of the population and it should lead to estimates of population characteristics with as great a precision or accuracy as one can reasonably expect for the cost or effort expended (Barnett, 1974). Suitable statistical tests make it possible to predict whether the results obtained give the same results as those that would have been obtained by working with all the farms/households in the population (Norman *et al.,* 1995). The purpose of sampling is, therefore, to select a subset of the population that has the same characteristics as the whole population, or is representative of the population (Barnett, 1974). The term 'population' includes all farms and households (homesteads) from which the sample is selected, whereas a sample is a representative portion of the population under study (Barnett, 1974 and Norman *et al.,* 1995).

Random sampling requires that each member of the population has an equal probability of being selected into the sample and that each member of the population must be identifiable (Van Vuuren & Maree, 1999). According to Van Vuuren & Maree (1999), each element in the population should be numbered, so that a statistical computer programme can easily draw a simple random sample. This then ensures that each element in the population has an equal chance of being included in the sample (Van Vuuren & Maree, 1999). Researchers in this manner have no say in the choice of the participants, and therefore cannot bias the selection process, and thereby the results of the study (Van Vuuren & Maree, 1999).

The source of a sample is the set of sampling units, such as farmers and households, and is called the sampling frame (Barnett, 1974). The development of such a sampling frame is the first step in simple random sampling (Van Vuuren & Maree, 1999). A sampling frame constitutes a list of the units from which the sample is selected; for example, lists of farmers kept by Extension Staff, a list of people receiving food at schools or clinics during a drought relief programme, lists of farmers participating in government production campaigns, a list of households associated with a community development project, census lists, and maps or aerial photographs (Bernsten, cited by Shaner *et al.*, 1982). Aerial photographs, according to Norman *et al.* (1995), are particularly useful in the planning of Rapid Rural Appraisals. The Development Studies Unit of the University of Natal in Durban used aerial photographs, at a 1:10 000 scale, to undertake a socio-economic survey in the Upper Tugela Location (Muller *et* *al*., 1987). These orthophotographs were used to draw the samples. The homesteads were numbered and a grid super-imposed on the maps.

For many projects, budget restrictions have more influence on sample sizes than does the researcher's desire for precision (Collinson, 1976). Researchers are often interested in several different parameters and each requires a different sample size to obtain a particular precision (there is often a need to increase the sample size to reduce the standard error). But, as the sample size increases, so do sampling costs, and often a higher level of precision is not worth the additional costs (Shaner *et al*., 1982). The sample size is influenced by a number of other factors, including (Byerlee *et al*., 1980; Murphy & Sprey, 1982 and Norman *et al.*, 1995):

a) diversity in the technical and human environment;
b) variability of local farm conditions - if great differences between the elements of the population are expected, the sample has to be large - if those differences are expected to be small, the sample can be small;
c) available time and research resources;
d) data handling facilities.

From the above it is clear that no specific guideline for the sample size is possible in survey studies. Many survey studies in literature indicate only the number of the households included in the sample without an indication of the total number of households from which the sample was drawn. In many studies, however, 20% has been used as the sample size of homesteads selected. In a study by Wessels *et al.* (1997), assessing the impact of a Proteaceae research programme, a sub-sample of at least 15 percent in the different categories of farmers was used and farmers were personally interviewed. Van Vuuren & Maree (1999) gave a rule of thumb that a sample size of about 30% is required for small populations of approximately 1000. In a survey to study factors affecting goat production in communal farming systems in the Eastern Cape region, Mahanjana & Cronje (2000) selected a random sample of 100 households (20% of the population), using random number tables and a map of district households. In a study in the former Ciskei, in one of the Tribal Authority areas, Eckert & Williams (1995) selected from 620 households a 20% sample (n = 125), to identify 'serious' small-scale farmers. The sample of 125 households was selected from a household list provided by the headmen. In Kenya, Waiganjo & Maina (1996) studied the changing roles in livestock management and selected a 20% sample to be interviewed. From the literature it is noticeable that, in many studies, no mention was made of the techniques used to decide on how the sample of households or farmers was selected and how the size of sample was determined.

This chapter describes the method used to select a sample of homesteads from the entire community in order to determine the impact the on-farm research and technology dissemination programme had on the people and agriculture in Obonjaneni. Although the participants in the on-farm research programme were mainly members of the Amazizi Maize Association and the Phuthumani Community Garden (as mentioned in Chapter 5), the impact assessment includes a representative sample of all the residents of Obonjaneni.

6.2 Materials and methods

6.2.1 Aerial photographs as a sampling frame

An aerial photograph of Obonjaneni was used as the sampling frame to select a random sample of homesteads (Figure 6.1).

The Surveyor-General's Office, Department of Land Affairs, Pietermaritzburg, supplied a black and white contact aerial photograph that covered the community. Aerial photographs of the area were taken on 31 March 1996 (Job 985G, Strip 9W, Photograph No: 1032) and on 9 August 2000 (Job1047, Strip 008, Photograph No: 2719). The boundary of the community was demarcated on the black and white contact aerial photographs and a 6x enlargement (scale of 1:8300), as seen from Figure 6.1, was obtained from the Chief Directorate: Surveys and Mapping, Mowbray, in Cape Town). Homesteads, schools and other well-known landmarks are clearly visible on the enlarged photographs, which made it an ideal sampling frame for homestead selection.

6.2.2 The number of homesteads counted on photographs

The term "homestead" in this study refers to a plot with clusters of buildings on it where a family lives. The term "household" is used for the family members living in the homestead. The number of homesteads in the community was counted on both the 1996 and 2000 laminated photographs. Once counted, the homesteads were crossed out with an erasable CMNCROM 108-5 Staedtler pencil. The trend in the numbers also provided an indication of the migration of people in and out the community over the period.

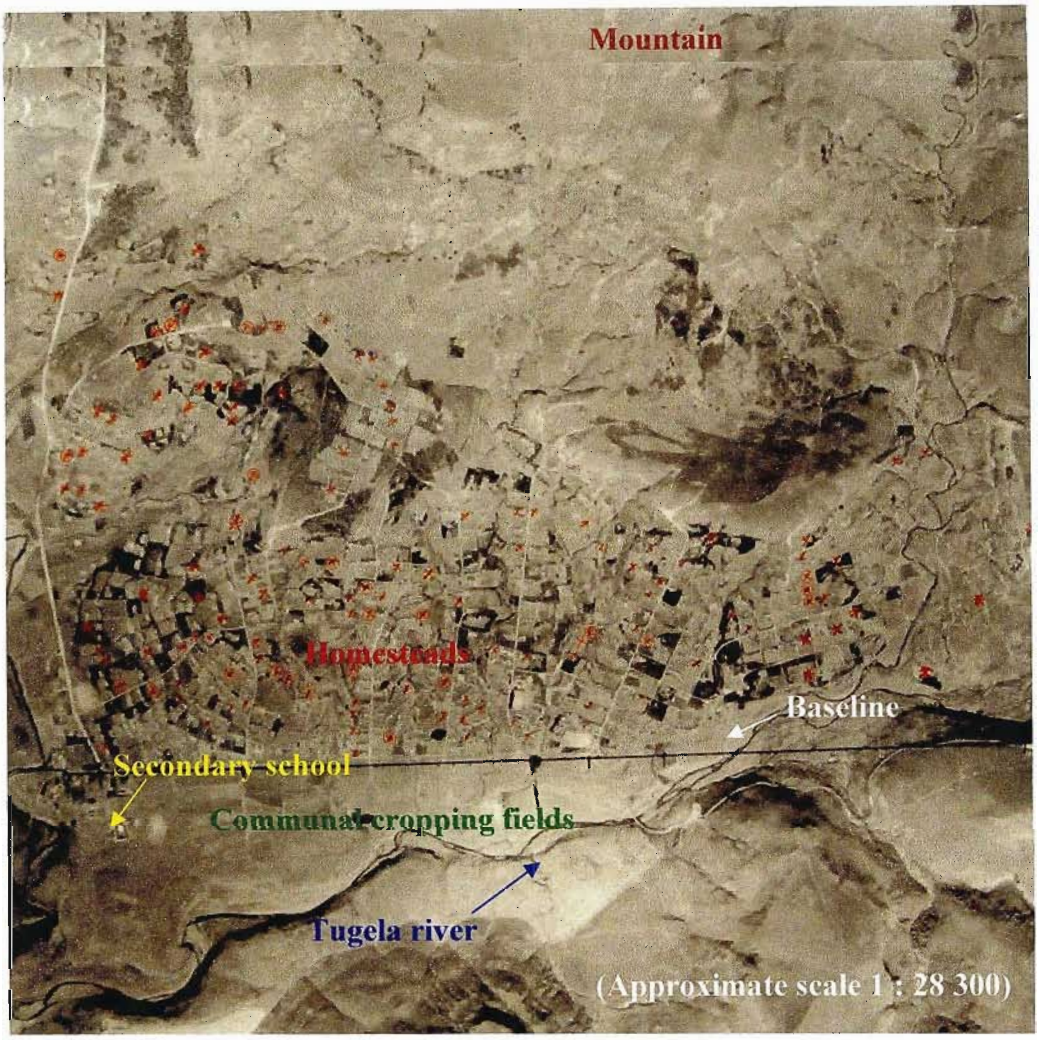

Figure 6.1 The Obonjaneni community from an aerial photograph taken on 9 August 2000 (red crosses show the sample of homesteads selected)

The average number of homesteads counted on the 1996 and 2000 photographs was 839 and 937, respectively. These averages were derived from separate counts by three staff members of the FSRS (see Table 6.1). The increase in the number of homesteads from 1996 to 2000 indicates growth in the community.

Table 6.1 The number of homesteads counted on the 1996 and 2000 photographs and the increase thereof over the period

Photographs	Person 1	Person 2	Person 3	Average
1996	827	934	756	839
2000	995	960	855	937
Increase in the number of homesteads	168	26	99	98

A reason for the discrepancy in the number of homesteads counted, as reflected in Table 6.1, could be that, in some cases, several small units are clustered together on the same plot, while in other instances several units are situated further apart from each other on the same plot. This makes it difficult to distinguish between homesteads. It would therefore be extremely difficult to number the homesteads for random sampling using a statistical computer programme.

Accordingly it was necessary to develop a system of selecting a representative sample which did not require homesteads to be numbered, but which ensured that the researchers concerned had no say in the choice of the respondents and therefore could not bias the selection process.

6.2.3 Grid technique used to select homesteads

In this study it was decided to select a 20% sample of homesteads for the interviews. A grid, superimposed over the entire community (using the August 2000 photograph), was used to select an unbiased sample of homesteads. The technique was used without any ground truthing or preliminary study. It was decided to select the homesteads that were clearly visible and closest to the top right corner of each square of the grid and, if needed, the bottom right corner. To facilitate the drawing of a grid, a baseline was drawn (see Figure 6.1) using certain reference points such as the KZN Wildlife accommodation complex, the Thandanani Craft Centre, the irrigation scheme and the Phuthumani Community Garden, all situated in a straight line.

A 2 x 2 cm grid was found to be too coarse for identifying the needed 20% homesteads and this was consequently reduced to 1 x 1 cm. The number of homesteads marked in the right top corner of the 1 x 1 cm were 118, representing 12.6% of the approximately 937 homesteads. Homesteads marked in the bottom right corner were a further 105. A total of 223 homesteads (or 23.8%) were selected in the top and bottom right corners. A sample size of 194 for the survey was calculated by using the software package STATS (Decision Analyst Incorporated Stats Software) to yield a 5% tolerance level for an estimated proportion of 20% of the population.

The enlarged photograph of the Obonjaneni community, seen in Figure 6.1, was split into eight sections. A3 copies of the eight photographs (that will be referred to as maps) were made and were numbered 1 to 8 (*e.g.* Figure 6.2 was Map 2 of eight with the 48 households to be visited circled).

Figure 6.2 The photograph of the community showing the baseline used to superimpose the 1 x 1 cm grid to select the homesteads in the top right and bottom right corners (red crosses show the spread of homesteads where questionnaires were completed where people were found not to be involved in agriculture, blue circles show homesteads where no-one was present or available for an interview)

This enabled a number of teams to visit the selected homesteads and it also assisted in better control of the interview process by splitting up the number of homesteads into groups. The same baseline, referred to earlier, was used to superimpose the 1 x 1 cm grid on each of the eight A3 maps (see Figure 6.2). The selected homesteads were circled in red and numbered.

The total number of homesteads to be interviewed was indicated on each map.

The number of homesteads selected per map is summarized in Table 6.2. All the well-known landmarks were identified on the eight enlarged (6x) copies to assist the interviewing team to find the selected homesteads. The maps were laminated for protection and to allow them to be written on with permanent marker pens. Prior to embarking on the survey, the Scientists, Research and Extension Technicians were of the view that they would be able to locate the selected homesteads.

Table 6.2 Number of homesteads per map section

Map	Number of homesteads
1	27
2	48
3	50
4	26
5	9
6	22
7	29
8	12
Total homesteads identified and numbered	223

6.2.4 Use of questionnaires and communication with community

A formal survey, using questionnaires (Appendix B), was used to determine whether or not the inputs from FSR and the staff from the Bergville Extension District had resulted in a revival of agriculture in Obonjaneni. The questionnaires were numbered according to the numbered homesteads on the maps, with questionnaire number and relevant map number printed on the front page of each questionnaire (see Appendix B). This system allowed a questionnaire and a homestead to be linked and made the control of the interviewing process easier. The sampling technique used to select the homesteads was explained during the training sessions to enable staff to answer possible questions and enquiries from community members. During the interview process, the selected homesteads were visited without prior notification. Community members who had attended meetings were, however, informed about the interviews, and asked to inform family, friends and neighbours of possible visits, and what the interviews entailed. The sampling technique was also explained at meetings with farmers in Obonjaneni in advance of the visits.

6.3 Results of the interview process

All the homesteads identified in the sample were visited. The person responsible for the agricultural activities in the household was the designated respondent. A questionnaire was completed only where the household was actively involved in agriculture and the person responsible for agriculture was at home. After a household was visited, it was crossed out on the laminated map or listed on the back of the map with a marker pen. The interview process was summarized as follows: a red cross indicated a positive visit (people indicated that they were involved in agriculture allowing the questionnaire to be completed); a red cross, circled, indicated that people were available for the interview but were not involved in agriculture; a blue circle indicated that the person responsible for agriculture was absent or nobody was at home; and a black dot reflected a shop, or an abandoned homestead, or a homestead that could not be found.

Figure 6.1 shows the spread of homesteads (red crosses) of successful interviews and the homesteads where people were found not to be involved in agriculture. The homesteads where visits were unsuccessful, for whatever reason, were not revisited. In general, the selected homesteads were relatively easily found. Accessibility to some of the homesteads, however, was sometimes difficult and interviewers were forced to walk through difficult terrain.

The data summarized in Table 6.3 show the map number, the number of households active in agriculture where questionnaires were completed, the number of households not interested in agriculture, the number of households where the person responsible for agriculture was absent, homesteads where no one was at home, homesteads abandoned, not found or those that were actually a shop, and the total number of selected homesteads. Out of the total sample of 223 homesteads visited, it was possible to interview 113 people and complete the assigned questionnaire.

It was found that, of the 223 homesteads visited, 6.7% were abandoned, missing or were shops. On the day of the interviews, 17.3% of the homesteads had no one at home, and, at 14.4% of the homesteads, the people who were actively involved in agriculture were not available for interviews. From the selected sample it was established that 20.3% of households in Obonjaneni are not involved or interested in agriculture.

Table 6.3 The number of homesteads visited in the different parts of Obonjaneni, classified according to whether or not the questionnaire was completed and the reason for not being able to complete a questionnaire, where this occurred

Map Number (Photograph number)	Households active in agriculture and questionnaires completed	Households not interested in agriculture	Households where person responsible for agriculture was absent	Homesteads where no one was at home	Missing samples (homesteads abandoned, not found, or actually a shop)	Total number of selected homesteads
1	8	3	5	9	2	27
2	30	6	4	5	3	48
3	23	10	9	5	3	50
4	10	4	4	4	4	26
5	8	0	1	0	0	9
6	15	1	4	1	1	22
7	12	5	2	9	1	29
8	7	0	1	3	1	12
Total number of homesteads	113 54.3% [1]	29 20.3% [2]	30 14.4% [3]	36 17.3% [4]	15 6.7% [5]	223

[1] 113/(223 – 15) as percentage

[2] 29/(113 + 30) as percentage

[3] 30/208 as percentage (208 = 233 – 15)

[4] 36/208 as percentage (208 = 223 – 15)

[5] 15/223 as percentage

The following criteria were used to calculate the number of households actively involved in agriculture:

a) missing samples (homesteads abandoned, not found or those that were shops) were eliminated from the selected sample;
b) the homesteads where no one was at home were eliminated from the sample;
c) the homesteads visited where people were not interested in agriculture were eliminated from the sample;
d) the households actively involved in agriculture, but where the respondent was absent from the homestead, were retained as part of the sample.

If the percentages obtained from the study, as summarised in Table 6.3, are extrapolated to the entire community, 64.1% of households are actively involved in agriculture in Obonjaneni. This was calculated as follows; 223 – (15 + 36 + 29) = 143/223 x 100. It can therefore be extrapolated that, from the counted 937 homesteads, 64.1% or 600 households in the community are actively involved in agriculture. Therefore the 113 households interviewed, of which the questionnaires were successfully completed, represented 18.8% of the 600 households in Obonjaneni that are actively involved in agriculture.

6.4 Conclusion

a) The counting of the homesteads by the three staff members of the FSR Section showed that more accuracy is needed when interpreting a photograph to select homesteads. It is necessary to study aerial photographs in relation to the situation on the ground before this technique is used (ground truthing).

b) In this study it was decided to select a 20% sample of homesteads for interviews. This was done by overlaying a 1 x 1 cm grid on a 1:8 300 photograph and using a fixed, predetermined point in the grid square offered a workable method for selecting an unbiased sample unit. The size of the grid will depend on the size of the sample to be selected. In this study the 1 x 1 cm grid allowed a sample size of 23.8% homesteads to be surveyed over the entire community.

c) In Obonjaneni approximately 64% of the households were actively involved in agriculture. No provision was made to use alternative samples when no one was at home, or where households were not interested in agriculture, or where a person responsible for agriculture in a household was absent, or where no homestead was found at the selected location. In future additional homesteads should be selected when preparing the sample, so that there will be sufficient numbers should some of the units not be available or suitable, as was found in this study.

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CHAPTER 7

IMPACT EVALUATION OF THE ON-FARM RESEARCH AND TECHNOLOGY DISSEMINATION PROGRAMME CONDUCTED IN THE OBONJANENI COMMUNITY

7.1 Introduction

The on-farm research and technology dissemination approach is eminently suitable to play a key role in addressing the agricultural constraints of small-scale farmers, and they themselves have a crucial role to play in the process. The purpose of investing in such agricultural research and extension is to identify, develop and transfer new technologies, with the ultimate goal of increasing the agricultural productivity and income of small-scale farmers in rural areas (Maredia *et al.*, 1998). Rural economic growth is a critical contributor to poverty alleviation, and broad-based agricultural development is a vital factor in achieving such growth (Kerr & Kolavalli, 1999). A successful programme results in increased production and raised productivity, thereby effecting an improvement in the availability and the quality of food, improved income earning potential and improved nutrition and health (Hart, 2000). The advantage of the on-farm research approach is the relevance of the programme through the participation of farmers. The demand-driven nature of this approach increases the chances of the adoption of technology (Eckert *et al.*, 1988 and Chambers *et al.*, 1989). High adoption rates were found in an on-farm, client-orientated research approach in Guatemala, which resulted from developed technology which was relevant to the needs of resource-poor farmers (Ortiz *et al.,* 1991).

The output of on-station research in terms of, for example, the number of varietal trials, number of crosses, improvements in research techniques, number of varieties released and potential yield improvements are important in terms of research success, but are measures of success at an intermediate stage (Eponou, 1996). These indicators do not quantify the impacts of research on factors such as farm income, consumer welfare or agricultural growth, which, depend on the actual adoption of new technology by the farmers (Maredia *et al.*, 1998). The process of farmer adoption of on-station research could perhaps be seen as a top-down approach and it could only be considered effective if an on-station approach would result in farmers modifying their farming practices to solve constraints and to improve production.

In the context of research and development activities, impact includes both the direct product of research and the effect on the ultimate users of the technology, also referred to as the "people-level impact". It includes the economic, socio-cultural and environmental impact (Anderson & Herdt, 1990; Anandajayasekeram & Marasas, 1999 and Matata *et al.,* 2001). The danger, however, is that the "people-level impact" could confound variables and that some changes would have occurred naturally, regardless of the intervention (Anandajayasekeram & Marasas, 1999). The apparent effects could then be a result of these confounding variables in which case the programme could be said to have had little or no real effect (Hart, 2000). Furthermore, it is always difficult to assess the impact of agricultural research on poverty, as there are so many ways in which agricultural research can have an effect (Kerr & Kolavalli, 1999). In this context, it must be remembered that technical change, resulting from agricultural research, takes place under the influence of political, social and economic factors (Kerr & Kolavalli, 1999) each of which have a further confounding effect.

The extent of the impact of farming systems research and extension has been reported to range from tepid (Merrill-Sands & Collin, 1992) to positive (Tripp, 1991), in terms of both production and the adoption of technologies. The adoption of technology by small-scale farmers is influenced by factors such as: personal attributes (age, level of education and gender), the farming systems and resource characteristics (cultivated area, family size and availability of appropriate inputs such as fertilizer, seed, machinery, equipment and the liquidity position of the farmer), institutional and infrastructural factors (which covers laws and regulations governing the supply and accessibility of credit, extension advice, training and input markets) and environmental factors (Desai, 1988 and Jha & Hojjati, 1994).

The non-adoption of research findings by farmers, according to Onyango *et al.* (1998), is a widespread phenomenon. Thus, it is important to identify farmers' priorities with them and also help them meet these needs. This will lead to innovations that encourage sustainable development. When small-scale farmers rejected technologies, according to Merrill-Sands (1986), it was not out of sheer ignorance, traditionalism or sloth. According to Farrington (2001), farmers themselves selected from a range of possible new technologies that best fitted the fluid and uncertain conditions underpinning their farming systems and livelihoods. Farmers, therefore, pursue goals and employ criteria for evaluating technologies distinct from those used by agricultural scientists (Norman, 1974; Hildebrand, 1977; Norman *et al.*, 1982 and Collinson, 1983). This implies a re-emphasis on offering farmers "baskets of choices"

(Chambers & Jiggins, 1987). It has been reported that when small-scale farmers were not adopting technologies, or where on-farm research had limited impact, the following diverse reasons were advanced: the wrong problems were addressed, a superficial diagnosis of problems and causes, an one-way research approach with no farmer-feedback, an insufficient supplies of equipment, insufficient supply of inputs in appropriate pack sizes, a lack of input of supply services and links to markets, unfavourable agro-climatic conditions, poor integration of on-farm research with disciplinary and commodity research, weak links with extension services, a poor implementation of trials and inadequate analysis and an interpretation of trial results in relation to the implications for farmers (Nagy *et al.,* 1990, Low *et al.*, 1991, Eponou, 1996, Onyango *et al.*, 1998 and Oehmke & Crawford, 2002). It is thus evident that adoption can be influenced by many factors and that non-adoption of technology to some degree in any research and technology dissemination programme is likely to occur.

In contrast to the possibility of poor adoption or non-adoption of technologies, Oehmke & Crawford (2002) reported that the benefits of technology development and training achieved by African agricultural research were not only positive, but also sufficient to indicate economic profitability. Technology, over the decades, proved to be a key ingredient in the African agricultural picture, in boosting production in commodities such as maize, cassava, rice, cocoa, livestock, cotton, dairy, horticultural products and bananas (Gabre-Madhin & Haggblade, 2003). Adoption of high-yielding varieties by small-scale farmers was reported, for example, in Zimbabwe (Eicher, 1995), in Kenya (Byerlee & Eicher, 1997) and in Nigeria and Senegal (Byerlee, 1994). Economic assessments reflected generally high rates of return on agricultural research in Africa. One review of 32 agricultural research evaluations, found rates of return in excess of 20% for three-quarters of the studies conducted, with a median rate of 40% (Masters *et al.,* 1998). A more recent review, of 44 cases computed a median rate of return of 37% for agricultural research and 27% for agricultural extension in Africa (Evanson, cited by Gabre-Madhin & Haggblade, 2003) and, according to Gabre-Madhin & Haggblade, (2003), these figures were comparable to those found in Asian agriculture. This suggests that investment in agricultural research represents one of the most productive available uses of public investment in Africa.

The on-farm research approach, with farmer involvement and with the farmer as final user of the technology, is ideally positioned for an assessment of the impact of the research efforts (Norman *et al.*, 1994). Available tools to be used by on-farm research teams for evaluations, monitoring and measuring impact include, for example, the Logical Framework Approach and the Project Management Cycle Approach (Hart, 2000), technology diffusion map (Adamo, 2001), Rapid Appraisal of Agricultural Knowledge Systems (RAAKS) (Solomon, 1998), Participatory Monitoring and Evaluation (PME) (Ewang & Mtshali, 1998), a wealth-ranking technique (Adamo, 2001), the farmer research group participatory evaluation tool (Adamo, 2001) and formal surveys (Norman *et al.*, 1994).

In the present investigation, a formal survey was decided upon to determine whether or not the on-farm research and technology dissemination programme conducted over five years resulted in unlocking agricultural potential in Obonjaneni. The outcome of the study is important for the future of the research and technology dissemination approach to be followed by the KwaZulu-Natal Department of Agriculture and Environmental Affairs in service delivery to small-scale farmers in rural communal areas of KwaZulu-Natal. The constraints and production problems faced by many thousands of small-scale farmers in the Province need to be effectively addressed in order to overcome the low agricultural productivity in this sector.

In this chapter, firstly a brief overview of household demographics and the agricultural activities is provided. Secondly the awareness of people to the on-farm trials and technology dissemination programme is evaluated. Thirdly, the impact of the programme on the community is considered. Lastly, the comments and feedback from Extension staff of the Bergville District office are considered.

7.2 Materials and methods

7.2.1 Objectives of the impact assessment study

The on-farm research and technology dissemination programme, conducted between September 1997 and October 2002 in Obonjaneni, addressed agricultural constraints in that community. The objectives of the impact assessment study were:

i. to establish whether or not people were aware of the on-farm research and technology dissemination programme;
ii. to determine whether or not constraints were addressed and how people in the community benefited;
iii. to establish the value of the approach to Extension staff.

7.2.2 Participants in the study

The on-farm research and technology dissemination programme was for the benefit of the *entire* community. This aspect was thoroughly discussed and explained at community meetings, especially during the diagnostic phase. However, it transpired that the main participants in the research programme were the members of the Amazizi Maize Association and the Phuthumani Community Garden, although the technology dissemination events were attended by a wider group of Obonjaneni residents, as well as by people from neighbouring communities. For the impact evaluation study, a sample of respondents from the entire community was used (selection of the samples was described in Chapter 6).

7.2.3 Development of the questionnaire

A structured questionnaire was developed, with open- and closed-ended questions (Appendix B). Questions covered the objectives of the FSR Section (FSRS) involvement in Obonjaneni and aspects of the on-farm research and technology dissemination programme. The closed-ended questions provided the respondents with predetermined descriptors, from which they were asked to select the one that best described the situation. The open-ended questions were included to allow for some freedom in answering the questions.

Contributions and comments in developing the questionnaire were provided by Scientists, Research Technicians and Extension staff that were involved in the programme; the Statistician at Cedara; Managers from the North West Region (Extension) and from the Directorate: Research, Analytical Services and Training; a retired Deputy Director: Extension of the former Natal Department of Agriculture; staff at the Centre for Rural Development Systems (University of Natal) and the Statistics Department at the University of Pretoria.

7.2.4 Training of staff on the use of the questionnaire

Due to distance and programmes, separate training sessions on how to use the questionnaire were held with the FSRS and Extension staff who assisted in the interviews. Special attention was given to the instructions on the cover page of the questionnaire. The questions were "tested" using FSRS staff and this resulted in a few changes, such as rephrasing for better understanding. The procedure that was followed to select homesteads (identification of the respondents) was explained and discussed, to prepare the interviewers should respondents or any other resident of Obonjaneni ask questions in this regard. The questionnaire was not pre-tested in the community.

7.2.5 Interview process

In the study, individual interviews were held and 113 questionnaires were completed from a selected sample of 223 out of a possible 937 homesteads in Obonjaneni (Chapter 6). The interviews were conducted over four days (19, 20, 25 September and 9 October 2002). On the first day, 16 staff members (eight from Extension and eight from the FSRS) participated as interviewers, 10 on the second day (including three Extension staff), eight FSRS staff on the third day and eight (six FSRS and two Extension staff) staff members on the fourth day.

Aerial photographs of the community were used to find the selected homesteads, as described in Chapter 6. Zulu-speaking Departmental colleagues conducted the interviews. Homesteads were visited by one person, who conducted the interview. During the interviews a non-Zulu-speaking team member was responsible for:

a) transporting team members between the homesteads;
b) controlling the handing out of questionnaires, which were numbered for a selected homestead, and corresponded with the identified homestead on the aerial photograph;
c) receiving returned questionnaires (successfully or unsuccessfully completed);
d) checking that questionnaires were properly filled in.

On arrival at a homestead, the interviewer asked whether the household was actively involved in agriculture by way of planting crops and/or growing vegetables and/or owning livestock. A "no" answer terminated the interview. A "yes" answer required the interviewer to establish whether the person responsible for the agricultural activities (hereafter referred to as the respondent) was available for being interviewed or not. If a person was not available for an interview, a reason was established and the interview terminated.

7.2.6 Evaluation and feedback from the Bergville District Extension staff on the on-farm research and technology dissemination programme

The Extension staff of the Bergville District evaluated, and commented on, the on-farm research and technology dissemination programme by completing a questionnaire anonymously, while I was available to assist with any questions or any uncertainties. Eight Extension staff, which included the Head of Extension, the Home Economist and six Agricultural Development Technicians (ADTs) (of a possible nine in the District, including the ADT who was involved as a team member during the programme), participated in the study.

7.2.7 Statistical analysis

The data of the 113 questionnaires were subjected to a descriptive statistical analysis of simple percentages and proportions using the Genstat and SPSS software programmes. Correlations between the variables (questions) were investigated by using either regression analysis or chi-squared tests, depending on the data requiring analysis (Genstat 6.1, 2002 and SPSS, 2001).

An Alpha reliability coefficient test was done to measure whether the respondents gave similar answers to different questions in the questionnaire (SPSS, 2001). The repeatability of the answers could indicate reliability of the questions in the questionnaire. The Alpha reliability coefficient test was conducted on the following questions:

a) When Cedara started in Obonjaneni, members of the community stated, "agriculture is not sick in this community but dead". What is the status of agriculture in Obonjaneni at present?

b) How was the production of green maize in Obonjaneni during the 2002 cropping season, compared to before the involvement of Cedara and Bergville District Extension staff?

c) How did the maize grain during the 2002 season compare to before the involvement of Cedara and Bergville District Extension staff?

A high Alpha coefficient of around 0.8 would occur if items yielded almost identical responses. An Alpha coefficient of around 0.70 would indicate a reliable scale with items that were measured overlapping but not completely identical (SPSS, 2001). The test was only possible on the three indicated questions because they were measured on the same scale.

The answers to the open-ended questions were summarized and grouped in different categories of answers given by the respondents.

7.3 Results and discussion

7.3.1 Demographic profile of respondents

7.3.1.1 Age

The mean age of the respondents (n = 99) active in agriculture was 50.45 years (SD = 14.66; median of 48), with the youngest person being 23 and the oldest 86 years. The median age for both male and female respondents was 48 years. The age distribution of respondents is shown in Figure 7.1. The indication is that the younger people in Obonjaneni were not responsible for the agricultural activities of homesteads. The only significant correlation found between age and the other variables was with respect to education, which indicated that the younger respondents had a better level of education (Chi-square P = 0.001).

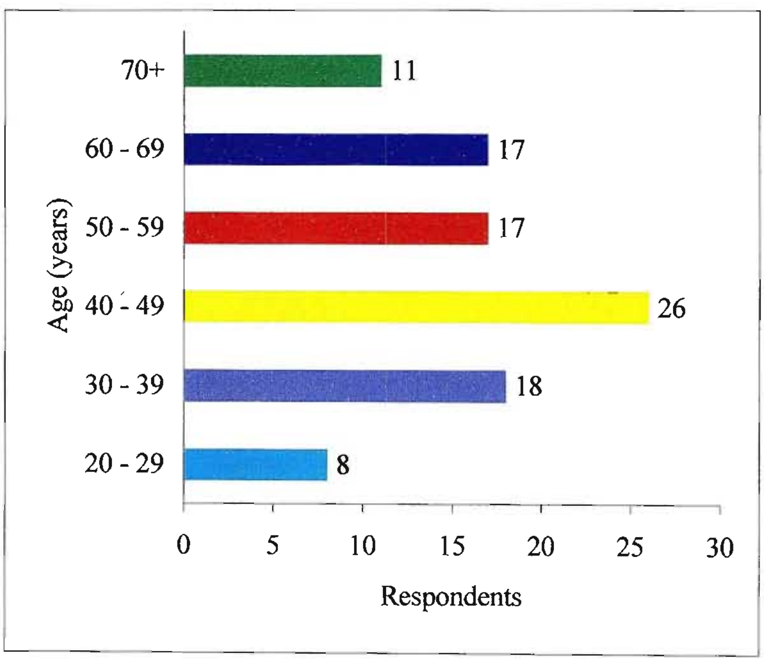

Figure 7.1 Age distribution of respondents (n = 99)

The situation in Obonjaneni was similar to what was found in Nigeria and Zambia. In Nigeria, in the Yewa North Local Government Area (county) of Ogun State, which covers a total land area of 2 043 km^2, the mean age of people involved in cassava/maize production was 48 years. This study conducted by Apantaku *et al.* (2003), reflected the involvement of the older community members, while the younger ones (below 30 years) were less involved or totally uninvolved in cassava/maize farming. In a study conducted in the Choma District in the Southern Province of Zambia, where crop production and cattle rearing are the main economic activities, the farmers' ages ranged from 21 to 86, with the average age being 49 (Kalinda *et al.*, 2000).

7.3.1.2 Period lived in Obonjaneni

Respondents and their families had lived in Obonjaneni for an average period of 29.61 years (n = 112; SD = 21.483; median of 20 years). The distribution is shown in Figure 7.2. It is clear from the information that respondents were a well-established group in Obonjaneni. This would add to the reliability of the data collected during the study.

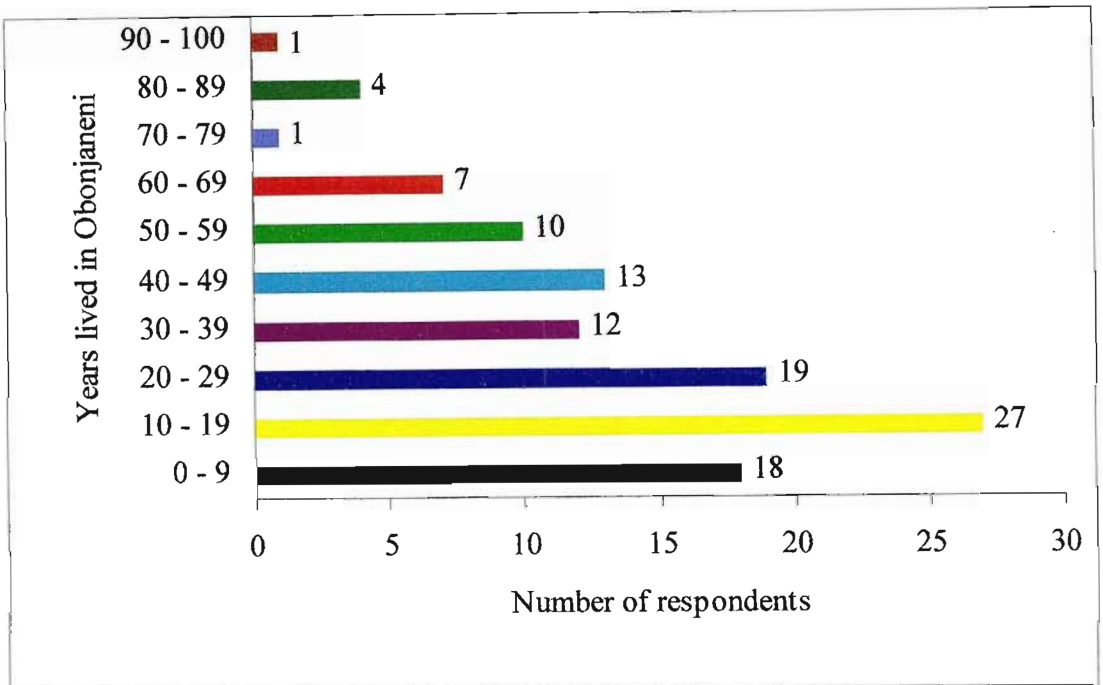

Figure 7.2 Number of years lived in Obonjaneni as indicated by respondents (n = 112)

7.3.1.3 Gender

Of the 113 respondents, 77 (68.1%) were females and 36 (31.9%) males. The fact that respondents were mainly responsible for the agricultural activities of a household indicated that women in 68% of households in Obonjaneni are responsible for agricultural activities. It is, therefore, crucial to include women in all the steps of an on-farm research and technology dissemination programme. This will ensure the adoption or the modification of existing practices by a larger group of people in a community. In Kenya it was found that, due to the migration of men from rural areas, women were left as the main agricultural producers in small-scale farming. Approximately 80% of the female population in Kenya resides in the rural areas and most of them are engaged in agricultural production as a major economic activity (Mutoro, 1997). In a country such as Colombia, up to one-third of rural households are headed by females, whereas in Asia it is rarer for women to farm on their own and they often contribute as much to farm labour as men, either as unpaid family workers or as hired workers (Binswanger, 1996). The "invisible" role of women in farming systems, according to Nataraju & Nagaraja (1998), needs to be more fully appreciated and reflected in the research agenda. There is a need for a new perspective of women, based on their productive contribution, rather than their being viewed as beneficiaries of social welfare.

Significant correlations were found in Obonjaneni between gender and responses to questions, as summarized in Table 7.1.

Table 7.1 Correlations found between gender and responses to questions in the questionnaire

	Variables	Positive response		Chi-square
		Males (%)	Females (%)	P
Gender x	See FSRS staff often (once a month)	33	14	0.027
	Want FSRS to continue to be involved	94	74	0.036
	Awareness of maize trials	36	18	0.034
	Aware of notice board	75	43	0.001
	Aware of the livestock meetings	33	13	0.013

Although women play an important role in the agricultural activities in Obonjaneni, only a small number of them saw FSRS staff and were aware of the on-farm research programme and its activities, compared to the male respondents. This is perhaps an indication of the "invisible" role women play in a community such as Obonjaneni, due to the many other responsibilities they have to fulfil in their households. More men (94%) wanted FSRS staff to continue in Obonjaneni than women (74%). A study in Ethiopia showed that the performance aspects such as yield, adoption of new seed varieties and the adoption of fertilizer recommendations by female farmers were poor. This was largely attributed to the poorer contact between them and extension (Düvel *et al.*, 2003).

7.3.1.4 Education level

The level of schooling of respondents was poor, with 36% of the respondents indicating no formal education (29% were unable to read or write) and 26% indicating a secondary school education (17% Grade 8 – 10 and 9% Grade 9 – 12). Significant correlations between education and the other variables found in the study are summarized in Table 7.2.

Significant correlations showed that the respondents with the higher education were the ones who changed their crop production practices, were prepared to learn from other people in the community, were willing to share their knowledge and wanted the FSRS to continue working in Obonjaneni. Education, therefore, could play an important role in the adoption of technology, and in the promotion of technology amongst other people in Obonjaneni. Education was not the determining factor for attending farmers' field days, but the more educated people were eager to participate, wanted to learn and wanted to improve their agricultural productivity.

Table 7.2 Correlations found between education level of the respondents and other variables

	Variables	Chi-square P
Education x	Changed crop production practices	0.015
	Got knowledge from other community members	0.02
	Shared knowledge with others	0.036
	Want FSRS staff to continue to be involved in Obonjaneni	0.07
	Attendance at farmers' field days	NS

Although Haven (1965) found no relationship between education and the adoption of technology, the contrary was shown in later studies which showed that education was related to the adoption of technologies developed and linked to better farming practices (Sandhu & Allen, 1974; Abd-Ella *et al.*, 1981; Botha & Lombard, 1992 and Düvel *et al.*, 2003). A study by Ndaeyo *et al.* (2001) in south-eastern Nigeria, where the majority of the population in the region is engaged in farming, showed that the largest group of respondents (47%) had only primary education. Although it was found in the study in Nigeria that 88% of the respondents were aware of fertilizers, 61% were aware of other agrochemicals, and 56% and 16% utilized them, respectively, low educational attainment was identified as one of the constraints to adoption of agricultural innovations (Ndaeyo *et al.,* 2001). Apantaku *et al.* (2003) revealed that, generally, the socio-economic characteristics of farmers in Ogun State, Nigeria, had no significant relationship to the farmers' level of involvement in problem identification and prioritization. The level of education, however, had a significant positive relationship with the level of involvement in problem identification and prioritization.

7.3.2 Alpha reliability coefficient test

The Alpha reliability coefficient test showed a significant relationship of 0.7186 (n = 113) between the answers given to three questions in the questionnaire testing whether people observed an improvement in agriculture since the FSRS started to work in Obonjaneni in 1997 or not. This result indicated that the answers to the three questions were consistent and that respondents who saw or experienced an improvement in the agricultural position in the community indicated this in all three questions.

7.3.3 Agricultural activities in Obonjaneni

7.3.3.1 Membership in agricultural organisations

A small number of the 113 respondents belonged to agricultural organisations in Obonjaneni (Table 7.3).

Table 7.3 Membership of respondents to different agricultural organizations in Obonjaneni

Organisation	Number of respondents
Grazing Committee	5 (4.4%)
Amazizi Maize Association	3 (2.7%)
Broiler group	3 (2.7%)
Phuthumani Community Garden	2 (1.8%)
KwaNalu (organised agriculture in KwaZulu-Natal)	1 (0.9%)
Crafts	1 (0.9%)

However, during the first meeting with the community in October 1997 (see Chapter 2), respondents had mentioned only the Amazizi Maize Association, Phuthumani Community Garden and sewing club as active organizations in Obonjaneni.

7.3.3.2 Crops and vegetable production

The majority of the respondents (104 or 92%) planted maize and 37 (32.7%) also planted dry beans in the homestead gardens and the communal cropping fields. The diagnostic survey in 1998 showed that 94% of respondents planted maize in the homestead gardens, with no maize planted in communal cropping fields. In the communal cropping fields, 18 (15.9%) of the respondents (10 or 13% of the 77 women and 8 or 22% of the 36 male respondents) planted maize and three (2.7%) planted dry beans (see Plates 7.1, 7.2, 7.3 and 7.4). This is a significant increase since the time of the diagnostic survey in 1998, when not one person used the communal fields for crop production (see Plate 7.5).

Plate 7.1 Farmers planting maize in communal cropping fields, using animal-drawn and tractor planters

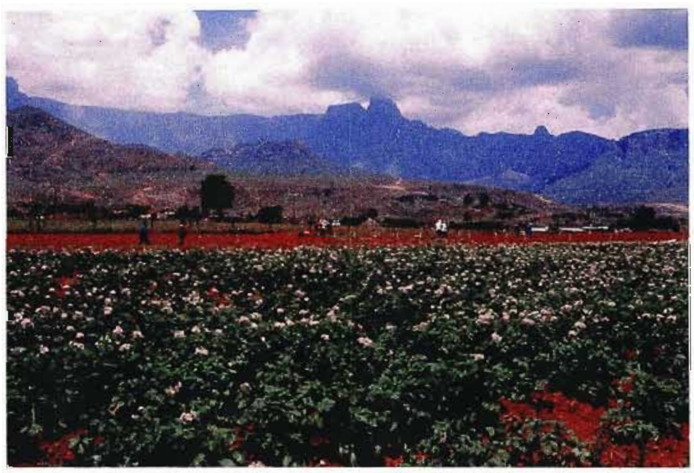

Plate 7.2 Potatoes grown by farmers in communal cropping fields for own consumption and to sell

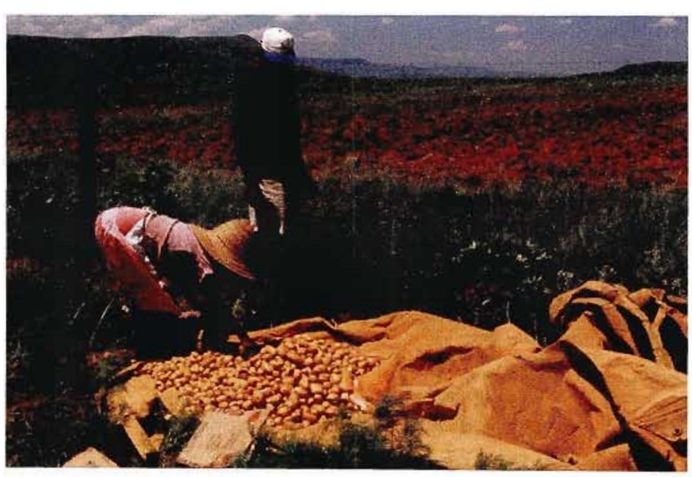

Plate 7.3 A farmer supervising the sorting of potatoes for packaging

Plate 7.4 Good stand of dry beans grown by farmers in communal cropping fields for own consumption and for sale to the community

Plate 7.5 September 2001, 13 ha (20 fields) of the communal cropping fields under cultivation

Plate 7.6 Good yields encourage some farmers to envisage being upgraded from a "small- to a larger-scale farmer"

Plate 7.7 A farmers' field day

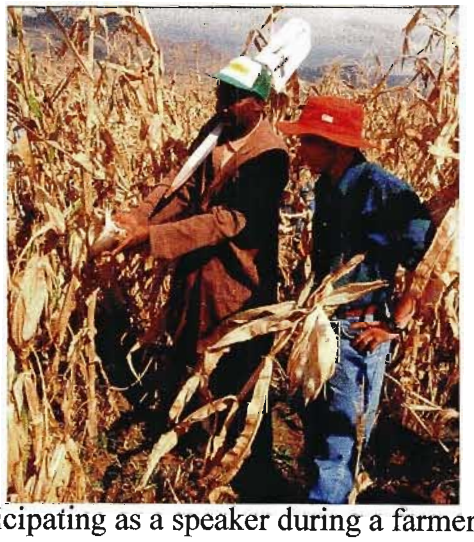

Plate 7.8 A farmer participating as a speaker during a farmers' field day

Plate 7.9 Farmer using hybrid maize seed in the communal cropping fields in Obonjaneni

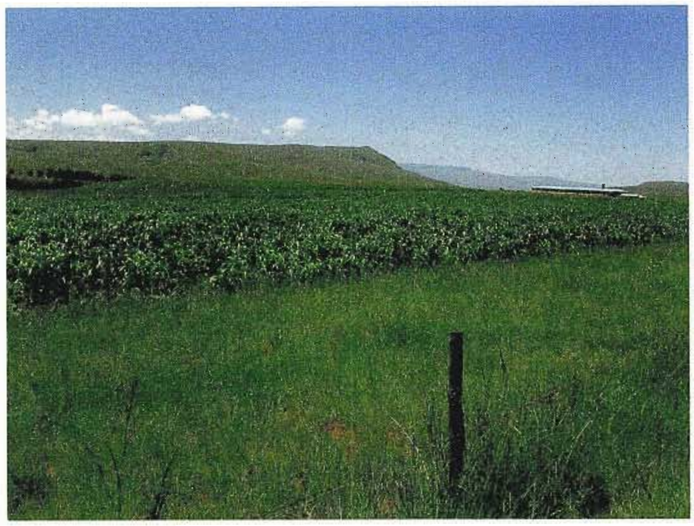

Plate 7.10 The communal cropping fields with a good stand of maize

Plate 7.11 Farmers employing local labour to weed crops

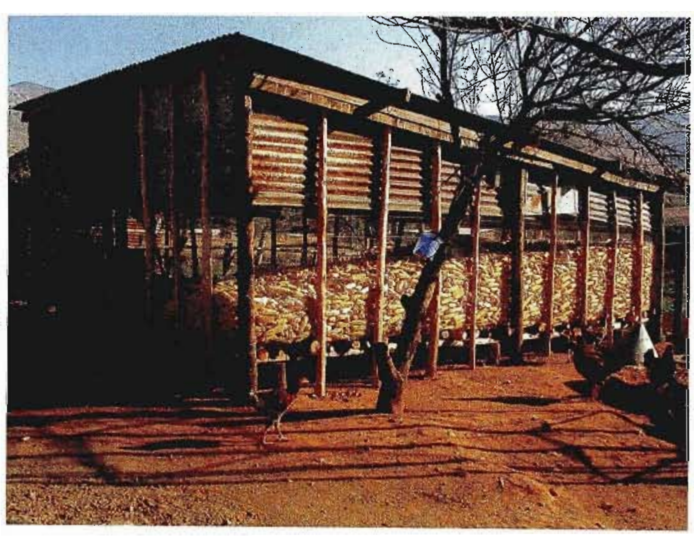

Plate 7.12 A structure used for maize-storage (maize for own consumption and to sell)

Plate 7.13 Farmer topdressing his maize in the communal cropping fields

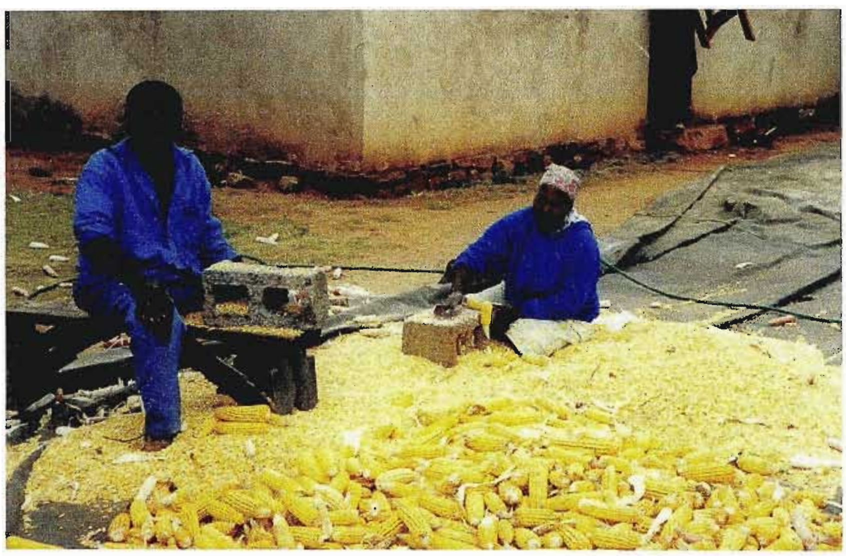

Plate 7.14 Shelling maize cobs after harvesting, using a concrete block

Plate 7.15 A crop of cabbage in a homestead garden of a participant in the on-farm research and technology dissemination programme

Plate 7.16 Maize grown in a homestead garden

The main types of vegetables grown in the homestead gardens are shown in Figure 7.3. They indicate the range of crops planted by people in Obonjaneni.

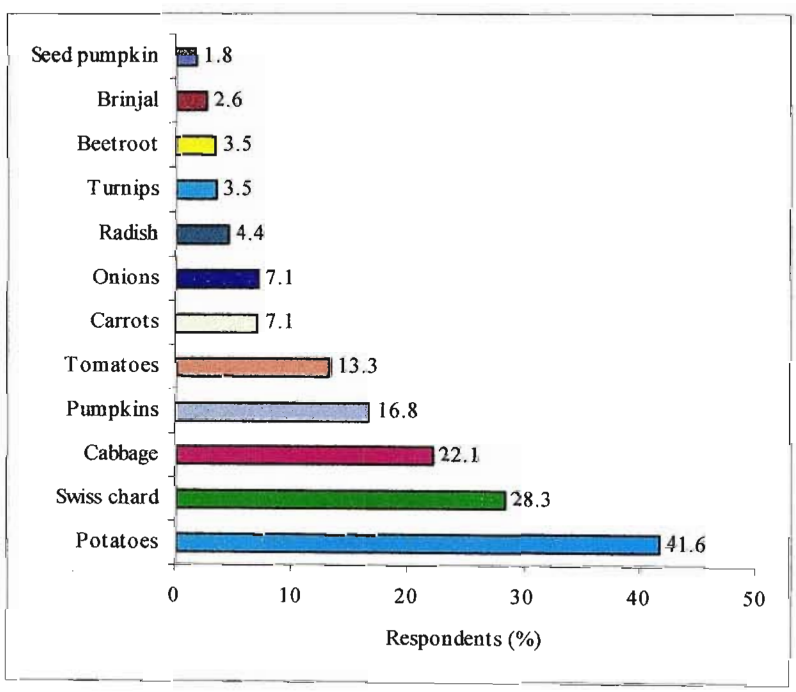

Figure 7.3 The main vegetables grown by respondents in Obonjaneni in homestead gardens

Other vegetables grown were butternut, chillies, green beans, lettuce, peanuts, pepper, sweet potatoes, calabashes, seed pumpkin and soyabeans. Peach trees were found in 75 (66.4%) of respondents' gardens. Other fruit types grown were (frequency indicated in brackets) grapes

(4), apricots (3), apples (2), plums (3), bananas (1), figs (1), granadillas (1), lemons (1), oranges (1), pears (1) and strawberries (1).

Concerning agricultural activities and practices, three groups were found in Obonjaneni. The first group, and the majority of respondents (86 or 76%), used homestead gardens to plant crops only (Table 7.4), showing the important role the small areas around the homesteads could play in supporting households with agricultural produce such as vegetables. Maize, dry beans and vegetables are grown in the homestead gardens on median-size fields of 2000, 1350 and 50 m^2, respectively (Table 7.4). Although homesteads could be used to produce valuable and much-needed vegetables and crops, the sizes of the homestead gardens were small and families would certainly have to depend on "outside" money to make a living. In was mentioned by Ninez (1987) that, despite increasing attention given by agricultural research organizations to small-scale farmers, household gardens are still neglected as a subsistence strategy. The second group of respondents (18 or 15.9%) was involved in the communal cropping area, in addition to their home gardens, on fields that ranged from 0.5 to 3 ha in size, with a median of 1 ha for maize and 1.25 ha for dry beans (Table 7.4). A third group, of nine respondents (8%), reported that they had no fields to cultivate and did not indicate whether or not they were interested in obtaining land for cultivation.

Table 7.4 Size of the communal cropping fields and homestead gardens in Obonjaneni used to plant maize, dry beans and vegetables

Area	Number of respondents who supplied field sizes	Minimum	Maximum	Median
Communal cropping fields:				
Maize	12	0.5 ha	3 ha	1ha
Dry beans	2	1ha	2 ha	1.25 ha
Homestead garden:				
Maize	45	90 m^2	8000 m^2	2000 m^2
Vegetables	31	1 m^2	7000 m^2	50 m^2
Dry beans	16	50 m^2	3 000 m^2	1350 m^2

Field sizes in Obonjaneni were similar to those found in other developing countries. In Nigeria, 40% of farmers cultivated fields of between 2 and 5 ha, while about 23% cultivated less than 2 ha (Apantaku *et al.*, 2003). In some areas of Kenya, population pressure has reduced farm sizes to about 0.8 ha per household, for an average family of 6 to 10 persons

(Mutoro, 1997). In Ethiopia, land holdings in the Arsi Negele farming zone ranged from 0.25 to 5.2 ha. Of significance is the fact that farm size in the Arsi Negele farming zone was not an important factor affecting the probability of the adoption of improved maize seed or fertilizer technology (Düvel *et al.*, 2003). In several areas in sub-Saharan Africa, as a result of rapid population growth, average field sizes have fallen to under 0.5 ha, which, according to Dixon & Gulliver (2001), was not viable and supplementary, off-farm earnings were needed. In rural Honduras, more than 70% of household income in small farms of less than 5 ha was derived from off-farm activities (mainly female wage labour for coffee picking) (Ruben & Van den Berg, 1997). The size of farms in China defines its agriculture, more than any single feature, according to Huang *et al.* (2000). More than 70% of China's population, nearly 900 million people, live in rural areas. With only 10% of China's land being arable, China has the smallest farms in the world and, according to Huang *et al.* (2000), farm size is falling. In 1980 the average size was only 0.56 ha per farm (around 0.15 ha per capita) and by 1997 the average size had fallen to 0.40 ha. Despite this minute size, China's farms still produce more than half of the income for rural households.

In this investigation, an analysis of variance showed that the respondents with bigger homestead gardens felt that the yields of green maize (n = 44; F Probability = 0.042) and maize grain (n = 44; F Probability = 0.001) was poorer compared to before the involvemnt of FSRS and Bergville District Extension staff, while the respondents with the smaller fields indicated better maize production. Many factors could have contributed to this finding. Higher application rates of manure and fertilizer, as well as the management of organic materials on the smaller homefields could, according to Roberts *et al.* (2003), have contributed to higher soil fertility levels in these fields.

7.3.3.3 Livestock

The type and number of livestock owned by the respondents are summarized in Table 7.5.

Only 28% of the respondents owned cattle, with a median of four per household. Goats were owned by 20% of the respondents. The findings summarized in Table 7.5 confirm the findings of the diagnostic study in 1998, namely that cattle and goats are the main animal types found in Obonjaneni. During the 1998 study, 59% of the respondents who attended the first agriculture meetings indicated that they owned cattle, while, in 2002, 28% of the sample in the impact evaluation study owned cattle. This could indicate that the people who participated during the diagnostic study were the farmers of the community who attended the meetings. Of interest was that, for unknown reasons, fewer than half the respondents owned chickens. The low incidence of livestock ownership is an indication that many respondents rely on means other than agriculture to make a living.

Table 7.5 The type and numbers of livestock owned by respondents in Obonjaneni

Animal type	Number of respondents	Minimum	Maximum	Median
Cattle	32 (28%)	1	28	4
Goats	23 (20.4%)	1	14	4
Sheep	6 (5.3%)	2	16	6.5
Pigs	2 (1.8%)	2	3	2.5
Geese	1 (0.9%)	3	3	3
Chickens	48 (42.5%)	1	62	11

The main reasons for keeping cattle, goats, sheep and chickens are summarized in Table 7.6. The diverse reasons for keeping livestock show the important role they fulfil for livestock owners. The majority of these factors contribute to food and income security.

Table 7.6 The main reasons indicated by respondents for keeping cattle, goats, sheep and chickens in Obonjaneni (n = number of respondents owning livestock type)

Reasons	Cattle (n = 32)	Goats (n = 23)	Sheep (n = 6)	Chickens (n = 48)
Milk	11	-	-	-
Cultural	11	10	-	-
Animal traction	8	-	-	-
Food	5	7	2	44
Lobola	4	1	-	-
To sell	4	4	4	5
Love of it	2	1	1	1
School fees	1	-	-	-
Home function – ceremonies		1	-	-
Manure		1	-	-
Eggs				5
Hatch eggs				1

In spite of the important roles livestock plays, a total apathy was found amongst livestock owners concerning the forming of a livestock association. The seeming lack of an organized structure for livestock could have been responsible for the absence of a constructive and demand-driven, on-farm livestock research programme to address the constraints identified during the diagnostic study. Regarding this aspect, it is of interest to note that Sikana, cited by

Adamo (2001), mentioned that partnerships with farmers' networks ("associations") in Ethiopia and Tanzania were likely to be effective groupings with which to work and communicate, and which could sustain research and development initiatives following a project's completion.

7.3.3.4 Agricultural goals of households

The most important agricultural goal for 77.8% of the respondents was to produce for their own consumption (Figure 7.4), while 22.2% indicated selling produce as an additional goal.

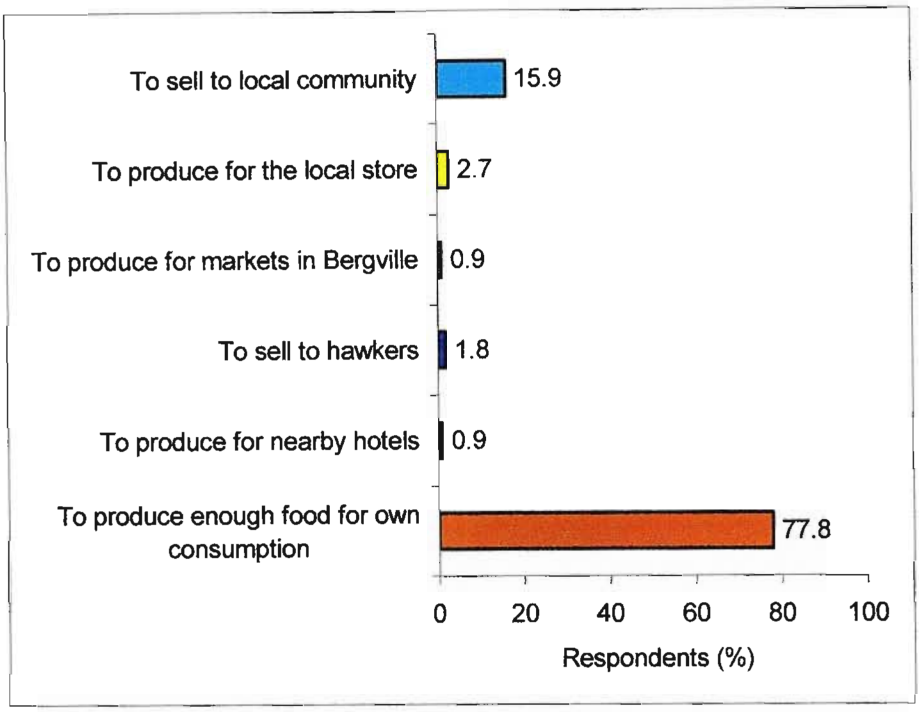

Figure 7.4 The most important agricultural goals indicated by 113 respondents in Obonjaneni

From the data illustrated in Figure 7.4, Obonjaneni was indicated as the main market, while a small percentage of respondents mentioned markets such as the nearby hotels in the area, hawkers and the nearest town, Bergville. This information could indicate that a number of people in Obonjaneni saw themselves as possible emerging farmers (see Plate 7.6). The intention to sell produce, and therefore to start making use of the economic opportunities in a self-identified market by some of the respondents, was a significant sign of agricultural revival in the community. When asked in 1998 why respondents wanted to farm with the enterprise of choice, 53% of them indicated that they wanted to sell surplus produce and generate income from agriculture. This high percentage could be an indication of the bias of the group of people who attended the initial agricultural meetings during the diagnostic meetings. This could also be an indication that the results of a diagnostic study where people are invited to a meeting and from which a sample for interviews is taken needs to be interpreted with caution.

There were no gender differences among the respondents whose aim was to sell produce. No correlation was found between the respondents who wanted to sell and the ones who worked in the communal cropping fields. The produce to be marketed was (frequency indicated in brackets): vegetables in general (4), Swiss chard (4), potatoes (3), chickens (2), maize (2), radish (2), beans (1) and cabbage (1).

As early as the 1960s, Schultz (1968) identified lack of economic opportunities as the real culprit for causing the poor performance of agriculture in the less-developed countries. Kirsten *et al.* (1998) listed the following critical actions required to achieve meaningful and sustainable development in agriculture: land reform and measures to ensure access to other resources and services, such as water, capital, input supplies and markets.

7.3.4 Community awareness of the on-farm research and technology dissemination programme

7.3.4.1 Frequency of contact between respondents and Departmental staff

The frequency of contact between the respondents and staff from the FSRS (including the on-station researchers) and the Bergville District Extension office (during the period 1998 to 2002) is summarized in Table 7.7. When Obonjaneni was identified by the Extension staff as the target area to conduct the on-farm research (section 2.3.1, Chapter 2), they mentioned that one of the reasons for the poor state of agriculture in the community was the lack of contact between Departmental officials and farmers.

Table 7.7 Frequency of contact between respondents and Departmental staff

Frequency of contact	Contact between respondents and Departmental staff	
	Extension staff (n = 106)	FSR Section staff (n = 107)
Never	63 (59.5%)	52 (48.6%)
Don't know	7 (6.6%)	7 (6.5%)
Weekly	6 (5.7%)	-
Monthly	14 (13.2%)	32 (29.9%)
Every three months	8 (7.5%)	5 (4.7%)
Less than three times per year	8 (7.5%)	11 (10.3%)

Approximately 49% of respondents disclosed that they had never seen FSRS staff, while nearly 60% had not seen the Extension staff during the study period. An analysis of variance and a chi-square analysis showed that there was no specific group of respondents which had or had not had contact with FSRS or Extension staff (Table 7.7). This could be a further indication that many people living in Obonjaneni had no interest in agriculture and therefore did not make an effort to be involved in the research and technology dissemination activities. It is of interest that more respondents had more contact with staff of the FSRS than with Extension staff, an indication of the intensive involvement by research staff in Obonjaneni during the programme. The information in Table 7.7 shows that the on-farm research approach created a link between researchers and approximately 30% of the people (farmers), which did not exist at all before 1998. Although important linkages were formed between researcher, farmer and extension staff, the study did not determine the strength thereof.

Approximately 45% of the respondents indicated that they wanted to see Departmental staff monthly, while 20% preferred twice a month and approximately 10% weekly contact (data not shown). These data underline the desire of community dwellers for regular contact with Departmental staff.

7.3.4.2 Awareness of the on-farm research programme

Awareness by respondents of the different research activities varied from 3.5 to 24% (Table 7.8).

Table 7.8 Awareness of respondents to different on-farm research activities that took place in Obonjaneni during the period 1998 to 2002 (n = 113)

On-farm research programme or other activities	Awareness by respondents	
	n	%
Maize trials (cultivar x lime x fertilizer)	27	23.9
Cabbage trials in the community garden	27	23.9
Fencing of grazing camps in mountain	26	23.0
Effect of planting date on maize yields	14	12.4
Dry bean trials (cultivar x lime x fertilizer)	12	10.6
Potato cultivar trials	12	10.6
Tomato cultivar trials in the community garden	10	8.8
Seedling nursery in the community garden	9	8.0
"Family Drip Irrigation System" in the community garden	4	3.5
Vegetable soya bean trials	4	3.5
Taking of soil samples	4	3.5

The degree of awareness was not very high, and this could possibly be an indicator of the lack of importance of agriculture in the community through the interest of respondents shown to the research trials. However, it shows that some of the respondents were aware of a wide range of activities that took place in the community over the period 1998 to 2002.

7.3.4.3 Attendance at farmers' field days

Of the 113 respondents, 32 (28.3%) indicated that they attended the annual farmers' field days (see Plate 7.7). This is a good attendance figure, taking into consideration that the majority of people (76%) worked only in their homestead gardens. The farmers' field day in 1998 was the first information dissemination event that took place in Obonjaneni. The days were advertised by distributing notices via Extension staff, school children, contact persons (*e.g.* Amazizi Maize Association members) through announcements at meetings and the placement of A3 posters at strategic places such as the local craft centre. The channels mentioned by respondents, on how they were informed of the farmers' field days, is of interest and should be interpreted and used to communicate with people in Obonjaneni in future (frequency mentioned in brackets):

a) Chairman: Amazizi Maize Association (12);
b) school children (9);
c) notices (5);
d) posters (3);
e) member of the Amazizi Maize Association (2);

A disturbing finding, however, was that nobody indicated that the Agricultural Development Technician had informed them of the farmers' field days. The Extension staff could, however, have left notices with the Chairman of the Amazizi Maize Association and other prominent people and would thus not be mentioned by name. It is important that Extension staff be used more purposefully and prominently, for example in advertising technology dissemination or any other events, and thus be seen as an active partner in the activities.

The reasons provided by 47 respondents for not attending the farmers' field days are summarized in Table 7.9.

Information obtained from the open questions as to why people did not attend the farmers' field days revealed the following three main reasons (i) a lack of communication, (ii) people too busy with their own programmes and (iii) notices were received too late. A perception among the people was that they thought the technology dissemination events were only for those who were involved in activities in the communal cropping fields. Of interest, and valuable feedback, was the fact that only two respondents indicated that the inputs advocated were unaffordable.

Table 7.9 Reasons why respondents did not attend the farmers' field days held in Obonjaneni (n = 47)

Reasons for non-attendance of farmers' field days	Frequency	
	n	%
Did not get notice, not informed, never heard of it	21	44.7
Not available, other commitments, work away, at work	19	40.4
Only for maize association and garden members	8	17
Received invitation too late	7	14.9
Too old, no energy	6	12.8
Sick and not in good health	6	12.8
Do not know the Cedara and Bergville people	3	6.4
Distance to travel too far – money needed to get there	3	6.4
Not involved and not bothered to attend	2	4.2
Cannot afford the inputs – knowledge too expensive	2	4.2

The impact and the value of farmers' field days on the revival of agriculture in Obonjaneni are reflected in Table 7.10.

Table 7.10 Significant correlations found between attendance of the farmers' field days and variables in terms of the on-farm research and technology dissemination programme

Elements of on-farm research approach	Feedback criteria from respondents	Chi-square P
Attended farmers' field days x	Improved state in agriculture ("sick/dead statement")	0.07
	Changed crop production practices	0.001
	Constraints addressed	0.017
	Awareness of activities in the Phuthumani Community Garden	0.004
	Preparedness to share knowledge	0.002
	Desire to want FSRS to continue in Obonjaneni	0.017

Respondents who attended the days were the people who indicated that the state of agriculture had improved over the period since the implementation of the on-farm research programme in 1998, who changed their crop production practices (who made modifications to previous practices), who said that the constraints identified in 1998 were addressed and who said they were aware of the activities in the Phuthumani Community Garden. Another important, significant correlation was that the respondents who attended the farmers' field days were prepared to share their knowledge with other residents in the community (see Plate 7.8). Thus, the people who attended the field days were the people who wanted the FSRS to continue with its activities in Obonjaneni.

The farmers in Obonjaneni who attended the farmers' field days and were prepared to share their knowledge should be identified to undergo further training and to be used in a farmer-to-farmer extension programme in the community. Botha & Lombard (1992) showed that people who were willing to be trained are more successful than those who are not. This follows the adage, "one hasn't really interiorized something until one has taught it". In the early 1990s, leading farmers in Guatemala played a vital link in mobilizing communities and promoting the adoption of technology (Ortiz *et al.,* 1991). This approach, according to Ortiz *et al.* (1991), could solve the problem in many developing countries where extension agents are expected to link directly with all members of the farming communities, a task that, in terms of sheer numbers, is clearly beyond their capacity.

7.3.4.4 Children attending farmers' field days

Of the 113 respondents interviewed, 20 (17.7%) of the households' children (all were scholars at the local secondary school where agricultural subjects were being taught) attended the farmers' field days. Fourteen of the 20 respondents (70%) mentioned that the children brought home information on the following topics (frequency mentioned in brackets):

a) importance of soil samples (9);
b) effect of planting date on maize yield (8);
c) maize cultivars (7);
d) role of lime in crop production (6);
e) cabbage production (6);
f) planting without ploughing (3);
g) vegetable soya bean production (1);
h) production of sweet potatoes (1);
i) planting method of potatoes (1);
j) employment opportunities in agriculture (1).

Nine (64.3%) of the 14 respondents indicated that they applied the information brought home by the children. This represents 8% of the 113 respondents. The attendance of field days by the school children was significantly correlated with the respondents who indicated that agriculture had improved in Obonjaneni (Chi-square P = 0.018) and the ones who had changed their crop production practices (Chi-square P = 0.005). This feedback is encouraging and shows that school children have the potential to contribute towards the creation of an awareness of new technology and in the dissemination of information. This kind of involvement could make an invaluable contribution towards changing the negative attitude of the youth towards agriculture and to the sustainability of agricultural production in communal areas. Nyamapfene (1995) said that the image people have of agriculture needs to be changed, so that it can take its proper place as a science and as a creator of employment and an instrument for the economic development of rural areas. This could be initiated at school level, by involving children in agricultural development programmes.

7.3.4.5 Notice board as communication method

A notice board (1.2 x 0.8m) was erected with the collaboration of farmers, inside the perimeter fence of the Obonjaneni community hall during September 2001. The purpose of the board was to advertise the monthly agricultural meetings and other technology dissemination events. Apart from the space to advertise agricultural events, the official logo and name of the KwaZulu-Natal Department Agriculture and Environmental Affairs were present on the board. Sixty (53.1%) of the 113 respondents knew about the notice board. Feedback from respondents was that the letter size used to advertise the events was too small. The high awareness indicated that a well-placed notice board has considerable potential as a medium of communication. A board could be used for purposes such as:

a) communicating technology relevant for a specific time of the year *e.g.* results from on-farm trials or the name(s) of recommended maize cultivars to be planted in the community;
b) listing of names and telephone numbers of input suppliers in the area;
c) advertising of events;
d) furnishing details regarding the local Extension office and staff.

7.3.5 The impact of the on-farm research and technology dissemination programme on agriculture in Obonjaneni

7.3.5.1 State of agriculture in Obonjaneni

The feedback from 65% of the respondents, as shown in Figure 7.5, was that the state of agriculture in Obonjaneni was better, or much better, at the time of the interviews, compared to the situation prior to the on-farm research and technology dissemination programme, when people described agriculture as *"dead and not sick"* at a community meeting in 1998, before the onset of the diagnostic survey.

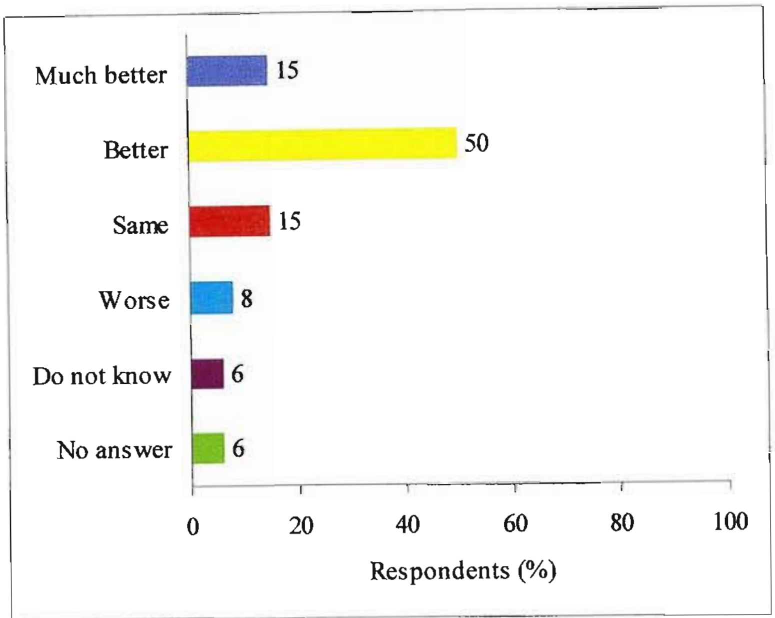

Figure 7.5 The state of agriculture in Obonjaneni, as seen by respondents at the time of the survey, compared to the situation prior to the involvement of the FSRS and Extension staff

Respondents gave the following reasons why they felt that the state of agriculture had improved (frequency mentioned in brackets):

a) able to sell or purchase produce grown in communal fields and community gardens (25);

b) more people back to farming and interested in crop production (17) (see Plate 7.9);

c) good maize yields in communal fields (11) (see Plate 7.10);

d) crops improved (vegetables and maize) (7);

e) no crops, or poor crops previously, but now crops were growing (5);

f) enough maize produced for own consumption (5);

g) FSRS and Extension staff brought agricultural development (3); and

h) a few farmers had become commercial and were creating job opportunities (1) (see Plate 7.11).

From the above it is clear that crop production contributed largely to the view that agriculture in Obonjaneni had improved. The feedback indicated that the respondents directly and/or indirectly benefited from the improved agricultural situation following the launching of the on-farm research and technology dissemination programme. This improvement in the situation of agriculture pertains to crop farming and not to livestock farming. Interviews with farmers in a Participatory Research for Improved Agroecosystem Management Project in eastern and central Ethiopia revealed that, as a result of on-farm experimentation with new technologies, farmers were able to dramatically improve crop yields and seasonal incomes (Adamo, 2001).

7.3.5.2 Livestock control

The diagnostic study in 1998 showed that uncontrolled movement of livestock was one of the most important factors which had negatively affected agriculture in Obonjaneni. Community members at the first meetings agreed that the problem of uncontrolled movement of livestock needed to be addressed first, before any of the other identified constraints. The matter was taken to the tribal authority and resulted in a commitment from them to assist in addressing the problem (see 4.4.3 in Chapter 4).

At the time of the impact assessment survey 56 (49.5%) of the respondents felt that livestock control in Obonjaneni had improved and 46 (40.7%) of the respondents felt that it was not better. A significant correlation (Chi-square P = 0.002) showed that the people who felt that the state of agriculture had improved (*e.g.* by the planting of maize in communal fields) were also the ones who indicated that livestock control was better. Further, the improved livestock control was significantly and positively correlated with improved maize grain (Chi-square P = 0.016) and green maize (Chi-square P = 0.028) production in 2002. Some of the respondents (40 or 43.5%) commented that the date of livestock removal from the cropping fields was well announced and that people feared fines and impoundment of their animals.

7.3.5.3 Maize production

The data illustrated in Figures 7.6a and 7.6b show that more than 54 and 59% of the respondents felt that the production of maize grain and green maize, respectively, during the 2002 cropping season was better, or much better, compared to seasons before the on-farm research and technology dissemination programme.

The reasons why respondents felt that maize production had increased are summarized in Table 7.11 (see Plate 7.13). The respondents who planted maize stated that enough maize was produced for their own consumption and to sell. They acknowledged the link between the on-farm research and the increased maize production. The respondents who did not plant indicated that the improved maize production enabled them to buy maize in Obonjaneni (see Plate 7.12).

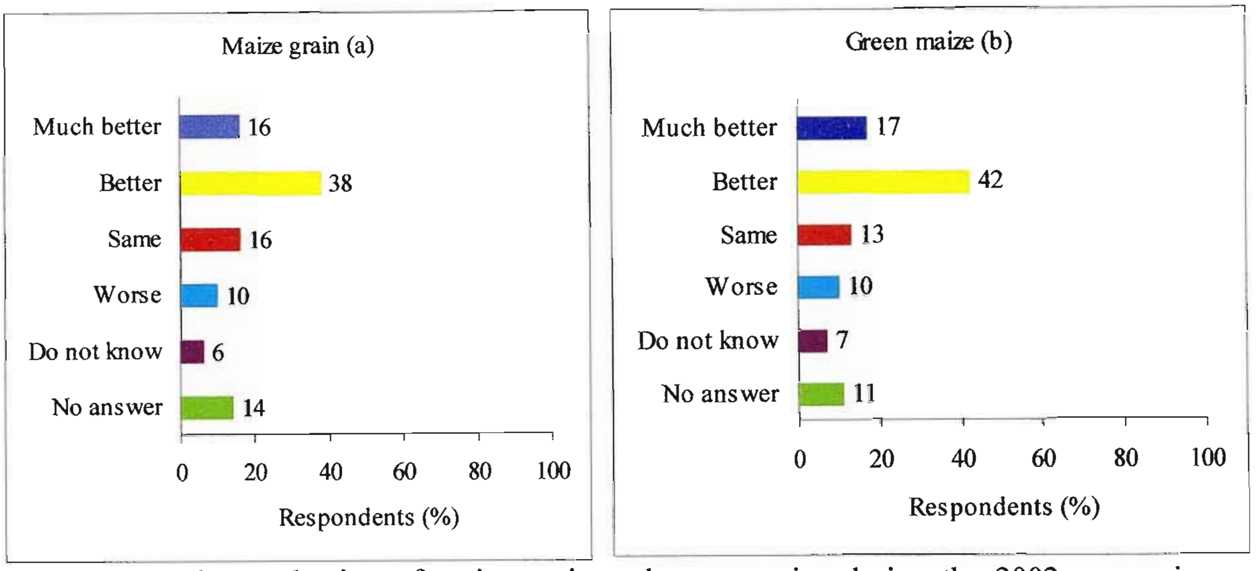

Figure 7.6 The production of maize grain and green maize during the 2002 season in Obonjaneni, compared to seasons before intervention with the on-farm research and technology dissemination programme

Only a small number of respondents attributed the better green maize and maize grain production to improved seasonal rainfall (Table 7.11).

Table 7.11 Reasons given by the respondents for maize production being better during the 2002 season, compared to seasons before the on-farm research and technology dissemination programme in Obonjaneni

Reasons for the improved maize production	Green maize (n = 19)	Maize grain (n = 20)
FSRS involvement:		
Gained knowledge, on-farm trials (fertilizer, lime, soil sample, planting time)	10	6
Improved agriculture:		
Fields are cultivated and larger area under maize	3	7
More people involved in agriculture	3	-
Climatic conditions:		
Good season (rain)	3	7

From the data shown in Figure 7.7 it is clear that there were no big differences in rainfall over the period 1998 to 2002 and the two seasons before the involvement (1996/1997 and 1997/1998) of the FSRS in Obonjaneni. The rainfall data were obtained from the Royal Natal National Park which is adjacent to Obonjaneni. The Institute for Soil Climate and Water, Agricultural Research Council, data bank weather station number AM298/791 refers.

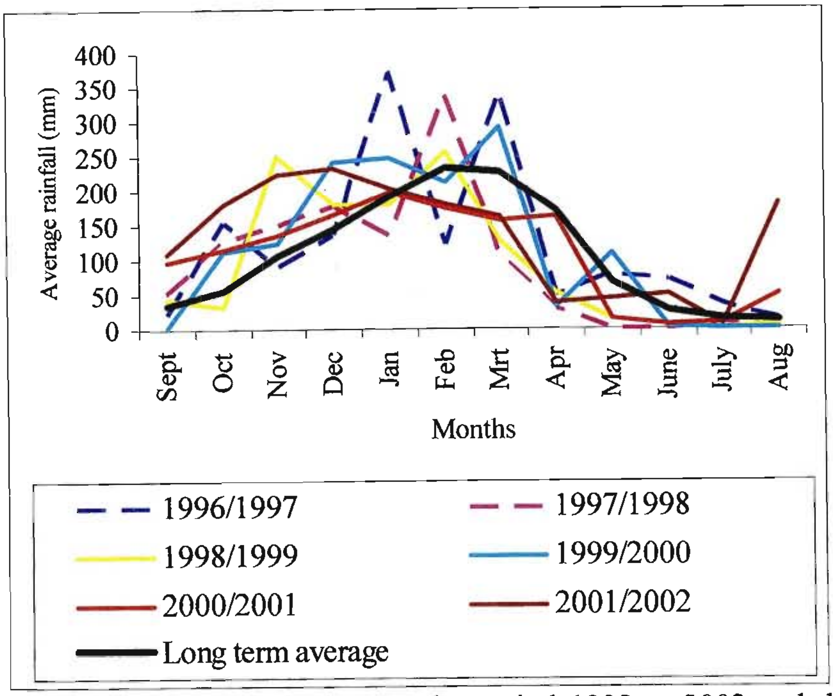

Figure 7.7 Rainfall data for the area over the period 1998 to 2002 and the two seasons before involvement

Maize yields provided by 68 respondents were often in non-conventional units, while it was often not clear from the information whether the grain was shelled or unshelled (see Plate 7.14). Because of the inaccuracy of the data it is not presented here. This points to a shortcoming in the questionnaire; it was not tested with farmers before the study and how farmers measure yields was not adequately catered for.

7.3.5.4 Success in addressing constraints

Of the 113 respondents, 41 (36.3%) felt that the constraints identified during the diagnostic study, listed in Table 7.12, were addressed through the on-farm research and technology dissemination programme, while 38 (33.6%) felt that they were not addressed and 34 (30.1%) indicated that they were not sure. A significant correlation showed that the respondents who felt that the constraints were addressed were the ones who reported that maize grain production during 2002 was better (Chi-square P = 0.038), compared to the seasons before the involvement of the FSRS.

The fact that the same agricultural constraints as those identified in 1998 during the diagnostic survey were still affecting households (ranked in Table 7.12 according to the frequency mentioned by respondents) makes it clear that it is quite easy to talk about solving the problems, but that it is another issue for many farmers to put the solution into practice. Thus, many people still viewed the problems originally listed during the 1998 diagnostic survey as constraints. Maize constraints identified during the diagnostic survey in 1998 were (in order of most frequently mentioned): hail and storms, uncontrolled livestock, poor yields, weeds and cutworms. The order of the crop constraints in 2002 indicated that respondents were more satisfied with livestock control and had started to concentrate on crop production issues. Of the trials initiated in one project in Tanzania, 50% resulted in no farmer adoption, but this was not viewed as a complete failure, as 32% resulted in feedback to researchers in redirecting technology selection, site selection and re-analysis of the problem (Lema & Meena, 1998). The survey results indicated that the stage had perhaps been reached, after five years of involvement, for re-planning of the on-farm research programme to adjust priorities to reflect the new information, summarized in Table 7.12. The firsthand feedback on the on-farm research and technology dissemination programme illustrated the flexibility of the approach, in terms of adjusting and modifying the processes and procedures, to address constraints experienced by farmers.

Table 7.12 Agricultural constraints affecting 113 households in Obonjaneni, identified during the impact assessment study in October 2002

Constraints	n	%	Constraints	n	%
Crops:			*Livestock continued:*		
Weeds	68	60.2	Internal parasites	22	19.5
Low maize yields	64	56.6	Litter – kills animals	17	15.0
Lack of maize knowledge	56	49.6	Redwater	16	14.2
Cutworms	54	47.8	Mastitis	7	6.2
Cattle and goats getting into fields	38	33.6	Marketing of broilers	4	3.5
Quality of maize grain unsatisfactory	27	23.9			
Storage of grain	16	14.2	*Vegetables:*		
Stalkborer	3	2.7	Lack of potato knowledge	35	31.0
			Moles	7	6.2
Livestock:					
Theft	44	38.9	*General:*		
Winter shortage of feed – animals thin	29	25.7	Shortage of funds	1	0.9
Mortalities of animals due to disease	24	21.2	Area too small to farm on	1	0.9
Poor feeding of cows and calves in winter	23	20.4	No fertilizer	1	0.9

Work done in Obonjaneni since the impact evaluation study of 2002 included (i) maize cultivar x lime trial under minimum tillage practices (ii) a trial in the communal cropping fields to address the weed problem (some farmers volunteered to take a preferred treatment to their own fields to evaluate the efficiency of weed control) (iii) following the dry bean trails, farmers requested work on alternative crops such as juko beans (*Vigna subterranean* L.) and groundnuts (*Arachis hypogaea* L.) (iv) the lime technology was taken to 15 homestead fields where half of the fields were limed (lime supplied and incorporated by FSRS) and farmers planted, managed and evaluated the crops they planted on the lime and unlimed areas. In the community garden sweet potatoes were added to the list of crops evaluated in the garden. The trial was accompanied by taste evaluations of the different cultivars. An animal traction survey was conducted, followed by a cattle survey, with six-weekly visits to the cattle owners with herds ranging from 3 to 19, to study the productivity and the constraints experienced by the owners. The change in, and the additional trials added to the research programmes in Obonjaneni show that the involvement in a community could be over many years and could address additional opportunities and challenges, with farmers participating in the programme.

7.3.5.5 Knowledge gained by respondents

The number of respondents who indicated that they had gained and applied knowledge from topics dealt with during the on-farm research and technology dissemination programme are summarized in Table 7.13.

The value of lime, the importance of soil sampling, fertilization practices, selection of maize cultivars, the importance of the maize planting date, how to grow cabbages, and potato production, were the main topics in which respondents gained and applied knowledge (see Plates 7.15 and 7.16). A significant correlation (Chi-square P = 0.02) indicated that respondents who mentioned that the state of agriculture in Obonjaneni had improved also indicated that they had gained knowledge in general from the on-farm research and technology dissemination programme. That 48.6% and 59.5% of the respondents never had any contact with the FSRS and Extension staff, respectively, that 28% of respondents attended the farmers' field days, and that the awareness of the different on-farm research activities varied between 3.5 and 24%, possibly explains the relatively poor response in terms of knowledge gained and applied. These percentages, however, need to be interpreted together with the following facts: (i) the response was obtained from a sample representing the entire community, of whom not all wanted to farm (ii) 76% of respondents had only their homestead garden for the production of crops and (iii) approximately 68% of the households' agricultural activities was the responsibility of women, who have many other daily duties. When the percentage of respondents who applied knowledge is extrapolated to the entire community, data summarized in Table 7.13 show that knowledge from the topics mentioned was applied by quite an appreciable number of people in Obonjaneni.

Table 7.13 Knowledge gained and applied by 113 respondents during the on-farm research and technology dissemination programme

Topics	Knowledge gained (frequency)	Knowledge applied		
		Frequency	As a % of 113 respondents	Extrapolated to the number of people in community
Crops:				
Value of lime	22 (19%)	7	6.2	58
Importance of soil sampling	17 (15%)	4	3.5	33
Maize cultivars	12 (10.6%)	4	3.5	33
Effect of planting date on maize yield	11 (9.7%)	3	2.6	24
Fertilization practices	4 (3.5%)	4	3.5	33
How to plant maize	2 (1.8%)	-	-	-
Kraal manure reduces acidity	1 (0.9%)	-	-	-
Planting without ploughing	1 (0.9%)	1	0.9	8
Weed control	1 (0.9%)	1	0.9	8
Dry bean production	-	1	0.9	8
Livestock:				
Lick supplement during winter	3 (2.6%)	-	-	-
Use of drugs to control internal parasites	2 (1.8%)	-	-	-
Branding – identification of livestock	1 (0.9%)	-	-	-
Camp rotation	1 (0.9%)	-	-	-
Control of ticks	-	1	0.9	8
Vegetable production:				
How to grow cabbages	18 (15.9%)	-	-	-
How to grow vegetables – general	5 (4.4%)	5	4.4	41
Potato production	4 (3.5%)	4	3.5	33
Management of seedling nursery	1 (0.9%)	-	-	-
Sweet potato production	-	1	0.9	8

In a very general statement, but which is still worth mentioning, Nataraju *et al.* (1996) pointed out that 30% of the technology generated by research in India was adopted by the farming community. They emphasized that effective transfer of technologies with active involvement of farmers is essential. In Tanzania, 36% of the technologies tested had some, but limited, success (weeding using oxen; a bean variety; intercropping combinations - maize-cowpea, maize-cotton, cotton-cowpea and maize density). Of this number, 22% were not widely adopted due to limited supply of inputs or lack of communication between research, extension and the farmer about the technology (Lema & Meena, 1998). A farming systems study in north-eastern Nigeria, by Ndaeyo *et al.* (2001), showed that many of the farmers knew about improved seed/seedlings, technological innovations such as fertilizers, herbicides, livestock vaccines and alley cropping, but very few used these innovations.

A question which arises is what an acceptable level of adoption of technology in small-scale agriculture would be. As seen from the literature, many factors influence the adoption of technology resulting from the on-farm research approach. It must be kept in mind that people living in rural communities, such as Obonjaneni, are not all farmers. Some are happy to plant in their small homestead fields, while others are real farmers who want to, and have the means of improving agricultural production. The literature and the findings in Obonjaneni show that adoption of technology, even when demand-driven research is conducted on farmers' fields, with the co-operation of the farmers, is unpredictable and often difficult to assess. To be able to determine adoption accurately, it would be necessary to conduct an in-depth practice study survey, followed by a similar type of study after conclusion of the research programme. The close link between research and the end-user of the technology places the approach in an ideal position to measure adoption and impact of research efforts. To improve the rate of adoption of the technology developed and disseminated, it would also perhaps be necessary to increase the level of involvement and the number of farmers who participated in all phases of the approach.

Although no reason was obtained to why respondents in Obonjaneni were not applying the knowledge, many factors or reasons for poor adoption, or for not using technology, are found in the literature. In Nigeria, 62.7% of 220 farmers interviewed said the technologies disseminated were not based on their identified problems and "felt" needs. Apantaku *et al.* (2003) concluded that there is bound to be poor adoption of those technologies developed that were not based on farmers' problems. Already back in the 1980s costs of inputs, risk and input dependency of many new technologies, irrelevance to then-pertaining farmer circumstances and storage and dietary requirements were identified as reasons for non-adoption in southern Africa (Blackie, 1989). Labour availability could also play a role in selection of intensive technology (Nataraju & Nagaraja, 1998). In Ghana, farmers rejected the labour-using parts of a maize improvement package, such as closer plant spacing and second weeding, but adopted other parts of the package such as maize variety and a moderate dose of fertilizer (Bruce *et al.*, 1980). These are examples of farmers modifying the technologies offered to them by researchers. It is thus of limited value to place emphasis on adoption rates when farmers often modify technologies to fit their own particular circumstances, but with good effects on production outputs. It was reported by Weber (1996) and Meertens (1999) that African farmers refused to adopt techniques, such as alley cropping, because high labour costs made these systems uneconomical and because the shortage of organic material made them impractical. Farmers very often compromise on crop and livestock management, not because of a lack of knowledge or for lack of cash to purchase inputs, or because inputs are not available, but because of time and other resource constraints (Low, 1986). In Malawi, the likelihood of using hybrid seed differed according to household assets, such as total landholding, human capital variables, such as farming experience, and past extension contact, and physical factors such as the agro-ecological zone (Smale & Jayne, 2003). Input supply problems in Swaziland, Zimbabwe, Zambia and Malawi were often blamed for the lack of impact of research recommendations (Low *et al.*, 1991).

From the information collected in Obonjaneni it was not possible to ascertain the wealth status of the respondents. Analysis of the data showed that the respondents who worked only in their homestead gardens owned a mean of 3.91 cattle, compared to a mean of 9.11 for the 10 respondents who worked in their gardens as well as in the communal fields. It could be assumed that the people working in the communal cropping fields were better off than the ones working in homestead gardens, because they were prepared to spend money on bigger fields to produce a crop away from their homesteads. It could further be said that these were probably the people more interested in farming and more interested in improving their situation. The people belonging to the maize association could be described as the more progressive farmers in Obonjaneni. Wealthier farmers may adopt new technologies more easily than poorer farmers, because of better access to information, because they are better connected to people in the research and extension system, or to representatives of commercial suppliers, and because they have better access to cash or credit to purchase inputs, or more capacity to bear risk (Freebairn, 1995 and Kerr & Kolavalli, 1999). They are also likely to be better able to absorb the risk associated with trying out a new technology, whereas a poorer person might wait to see how it performs on a neighbour's field (Kerr & Kolavalli, 1999).

Respondents in Obonjaneni did not mention the issue of land ownership as a possible reason for not participating in the on-farm research and technology dissemination programme and for not using the knowledge they had gained. It has been reported that land tenure, or the degree of land ownership, is expected to be positively related to adoption of technology (Abd-Ella *et al.*, 1981). Taking the agricultural potential of land in Zimbabwe in the different sectors into account, maize yields in the large-scale commercial sector were 3.6 times greater than yields from land with the same potential in the resettlement area and communal areas (Ashworth, cited by Moor & Nieuwoudt, 1998). It had further been reported by Ashworth (cited by Moor & Nieuwoudt, 1998) that small-scale commercial farmers achieve higher yields and demonstrate increased adoption of production-improving technologies and conservation, compared with communal-area farmers in regions of similar agricultural potential. Moor & Nieuwoudt (1998) reported that limited breadth, duration and assurance of an individual's property rights are significant constraints in the adoption of on-farm investments and agricultural productivity in the small-farm sector of southern Africa. Moor & Nieuwoudt (1998) concluded that indigenous tenure institutions in communal areas of southern Africa are a constraint to agricultural development. It was mentioned by Das Gupta, cited by Nataraju & Nagaraja (1998), that subsistence farmers in the eastern regions of India might disregard higher productivity in preference to a technology with a low but stable return to ensure security, with land tenure influencing farmers' decisions to make higher investments.

The poor response concerning livestock activities, as indicated in Table 7.13, is a symptom of the lack of a demand-driven programme to address the constraints identified during the diagnostic studies. This result indicates perhaps a need for further diagnostic studies, specifically with livestock owners, in an attempt to understand their needs and requirements and the role animals play in small-scale agriculture.

From the survey, 46 (40.7%) of the respondents indicated that they had shared their agricultural knowledge with other people in Obonjaneni. This aspect needs to be investigated further, because farmer-to-farmer extension in Guatemala had impressive impacts (Bunch, 1982). Lightfood & Noble (1993) noted that farmers with whom researchers had interacted had adopted, modified and spread the technologies that they had helped to develop, to at least four other farmers each. Enhanced knowledge and skills obtained through training, contact with fellow farmers or any other form of learning, according to Van de Fliert (2003), are catalysts for change in farming practices.

7.3.5.6 Farming Systems Research Section to continue in Obonjaneni

The majority of the respondents (91 or 80.5%) indicated that they wanted the FSRS staff to continue in Obonjaneni. A variety of reasons (frequency in brackets) were given:

a) receive knowledge and teach a good way of farming (but need more knowledge) (48);
b) see improvement and progress, problems are solved and people benefit (16);
c) to teach the children who then take the knowledge back to parents (4);
d) to advise on, and to build, contours and to fight soil erosion (3);
e) more people will be in agriculture in the future (3);
f) assist community with activities – more development is to take place (3);
g) foresee hunger and the need to address this threat (1);

h) extension staff work in to big an area - they do nothing to help us (1);

i) to solve tap-water problems (1);

j) presence means something to us (1);

k) for continuing support (1);

l) to help to take soil samples that will mean food to us (1).

Thus, after five years of involvement by the FSRS, respondents requested the latter to continue with their activities in Obonjaneni, largely from the point of view of providing support and knowledge. The continued involvement requested by the respondents in Obonjaneni could further be interpreted as a vote of trust and confidence in the FSRS staff and in the approach followed in the community. From the list of reasons provided by the respondents why the FSRS needs to continue in Obonjaneni it is very clear that a reliable extension service is needed. It is important to realize that as farmers advance in their agricultural activities, as in the case of Obonjaneni, opportunities and problems change continuously. Significant correlations showed that the respondents who wanted the FSRS to continue in Obonjaneni were the same people who reported better maize grain production during the 2002 season, compared to previous seasons (Chi-square $P = 0.004$), and where also the people who reported that the state of agriculture in Obonjaneni had improved since the start of the on-farm research and technology dissemination programme (Chi-square $P = 0.001$). This was a clear indication that people linked the improved agricultural situation in their community with the on-farm research activities.

The ideal duration of involvement of an on-farm research programme in a community is unknown. There is no real guidance from the literature. The period will certainly depend on factors such as the scale and type of programme, progress in terms of adoption, availability of funds and the continuous commitment of the various partners. The small-scale farmer is generally averse to risk-taking, and lacks confidence in the innovation until it is successfully tried in his own situation. According to Nataraju & Nagaraja (1998), this could take time. In Guatemala the dissemination of new technology in subsistence-orientated agricultural systems was a slow process because: (i) resource-poor farmers who first tested the new technology required more than one crop cycle to be convinced of its advantage (ii) risk aversion was still a major factor determining the pace of adoption and (iii) technologies such as the use of fertilizers and pesticides required training (Ortiz *et al.*, 1991).

7.3.5.7 Vision for agriculture in Obonjaneni

The vision of 92 respondents for agriculture in Obonjaneni is summarized in Table 7.14. Of the 113 respondents interviewed, 11 did not answer the question and 10 said that they did not know.

Bearing in mind the poor state of agriculture, and the total absence of any cropping activity in the communal fields when the FSRS arrived in Obonjaneni in November 1997, the vision of approximately 90% of the respondents in October 2002 was positive. They saw a good and bright future for agriculture in the community. An important aspect was that approximately 23% of the respondents saw themselves being upgraded from "a small to a large-scale farmer", to sell produce. Only 10 respondents were negative about the future, for various reasons, as summarized in Table 7.14.

Table 7.14 The vision for agriculture in Obonjaneni, as seen by 92 respondents

	Vision	Frequency
✓	Good and bright future – see progress in agriculture, more produce, self reliance, extend fields and plant new crops (*e.g.* sorghum)	60 (65.2%)
✓	Respondents to develop from small to large farmers, people from other areas buy here, supply markets with produce	21 (22.8%)
✓	More involvement of government in the form of development projects	1 (1.1%)
•	Not good: young people not interested in agriculture, lack of inputs, garden poorly fenced, lack of equipment	4 (4.3%)
•	Frustrations because of lazy people and young people not co-operative	3 (3.3%)
•	No bright future due to poor health	2 (2.2%)
•	In 10 years no people be will involved in agriculture	1 (1.1%)

The following noteworthy comments were received from respondents during the interviews:

a) *"I see activities when passing by, but do not know what really goes on"*

b) *"I want to see FSRS staff, especially towards planting time"*

c) *"I cannot differentiate between Cedara (FSRS) and Bergville staff"*

d) *"I only heard about the garden. The quality of produce and the prices are good"*

e) *"I always see the people from Cedara at the irrigation scheme"*

f) *"I do not always attend meetings, I thought that the message of training is only for the association members"*

g) *"Farmers' days are for people involved in the garden activities and who have big lands to plough"*

h) *"I would like to be a member of the association because it will be beneficial to* *me"*

i) *"There is no service offered by Extension if you are not in a local association; we figure that out by ourselves"*

j) *"I do not know how I can be involved in the activities that are taking place, such as the monthly meetings"*

k) *"The problem lies with us, who do not practise what the Department is teaching us to do"*

l) *"It is a waste of time to attend agricultural meetings because we do not have money to apply some of the technologies being transferred to us".*

m) *"We do not have land, while plenty of fields are lying fallow".*

7.3.6 Feedback from extension staff on the on-farm research and technology dissemination approach

The Extension staff members (n = 8) were requested to give, in their view, the five most important agricultural constraints that small-scale farmers in their wards were experiencing, by using the list given in Table 7.12. The following constraints were identified (frequency in brackets): lack of capital for production inputs (4); livestock theft (4); low maize yields (4); weeds (3); lack of maize knowledge (3) and poor storage of grain (3). The constraints mentioned compared well with the ranking listed in Table 7.12.

The Extension staff remarked positively on the contribution that the on-farm research and technology dissemination programme had had on agriculture in Obonjaneni. Comments were:

a) prioritized problems and addressed them through trials;

b) empowered people with knowledge and gave farmers an opportunity to participate;

c) it had an impact and was working well in Obonjaneni.

The following strengths of the on-farm research and technology dissemination programme were mentioned (frequency mentioned):

a) identification of constraints (8);

b) conduct on-farm trials to address constraints (8);

c) farmers' field days (5);

d) personal contact with farmers (4).

It was felt by Extension staff that the wider section of Obonjaneni was not reached and FSRS staff needed to devise ways to address this issue. For an on-farm research programme to successfully involve and ensure participation by all relevant stakeholders, special attention would have to be given to proper communication between the partners. Thus cognizance needs to be taken of the desire expressed that proper planning needs to take place between the FSRS and Extension staff, to avoid clashes when working together. (This could be interpreted as Extension staff wanting to be more involved in the on-farm research programme. It needs to be mentioned that the involvement and participation of the Extension staff during the diagnostic survey and impact assessment, the meetings and technology dissemination events, which were all well planned in advance, was good, while their participation in the on-farm trials activities was erratic and poor).

The Extension staff said that it would be to their advantage to be involved in an on-farm research and technology dissemination programme in other Extension wards in the District, for the following reasons:

a) *"multi-disciplinary teams are effective in service delivery"*;
b) *"the approach is good and could be the framework for Extension to work in;*
c) *to learn more of clients"*;
d) *"appropriate technology will be developed for own ward"*;
e) *"farmers want to see and gain practical knowledge (knowledge they know works)"*.

Feedback from Extension staff was that they used the following knowledge gained at the farmers' field days: maize and dry bean production, addressing the problem of soil acidity, soil sampling, cultivar choice for crops and supplementary feeding in winter of livestock. They rated their work and service delivery as much better (4 respondents) and better (3 respondents) since FSRS got involved in the District, for the following reasons (frequency mentioned):

a) contact with Technology Development (Research) at Cedara (7);
b) gained knowledge (6);
c) assistance in Extension programme (5);
d) built confidence of Agricultural Development Technician (5);
e) improved contact with community (4);
f) take soil samples to Cedara (2).

A comment made by one Extension staff member was that "although it is important to help farmers to identify problems and to find solutions, it cannot be done by me". This is clearly cause for concern as identification of problems and constraints needs to be one of Extension staffs' priority tasks.

Extension staff wanted the FSRS to continue in the Bergville District, as their credibility would be improved by using the on-farm research approach in a ward. Significantly, seven of the eight Extension staff (one did not reply) were of the view that the FSRS had an important role to play in service delivery of the Department of Agriculture and Environmental Affairs, and strongly request that the FSRS spread their involvement to other areas in the District.

The feedback from the Extension staff acknowledged the contact and the link formed with researchers, which contributed to an improvement in their service delivery. This is in keeping with the observation of Low (1997) that participatory approaches to diagnosis and experimentation have the potential to close the technology development and communication gap between research, extension and small-scale farmers.

The positive feedback from farmers and Extension staff strongly indicated that the approach that was used in Obonjaneni could fruitfully be used in the rest of KwaZulu-Natal, to address the agricultural constraints of small-scale farmers. The approach is an extremely powerful tool, in the sense that seeing is believing. The message could spread rapidly through different channels. The FSRS has become involved, since 2002, in one additional district in the province with an on-farm research and technology dissemination programme. The author also initiated a three-day farming systems approach short-course through the non-formal training programme of the KwaZulu-Natal Department of Agriculture and Environmental Affairs. Over two courses, approximately 50 people, who were mainly Extension staff of the Department, attended. In a recent (2004) restructuring process of the KwaZulu-Natal Department of Agriculture and Environmental Affairs, the province was divided into two regions and in both regions Farming Systems Research Sections were included in the structures. Additional posts were allocated to the Sections to enable the Department to become involved with on-farm research and technology dissemination programmes in more districts.

7.4 Conclusion

a) In spite of the fact that the participants in the on-farm research programme were all members of the Amazizi Maize Association and the Phuthumani Community Garden, more than 50% of the respondents (from the larger community) said that agriculture was better since the start of the on-farm research activities. It may be concluded that the on-farm research and technology dissemination programme contributed to the revival of agriculture and benefited the people of Obonjaneni who were actively involved in the programme. Working with the organized groups benefited the larger community.

b) The intervention of the FSRS has engendered new enthusiasm for agricultural production in the community, in particular in crop production, and has contributed to the appreciation by some farmers of the enormous potential that agriculture holds for food security and upliftment.

c) The on-farm research and technology dissemination programme followed in Obonjaneni closed the communication gap between researchers and the small-scale farmers and the Extension staff. A positive outcome is the direct link created between scientists and farmers by the approach.

d) The people of Obonjaneni indicated and expressed the need for regular contact, monthly or more frequent, between them and officials of the Department. Most extension officers work in more than one community and it is not always easy for farmers to locate them when they have a specific request or problem. Similarly, FSRS staff do not have a regular pattern regarding their visits to the communities in which they are working.

e) The high percentage of women interviewed indicated the important role they play in agriculture in Obonjaneni, and emphasized that special attention needs to be given to involve women in all the steps of an on-farm research and technology dissemination approach.

f) The majority of the respondents (76%) were using only small areas of land around the homesteads to plant crops. This indicates that "outside money" has a life-saving role to play in Obonjaneni, and that the majority of households could not rely on agriculture alone, for a living.

g) If poor and hungry people do not participate in an on-farm research and technology dissemination programme, it will not be possible to develop technologies and practices to assist them in improving their situations.

h) Livestock is kept for many different reasons, all including some economic considerations. However, the reason for the lack of a relevant demand-driven livestock research and technology dissemination programme could be the apparent absence of an organised group such as a livestock association, and possibly, the absence of a real urge to farm with animals.

i) The farmers' field days played a significant role in transferring technology that emanated from the on-farm research programme to people who voluntarily attended because of their interest in agriculture. Contact with the wider community was a problem, and many people did not attend the events.

j) The different types of crops and vegetables grown in the communal fields and at the homesteads, the different reasons why livestock are kept, the variation in awareness by the community of the on-farm research activities and their responses to the programme, indicated that small-scale agriculture is multifaceted. On-farm research and technology dissemination programmes need, therefore, to have target groups and clear objectives.

k) Not all people in Obonjaneni are agriculturalists and would only benefit indirectly through buying locally grown produce, thus supporting a growing economy.

l) The fact that the school children who attended the farmers' field days took the information home indicated the potential role children can play in creating awareness of the on-farm research programmes and the dissemination of information. Their involvement could, furthermore, improve their attitude towards agriculture.

m) The requests from the respondents for regular contact with staff of the Department is a clear indication of the rural farmers' needs for support.

n) Some farmers are prepared to share and transfer knowledge through their involvement in the on-farm research and technology dissemination programme. They need to be identified, trained and used in farmer-to-farmer training programmes.

o) Extension staff of the Bergville District recognized the value of the programme in the improvement of agriculture in Obonjaneni and in terms of a positive influence on their knowledge base and service delivery in the District.

p) Active participation in the on-farm research programme clearly empowers extension and enhances its credibility with its clients.

7.5 Recommendations

a) A system allowing for regular contact between farmers and Departmental staff should be implemented. The following system could be put in place:

- A room could be hired, or a container, converted to an office, could be situated at a convenient site.
- The site would be central, safe and close to trials and to toilets.
- The room or container should be manned for one day each week so that farmers could, for example, obtain advice or book a meeting with the Extension Officer or researcher.
- Two people should man the site at one time, for safety reasons. Trained leader farmers could also be used to man the site with Departmental staff.
- Since the persons manning the site may not be knowledgeable in terms of crop and livestock issues, posters covering basic information such as cultivars, planting dates and animal remedies could be prepared and displayed at the site. Any enquiry that cannot be dealt with immediately, needs to be forwarded to the relevant person or section and an answer should be available the following week or visit.

- All requests should be recorded; this will provide an indication of the types of problems/needs of the farmers in the area.

b) In all rural agricultural development programmes women participants must be involved in the decision-making processes. Women and men could be divided into groups at meetings during discussion time, in order to allow them to participate freely and for them to give their views and opinions during feedback sessions.

c) With the majority of residents only active in their homestead gardens, on-farm trials should also be carried out in these gardens.

d) Farmer-to-farmer technology dissemination should be encouraged.

e) People interested in the performance and production of livestock need to be assisted by Extension staff to form associations.

f) More and better use should be made of notice boards as a means of communication in communities.

g) The interest shown and the knowledge taken home by children who attended the farmer field days emphasizes the potential role they can play in agricultural development in communities. Secondary school children who study agriculture as a subject (*e.g.* Grade 10 pupils) should be encouraged to become involved in a participatory, on-farm research programme at their homes.

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CHAPTER 8

SYNTHESIS AND SUMMARY

8.1 On-farm research approach

During the 1990s the KwaZulu-Natal Department of Agriculture recognised the fact that the research conducted on-station did not fully address the needs of the thousands of small-scale farmers in the province. The Farming Systems Research Section (FSRS) was formed in 1995 to conduct research to overcome constraints to production identified by small-scale farmers. Agriculture is a vital activity to address poverty, hunger and unemployment in rural communal areas. Agricultural research needs to be demand-driven and needs to be conducted within communities, where farmers can have easy access to the research sites and be involved in the planning and management of the programme. The challenge of an on-farm research approach was to close the gap, for example in communication, which existed between research and extension and small-scale farmers. The method decided upon by the FSRS to follow, to address constraints identified, was the on-farm, client-orientated research approach. According to Ewell (1989), on-farm research has been promoted as a means of developing appropriate technology and adapting it to the specific agro-ecological and socio-economic conditions of small-scale farmers and is designed to link research and resource-poor farm households more closely. The approach focused on farmers as the clients of the research, with emphasis on diagnosing constraints and setting research priorities and designing technological solutions in response to opportunities or constraints identified on-farm and the involvement of farmers at various stages in the research process (Ewell, 1989). The success of the approach was to be addressed in terms of the extent to which technology was to be adopted and the impact was to have on the well-being of farmers and the people of a community.

By adopting the on-farm research approach, the FSRS identified the following objectives for its programme:

- to study the small-scale farming system in Obonjaneni and to identify agricultural constraints experienced by the farmers;

- with the participation of extension, commodity researchers and farmers, to conduct on-farm research aimed at developing relevant technologies, which should be:
    - economically viable;
    - environmentally sustainable;
    - socially acceptable;
    - providing solutions to priority problems;
- to disseminate relevant technology.

8.2 Diagnostic studies

The approach created new links between FSRS and Extension staff and resulted in an on-farm research programme followed in the Obonjaneni community. The selection of Obonjaneni as a target area by Extension staff was based on the fact that agriculture was in a poor state and that very few agricultural activities were taking place in the community. Members of the community endorsed this by describing agriculture as *"dead and not sick"* during the diagnostic phase of the study.

Observations made during the first visit showed that agriculture in the community was in a poor state. Fences were not in place to protect communal fields from livestock damage. For several years, no maize had been planted in the 40 ha communal cropping fields, apparently because of the theft of fencing and the presence of stray animals. Crops were produced only in small gardens adjacent to homesteads. The quality and quantity of the vegetables, seen during the visit to the community garden, reflected poor management practices. Valuable secondary information, emanating from various sources, was identified and used to plan and conduct the on-farm research and technology dissemination programme. This information indicated a considerable potential for agriculture in the community. The experience gained in the diagnostic phase agreed with the statement of Dillon & Hardaker (1993), that the best starting point for on-farm research is to review available secondary information.

Community meetings during the diagnostic phase, at which respondents for the diagnostic studies were identified, were advertised as agricultural meetings. It is therefore likely that non-farmers stayed away and were thus not involved in the process that followed the meetings. Respondents and participants could therefore have been biased in terms of the absence of non-farmers or community members no longer farming. However, it would have been useful to include non-farmers or ex-farmers, to assess their attitudes towards agriculture and other aspects concerning the functioning and the well-being of people in Obonjaneni. However, the diagnostic survey provided an opportunity to gain a good understanding of the farming operations, household demographics, choice of activities, agricultural practices and constraints affecting production from volunteers who showed interest in the approach. In addition, an important selection criterion for farmer participation in on-farm trials, according to Norman *et al.* (1994), is that farmers should be interested, willing and able to co-operate. The information gave researchers, extension staff and farmers an informed basis for the planning of a relevant on-farm research and technology dissemination programme. The diagnostic survey, and discussions with members of the community, confirmed that agriculture was in a poor state *e.g.* maize yields obtained from the small areas at homesteads in general did not meet the requirements of households. The community garden was in a bad state, with low vegetable yields and despondent garden members. The information showed that no-one in the community was permanently involved in agriculture and that no-one seemed to rely on agriculture as a sole source of income. The diagnostic phase was successful in attaining a better understanding of the system and the circumstances under which people in Obonjaneni operated. Collinson (1998) mentioned that while diagnosis is important for an understanding of farmers' problems, the understanding of their priorities, management strategies and resource constraints is particularly vital for the shaping of the solutions, including improved technologies.

8.3 On-farm research and technology dissemination programme

The on-farm research activities, *e.g.* planning of trials, harvesting, organizing technology dissemination events, relied heavily on organised groups such as the Amazizi Maize Association and the Phuthumani Community Garden. In meetings with the farmers and Extension staff, the research team experienced no difficulty in identifying clear sets of research opportunities from the initial diagnostic studies. Although farmers in Obonjaneni played a significant role in identifying possible solutions to constraints, the impression gained during planning meetings was that they, especially during the first two seasons, did not think beyond new varieties to address the constraints identified in Obonjaneni. However, after the second season of on-farm trials, farmers requested trials and demonstrations on weed control and an alternative production practice such as minimum tillage procedures. In general, farmers, and even the young, inexperienced researchers and technicians, did not consider solutions beyond the "normal" variety and management practices. Possible reasons for the lack of identification of more solutions from farmers could have been that they were not involved with crop farming for many years in Obonjaneni and that the small-scale farmers in KwaZulu-Natal have been deprived of technology and a proper service for decades, which could possibly contribute to the fact that they did not think outside their "box of limited technology". Collinson (1985) commented that farmers often see themselves as incapable of providing answers to local problems and needs.

During the execution of the research programme, farmers and Extension staff were involved in the management of the trials, when their time allowed. Active farmer involvement during the first two seasons was experienced when very little agricultural activity took place in the communal fields. However, during the third and fourth seasons, farmer involvement in trial management became limited as they increased their own agricultural activities. Their main involvement in the trials was at planning and feedback meetings, visits and discussions at the trial sites and farmers' field days. It was quite evident that the participation of farmers in the on-farm trials took on a new meaning and could perhaps not be seen as being of a participatory nature. At this stage of the process, it is perhaps required that researcher-designed and farmer-managed trials be conducted simultaneously with the researcher-designed and researcher-managed trials, as classified by Biggs (1989).

The on-farm trials showed that the Obonjaneni area has considerable agricultural potential. Miles (1996) commented that, indirectly, soil infertility might have major sociological effects on rural communities. In KwaZulu-Natal, surveys based on soil tests indicated that crop yields are often severely restricted by excessive soil acidity and/or nutrient deficiencies (Miles, 1996). An important message emerged from the on-farm trials that resource-poor farmers might plant commercial hybrids to obtain better yields under correct agronomic practices. In the absence of liming, it could be more profitable for farmers to plant their own seed, which, as a result of selection of the community over many years, has developed acid tolerance. This kind of information emanating from on-farm research should drive the KwaZulu-Natal Department of Agriculture and Environmental Affairs to take the initiative to protect, conserve and even to improve the gene pool of the local maize variety (open-pollinated) and other important genetic material in the possession of small-scale farmers. The different options available to small-scale farmers in terms of maize production, as shown in the research, emphasise that "adoption of an on-farm research approach in extension implies moving away from packaged recipes towards providing farmers with options and advice on how to improve production" (Low *et al.,* 1991).

The crop production trials in the communal fields showed that a minimum of four seasons were needed to enable scientists to make responsible and sound recommendations. Factors such as variation in soil fertility among the different treatment plots, a change in the experimental site and the poor service of the contractors, emphasized the importance of medium-to-long-term, properly planned, on-farm trials. The "hit-and-run" approach, where organizations are involved in communities for only one or two seasons, makes their recommendations unreliable. The ideal duration of involvement in an on-farm research programme in a community is unknown. There is no real guidance from the literature available. The period will certainly depend on factors such as the scale and type of programme, progress in terms of adoption, availability of funds and the continuous commitment of the various partners. The small-scale farmer is generally averse to risk-taking and lacks confidence in the innovation until it is successfully tried in his own situation.

8.4 Outcome and impact of the approach followed in Obonjaneni

The intervention in Obonjaneni with the on-farm research programme resulted in a definite revival of and a new interest in agriculture, as reflected by the following:

- the successful intervention in the controlled movement of livestock;
- an annual increase in fields planted with maize, potatoes and dry beans;
- a newly defined vision of the Maize Association members, who displayed a positive attitude towards agriculture and a strong desire to become commercial small-scale farmers;
- the employment of casual labour to assist in planting, weeding and harvesting;
- the adoption of new technology (*e.g.* use of new varieties and of lime);
- the focused attention, training, demonstrations and the hands-on experience received by the members of the community garden changed it from a once doomed garden to a productive and relatively well-managed one;
- the selling of produce from the communal fields and the community garden;
- the successful technology dissemination events, with contributions from farmers as speakers.
- sound advice led to more efficient use of inputs, *e.g.* a farmer who paid R10 for a soil sample analyses, paid R1 133 less for inputs (fertilizer), compared to the previous season, but harvested maize worth approximately R1 000 more than in the previous season.

A very strong indicator of the growing interest in agriculture was the increase in the number of fields being cultivated and planted in the communal cropping area since the arrival of the FSRS in 1997. In 1997 not one field was planted, during 1998/1999 (Season 1) eight fields were planted with maize, 16 fields during 2001/2002 (Season 4) and 44 fields in January 2003 (41 fields with maize and three with potatoes). The increase in the use of fields to 41 in the 2002/2003 season and an increase from no maize grown in the communal fields to an average yield of 1.55 t/ha resulted in a total maize production from the communal cropping fields (with an average size of 0.578 ha) of approximately 36.7 tons, at a value of R36 731 (taken at R1000/ton). Records kept by two farmers showed net profits during the 2001/2002 season of R3 572 and R2 443 from the maize they produced. Both farmers based their fertilizer applications on soil analyses.

The research team, over the five years of involvement, was regularly asked to provide information on a wide variety of topics and subjects. A large number of subjects, through requests from farmers, were maize and dry bean production, soil fertility, maize planting dates and potato production, which received particular attention. The success of the technology dissemination events, in terms of attendance, relevance of topics dealt with in programmes and other administrative matters could largely be attributed to the contribution of the members of the Maize Association and the community garden. The farmers' field days played a significant role in transferring technology that emanated from the on-farm research programme to people who voluntarily attended because of their interest in agriculture. Contact with the wider community was a problem, and many people did not attend the events. Except for a small core group of people, a concern was that "different" people were seen at each meeting, which resulted in a lack of continuity from meeting to meeting and event to event. An important aspect of the technology dissemination stage was that pupils from the local secondary school who attended the farmers' field days showed interest in the subjects covered and were even prepared to assist in the management of the trials.

In spite of the indicators of a revival of agriculture in the community, farmers continuously complained about the high input costs, *e.g.* hybrid seed and fertilizer. High costs could have a negative effect on the adoption of technology developed in the communal areas. A support system to allow farmers to obtain inputs more easily is needed for households in communities, of which the majority rely on women for agricultural activities. This would enable them to make use of new technologies to enhance agricultural production.

After five years of involvement by the FSRS, respondents requested the latter to continue with their activities in Obonjaneni, largely from the point of view of providing support and knowledge. It is important to realize that as farmers advance in their agricultural activities, as in the case of Obonjaneni, opportunities and problems change continuously.

The continued involvement requested by the respondents in Obonjaneni could further be interpreted as a vote of trust and confidence in the FSRS staff and in the approach followed in the community. Feedback from the community was that a reliable extension service is needed.

A challenge facing on-farm research teams is the identification of smallholders who are "farmers" and for whom farming is of significant interest, as opposed to those who simply eke out an existence on the land available to them. The average attendance of 38 people at the farmers' field days, or 4% of the households in the community, showed clearly that not all the residents in Obonjaneni were farmers or interested in agriculture. It is, however, important to take note of the comment by Collinson (1987), that the key to an effective on-farm experimental programme is the mobilization of the *community* in its support. It is also possible, due to the poor state of agriculture in this community, that many have become disenchanted with the idea of being farmers. The author believes that it is quite likely that those eking out an existence do so because they believe that agriculture cannot provide them adequately with food. The challenge therefore is to show, through a demand-driven process, the potential of agriculture and to convince them that they are mistaken. For people who, as an only resource, have some land or access to land, improving their agriculture must be a first step in their upliftment. The majority of the respondents in this study (76%) were using only small areas of land around the homesteads to plant crops. This indicates that "outside money" has a life-saving role to play in Obonjaneni and that the majority of households could not rely on agriculture alone, for a living. It is therefore questionable whether the people using only their homestead gardens want to become commercial farmers. However, with the majority of residents only active in their homestead gardens, on-farm trials should also be carried out in these gardens to address household food security. The challenge is for rural practioners to involve poor and hungry people in an on-farm research and technology dissemination programme, through obtaining their voluntary inputs in meetings where on-farm trials are planned. The high percentage of women interviewed indicated the important role they play in agriculture in Obonjaneni and emphasized that special attention needs to be given to involve women in all the steps of an on-farm research and technology dissemination approach.

The important role and function played by the Maize Association and the garden committee members in the on-farm research approach, showed the value of organised structures in communities. They should therefore be trained to fulfil roles properly in communities. Training could be on how to organize events, bookkeeping and how to negotiate with input suppliers, to mention a few. In this regard the Department of Agriculture and Environmental Affairs needs to play an important role, to ensure that these organised groups in communities operate to their full potential. The reason for the lack of a relevant demand-driven livestock research and a technology dissemination programme could be the apparent absence of an organised group such as a livestock association and possibly the absence of a real urge to farm with animals.

The on-farm research approach followed in Obonjaneni has stimulated a new enthusiasm for agricultural production in the community, in particular in crop production, and has contributed to the appreciation by some farmers of the enormous potential that agriculture holds for food security and upliftment. Bearing in mind the poor state of agriculture, and the total absence of any cropping activity in the communal fields when the FSRS arrived in Obonjaneni in November 1997, the vision of approximately 90% of the respondents in October 2002 was positive. They saw a promising and bright future for agriculture in the community. An important aspect during the impact assessment study was that approximately 23% of the respondents saw themselves being upgraded from "a small to a large-scale farmer", and to sell produce. A nine-country study by the International Service for National Agricultural Research (ISNAR) showed that national institutions have been able to respond more effectively to the needs of resource-poor farmers through an on-farm, client-orientated research approach, which raised scientists' understanding of clients' priority problems and technology needs (Merrill-Sands *et al.,* 1990). This approach has been part of national research programmes in Asia, Africa and Latin America, to bring beneficial technology to resource-poor farmers (Bembridge *et al.,* 1993).

A positive outcome of an on-farm research and technology dissemination programme is the direct link created between scientists, extension staff and farmers. Feedback from the extension staff acknowledged the contacts and the links formed with researchers, which they mentioned contributed to an improvement in their service delivery. This is in agreement with the observation by Low (1997), that participatory approaches to diagnosis and experimentation have the potential to close the technology development and communication gap between research, extension and small-scale farmers. One of the biggest challenges encountered was communication and getting all the stakeholders (team members) involved in each activity, *e.g.* different management activities of trials, meetings and visits to trials. One of the issues, according to Low (1995), that needs to be successfully addressed, if the concept of changing from a "top down" to a "bottom up" system of technology generation and dissemination, is that many sets of actors need to be involved and that the flow of information between them needs to be regular, relevant and understood.

The positive feedback from farmers and extension staff strongly indicated that the on-farm research and technology dissemination approach used in Obonjaneni could fruitfully be used in the rest of KwaZulu-Natal to address the agricultural constraints of small-scale farmers. The approach is an extremely powerful tool, in the sense that seeing is believing. Positive indicators in this regard are evident. The KwaZulu-Natal Department of Agriculture and Environmental Affairs needs to use the on-farm research and technology dissemination approach throughout the Province, in an effort to reach many thousands of small-scale farmers in rural areas. The FSRS has become involved, since 2002, in one additional district in the province with an on-farm research and technology dissemination programme. A three-day farming systems approach short-course, through the non-formal training programme of the KwaZulu-Natal Department of Agriculture and Environmental Affairs, was initiated. Over two courses, approximately 50 people, who were mainly Extension staff of the Department, attended. In a recent (2004) restructuring process of the KwaZulu-Natal Department of Agriculture and Environmental Affairs, the province was divided into two regions and in both regions Farming Systems Research Sections were included in the structures. Additional posts were allocated to the Sections to enable the Department to become involved with on-farm research and technology dissemination programmes in more districts.

On-farm research and technology dissemination could change the perception of agriculture in rural communities for farmers and the rural dwellers in general, to appreciate the huge potential that agriculture holds for food security, as a source of income, a job creator and for upliftment. With an on-farm research approach, it is critically important for inputs of time, labour and knowledge to have a lasting effect so that the only work that should take place within rural communities is that requested or identified by the people themselves.

8.5 References

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APPENDIX A

KWAZULU-NATAL DEPARTMENT OF AGRICULTURE AND ENVIRONMENTAL AFFAIRS

FARMING SYSTEMS RESEARCH QUESTIONNAIRE

Private Bag X9059, PIETERMARITZBURG 3200

Tel: (033) 3559100
Fax: (033) 3559401

Instructions to interviewer

1. Please write clearly.
2. Indicate the correct or the most appropriate answer with an [X] where applicable.
3. Complete the part on "General information of farmer" for each visiting point (farmer).
4. Complete only the relevant sections on farm enterprises (pages 5 to 34) of the questionnaire as asked for and indicated in the general information section on page 3.

INTERVIEWER

Name: ....

Designation: ....

Date: ....

GENERAL INFORMATION OF FARMER

FARMER'S NAME AND SURNAME:
(Doing the Work)

MR	MRS	MISS

ADDRESS/LOCALITY:

GIS (Geographic Information System)

DISTRICT AND WARD:

DISTRICT		WARD	

DO YOU STAY ON

YOUR OWN LAND	COMMUNAL LAND	RENTED LAND	BORROWED LAND

WHAT IS YOUR EDUCATIONAL STATUS:

NO SCHOOLING		GRADE 1 - STD 5		STD 6 - STD 10		POST SCHOOL	

WHAT IS YOUR AGE (YEARS)

<25	25 - 35	36 – 45	46 - 55	56 - 65	>65

	ZULU	ENGLISH	AFRIKAANS	OTHER
DO YOU SPEAK:				
DO YOU READ:				

WHO IS THE n'KOSI OF THE AREA: ....

WHO IS THE LOCAL INDUNA(S):

NAME OTHER PEOPLE OR ORGANISATIONS ACTIVE IN AREA:

CONTACT TELEPHONE NUMBERS OF THE ABOVE PEOPLE OR ORGANISATIONS

HAVE YOU FILLED IN ANY QUESTIONNAIRES BEFORE

NO	YES	HOW MANY?	

IF YES, BY WHOM

ARE YOU MARRIED

YES	NO

	YES	NO	OCCASIONALLY
DOES YOUR HUSBAND/WIFE WORK ON THE FARM			

FAMILY COMPOSITION	SONS	DAUGHTERS	RELATIVE/S (SPECIFY)	DAUGHTERS/ IN-LAW	BOARDERS
TOTAL NUMBER OF					
AT PRE-SCHOOL:					
AT SCHOOL:					
AT POST-SCHOOL:					
LIVING AT HOME:					
NUMBER INVOLVED IN AGRICULTURE					
OCCASIONALLY:					
PERMANENTLY:					

FROM WHERE DO YOU PURCHASE FOOD NOT PRODUCED BY YOURSELF?

1. FRESH PRODUCE: NEIGHBOURS ☐ LOCAL MARKET ☐ LOCAL STORE ☐ TOWN ☐
2. MAIZE MEAL: NEIGHBOURS ☐ LOCAL MARKET ☐ LOCAL STORE ☐ TOWN ☐
3. OTHER FOODSTUFFS: NEIGHBOURS ☐ LOCAL MARKET ☐ LOCAL STORE ☐ TOWN ☐

WHAT MEANS OF TRANSPORT DO YOU USE ON A REGULAR BASIS? TAXI ☐ BUS ☐ OWN ☐

APPROXIMATELY HOW MUCH IS SPENT ON EACH OF THE FOLLOWING PER HOUSEHOLD?

	RANDS/MONTH	RANDS/YEAR	(FOR OFFICE USE) % OF ANNUAL INCOME
1. FOOD:			
2. EDUCATION:			
3. TRANSPORT:			
4. CLOTHING:			
5. MEDICAL:			
6. FARMING:			
7. TAX:			
8. SAVINGS:			
9. TOTAL			

SOURCES OF ANNUAL INCOME PER HOUSEHOLD:	RANDS/MONTH	RANDS/YEAR
SALARIES:		
PENSION:		
HOME INDUSTRIES:		
AGRICULTURE:		
CONTRIBUTIONS FROM FAMILY MEMBERS, BOARDERS		
OTHER:		

DO YOU FARM WITH THE FOLLOWING (indicate YES with an X)

BEEF CATTLE	☐	DAIRY CATTLE	☐	SHEEP	☐	GOATS	☐
PIGS	☐	CHICKENS	☐	RABBITS	☐	CRAFT PLANTS	☐
MAIZE	☐	DRY BEANS	☐	SORGHUM	☐	MEDICINAL PLANTS	☐
POTATOES	☐	SUGAR CANE	☐	FRUIT (Specify)	☐	VEGETABLES (Specify)	☐
OTHER	☐						

WHAT WOULD YOU FARM WITH IF YOU HAD A CHOICE ☐ ☐

IF APPLICABLE WHY DON'T YOU FARM WITH YOUR CHOICE? ______________________

WHY WOULD YOU LIKE TO FARM WITH ENTERPRISE OF YOUR CHOICE? ______________________

DESCRIBE INFRASTRUCTURE

1. Telephones ______________________

2. Roads ______________________

3. Electricity ______________________

4. Water ______________________

TO BE COMPLETED BY INTERVIEWER

HOW WOULD YOU RATE THE MANAGERIAL SKILLS OF THIS FARMER?

WEAK ☐ BELOW AVERAGE ☐ AVERAGE ☐ GOOD ☐ VERY GOOD ☐

GRID REFERENCE: ____________ **MAP NO.** ____________ **BIORESOURCE GROUP:** ____________

NOW, COMPLETE ONLY THE RELEVANT SECTIONS OF THE QUESTIONNAIRE AS INDICATED ABOVE:

FARMING SYSTEMS RESEARCH QUESTIONNAIRE

FARM ENTERPRISE INDEX

CATTLE - BEEF **FARMER'S INITIAL AND SURNAME: ....**

	NGUNI TYPE	CROSS BREED	OTHER (SPECIFY)
BREED OF ANIMAL KEPT			
BREED OF BULL USED			

	MILK	MEAT	BANK	CULTURAL	LOBOLA
WHY DO YOU KEEP CATTLE					

WHY DO YOU KEEP SPECIFIC BREED	

	YES	NO
DO YOU BUY IN COWS		
IF YES: SUPPLIER		

	COMMU-NAL VELD	OWN VELD	PASTURE	MAIZE STALKS		HAY	RADISH	OTHER (SPECIFY)
				OWN	COMMUNAL			
WHERE DO THE COWS GRAZE IN **SUMMER**								
WHERE DO THE COWS GRAZE IN **WINTER**								
AREA OF (IN HA)								

(TO BE VERIFIED BY INTERVIEWER)

	YES	NO
DO YOU FEED LICKS TO THE ANIMALS		

	SUMMER	WINTER	AUTUMN	SPRING
IF YES, WHEN				

	IN SUMMER		IN WINTER	
	YES	NO	YES	NO
IS ENOUGH WATER AVAILABLE TO THE ANIMALS				

FROM WHAT SOURCE

RIVER	DAM	SPRING	PIPED WATER

DO THE CATTLE HAVE TO WALK A LONG WAY TO THEIR DRINKING WATER

YES	NO

ARE YOUR COWS HERDED

YES	NO

BY WHOM

HERDMAN	YOURSELF	CHILDREN

WHO PAYS THE HERDMAN

YOURSELF	COMMUNITY	NOT PAID

	HEAD
TOTAL NUMBER OF ANIMALS	
NUMBER OF COWS	
NUMBER OF STEERS	
NUMBER OF HEIFERS	
NUMBER OF OXEN	
NUMBER OF BULLS	
TOTAL (To be calculated by interviewer)	

HOW MANY COWS ARE YOU MILKING ....

WHERE DO YOU MILK YOUR COWS

SHED	OPEN AIR

DO YOU SELL YOUR MILK

YES	NO

AT WHAT PRICE PER LITRE ____________________

DO YOU GIVE YOUR MILK AWAY	YES	NO

IF "YES", TO WHOM	NEIGHBOURS	MARKET	SHOPS	CO-OP

HOW DO YOU SELL / GIVE AWAY YOUR MILK?	MAAS	FRESH MILK	OTHER (SPECIFY)

TO WHOM DID YOU SELL / GIVE AWAY YOUR MILK	NEIGHBOURS	LOCAL MARKET	SHOPS	CO-OPERATIVE

DO YOUR COWS SUPPLY YOUR HOUSEHOLD'S MILK NEEDS	SOMETIMES	ALWAYS	NEVER

HOW MUCH MILK DO YOU USE IN THE HOUSEHOLD .... .litre/day

OVER THE LAST 12 MONTHS (WHERE OPTIONS ARE GIVEN WRITE IN THE CORRECT ANSWER)

WHEN DID THE COWS HAVE CALVES	ALL YEAR ROUND	SUMMER	AUTUMN	WINTER	SPRING

HOW MANY CALVES WERE BORN	
HOW MANY CALVES DIED	
MAIN DISEASES OF CALVES	
AT WHAT AGE DO YOU WEAN THE CALVES	months

HOW MANY MATURE ANIMALS DIED				
MAIN DISEASES OF MATURE ANIMALS				
HOW MANY ANIMALS DID YOU SLAUGHTER				
WHY	MEAT HOME	TO SELL	CULTURAL	OTHER
WHAT DO YOU DO WITH HIDES	OWN USE	SELL	WASTE	OTHER

HOW MANY ANIMALS DID YOU BUY

WHO DID YOU BUY THEM FROM

COMMERCIAL FARMER	NEIGHBOUR	SALE

WHAT WERE THE ANIMALS BOUGHT FOR

LOBOLA	CEREMONIES	OTHER

HOW MANY ANIMALS DID YOU SELL

WHAT WAS THE AVERAGE PRICE RECEIVED PER ANIMAL

R

WHO DID YOU SELL THEM TO

NEIGHBOUR	SALE	OTHER

HOW OFTEN DID YOU DIP YOUR CATTLE

NEVER	ONCE OR TWICE A MONTH	EVERY TWO TO THREE MONTHS

TYPE OF DIP USED
(IF OTHER, SPECIFY)

TANK DIP	SPRAY DIP	KNAP-SACK	POUR-ON	OTHER

PRODUCT USED (GIVE NAME)

VACCINATION/DOSING PROGRAMME ....

ANY CONTACT WITH STATE VET/HEALTH TECHNICIAN ....

HOW MANY OF YOUR ANIMALS WERE STOLEN ....

MAIN PROBLEMS CONCERNING BEEF CATTLE:

1.
2.
3.
4.
5.

CATTLE - DAIRY **FARMER'S INITIAL AND SURNAME: ....**

BREED OF ANIMAL KEPT

JERSEY	FRIESLAND	OTHER (SPECIFY)

DO YOU BUY YOUR COWS

YES	NO

IF YES, SOURCE OF SUPPLY

NEIGHBOUR	COMMERCIAL FARMER	STOCK SALE

IF YOU BREED, WHAT SYSTEM DO YOU USE

UNKNOWN BULL	OWN BULL	COMMUNAL BULL	AI / OTHER

	COMMUNAL VELD	OWN VELD	PASTURE	MAIZE STALKS		HAY	RADISH	OTHER (SPECIFY)
				OWN	COM-MUNAL			
WHERE DO THE COWS GRAZE IN **SUMMER**								
WHERE DO THE COWS GRAZE IN **WINTER**								
AREA OF (in HA)								

(TO BE VERIFIED BY INTERVIEWER)

DO YOU FEED LICKS TO THE ANIMALS

YES	NO

IF YES, WHEN

SUMMER	WINTER	AUTUMN	SPRING

HOW DO YOU MILK YOUR COW

HAND	MACHINE

DO YOU HAVE ELECTRICITY ON THE FARM

YES	NO

NUMBER OF ANIMALS	
NUMBER OF COWS IN MILK	
NUMBER OF DRY COWS	
NUMBER OF MALE CALVES	
NUMBER OF FEMALE CALVES	
NUMBER OF HEIFERS	
NUMBER OF OXEN	
NUMBER OF BULLS	
TOTAL (To be calculated by interviewer)	

DO YOU PURCHASE FEED FOR THE DAIRY

YES	NO

IF YES, WHEN DO YOU PURCHASE

ALL YEAR	SUMMER	AUTUMN	WINTER	SPRING

WHAT DO YOU BUY

CONCENTRATE	HAY	OTHER (SPECIFY)

HOW MUCH DO YOU FEED/ANIMAL/DAY ________________

OVER THE LAST 12 MONTHS (Where options are given write in the correct answer)

HOW MANY CALVES WERE BORN	
HOW MANY CALVES DIED	

MAIN DISEASES OF CALVES ________________

HOW OLD WERE THE COWS WHEN THEY CALVED	
HOW MANY COWS DIED	

MAIN DISEASES OF COWS ________________

ARE COWS TB AND CA TESTED

YES	NO

	AUCTION	SPECULATOR	PRIVATE
WHERE DID YOU SELL YOUR ANIMALS			
HOW MANY DID YOU SELL			

HOW MUCH MILK DID THE AVERAGE COW PRODUCE	LITRES/DAY
HOW MUCH MILK DID YOUR COWS PRODUCE IN TOTAL	LITRES/DAY
HOW MUCH MILK DID YOU SELL	LITRES/DAY
AT WHAT PRICE PER LITRE	R
HOW MANY COWS ARE YOU MILKING	

	SHED	OPEN AIR
WHERE DO YOU MILK YOUR COWS		

	MAAS	FRESH MILK	OTHER (SPECIFY)
HOW DO YOU SELL YOUR MILK			

	NEIGHBOURS	LOCAL MARKET	SHOPS	CO-OPERATIVE
TO WHOM DID YOU SELL YOUR MILK				

HOW MANY OF YOUR ANIMALS WERE STOLEN ....

MAIN PROBLEMS WITH DAIRY CATTLE:

1.
2.
3.
4.
5.

SHEEP **FARMER'S INITIAL AND SURNAME: ....**

	WOOL TYPE	MUTTON TYPE	OTHER (SPECIFY)
TYPE OF SHEEP			
TYPE OF RAM			

NAME BREED OF SHEEP			
BREED OF RAM			

	NEIGHBOURS	COMMERCIAL FARMER	STUD BREEDER
WHERE DO YOU BUY YOUR RAMS			

	< 3 YEARS	3 - 5 YEARS	> 5 YEARS
HOW LONG DO YOU USE THE SAME RAM			

	COM-MUNAL VELD	OWN VELD	PASTURE	MAIZE STALKS		OTHER (SPECIFY)
				OWN	COM-MUNAL	
WHERE DO THE SHEEP GRAZE IN **SUMMER**						
WHERE DO THE SHEEP GRAZE IN **WINTER**						
AREA OF (IN HA) (TO BE VERIFIED BY INTERVIEWER)						

	YES	NO
DO YOU FEED MINERALS AND CONCENTRATES TO THE ANIMALS		

	SUMMER	WINTER	AUTUMN	SPRING
IF YES, WHEN				

	OWN MIX	BLOCKS	OTHER (SPECIFY)
IN WHICH FORM DO YOU FEED MINERALS			

	OWN MIX	COMMERCIAL	OTHER (SPECIFY)
IN WHICH FORM DO YOU FEED CONCENTRATES			

IS ENOUGH WATER AVAILABLE TO THE ANIMALS

IN SUMMER		IN WINTER	
YES	NO	YES	NO

FROM WHAT SOURCE

RIVER	DAM	SPRING	PIPED WATER

DO THE SHEEP HAVE TO WALK A LONG WAY TO THEIR DRINKING WATER

YES	NO

	HEAD
NUMBER OF EWES	
NUMBER OF LAMBS	
NUMBER OF WETHERS	
NUMBER OF RAMS	
TOTAL (To be calculated by interviewer)	

AT WHAT AGE ARE THE YOUNG EWES MATED

< 12 MONTHS	12 - 18 MONTHS	> 18 MONTHS

WHEN DO THE EWES LAMB

ALL YEAR ROUND	SUMMER	AUTUMN	WINTER	SPRING

OVER THE LAST 12 MONTHS (Where options are given write in the correct answer)

HOW MANY LAMBS WERE BORN	
HOW MANY LAMBS DIED	
MAIN DISEASES OF LAMBS	

HOW MANY LAMBS DID YOU SELL	
AVERAGE PRICE PER LAMB	**R**

DID YOU CASTRATE YOUR RAM LAMBS

YES	NO

HOW MANY SHEEP DIED FROM DISEASE

MAIN DISEASES OF SHEEP

DO YOU HAVE A REGULAR DOSING PROGRAM

YES	NO

DO YOU HAVE AN INOCULATION PROGRAM

YES	NO

HOW MANY SHEEP DIED FROM OTHER CAUSES

HOW MANY SHEEP DID YOU SLAUGHTER FOR OWN USE

HOW MANY SHEEP DID YOU SELL

AVERAGE PRICE PER ANIMAL

R

TO WHOM DID YOU SELL THE ANIMALS

AUCTION SALE	SPECULATOR	PRIVATE

WHY DO YOU SELL

(IF OTHER, SPECIFY)

MONEY	OTHER

DO YOU SELL WOOL

YES	NO

HOW MANY KILOGRAM DID YOU SELL LAST SEASON

AVERAGE PRICE PER KILOGRAM

KG
R

TO WHOM DID YOU SELL THE WOOL

HOME WEAVER	CO-OP	OTHER (SPECIFY)

HOW MANY OF YOUR ANIMALS WERE STOLEN ....

WHAT DO YOU DO WITH THE SKINS

OWN USE	SELL	OTHER (SPECIFY)

HOW OFTEN DID YOU DIP YOUR SHEEP

TYPE OF DIP USED

NEVER		ONCE A YEAR	
TANK DIP	SPRAY DIP	KNAPSACK	OTHER (SPECIFY)

PRODUCT USED

MAIN PROBLEMS CONCERNING SHEEP:

1.
2.
3.
4.
5.

GOATS **FARMER'S INITIAL AND SURNAME: ....**

WHY DO YOU KEEP GOATS

CASH SALE	BARTERING	MILK	MEAT	CEREMONIAL PURPOSES

	BOER GOAT TYPE	MILK TYPE	INDIGENOUS TYPE
TYPE OF GOATS			
TYPE OF RAM			

	COMM-UNAL VELD	OWN VELD	MAIZE STALKS		PASTURE	OTHER (SPECIFY)
			OWN	COM-MUNAL		
WHERE DO THE GOATS GRAZE IN **SUMMER**						
WHERE DO THE GOATS GRAZE IN **WINTER**						
AREA OF (IN HA)						

(TO BE VERIFIED BY INTERVIEWER)

DO YOU SUPPLEMENT THEIR GRAZING IN ANY WAY

YES	NO

WITH WHAT

LICK	CONCENTRATE	ROUGHAGE

WHEN

SUMMER	AUTUMN	WINTER	SPRING

IN WHICH FORM DO YOU FEED THE MINERALS

BLOCKS	OWN MIX	OTHER (SPECIFY)

IN WHICH FORM DO YOU FEED THE CONCENTRATES

OWN MIX	COMMERCIAL	OTHER (SPECIFY)

IS ENOUGH WATER AVAILABLE TO THE ANIMALS

IN SUMMER		IN WINTER	
YES	NO	YES	NO

FROM WHAT SOURCE

RIVER	DAM	SPRING	PIPED WATER

DO THE GOATS HAVE TO WALK A LONG WAY TO THEIR DRINKING WATER

YES	NO

TOTAL NUMBER OF GOATS	
NUMBER OF MATURE FEMALES	
NUMBER OF KIDS	
NUMBER OF YOUNG MALES (KAPATERS)	
NUMBER OF YOUNG FEMALES	
NUMBER OF RAMS	
TOTAL (To be calculated by interviewer)	

WHEN DO THEY KID

ALL YEAR ROUND	SUMMER	AUTUMN	WINTER	SPRING

DO YOU HAVE A REGULAR DOSING PROGRAM

YES	NO

DO YOU HAVE A REGULAR INOCULATION PROGRAM

YES	NO

OVER THE LAST 12 MONTHS (Where options are given write in the correct answer)

HOW MANY KIDS WERE BORN	
HOW MANY KIDS DIED	

MAIN DISEASES OF KIDS

HOW MANY GOATS DIED OF DISEASE

MAIN DISEASES OF GOATS

HOW MANY GOATS DIED FROM OTHER CAUSES

HOW MANY GOATS DID YOU SLAUGHTER FOR OWN USE

HOW MANY ANIMALS DID YOU SELL

WHAT WAS THE AVERAGE PRICE PER ANIMAL

R

WHAT HAPPENS TO HIDES AND SKINS OF SLAUGHTERED STOCK

SOLD	OWN USE	DISCARDED

WHERE DID YOU SELL THE ANIMALS

AUCTION SALE	SPECULATOR	PRIVATE

WHY ....

HOW MANY OF YOUR ANIMALS WERE STOLEN ....

WHAT DO YOU DO WITH THE SKINS

(IF OTHER, SPECIFY)

OWN USE	SELL	CULTURAL	OTHER

HOW OFTEN DID YOU DIP YOUR GOATS

NEVER	ONCE OR TWICE A MONTH	EVERY TWO TO THREE MONTHS

TYPE OF DIP USED

(IF OTHER, SPECIFY)

TANK DIP	SPRAY DIP	KNAP-SACK	POUR-ON	OTHER

VACCINATION/DOSING PROGRAMMME ....

MAIN PROBLEMS CONCERNING GOATS:

1. ______________________________
2. ______________________________
3. ______________________________
4. ______________________________
5. ______________________________

CHICKENS **FARMER'S INITIAL AND SURNAME: ....**

	BROILERS	LAYERS
DO YOU FARM WITH		
NAME THE BREED OF CHICKEN USED		
NUMBER OF CHICKENS RAISED PER HOUSE		
NUMBER OF CHICKEN HOUSES ON FARM		
AREA OF HOUSES (m^2)		
DIMENSIONS OF HOUSES (LENGTH X WIDTH)	L x W	L x W
HOW MANY GROUPS OF BROILERS ARE CARRIED OVER **12** MONTHS		
HOW MANY GROUPS OF LAYERS ARE CARRIED OVER **24** MONTHS		

	CEMENT BLOCK HOUSES	WOODEN HOUSES	MUD HOUSES	CORR/IRON HOUSES	FENCED ENCLO-SURES	CAGES
DO YOU KEEP YOUR CHICKENS IN						

	YES	NO
DO YOU ADD FRESH BEDDING TO THE EXISTING LITTER DURING THE PRODUCTION CYCLE		

	ONCE PER CYCLE	ONCE EVERY TWO CYCLES
HOW OFTEN DO YOU CHANGE THE BEDDING IN THE HOUSES		

	YES	NO
DO YOU STERILIZE YOUR BUILDINGS		
IF YES, WITH WHAT (NAME)		

	BROILERS	LAYERS
WHAT DO YOU DO WITH OLD LITTER		

WHERE DO YOU BUY YOUR CHICKS FROM			
HOW ARE THESE CHICKENS DELIVERED			
AT WHAT PRICE ARE DAY OLDS DELIVERED PER 100	R150+	R175+	R200+

AT WHAT PRICE ARE POINT OF LAY PULLETS DELIVERED PER BIRD

R15+	R17.50+	R20

FROM WHOM DO YOU BUY YOUR FEED

AT WHAT COST PER 50 KG BAG

FROM WHOM DO YOU BUY YOUR FEED	
AT WHAT COST PER 50 KG BAG	R

DO YOU SELL

LIVE BIRDS	EGGS	BOTH	SLAUGHTERED BIRDS

TO WHOM DO YOU SELL THE EGGS / CHICKENS

NEIGHBOURS	LOCAL MARKET	LOCAL SHOP	SPECULATOR	NEAREST TOWN

FROM ARRIVAL UNTIL DATE OF SALE, HOW MUCH FEED DID YOU USE PER BATCH OF 100 BROILERS

< 8 BAGS	8 BAGS	> 8 BAGS

HOW MUCH FEED DID YOU USE PER 10 BROILERS PER MONTH

< 1 BAG	1 BAG	> 1 BAG

QUANTITY SOLD/PERIOD

NUMBER OF BIRDS		SOLD EVERY		WEEKS	
AMOUNT OF EGGS		SOLD EVERY		DAYS	

SOLD AT WHAT PRICE

BIRDS	EGGS
R	R

COULD YOU SELL MORE IF YOU HAD MORE

YES	NO

DO YOU USE EGGS FOR OWN CONSUMPTION

IF YES, HOW MANY PER WEEK

YES		NO	
NONE	< 10	10 – 20	20+

DO YOU USE MEAT FOR OWN CONSUMPTION

YES	NO

IF YES, HOW MANY BIRDS PER WEEK

NONE	ONE	TWO	THREE+

FROM EVERY 100 BIRDS BOUGHT, HOW MANY DIED

MAIN DISEASE

CHICKS			GROWING BIRDS		MATURE BIRDS	
<5	5 – 10	10+	<2	2+	<2	2+

CAUSE OF DEATH

(IF DISEASE, SPECIFY)

DISEASE	HEAT	COLD	UNKNOWN

IS WATER LAID ON TO THE HOUSES

YES	NO

HOW MANY OF YOUR CHICKENS WERE STOLEN ....

MAIN PROBLEMS WITH BROILERS:

1.
2.
3.
4.
5.

MAIN PROBLEMS WITH LAYERS:

1.
2.
3.
4.
5.

PIGS **FARMER'S INITIAL AND SURNAME: ....**

TYPE OF PIGS FARMED

LANDRACE TYPE	LARGE WHITE	OTHER (SPECIFY)

DO YOU KEEP YOUR PIGS IN

BLOCK HOUSES	WOODEN HOUSES	FREE RANGE	CORR/IRON HOUSES	OPEN ENCLO-SURES	OTHER (SPECIFY)

WHERE DO YOU BUY YOUR SOWS AND BOARS FROM

IF BREEDER, GIVE NAME

NEIGHBOURS	STOCK SALE	BREEDERS

WHAT DO YOU FEED YOUR PIGS

FROM WHOM DO YOU BUY YOUR FEED

AT WHAT COST PER 50 KG BAG

(IF OTHER, SPECIFY)

COMMERCIAL (BAG FROM EPOL/MEADOW)	OTHER
R	

HOW MUCH DO YOU FEED PER PIG PER DAY IN KILOGRAMS

DO YOU SELL

SUCKLING PIGS < 21 KG	PORKERS 21 - 50 KG	BACONERS > 51 KG

NUMBER OF PIGS	
NUMBER OF BOARS	
NUMBER OF SOWS FARMED	
NUMBER OF SUCKLING PIGS (on average)	
NUMBER OF YOUNG PIGS (on average)	

HOW OFTEN DO YOUR SOWS GIVE BIRTH PER YEAR

ONCE	TWICE

HOW MANY PIGLETS ARE BORN PER SOW PER LITTER

< 8	8 – 10	> 10

HOW MANY PIGLETS DIE FROM EACH LITTER

DISEASED				SQUASHED				UNKNOWN			
0	1 - 2	3 - 4	> 4	0	1 - 2	3 - 4	> 4	0	1 - 2	3 - 4	> 4

IF POSSIBLE, NAME THE DISEASES	

AT WHAT WEIGHT DO YOU SELL YOUR ANIMALS	KG
AT WHAT AGE DO YOU SELL YOUR ANIMALS	MONTHS
HOW MANY PIGS HAVE YOU SOLD OVER THE LAST 12 MONTHS	
WHERE DO YOU SELL YOUR PIGS	
WHAT IS THE AVERAGE PRICE RECEIVED	R

WERE ANY PIGS REJECTED BECAUSE OF DISEASE	YES	NO

COULD YOU SELL MORE IF YOU HAD MORE	YES	NO

HOW DO YOU TRANSPORT YOUR PIGS TO THE SALE OR ABATTOIR	OWN TRANSPORT	CON-TRACTOR	OTHER (SPECIFY)

HOW MANY PIGS DID YOU SLAUGHTER FOR HOME USE DURING THE PAST 12 MONTHS	NONE	ONE	TWO	> TWO

HOW MANY ADULT PIGS DIED DURING THE LAST 12 MONTHS	
WHAT DISEASES DID THEY DIE FROM	

IS WATER LAID ON TO THE PIGGERY	YES	NO

HOW MANY OF YOUR ANIMALS WERE STOLEN ....

VACCINATION/DOSING PROGRAMME ....

MAIN PROBLEMS WITH YOUR PIG FARMING:

1.

2.

3.

4.

5.

VEGETABLES AND FRUIT **FARMER'S INITIAL AND SURNAME: ....**

WHAT VEGETABLES DID YOU GROW DURING **THE PAST 12 MONTHS**

NAME THEM IN **ORDER OF PREFERENCE:**

1.
2.
3.
4.
5.

WHICH FRUIT DO YOU GROW

1.
2.
3.
4.

	YES	NO
DO YOU PRODUCE ENOUGH VEGETABLES FOR HOME USE:		
DO YOU PRODUCE ENOUGH FRUIT FOR HOME USE:		

WHAT OTHER VEGETABLES/FRUIT WOULD YOU LIKE TO GROW ____________________

WHY ____________________

INTERCROPPING:

	YES	NO
DO YOU PLANT DIFFERENT CROPS TOGETHER		

WHICH CROPS DO YOU PLANT TOGETHER [ ] + [ ] + [ ]

WHAT IS/ARE THE BENEFIT(S) OF PLANTING THESE CROPS TOGETHER

1.
2.
3.

COMPLETE THE FOLLOWING FOR EACH CROP GROWN FOR THE PAST 12 MONTHS:

CROP NAME:	

HOW MANY TIMES DID YOU PLANT	1	2	3
WHAT IS THE AREA OF EACH FIELD THAT YOU HAVE PLANTED			
INTERVIEWER MUST MEASURE LANDS IF AREAS ARE NOT KNOWN			
PLANTING DATES			

FROM WHOM DID YOU BUY THE SEED/SEEDLINGS				
HOW MUCH DID YOU BUY				
AT WHAT PRICE	R		R	

WHAT ARE THE CULTIVAR NAMES			

	YES	NO
DO YOU USE DIFFERENT CULTIVARS FOR DIFFERENT PLANTING DATES		

	YES	NO
DO YOU USE ANY HOME GROWN SEED		

	PLANTING NO. 1	PLANTING NO. 2	PLANTING NO. 3
WHICH PEST AND DISEASE PROBLEMS DO YOU EXPERIENCE			
WHICH CHEMICALS DO YOU USE			
HOW MUCH OF THE ABOVE CHEMICAL DO YOU MIX WITH WHAT AMOUNT OF WATER			
HOW MUCH DID YOU HARVEST			

	YES	NO
DO YOU SELL YOUR PRODUCE		
WHAT QUANTITIES DID YOU SELL		
PRICE PER QUANTITY	R	

DO YOU PRACTICE CROP ROTATION?

YES	NO

WHICH CROPS DO YOU ROTATE

PRODUCTION PRACTICES:

FIELD PREPARATION:

	BY HAND	OXEN	OWN TRACTOR	CONTRACTOR		COST PER PLANTING		
				TRACTOR	OXEN	1	2	3
HOW								

HOW OFTEN DO YOU DO SOIL SAMPLING

NEVER	ONCE A YEAR	EVERY SECOND YEAR	EVERY THIRD YEAR

	YOURSELF	LOCAL EO	OTHER (SPECIFY)
WHO USUALLY DOES THE SOIL SAMPLING			
HOW LONG BEFORE PLANTING DO YOU SAMPLE	< MONTH	1 - 2 MONTHS	> 2 MONTHS

FOR HOW MANY LANDS

DO YOU EVER RIP YOUR FIELDS

YES	NO

IF YES, HOW OFTEN

PRE-PLANT FERTILIZATION

DO YOU USE MANURE

YES	NO

IF YES, WHAT TYPE OF MANURE DO YOU USE

CHICKEN	SHEEP & GOAT	CATTLE

HOW MUCH MANURE DO YOU USE PER AREA

	YES	NO
DO YOU BUY FERTILIZERS		

IF YES, WHAT KIND			
AT WHAT PRICE PER 50 KG BAG	R	R	R
	LOCAL SHOP	CO-OP	AGENT
FROM WHOM			

	WHEEL-BARROW	OWN TRANS-PORT	TAXI	BUS	CON-TRACTOR	SUPPLIER	E O
HOW DO YOU TRANSPORT THE MANURE							
HOW DO YOU TRANSPORT THE FERTILIZER							

AFTER-PLANT FERTILIZATION (TOPDRESSING):

	YES	NO
DO YOU APPLY ANY FERTILIZER AFTER PLANTING		

IF YES, WHAT DO YOU USE			
HOW MUCH DO YOU USE PER FIELD			

	LOCAL SHOP	AGENT	CO-OP
WHERE DO YOU BUY IT			
AT WHAT PRICE	R	R	R

	YES	NO
DO YOU USE LIME		

IF NO, WHY NOT	
IF YES, HOW MUCH	
HOW DO YOU TRANSPORT THE LIME	

	YES	NO
DO YOU REALISE THE BENEFIT OF LIMING		

DO YOU USE IRRIGATION

YES	NO

WHAT TYPE OF IRRIGATION DO YOU USE

BY HAND	FLOOD	SPRINKLER	DRIP

INSECT CONTROL:

WHAT NATURAL OR TRADITIONAL MEANS DO YOU USE TO CONTROL INSECTS

DO YOU USE CHEMICALS TO CONTROL INSECTS

YES	NO

WHICH INSECTS DO YOU WANT TO CONTROL

NAME THE CHEMICALS USED FOR THESE INSECTS

WHERE DO YOU BUY THE CHEMICALS

LOCAL SHOP	CO-OP	OTHERS (SPECIFY)

DISEASE CONTROL:

DO YOU USE CHEMICALS TO CONTROL DISEASES

YES	NO

NAME THE DISEASES YOU WANT TO CONTROL

NAME THE CHEMICALS

WHERE DO YOU BUY THE CHEMICALS

LOCAL SHOP	CO-OP	OTHERS (SPECIFY)

WHAT ARE YOUR MAIN CROP PRODUCTION PROBLEMS:

1.
2.
3.
4.
5.

CROP PRODUCTION **FARMER'S INITIAL AND SURNAME: ....**

NAME THE CROPS THAT YOU PRODUCE IN **ORDER OF YOUR PREFERENCE:**

	IS THE PRODUCTION UNDER		
	IRRIGATION	RAIN-FED CONDITIONS	LIMITED IRRIGATION
1.			
2.			
3.			
4.			
5.			

	FIELD1 HA	FIELD 2 HA	FIELD 3 HA	FIELD 4 HA
WHAT ARE THE SIZE (S) OF YOUR ARABLE FIELDS				
INTERVIEWER MUST MEASURE FIELDS IF AREAS ARE NOT KNOWN				

TOTAL ARABLE FIELD AREA (TO BE CALCULATED BY INTERVIEWER)	HA

	NOBODY	YOURSELF	LOCAL E0	KFC	OTHER (SPECIFY)
WHO MEASURED THE FIELDS					

	JUNE-JULY	AUG-SEPT	OCT-NOV	DEC
WHEN DO YOU PREPARE YOUR FIELDS				

	HAND	OXEN	OWN TRACTOR	CONTRACTOR		OTHER
				TRACTOR	OXEN	
IS IT DONE BY						

	FIELD 1	FIELD 2	FIELD 3	FIELD 4
WHAT DOES IT COST/AREA	R	R	R	R

	YES	NO
DO YOU RIP YOUR FIELDS		
HOW OFTEN		

	YES	NO
DO YOU PLOUGH YOUR FIELDS		

	ONCE	TWICE
HOW MANY TIMES BEFORE EACH PLANTING		

	YES	NO
DO YOU DISC YOUR FIELDS		

	ONCE	TWICE
HOW MANY TIMES BEFORE EACH PLANTING		

INTERCROPPING:

	YES	NO
DO YOU PLANT DIFFERENT CROPS TOGETHER		

WHICH CROPS DO YOU PLANT TOGETHER ______ + ______ + ______

WHAT IS/ARE THE BENEFIT (S) OF PLANTING THESE CROPS TOGETHER

1.

2.

3.

FOR EACH OF THE CROPS MENTIONED ABOVE, COMPLETE THE FOLLOWING:

CROP NAME:

PLANTING TIME:

WHEN DO YOU USUALLY PLANT

SEPT	1 - 15 OCT	16 - 31 OCT	1 - 15 NOV	16 - 30 NOV	DEC	JAN	FEB

WHY THEN

TRADITIONAL PLANTING TIME	WAIT FOR RAIN	WAIT FOR CONTRACTOR

WHEN DO YOU USUALLY EXPERIENCE THE FIRST RAINS

15 SEPT	30 SEPT	15 OCT	31 OCT	15 NOV	15 DEC

DO YOU TRY TO SAVE MOISTURE IN THE SOIL BEFORE PLANTING

YES	NO

HOW DO YOU SAVE MOISTURE

PLOUGH ONCE	PLOUGH TWICE	KEEP LANDS WEED FREE	DON'T

FERTILIZATION:

DO YOU USE **SOIL SAMPLES**

YES	NO

WHO TAKES THE SOIL SAMPLES

YOURSELF	LOCAL EO	FERTILIZER COMPANY	NGO

DO YOU USE **KRAAL MANURE**

YES	NO

WHEN DO YOU APPLY THE MANURE

DURING WINTER	JUST BEFORE PLOUGHING	WHEN PLANTING

HOW DO YOU APPLY THE MANURE

BROADCAST WITH THE HAND	IN THE FURROW BY HAND	BY PLANTER: MANURE AND FERTILIZER MIXED

HOW MUCH MANURE DO YOU APPLY

MEASURED AS 50 KG BAGS			
FIELD 1	FIELD 2	FIELD 3	FIELD 4

	YES	NO
DO YOU BUY FERTILIZER		
DO YOU BUY IT ACCORDING TO A SOIL ANALYSIS AND RECOMMENDATION		

WHEN DO YOU BUY AND RECEIVE THE FERTILIZERS

AUG	SEPT	OCT	NOV

HOW MUCH MONEY DID YOU USE FOR FERTILIZER LAST YEAR

FIELD 1	FIELD 2	FIELD 3	FIELD 4	DON'T KNOW
R	R	R	R	

WHERE DO YOU USUALLY BUY YOUR FERTILIZER

LOCAL SHOP	CO-OP

HOW DID YOU TRANSPORT THE FERTILIZER TO YOUR HOUSE

WHEEL-BARROW	OWN TRANS-PORT	TAXI	BUS	CON-TRACTOR	SUPPLIER	E O

DO YOU USE LIME?

YES	NO

IF **NO**, WHY NOT

TOO EXPENSIVE	TOO DIFFICULT TO TRANSPORT	NOT AVAILABLE	NOT NECESSARY

DO YOU APPLY THE LIME ACCORDING TO A SOIL ANALYSIS

YES	NO

HOW DID YOU TRANSPORT THE LIME

HOW DID YOU APPLY IT

BROADCAST WITH THE HAND	IN THE FURROW BY HAND	BY PLANTER

SEED USED:

DO YOU USE YOUR OWN SEED (TRADITIONAL SEED)

YES	NO

WHERE DID YOU OBTAIN THE SEED FROM

PARENTS	FRIENDS	LOCAL SHOP	CO-OP

DO YOU BUY CERTIFIED SEED

YES	NO

IF NO, WHY NOT

TOO EXPENSIVE	NOT AVAILABLE	NOT NECESSARY

WHERE DO YOU BUY CERTIFIED SEED

LOCAL SHOP	TOWN	CO-OP

HOW MUCH DO YOU BUY AND AT WHAT PRICE KG ______ FOR R ______

PLANT SPACING:

WHAT IS THE APPROXIMATE DISTANCE BETWEEN PLANT ROWS (cm)

75	90	100	120

WHAT IS THE APPROXIMATE DISTANCE BETWEEN PLANTS IN THE ROW (cm)

5	7	10	15	20	30	40	50	60

HOW DEEP DO YOU PLACE THE SEEDS UNDER THE SOIL (cm)

2	3	4	5	6

PLANTING:

HOW DO YOU PLANT

BY HAND-HOE	BEHIND A PLOUGH	WITH AN OX PLANTER	WITH A TRACTOR AND PLANTER

WHO DOES THE PLANTING

YOURSELF	SPOUSE	YOUR CHILDREN	CONTRACTOR

DO YOU PRACTICE CROP ROTATION

YES	NO

WHICH CROPS DO YOU ROTATE

WEEDING:

WHO DOES THE WEEDING

YOURSELF	SPOUSE	CHILDREN	CHEMICALS APPLIED BY		HIRED LABOUR
			YOURSELF	CONTRAC-TOR	

WHEN DO YOU WEED THE FIELDS

WHEN THE WEEDS ARE STILL VERY SMALL	BEFORE THE WEEDS COVER THE CROP	AFTER THE WEEDS HAVE COVERED THE CROP

HOW MANY TIMES DO YOU WEED

ONCE	TWICE	THREE TIMES	DON'T KNOW

WHAT IS THE COST OF WEEDING

FIELD 1	FIELD 2	FIELD 3	FIELD 4	DON'T KNOW

NAME THE CHEMICALS THAT YOU USE TO CONTROL WEEDS

FROM WHOM DO YOU BUY THESE CHEMICALS

INSECT CONTROL:

WHAT NATURAL OR TRADITIONAL MEANS DO YOU USE TO CONTROL INSECTS

DO YOU USE CHEMICALS TO CONTROL INSECTS

YES	NO

WHICH INSECTS DO YOU WANT TO CONTROL

NAME THE CHEMICALS USED FOR THESE INSECTS

WHERE DO YOU BUY THE CHEMICALS

LOCAL SHOP	CO-OP	OTHERS (SPECIFY)

DISEASE CONTROL:

DO YOU USE CHEMICALS TO CONTROL DISEASES

YES	NO

NAME THE DISEASES YOU WANT TO CONTROL

NAME THE CHEMICALS

WHERE DO YOU BUY THE CHEMICALS

LOCAL SHOP	CO-OP	OTHERS (SPECIFY)

HARVESTING:

WHEN DO YOU USUALLY HARVEST (Months after planting)

3	4	5	6

CROP YIELD

HOW DO YOU NORMALLY MEASURE YOUR YIELD
(GOGOGO'S 16.5 KG MAIZE)

IN GOGOGO'S (20 PARAFIN TIN)	BAGS	
	50 KG	70 KG

WHAT IS YOUR TOTAL YIELD FOR THE MEASURED LANDS

IN GOGOGO'S	50 KG BAG	70 KG BAG

DID YOU PRODUCE ENOUGH FOR OWN USE

YES	NO

HOW MUCH DID YOU USE FOR OWN CONSUMPTION

IN GOGOGO'S	50 KG BAG	70 KG BAG

HOW MUCH DID YOU SELL

NUMBER OF GOGOGO'S	PRICE PER GOGOGO	NUMBER BAGS	PRICE PER BAG

STORAGE OF COBS

(IF OTHER, SPECIFY)

INSIDE HUT OR SHED	ON ROOF	OTHER

STORAGE OF GRAIN

(IF OTHER, SPECIFY)

TANKS	INSIDE HUT	BAGS	OTHER

PROCESSING (FOR MAIZE AND SORGHUM)

DO YOU MILL YOUR OWN MAIZE

YES	NO

IF NOT, WHO DOES IT

CONTRACTOR	CO-OP	OTHER (SPECIFY)

WHAT TYPE OF MEALIE MEAL DO YOU PREFER

COARSE	FINE	VERY FINE

OTHER USES; NAME

....

....

WHAT ARE YOUR MAIN CROP PRODUCTION PROBLEMS:

1.

2.

3.

4.

5.

MEDICINAL AND CRAFT PLANTS: **FARMER'S INITIAL AND SURNAME: ....**

WHICH OF THE FOLLOWING PLANTS ARE COLLECTED, BOUGHT OR CULTIVATED BY THE HOUSEHOLD?

PLANT NAME: ZULU	PLANT NAME: LATIN	USE	BOUGHT	COLLECTED	CULTI-VATED
IMISI	*Cyperus textilis, c. Sexangularis*				
INCEMA	*Juncus kraussii*				
IKHWANE	*Cyperus latifolius*				
INGONGOZANE	*Cyperus fastigiatus*				
ILALA	*Hyphaene coriacea*				
ISIBHAHA	*Warburgia salutaris*				
INDUNGULO	*Siphonochilus aethiopica*				
IGIBISILA	*Boweia volubilis*				
UMATHUNGA	*Eucomis autumnalis*				
UNUKANI	*Ocotea bullata*				
IKHATHAZO	*Alepidea amatymbica*				
UMLAHLENI	*Curtisia dentata*				
INGUDUZA	*Scilla natalensis*				
UMATHITHIBALA	*Haworthia limifolia*				

APPENDIX B

KwaZulu-Natal Department of Agriculture and Environmental Affairs

Evaluation and impact assessment questionnaire on the on-farm demand-driven approach to technology development and transfer followed in the Obonjaneni community

by

Farming Systems Research Section and
Bergville District Extension staff

Instructions:

1. Introduce yourself and inform household that you are from the KwaZulu-Natal Department of Agriculture and Environmental Affairs.
2. Be friendly and open, create a relaxed atmosphere.
3. Explain the purpose of the survey as clearly as possible: to determine whether the inputs from Farming Systems Research from Cedara and Bergville District Extension staff contributed in a revival of agriculture in Obonjaneni.
4. Explain that the information given will assist the Department to evaluate its work in Obonjaneni.
5. Participation of respondent is voluntary and all information will be confidential.
6. Interview the household member who is involved in the agricultural activities (the farmer).
7. Mention how the household was selected, and verify that the person interviewed is actually the person who is actively involved with farm or agricultural activities.
8. Do not lead respondent into an answer.
9. There is no wrong answer - tell the respondent this.
10. Clearly indicate the answer in appropriate square on the code with a clear tick ✓, for example:

Yes	1 ✓
No	2

11. Where answers/explanations are required, please note down the answer given by the respondent as completely as possible - if necessary write on the back of the page.
12. Read the constraints listed in questions 31 and 33 for respondent to indicate what is asked for in respective questions.
13. If the person who is actively involved with farm or agricultural activities is not available for the interview, try to re-visit household the following day.
14. Where you see .... please use this space to write down the answer given by respondent - if you want to express yourself better, write the answer in Zulu.
15. Ignore numbers in blocks - only for office use - **NOT an order of priority**

Name of interviewer: .... **Date of interview: ....**

Questionnaire No: .... **Map No: ....**

1. Is this household actively involved in agriculture by planting crops, growing vegetables and / or owning livestock?

Yes	1
No	2

If no, terminate the interview

2. Is the person who is responsible for the agricultural activities (called respondent) available for the interview?

Yes	1	continue with question 4
No	2	continue only with question 3

3. Why is the person who is involved in agriculture not available for the interview? ....

....

Terminate the interview if the person who is responsible for the agricultural activities is not available, come back for interview

4. Name of the person (s) who is mainly responsible for the actual agricultural activities for this household - the person who is planting maize and other crops, growing vegetables and perhaps involved with the livestock:

....

5. Name of the head of the household: ....

6. What is your relationship to the head of the household?

Head of household	1
Husband	2
Wife	3
Son	4
Daughter	5
Specify..............................	6

7. How long have you lived in Obonjaneni?

	Years

8. Gender of respondent:

Male	1
Female	2

9. Age of respondent:

	Years / or date of birth

10. Have you left and come back to Obonjaneni at some stage?

Yes	1
No	2

If yes, why did you leave?

....

Why did you come back?

....

11. What is your level of education?

No formal education (can not read or write)	1
No formal education (can read and write)	2
Grade 1 – Grade 3	3
Grade 4 – Grade 7	4
Grade 8 – Grade 10	5
Grade 11 - Grade 12	6
Post matric - **specify**	7
Other – specify	8

12. Are you or a member of the following:

Organisation	Yes	No
Phuthumani Community Garden	1	2
Amazizi Maize Association	1	2
Grazing Committee	1	2
Other **(Specify)**	1	2

13. What is the most important agricultural goal for the household - you may indicate more than one option?

		Name of product to be marketed
To produce enough food for own consumption	1	
To produce for nearby hotels **(specify market)**	2	
To sell to hawkers	3	
To produce for markets in Bergville **(specify market)**	4	
To produce for local store	5	
To sell to local community	6	
Other **(specify)**	7	

14. What type of transport will/do you use to deliver products to the market?

Own transport **(specify)**	1
Taxi	2
Wheel barrow	3
Bus	4
Selling from garden – no transport needed	5
Other **(specify)**	6

15. When Cedara started in Obonjaneni, members of the community stated that "agriculture is not sick in this community but dead". What is the state of agriculture in Obonjaneni at present?

Worse	1
Same	2
Better	3
Much better	4

Why do you say so? ....

16. Indicate the type of agricultural activity the household is involved with?

Commodity	**Planting area**	**Size of the field (farmers' measurement)**	**For how long is household involved with it (years)**
Maize	Home garden		
	Communal fields		
Dry beans	Home garden		
	Communal fields		
Other crops (**specify type**):	Home garden		
	Communal fields		
Other crops (**specify type**):	Home garden		
	Communal fields		
Vegetables (specify type):	**Growing area**	**Size of plot / field**	**For how long is household involved with it (years)**
1.			
2.			
3.			
Indigenous vegetables (including medicinal plants)	**Growing area**	**Size of plot / field**	**For how long is household involved with it (years)**
1.			
2.			
Fruit trees	**Number of trees**		
1.			
2.			
Livestock (specify type):	**Number**	**Reason for keeping livestock**	
1.			
2.			
3.			
Other activity (specify):			

17. How was the production of green maize in Obonjaneni during the 2002 cropping season compared to before the involvement of Cedara and Bergville District Extension Staff?

Worse	1
Same	2
Better	3
Much better	4

Why do you say so? ....

18. How did the maize for grain during 2002 compare with previous seasons before the involvement of Cedara and Bergville District Extension staff in Obonjaneni?

Worse	1
Same	2
Better	3
Much better	4

Why do you say so? ....

....

19. Have you changed your crop production practices since Cedara and Bergville District Extension staff started to work in Obonjaneni?

Yes	1
No	2

How have they changed? ....

....

20. Did you attend any farmers' field days organised by Cedara and Bergville District Extension over the last few years?

Yes	1
No	2

If no, why not? ....

....

....

If yes, indicate the number of farmers' field days attended (not planning meetings)?

One	1
Two	2
Three	3
Four	4
Five	5
Six	6
Seven	7
Eight	8

21. If you attended farmers' field days, how did you find out about them - you may indicate more than one option?

Notices	1
Mr Mbongwa	2
Bergville District Extension staff	3
Posters	4
Friend	5
Neighbour	6
School children	7
Other **(specify)**..	8

22. Which new knowledge do you apply that you learnt at the farmers' field days?

....

....

23. How often do you see staff from the Bergville District Extension office?

Weekly	1
Monthly	2
Every three months	3
Never	4
Other **(explain)**	5

24. How often do you want to see Extension staff?

Once a week	1
Once a month	2
Once in three months	3
Never	4
Other **(explain)**	5

25. Have you noticed better livestock control (by removing livestock from the cropping fields), in other words is it possible to plant crops in fields, since Cedara and Bergville Extension started to work in Obonjaneni?

Yes	1
No	2

Explain answer

....

....

26. Are you aware of the activities in the Phuthumani Community garden?

	Yes
Cabbage trials	1
Tomato trials	2
Family Drip Irrigation System	3
Seedling nursery	4
Other **(Specify)**	5

27. Do you get agricultural information/knowledge from other community members?

Yes	1
No	2

If yes, answer the following questions in Box 1 and 2 (RESPONDENT TO RECALL - MAY INDICATE MORE THAN ONE ANSWER)

Box 1 **Where?**	
At farmers' days	1
Field visits with Cedara people	2
Church meetings	3
Visits to friends	4
Neighbour	5
Amazizi Maize Association member	6
Phuthumani community garden member	7
Other (**specify**)...	8

Box 2 **What type of knowledge do you get?**	
Role of lime in crop / vegetable production	1
Maize cultivars	2
How to grow cabbage	3
Planting date of maize	4
Control of stalk borer	5
Control of cutworm	6
Other (**specify**)...	7

28. Do you share your agricultural knowledge with anyone?

Yes	1
No	2

If yes (answer questions in Box 3 & 4) and if no, why not? ....

....

....

Box 3	If yes, with whom?
Neighbour	1
Family	2
Friend	3
Other (**specify**)	4

Box 4	How do you share knowledge?
Conversations	1
Show or visit Cedara trials	2
Show own crops	3
Other (**specify**)	4

29. What is your vision (future) for agriculture in Obonjaneni? ....

....

....

....

30. Are you aware of the "Nqolobane" notice board that was erected at the community hall?

Yes	1
No	2

31. Do the following agricultural constraints affect you or your household? **(READ THE DIFFERENT CONSTRAINTS AND INDICATE WITH A ✓)**

Redwater	1	Weeds	11
Theft – livestock	2	Cattle and goats getting into fields	12
Poor feeding of cows and calves	3	Storage of grain	13
Mastitis	4	Cutworms	14
Winter shortage of feed - animals thin	5	Quality of maize grain unsatisfactory	15
Worms in livestock	6	Lack of maize knowledge	16
Mortalities of animals due to disease	7	Lack of potato knowledge	17
Goats do not get fat	8	Litter problems - kill animals	18
Lack of knowledge in vegetables	9	Marketing of broilers	19
Low maize yields	10	**Other (specify)**	20

32. Do you feel these constraints are being addressed by the Cedara and Bergville District Extension staff work programme in Obonjaneni?

Yes	1
No	2

33. Which constraints are not being addressed by the Cedara and Bergville District Extension staff? **(READ THE DIFFERENT CONSTRAINTS AND INDICATE WITH A ✓)**

Redwater	1	Weeds	11
Theft – livestock	2	Cattle and goats getting into fields	12
Poor feeding of cows and calves	3	Storage of grain	13
Mastitis	4	Cutworms	14
Winter shortage of feed - animals thin	5	Quality of maize grain unsatisfactory	15
Worms in livestock	6	Lack of maize knowledge	16
Mortalities of animals due to disease	7	Lack of potato knowledge	17
Goats do not get fat	8	Litter problems - kill animals	18
Lack of knowledge in vegetables	9	Marketing of broilers	19
Low maize yields	10	**Other (specify)**	20

34. Did any children of your household attend the farmers' field days?

Yes	1
No	2

If yes, did they bring agricultural information/knowledge back home?

Yes	1
No	2

If yes, indicate what type of information **(DO NOT READ OUT - RESPONDENT TO RECALL)**:

Importance of soil samples	1	Maize planting date	5
Role of lime in crop production	2	Cabbage production	6
Maize cultivars	3	Production of sweet potatoes	7
Vegetable soyas	4	Planting without ploughing	8
Other (specify)			9

35. Do you apply the knowledge the children bring home?

Yes	1
No	2

If no, why not ....

36. How often do you see the people from Cedara?

Never	1
Once a week	2
Once every two weeks	3
Once a month	4
Other (**specify**)	5

37. How often do you want to see Cedara people in Obonjaneni?

Once a week	1
Once every two weeks	2
Once a month	3
Other (**specify**)	4

38. Mention the activities that you are aware of that people from Cedara are involved with in Obonjaneni? **(DO NOT READ OUT - RESPONDENT TO RECALL)**

Activities in Obonjaneni	**Yes**
Livestock meeting	1
Fencing of grazing camps in mountain	2
Maize, cultivar, lime trials	3
Maize planting date trials	4
Dry beans, cultivar, lime trials	5
Vegetable soyas	6
Potato cultivar trials	7
Cabbage trials	8
Tomato trials	9
Family Drip Irrigation System	10
Seedling nursery	11
Other (**Specify**)	12

39. What knowledge did you gain from Cedara people and Bergville District Extension staff? **(USE MAIN HEADINGS ONLY, DO NOT READ OUT POSSIBLE ANSWERS - RESPONDENT TO RECALL)**

Crop production	
Importance of soil samples	1
Value of lime	2
Maize cultivars	3
Planting date	4
Other **(specify)**	5
Livestock / Veld	
Supplement during winter	1
Other **(specify)**..	2
Vegetable production	
How to grow cabbages	1
Value of lime	2
Other **(specify)**	3

40. Do you want the people from Cedara to continue to be involved in Obonjaneni?

Yes	1
No	2

Why do you say so?

....

....

41. What was your maize yield for the following two periods (any measurement, but the same for the two periods)?

	Maize yield (farmers measurement)
Before Cedara and Bergville District Extension staff started in Obonjaneni **(not planted = 0)**	
2002 season	

THANK YOU FOR YOUR TIME

APPENDIX C

**KWAZULU-NATAL DEPARTMENT OF AGRICULTURE
AND ENVIRONMENTAL AFFAIRS**

Farming Systems Research Section

Questionnaire for

**Bergville Extension District staff
(District Head, Head of Extension & Agricultural Development Technicians)**

on their

involvement or knowledge on the on-farm demand-driven approach to technology development and transfer initiative in the Obonjaneni community

Date of interview: ....

1) For how long have you been an Agricultural Development Technician (ADT) in your ward?

	Years

2) How many years of service do you have in the Department?

	Years

3) What is the size of your ward?

Sub-wards (no)	
No of households	
Hectares	

4) How do you see the current role/function of Farming Systems Research Section staff in an Extension District?

....

....

....

5) What are your future expectations of the FSR Section in the Department (future role and functions)?

....

....

....

6) Would it be to your advantage to be involved with Farming Systems Research activities in your ward?

Yes	
No	

Why do you say so?

....

....

7) What do you see is the strengths of the involvement of the FSR Section programme for the communities in the District?

Identify constraints	
Run on-farm trials to address constraints	
Hold farmers' days	
Knowledge gain from involvement	
Personal contact with farmers	
None	
Other **(specify)**	

8) Which of the following aspects of the involvement of FSR Section in Obonjaneni / District do you see as advantages to your work?

Knowledge I gained from the involvement	
Assistance in extension programme	
Improved contact with the community	
Build confidence of ADT	
Contact with Technology Development - Cedara	
Take soil samples to Cedara	
None	
Other **(specify)**	

9) Which of the following aspects of the involvement of FSR Section in Obonjaneni / District do you see as disadvantages to your work?

Gained no knowledge	
Regular contact with farmers - time demand	
Irrelevant programme	
Interfere with own programme	
Not sure what is expected from ADT	
Roles of different partners not clearly defined	
None	
Other **(specify)**	

10) Mention the five most important agricultural constraints that small-scale farmers in your ward are experiencing:

Redwater		Weeds	
Theft – livestock		Cattle and goats getting into fields	
Poor feeding of cows and calves		Storage of grain	
Mastitis		Cutworms	
Winter shortage of feed - animals thin		Quality of maize grain unsatisfactory	
Worms in livestock		Lack of maize knowledge	
Mortalities of animals due to disease		Lack of potato knowledge	
Goats do not get fat		Litter problems - kill animals	
Lack of knowledge in vegetables		Marketing of broilers	
Low maize yields		Capital for production inputs	
Other **(specify)**			

11) Mention the names of any group or NGO that is active in your ward with agricultural activities

		With which one do you cooperate
Agrelek		
ARC		
LIMA		
Other **(specify)**		

12) Do you see a future for the Farming Systems Research approach followed in Obonjaneni in our Department?

Yes	
No	

Why do you say so?

....

....

13) Would you like to use this approach in your ward?

Yes	
No	

Why do you say so?

....

....

14) Would you like assistance from FSR Section to launch / start similar type of programme in your ward?

Yes	
No	

15) Are farmers in your ward / other subwards aware of the FSR Section programme followed in Obonjaneni?

Yes	
No	

If yes, How?

....

....

What do they know?

....

....

16) Did you attend any farmers' field days in Obonjaneni over the last 4 years?

Yes	
No	

If no, why not?

....

....

If yes, indicate the number of farmers' field days attended?

....

17) Do you use the information gained at the farmers' field days in your work and contact with farmers'?

Yes	
No	

Explain how and for which enterprise ....

18) Do you see more people moving into your ward?

Yes	
No	

If yes; Where do they come from?

....

What is the reason for the move?

....

19) How do you serve and reach small-scale farmers?

Maize Associations	
Livestock Associations	
Individuals – on request	
Irrigation schemes	
Broiler groups	
Community Garden Members	
Individual visits to farmers	
Study groups	
PWP demonstration	
Other **(specify)**	

20) Which of the following types of agricultural projects do you run in your ward?

		Number of projects
Community gardens		
Broiler houses		
Piggeries		
Irrigation schemes		
PWP		
On-farm demonstrations		
Other **(specify)**		

21) Since the involvement of FSR Section in the District, how did it affect your work and service delivery?

Worse	
Same	
Better	
Much better	

Why do you say so?

....

....

22) What is your vision (future) for agriculture in the your ward / district?

....

....

23) Of which of the following subjects did you gain knowledge through the FSR Section programme followed in Obonjaneni?

Crop production	
Importance of soil samples	
Value of lime	
Maize cultivars	
Planting date	
Other (**specify**)	
Livestock / Veld	
Supplement during winter	
Other (**specify**)	
Vegetable production	
How to grow cabbages	
Value of lime	
Approach	
Farming systems approach	
Other (**specify**)	
None	

24) Do you want the people from Cedara to continue to be involved in the Bergville District?

Yes	
No	

Why do you say so?

....

25) FSR Section only works in one sub-ward in the District, how you do feel about this?

....

....

26) The credibility of an ADT in a community could be improved by using the Farming Systems Approach (research - farmer - extension)

Yes	
No	

Why do you say so?

....

....

27) How can Technology Development assist you in your work?

....

....

....

28) General comments

....

....

....

THANK YOU FOR YOUR TIME