TOWARDS IMPROVED LIVESTOCK PRODUCTION OFF SWEET GRASSVELD

VOLUME 2

JOCK ERIC DANCKWERTS

Submitted in partial fulfilment of the requirements for the degree of

DOCTOR OF PHILOSOPHY

in the Department of Grassland Science
Faculty of Agriculture
University of Natal
Pietermaritzburg

December 1984

TABLE OF CONTENTS

VOLUME 2

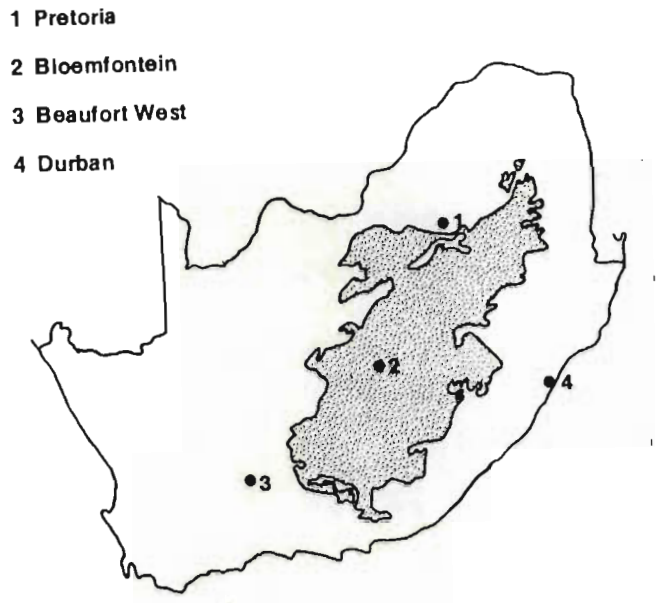

Figure 1.1 *Estimated extent of grassland in South Africa in the year 1400 (after Acocks, 1953).*

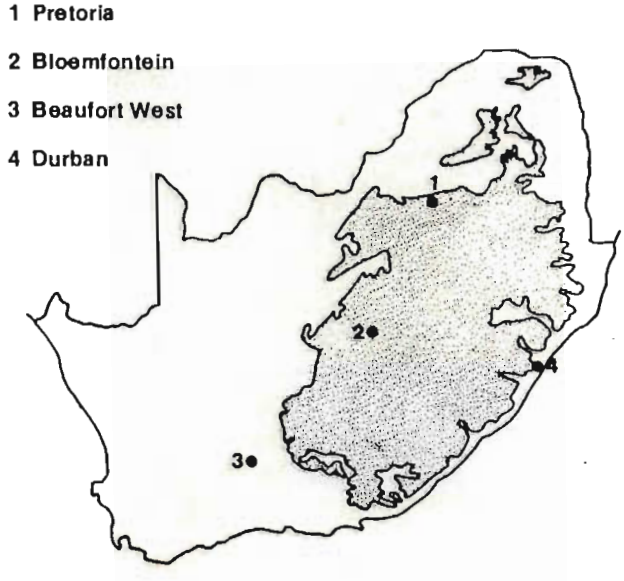

Figure 1.2 *The potential extent of the grassland formation in South Africa (after Acocks, 1953).*

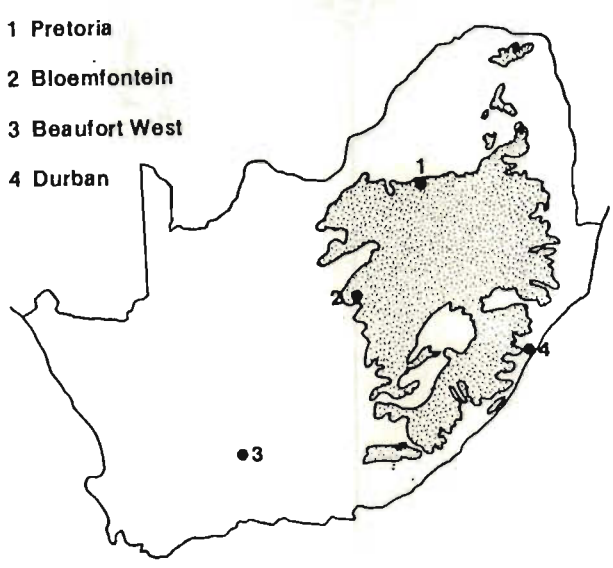

Figure 1.3 *The present extent of grassland in South Africa (after Acocks, 1953).*

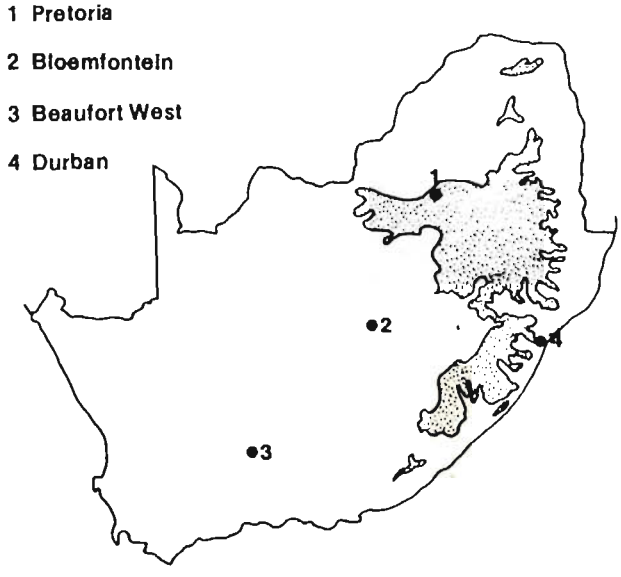

Figure 1.4 *Anticipated extent of grassland in South Africa in the year 2050 with continued mismanagement (after Acocks, 1953).*

TABLE 2.1

Mean percentage compositions (%) and coefficients of variation (CV) of consecutive daily recordings of composition during each period of occupation at Adelaide and percentage composition (%) of the experimental site at Kroomie.

Species	Adelaide								Kroomie
	Plot 1		Plot 2		Plot 3		Plot 4		
	%	CV	%	CV	%	CV	%	CV	%
Aristida barbicollis	0,1	137	0,2	169	0,7	31	0,8	50	
Cynodon dactylon	1,0	11	1,0	25	1,3	23	0,3	56	1,0
Cymbopogon plurinodis	26,8	5	27,8	7	30,1	8	13,3	8	
Digitaria eriantha	20,2	6	16,6	5	17,6	9	14,5	9	18,0
Eragrostis chloromelas	0,9	26	2,2	14	1,0	33	1,0	43	7,0
Eragrostis curvula	0,5	51	0,2	185	0,5	29	0,1	151	
Eragrostis obtusa	12,3	6	9,8	14	8,7	14	12,9	8	1,0
Eustachys mutica	0,1	137	0,2	71	0,2	65			
Heteropogon contortus					0,2	130			2,6
Karoochloa curva	0,2	20	0,2	138	0,1	129	0,1	160	
Microchloa caffra	1,0	47	0,2	141	0,5	42	0,7	26	2,2
Panicum maximum							0,2	94	
Panicum stapfianum	12,9	9	10,2	10	9,9	19	34,5	5	0,2
Setaria neglecta	0,6	29			0,5	50	0,2	144	
Sporobolus africanus									0,2
Sporobolus fimbriatus	14,6	9	21,4	9	18,4	7	10,4	10	7,2
Sporobolus nitens	0,3	40			0,4	62	2,0	38	
Themeda triandra	4,3	19	4,4	14	5,3	16	4,7	16	57,8
Tragus racemosa			1,6	33	0,8	33	1,1	25	
Forbs	4,2	17	4,0	12	3,8	15	3,2	18	2,8

TABLE 2.2

Preference rating of the six most abundant species on each plot at Adelaide. Brackets indicate where there was little preference shown (less than 10% difference in relative utilisation) between species.

Preference rating	Season of grazing			
	Spring	Summer	Autumn	Winter
1	*Themeda triandra*	*Themeda triandra*	*Themeda triandra*	*Themeda triandra*
2	*Sporobolus fimbriatus*	*Sporobolus fimbriatus*	*Panicum stapfianum*	*Sporobolus fimbriatus*
3	*Panicum stapfianum*	*Panicum stapfianum*	*Sporobolus fimbriatus*	*Panicum stapfianum*
4	*Digitaria eriantha*	*Digitaria eriantha*	*Digitaria eriantha*	*Digitaria eriantha*
5	*Cymbopogon plurinodis*	*Eragrostis obtusa*	*Eragrostis obtusa*	*Eragrostis obtusa*
6	*Eragrostis obtusa*	*Cymbopogon plurinodis*	*Cymbopogon plurinodis*	*Cymbopogon plurinodis*

TABLE 2.3

Preference rating of the marked tufts of four most abundant species during each period of occupation at Kroomie. Brackets indicate where there was little preference shown (less than 10% difference in relative utilisation) between species.

Preference rating	Period of occupation		
	1	2	3
1	*Sporobolus fimbriatus*	*Themeda triandra*	*Themeda triandra*
2	*Themeda triandra*	*Sporobolus fimbriatus*	*Sporobolus fimbriatus*
3	*Digitaria eriantha*	*Digitaria eriantha*	*Digitaria eriantha*
4	*Eragrostis chloromelas*	*Eragrostis chloromelas*	*Eragrostis chloromelas*

TABLE 2.4

Mean height (cm) of tallest leaves of six most abundant species at the beginning of periods of occupation at Adelaide.

Species	Season of grazing			
	Spring	Summer	Autumn	Winter
Cymbopogon plurinodis	39,7	35,9	45,7	39,4
Digitaria eriantha	11,6	12,5	22,5	11,8
Eragrostis obtusa	6,4	8,2	10,1	7,8
Panicum stapfianum	13,3	14,9	23,6	22,2
Sporobolus fimbriatus	15,8	16,8	32,3	20,4
Themeda triandra	15,3	18,3	33,8	25,3

TABLE 2.5

Mean height (cm) of tallest leaves of the marked tufts of the four most abundant species at the beginning of periods of occupation at Kroomie.

Species	Period of occupation		
	1	2	3
Digitatia eriantha	9,2	5,7	9,2
Eragrostis chloromelas	13,8	12,0	13,2
Sporobolus fimbriatus	9,6	5,0	6,9
Themeda triandra	12,3	9,0	13,8

TABLE 2.6

Herbage yields (g/cm²) of the five species clipped before and after each period of occupation, and the difference between the yields recorded before and after grazing (B-A) at Adelaide.

Species	Season of grazing	Before grazing	After grazing	(B-A)
Cymbopogon plurinodis	Spring	0,296	0,256	0,040 NS[1]
	Summer	0,331	0,322	0,009 NS
	Autumn	0,333	0,285	0,048 NS
	Winter	0,248	0,225	0,023 NS
Digitaria eriantha	Spring	0,079	0,031	0,048 NS
	Summer	0,104	0,051	0,053 NS
	Autumn	0,186	0,099	0,087*
	Winter	0,147	0,112	0,035 NS
Panicum stapfianum	Spring	0,140	0,091	0,049 NS
	Summer	0,217	0,081	0,136**
	Autumn	0,212	0,099	0,113**
	Winter	0,211	0,123	0,088*
Sporobolus fimbriatus	Spring	0,117	0,051	0,066 NS
	Summer	0,212	0,084	0,128**
	Autumn	0,316	0,138	0,178**
	Winter	0,249	0,111	0,138**
Themeda triandra	Spring	0,508	0,303	0,205**
	Summer	0,534	0,253	0,281**
	Autumn	0,603	0,225	0,378**
	Winter	0,612	0,214	0,398**

Standard error of a single observation: 0,170g/cm²

Standard error of a yield estimate in body of table: 0,031g/cm²

Least significant difference between two yield estimates: 0,086g/cm² (P=0,05)
0,113g/cm² (P=0,01)

Standard error of a difference between two yield estimates: 0,044g/cm²

Least significant difference between two differences: 0,121g/cm² (P=0,05)
0,0159g/cm² (P=0,01)

[1] * (P<0,05); ** (P<0,01); NS (difference not statistically significant).

TABLE 2.7

Herbage yields (g/cm²)of the four species clipped before and after each period of occupation, and the difference between the yields recorded before and after grazing (B-A) at Kroomie.

Species	Seasons of grazing	Before grazing	After grazing	(B-A)
Digitaria eriantha	Summer	0,082	0,068	0,014 NS[1]
	Autumn	0,175	0,174	0,001 NS
	Winter	0,171	0,203	-0,032 NS
Eragrostis chloromelas	Summer	0,191	0,178	0,013 NS
	Autumn	0,131	0,190	-0,059 NS
	Winter	0,279	0,169	0,110*
Sporobolus fimbriatus	Summer	0,177	0,203	-0,026 NS
	Autumn	0,183	0,176	0,007 NS
	Winter	0,265	0,129	0,136*
Themeda triandra	Summer	0,294	0,156	0,138*
	Autumn	0,309	0,279	0,030 NS
	Winter	0,359	0,176	0,183**

Standard error of a single observation: 0,216g/cm²
Standard error of a yield estimate in body of table: 0,040g/cm²
Least significant difference between two yield estimates: (P=0,05) 0,109g/cm²
(P=0,01) 0,145g/cm²

Standard error of a difference between two yield estimates: 0,056g/cm²
Least significant difference between two differences: (P=0,05) 0,155
(P=0,01) 0,204

[1]* (P<0,05); ** (P<0,01); NS (difference not statistically significant).

Table 2.8

Ranking of species according to above ground yield per unit basal area clipped at the beginning of periods of occupation on veld in poor (Adelaide) and good (Kroomie) condition respectively. Brackets represent where differences between species were not statistically significant.

Site	Ranking	Season			
		Spring	Summer	Autumn	Winter
Adelaide	1	*Themeda triandra*	*Themeda triandra*	*Themeda triandra*	*Themeda triandra*
	2	*Cymbopogon plurinodis*	*Cymbopogon plurinodis*	*Cymbopogon plurinodis*	*Sporobolus fimbriatus*
	3	*Panicum stapfianum*	*Panicum stapfianum*	*Sporobolus fimbriatus*	*Cymbopogon plurinodis*
	4	*Sporobolus fimbriatus*	*Sporobolus fimbriatus*	*Panicum stapfianum*	*Panicum stapfianum*
	5	*Digitaria eriantha*	*Digitaria eriantha*	*Digitaria eriantha*	*Digitaria eriantha*
Kroomie	1		*Themeda triandra*	*Themeda triandra*	*Themeda triandra*
	2		*Eragrostis chloromelas*	*Sporobolus fimbriatus*	*Eragrostis chloromelas*
	3		*Sporobolus fimbriatus*	*Digitaria eriantha*	*Sporobolus fimbriatus*
	4		*Digitaria eriantha*	*Eragrostis chloromelas*	*Digitaria eriantha*

TABLE 2.9

*Ranking of species according to absolute amount of forage eaten per unit basal area during periods of occupation on veld in poor (Adelaide) and good (Kroomie) condition respectively. * Represents where amount eaten was not statistically significant relative to total tuft yield, and brackets represent where there was no significant difference in amount eaten between species.*

Site	Ranking	Season			
		Spring	Summer	Autumn	Winter
Adelaide	1	*Themeda triandra*	*Themeda triandra*	*Themeda triandra*	*Themeda triandra*
	2	*Sporobolus fimbriatus* *	*Panicum stapfianum*	*Sporobolus fimbriatus*	*Sporobolus fimbriatus*
	3	*Panicum stapfianum* *	*Sporobolus fimbriatus*	*Panicum stapfianum*	*Panicum stapfianum*
	4	*Digitaria eriantha* *	*Digitaria eriantha* *	*Digitaria eriantha*	*Digitaria eriantha* *
	5	*Cymbopogon plurinodis* *	*Cymbopogon plurinodis* *	*Cymbopogon plurinodis* *	*Cymbopogon plurinodis* *
Kroomie	1		*Themeda triandra*	*Themeda triandra* *	*Themeda triandra*
	2		*Sporobolus fimbriatus* *	*Sporobolus fimbriatus* *	*Sporobolus fimbriatus*
	3		*Digitaria eriantha* *	*Digitaria eriantha* *	*Eragrostis chloromelas*
	4		*Eragrostis chloromelas* *	*Eragrostis chloromelas* *	*Digitaria eriantha* *

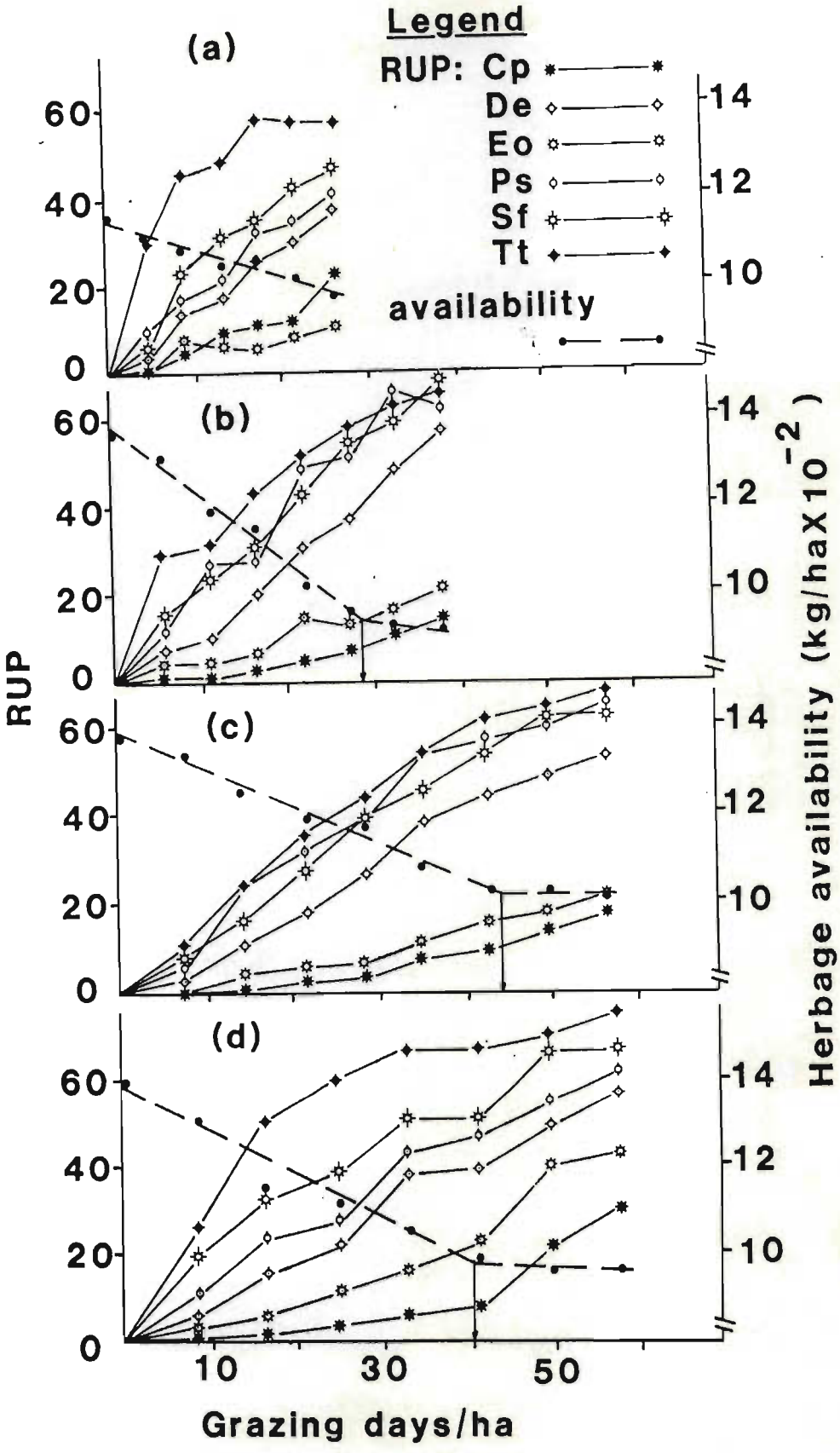

Figure 2.1 *Overall herbage availability and relative utilisation percentage (RUP) of the six most abundant grasses during periods of occupation on plots grazed during spring (a), summer (b), autumn (c), and winter (d) respectively at Adelaide. (Cp,* Cymbopogon plurinodis; *De,* Digitaria eriantha; *Eo,* Eragrostis obtusa; *Ps,* Panicum stapfianum; *Sf,* Sporobolus fimbriatus, *and Tt,* Themeda triandra)

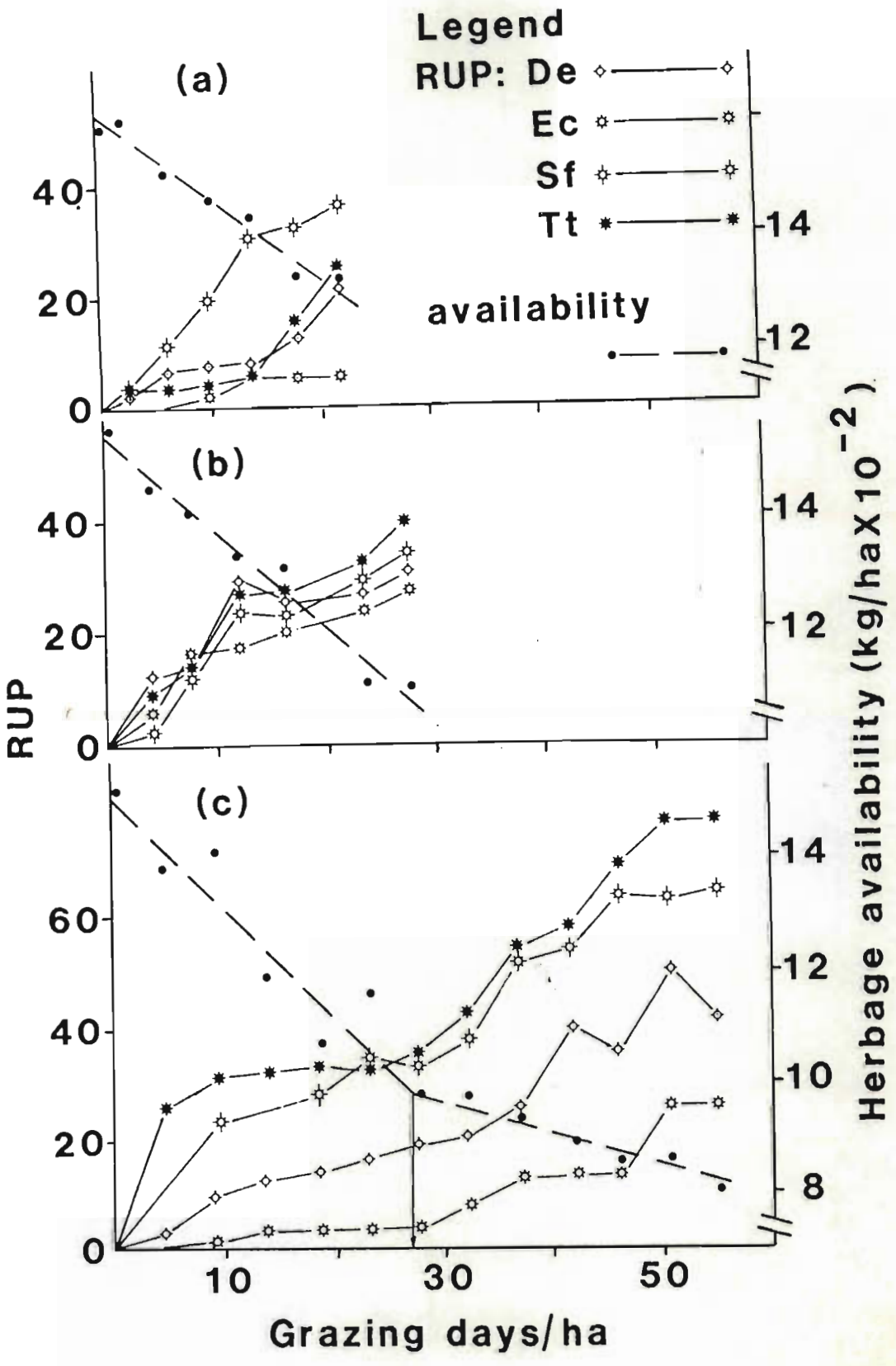

Figure 2.2 *Overall herbage availability and relative utilisation percentage (RUP) of the four most abundant grasses (De,* Digitaria eriantha; *Ec,* Eragrostis chloromelas; *Sf,* Sporobolus fimbriatus, *and Tt* Themeda triandra) *during the three consecutive (a, b & c) periods of occupation at Kroomie*

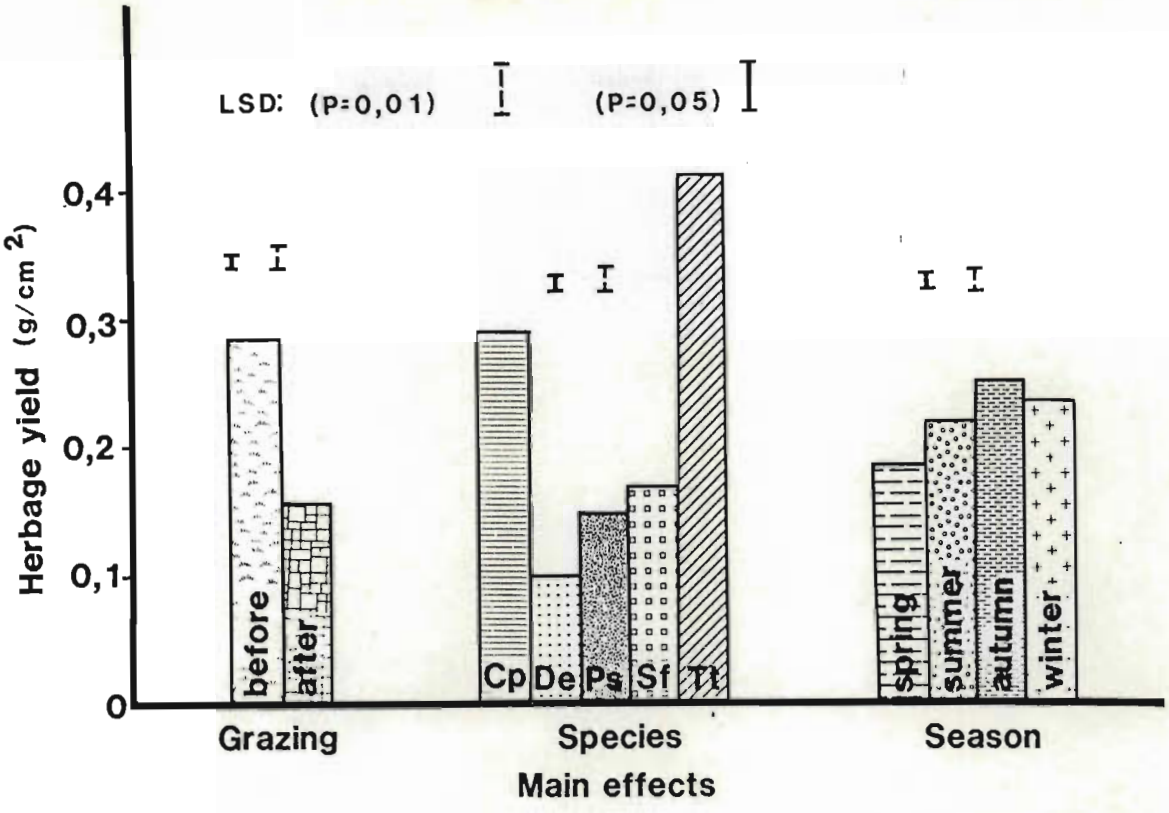

Figure 2.3 *Main effects of grazing, species and time of year, on herbage yield per cm² basal plant area at Adelaide. LSD represents least significant differences (g/cm²).* (*Cp,* Cymbopogon plurinodis; *De,* Digitaria eriantha; *Ps,* Panicum stapfianum; *Sf,* Sporobolus fimbriatus; *Tt,* Themeda triandra).

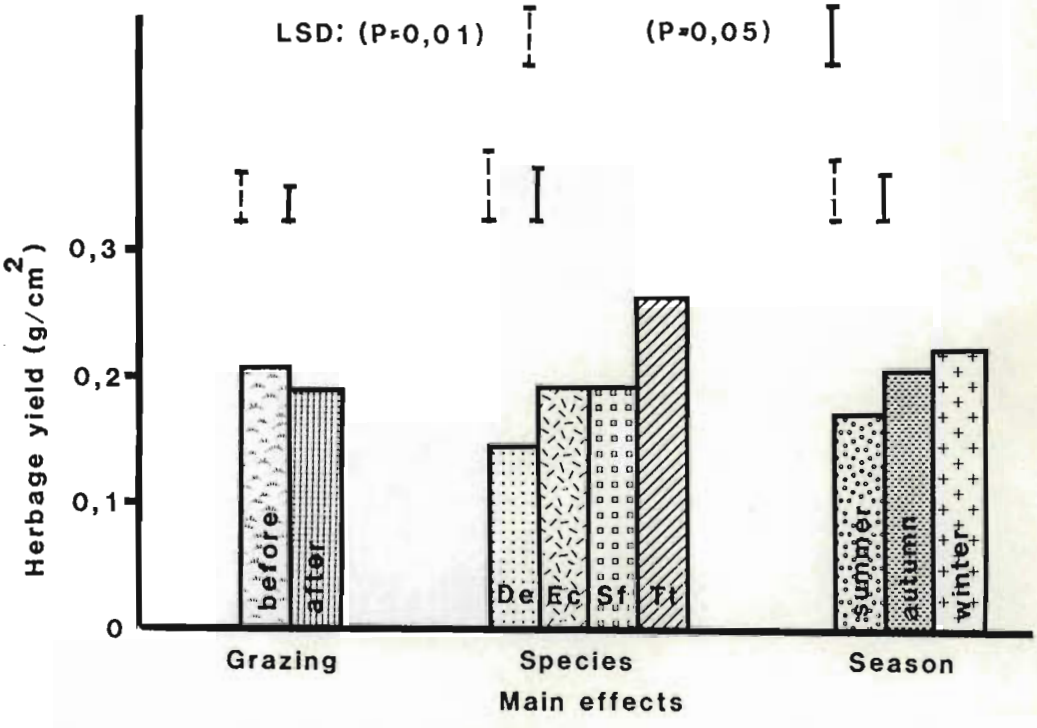

Figure 2.4 *Main effects of grazing , species and time of year on herbage yield per cm² basal plant area at Kroomie LSD represents least significant differences (g/cm²).* (*De,* Digitaria eriantha; *Ec,* Eragrostis chloromelas; *Sf,* Sporobolus africanus; *Tt,* Themeda triandra).

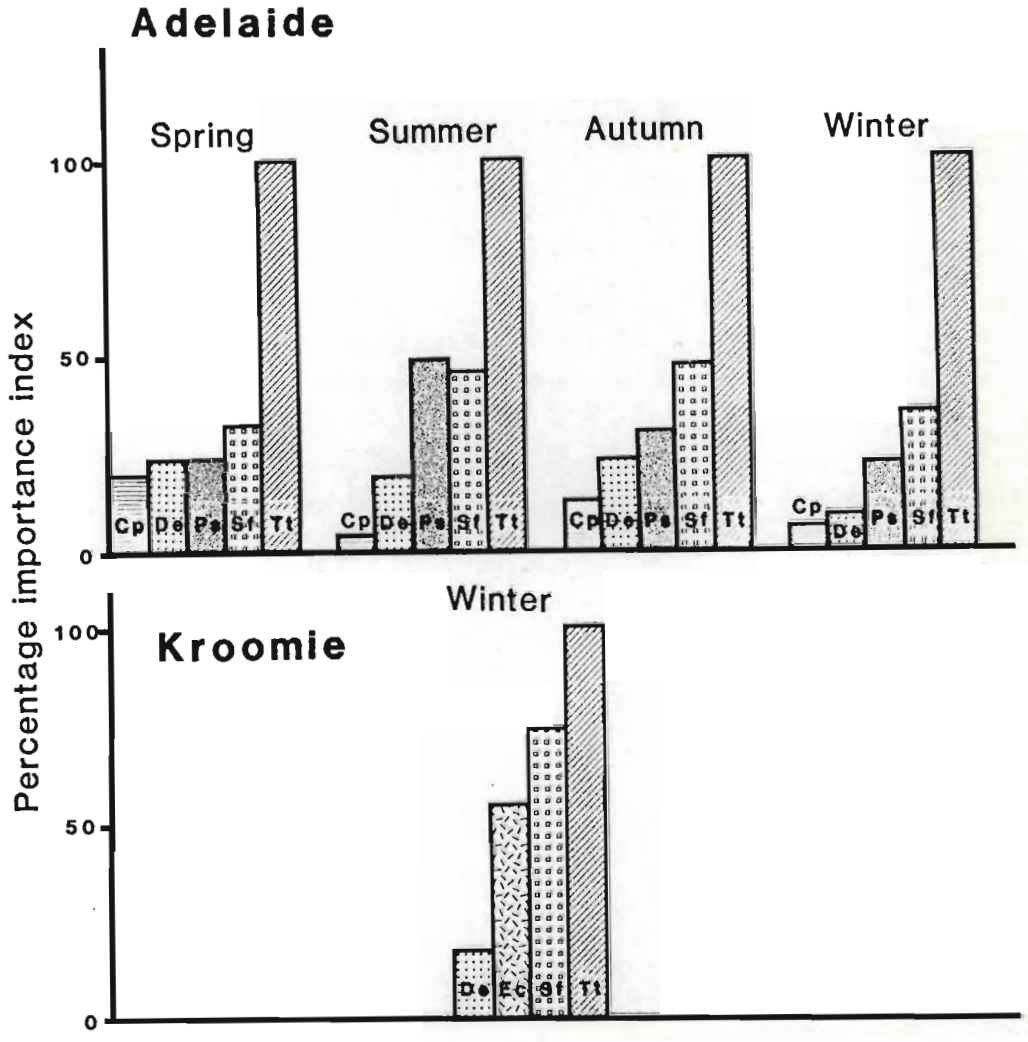

Figure 2.5 *Potential importance indices of commonly occurring species, expressed as percentages of the most important species during each period of occupation at Adelaide and during winter at Kroomie.* (*Cp,* Cymbopogon plurinodis; *De,* Digitaria eriantha; *Ec,* Eragrostis chloromelas; *Ps,* Panicum stapfianum; *Sf,* Sporobolus fimbriatus; *Tt,* Themeda triandra).

TABLE 3.1

Percentage of irrigated and non-irrigated Themeda triandra *and* Sporobolus fimbriatus *tillers initiated progressively during the 1980/81 season that flowered during spring* (Themeda triandra) *and autumn* (Sporobolus fimbriatus) *1981.*

Date of defoliation (tiller initiation)	Percentage of flowering tillers			
	Themeda triandra		Sporobolus fimbriatus	
	irrigated	non-irrigated	irrigated	non-irrigated
31 July 1981	100	100	60	54
30 September 1980	88	99	66	70
30 November 1980	94	48	37	26
31 January 1981	43	0	0	0
31 March 1981	0	0	0	0
30 May 1981	0	0	0	0

TABLE 3.2

Density of Themeda triandra *and* Sporobolus fimbriatus *roots* (g/m^3) *in the soil at increasing depths below the surface. Data presented as untransformed and log transformed values, and analysis of variance parameters presented for transformed data.*

	Species				Treatment means	
	T. triandra		*S. fimbriatus*			
Depth (cm)	Untransformed	Transformed	Untransformed	Transformed	Untransformed	Transformed
0-5	6090,6	8,70	5968,8	8,61	6029,7	8,65
5-10	1912,5	7,54	1528,1	7,18	1720,3	7,36
10-20	750,0	6,46	359,4	5,85	468,0	6,16
20-30	671,9	6,41	264,0	5,53	468,0	5,97
30-40	240,7	5,45	101,6	4,50	171,1	4,97
Treatment means	1933,1	6,91	1644,4	6,33	1788,75	6,62

Standard error of means:	(i) Species; 0,080 ln g/m^3 (ii) Soil depth; 0,127 ln g/m^3
Least significant differences between means:	(i) Species; 0,229 ln g/m^3 ($P<0,05$) 0,307 ln g/m^3 ($P<0,01$) (ii) Soil depth; 0,362 ln g/m^3 ($P<0,05$) 0,485 ln g/m^3 ($P<0,01$)
Largest differences between means:	(i) Species 0,58 ln g/m^3 (ii) Soil depth 3,97 ln g/m^3
Standard error in body of table:	0,179 ln g/m^3
Least significant differences body of table:	0,513 ln g/m^3 ($P<0,05$) 0,725 ln g/m^3 ($P<0,01$)
Largest difference in body of table:	0,95 ln g/m^3
Least significant differences between two differences in body of table:	0,686 ln g/m^3 ($P=0,05$) 0,970 ln g/m^3 ($P<0,01$)
Coefficient of variation:	5,42%

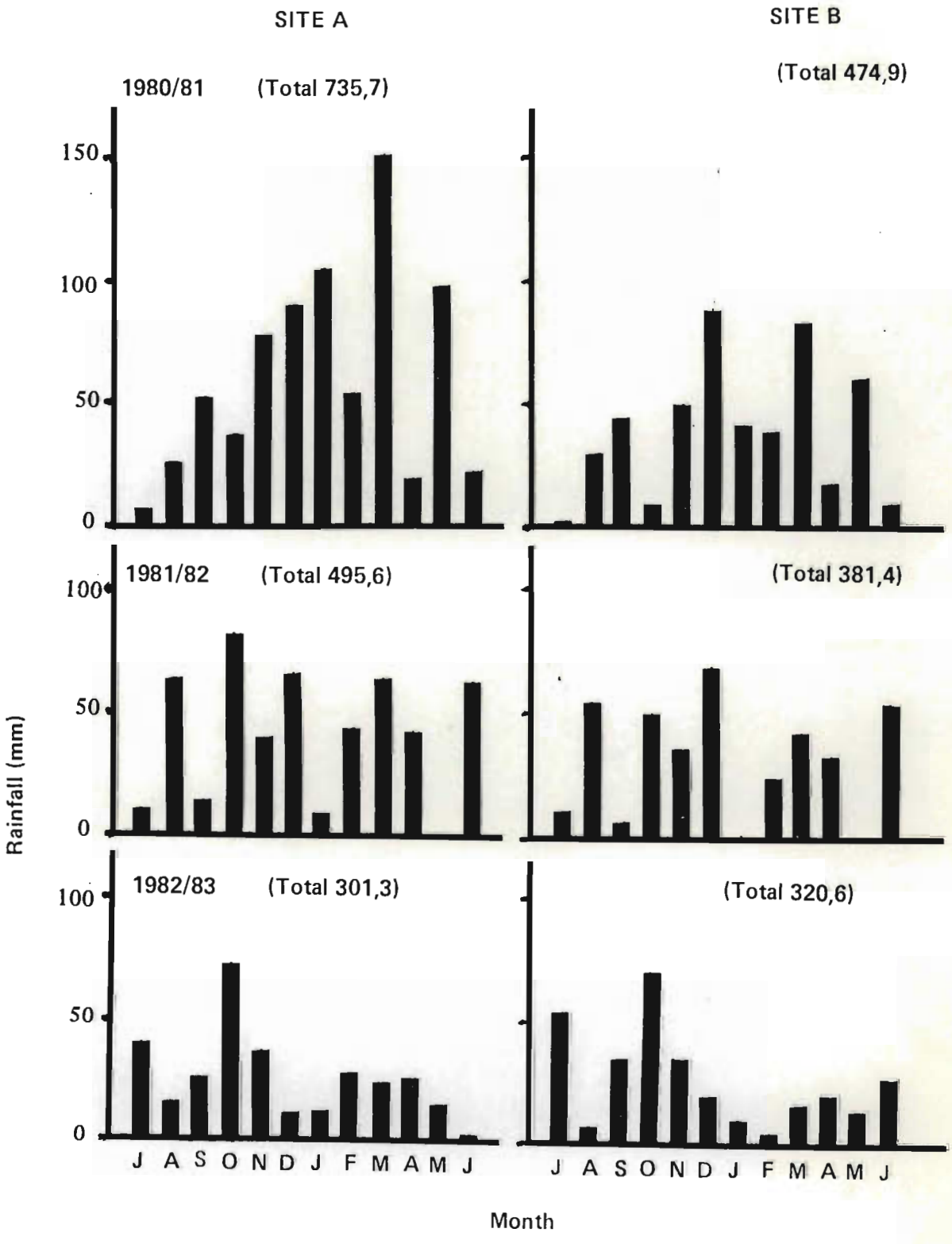

Figure 3.1 *Rainfall recorded at experimental sites from July 1980 to June 1983.*

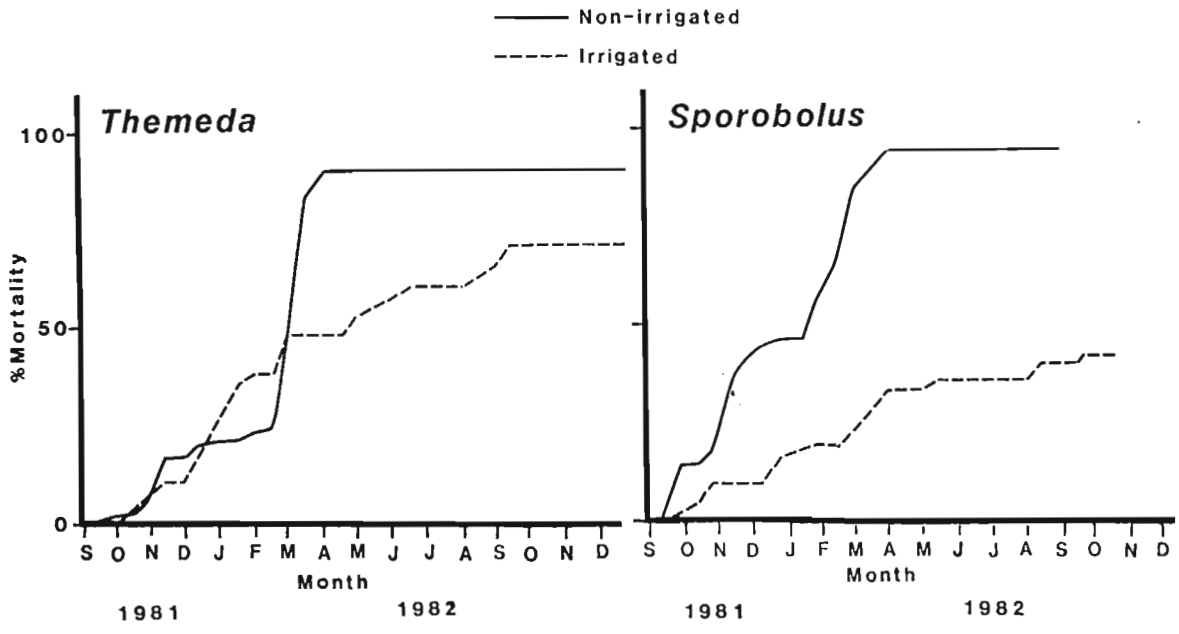

Figure 3.2 *Cumulative percentage of irrigated and non-irrigated* Themeda triandra *and* Sporobolus fimbriatus *tillers initiated in spring 1981 that senesced prematurely (experiment 3).*

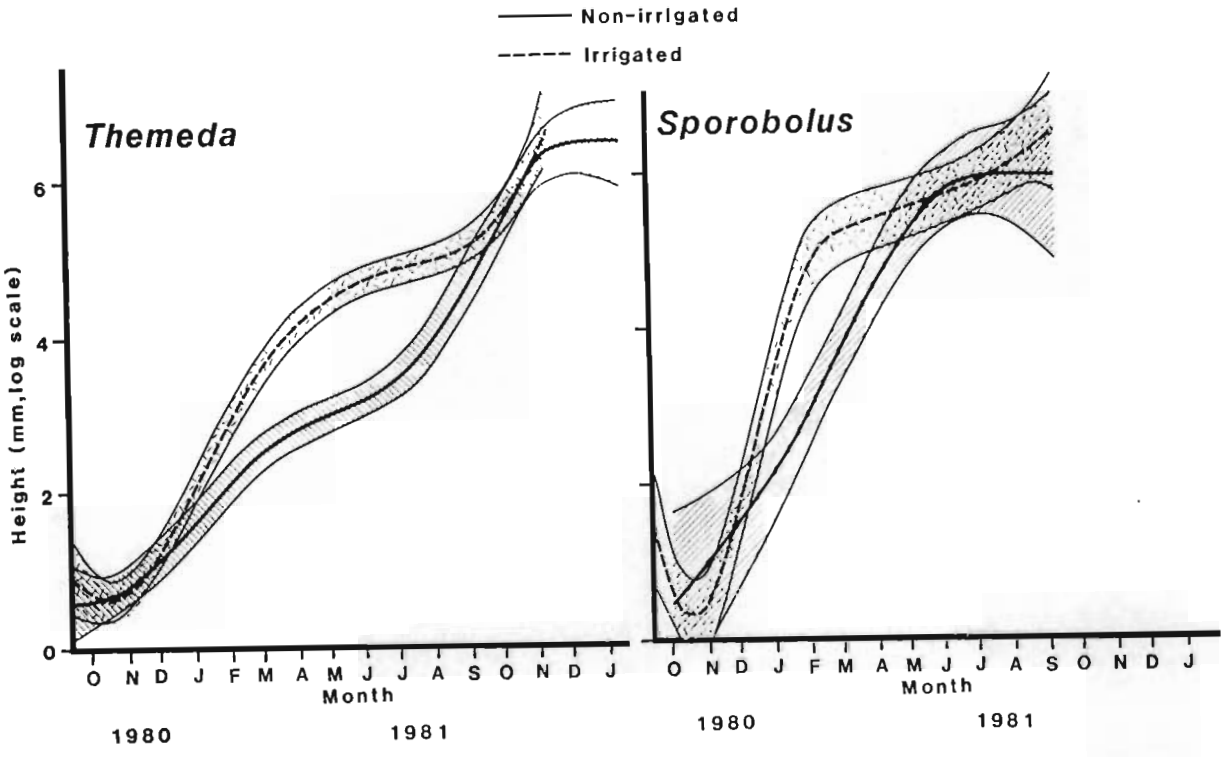

Figure 3.3 *Mean height (log scale) of shoot apices of irrigated and non-irrigated* Themeda triandra *and* Sporobolus fimbriatus *tillers initiated in spring 1980 (experiment 1). Shaded areas represent 95 °/o confidence intervals.*

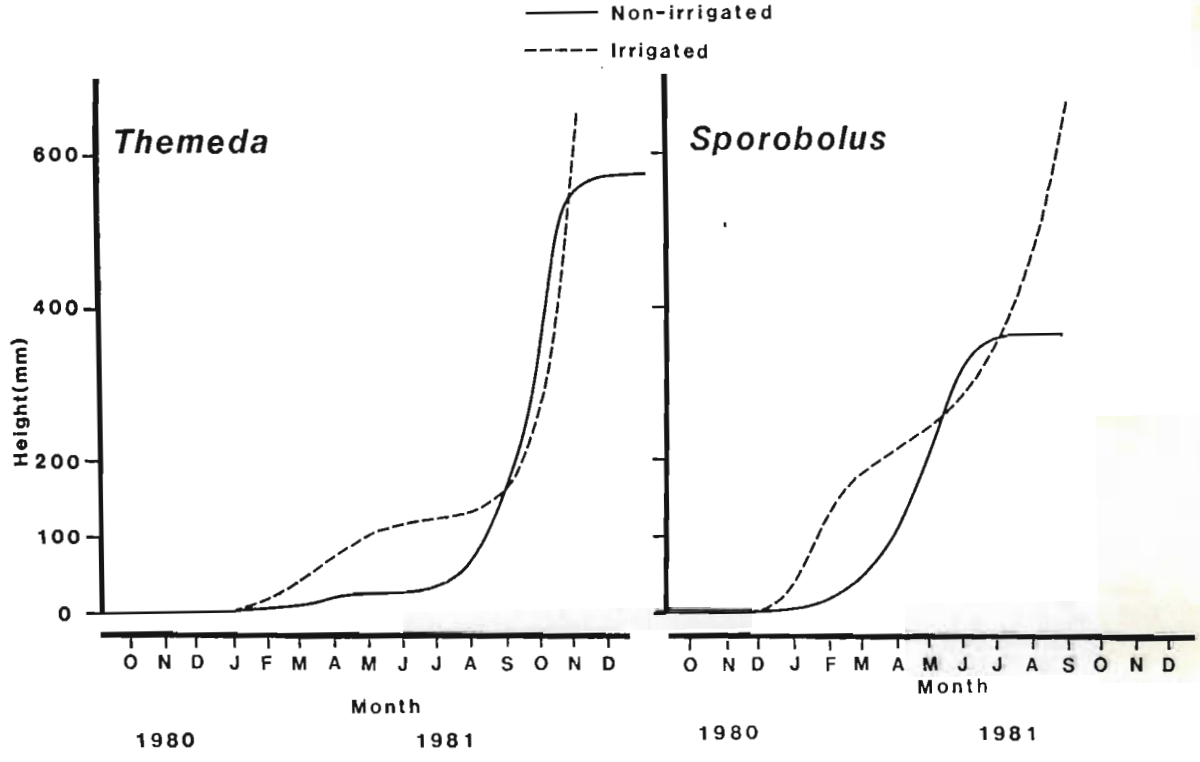

Figure 3.4 *Mean height (arithmetic scale) of shoot apices of irrigated and non-irrigated* Themeda triandra *and* Sporobolus fimbriatus *tillers initiated in spring 1980. (experiment 1).*

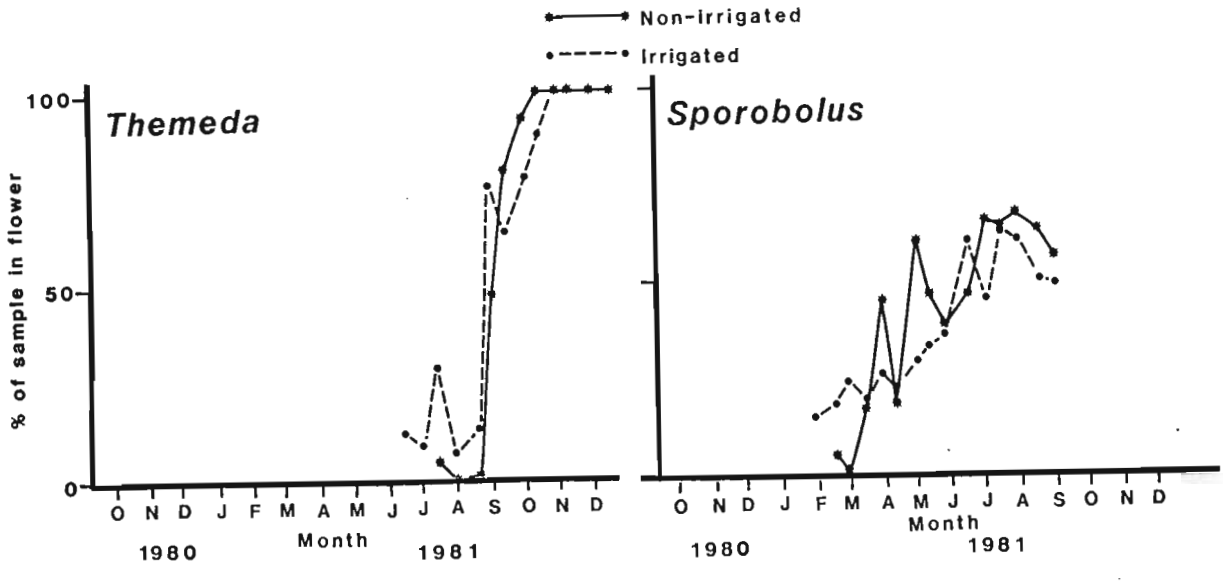

Figure 3.5 *Percentage of sequential samples of irrigated and non-irrigated* Themeda triandra *and* Sporobolus fimbriatus *tillers initiated in spring 1980 with flowering culms (experiment 1).*

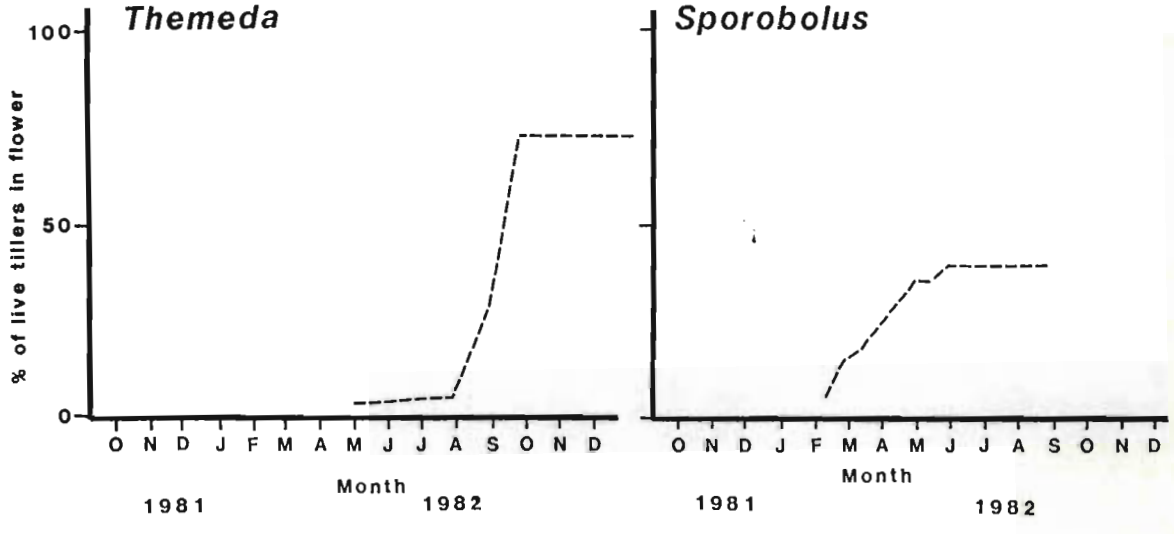

Figure 3.6 *Percentage of permanently marked irrigated* Themeda triandra *and* Sporobolus fimbriatus *tillers initiated during spring 1981 that flowered as time progressed (experiment 3).*

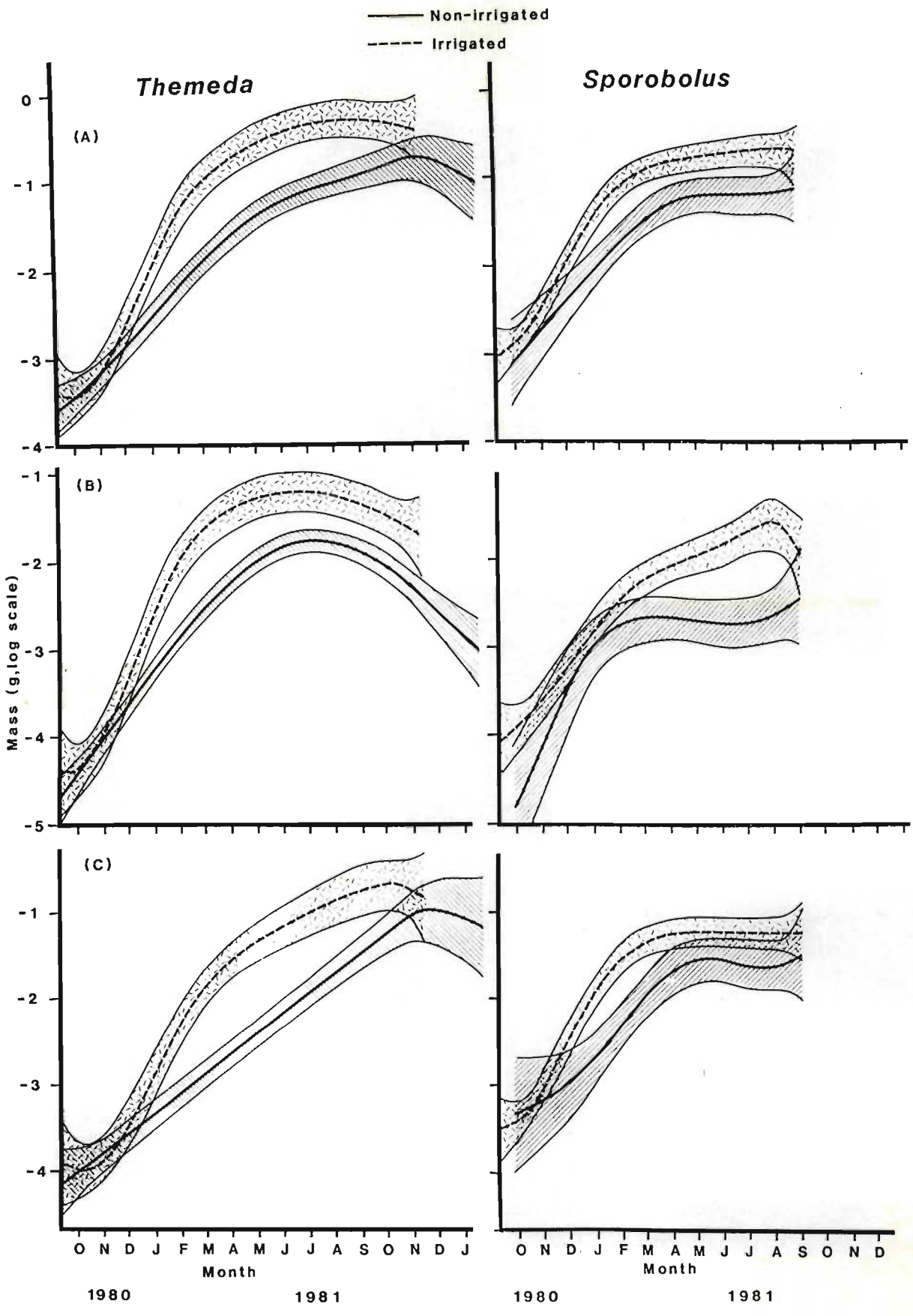

Figure 3.7 *Total tiller mass (A), leaf mass (B) and stem mass (C) (log scale) of irrigated and non-irrigated* Themeda triandra *and* Sporobolus fimbriatus *tillers initiated during spring 1980 (experiment 1). Shaded areas represent 95 % confidence intervals.*

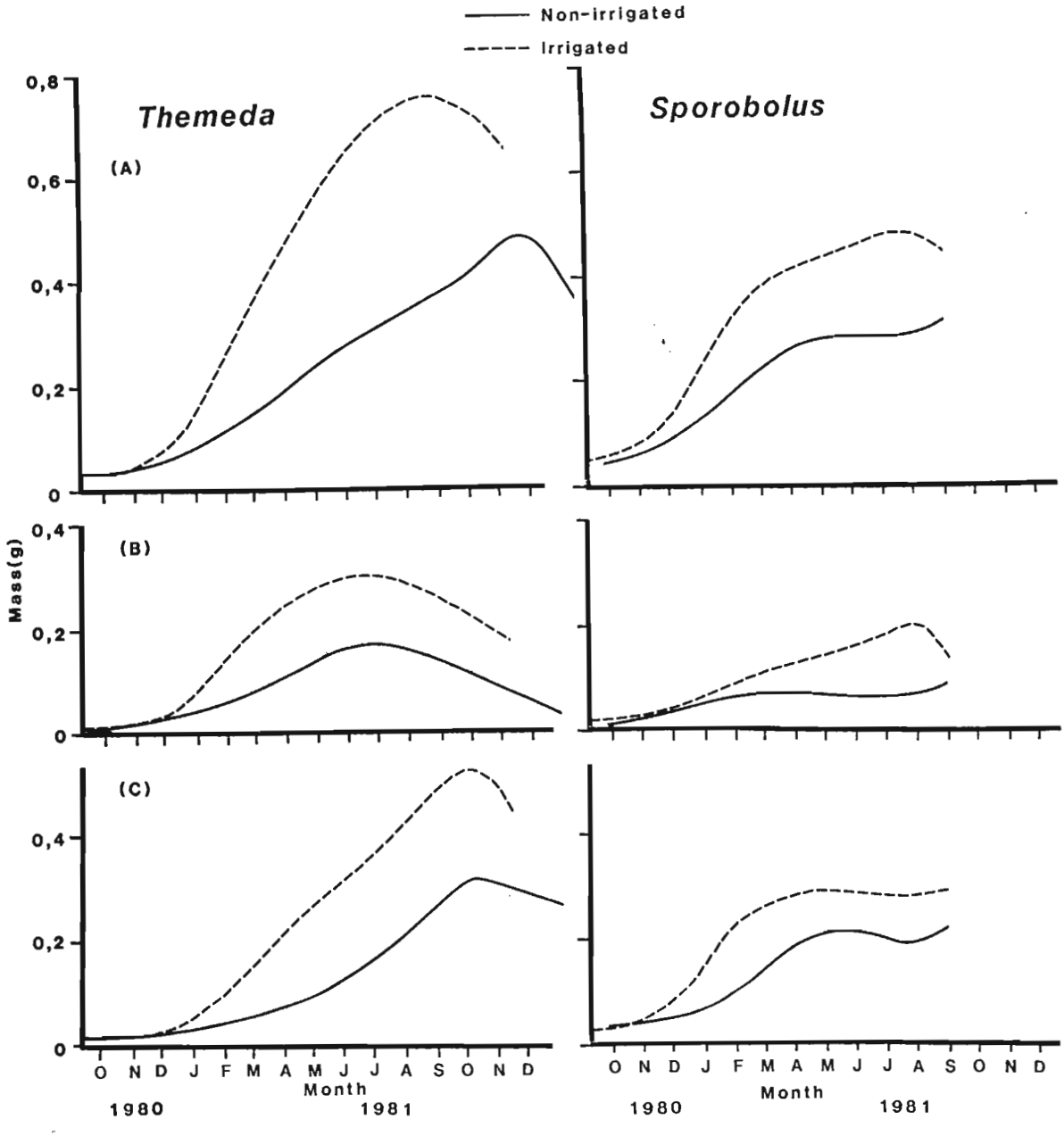

Figure 3.8 *Total tiller mass (A), leaf mass (B) and stem mass (C) (arithmetic scale) of irrigated and non-irrigated* Themeda triandra *and* Sporobolus fimbriatus *tillers initiated during spring 1980 (experiment 1).*

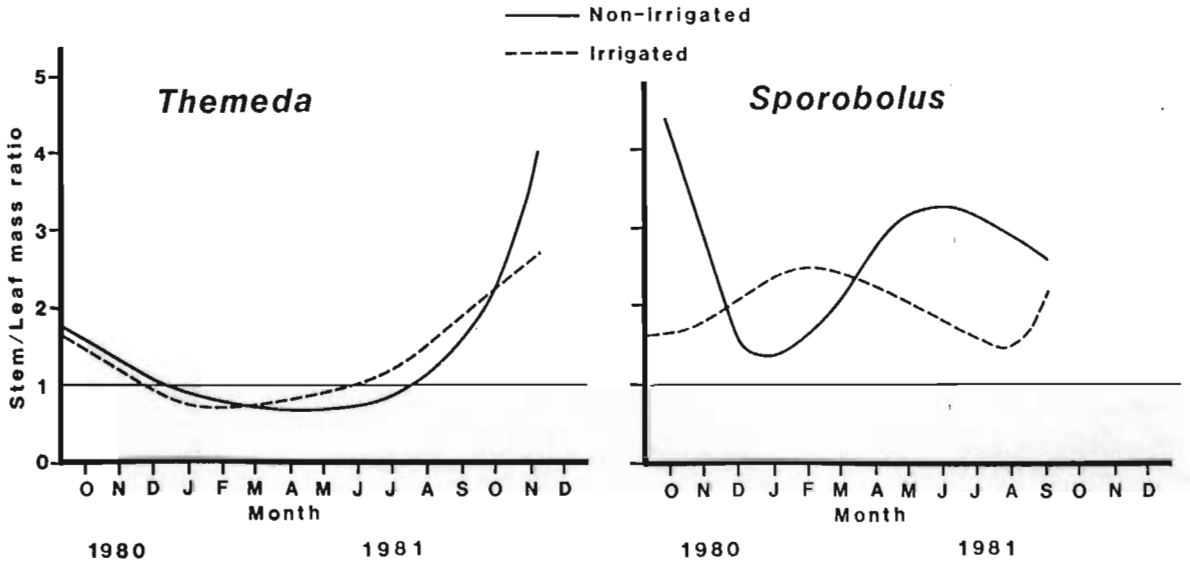

Figure 3.9 *Stem mass: leaf mass ratios of irrigated and non-irrigated* Themeda triandra *and* Sporobolus fimbriatus *tillers initiated in spring 1980 (experiment 1).*

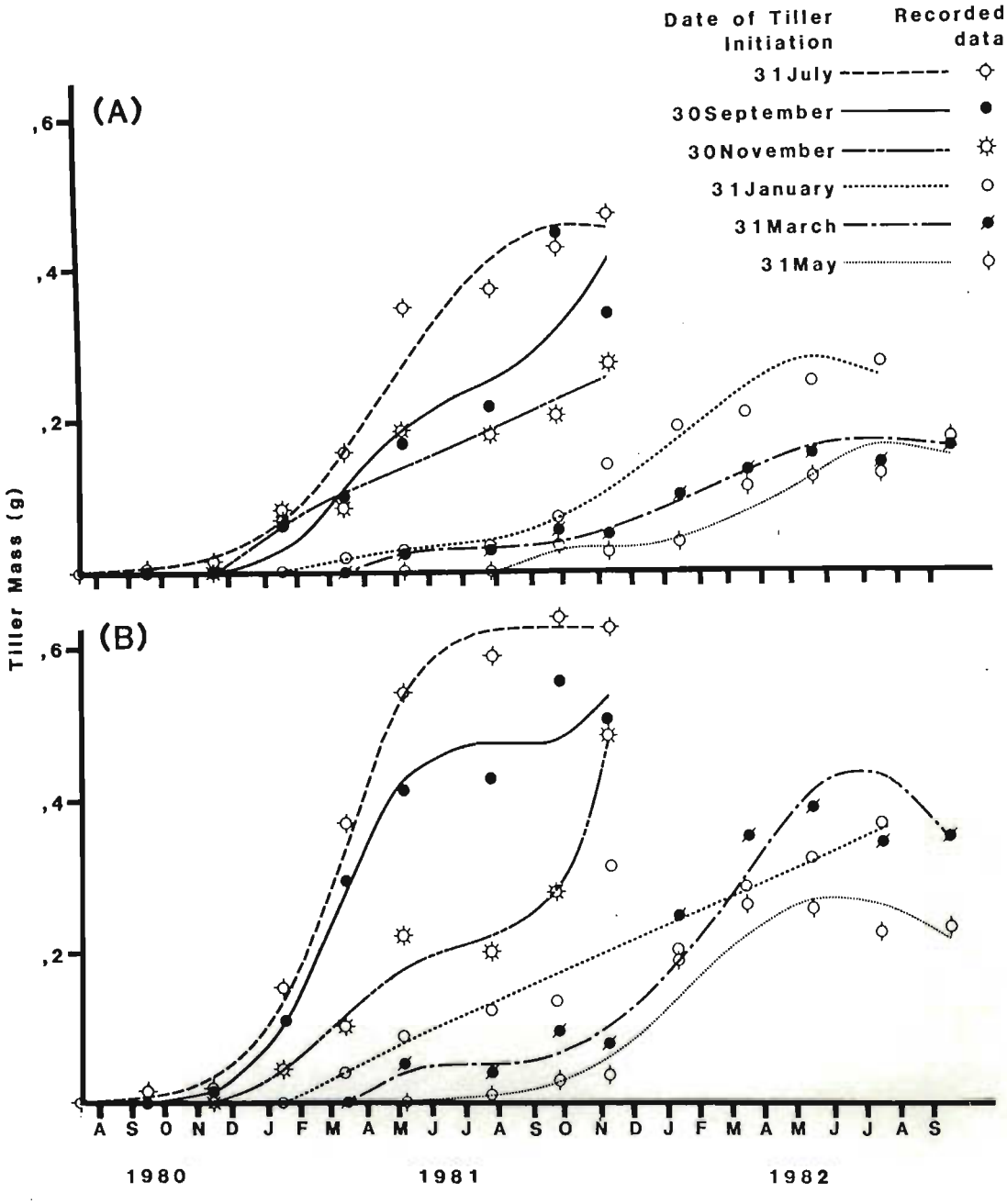

Figure 3.10 *Individual tiller mass of populations of non-irrigated (A) and irrigated (B)* Themeda triandra *tillers initiated progressively during the 1980/81 season (experiment 2). Symbols represent recorded mean tiller mass.*

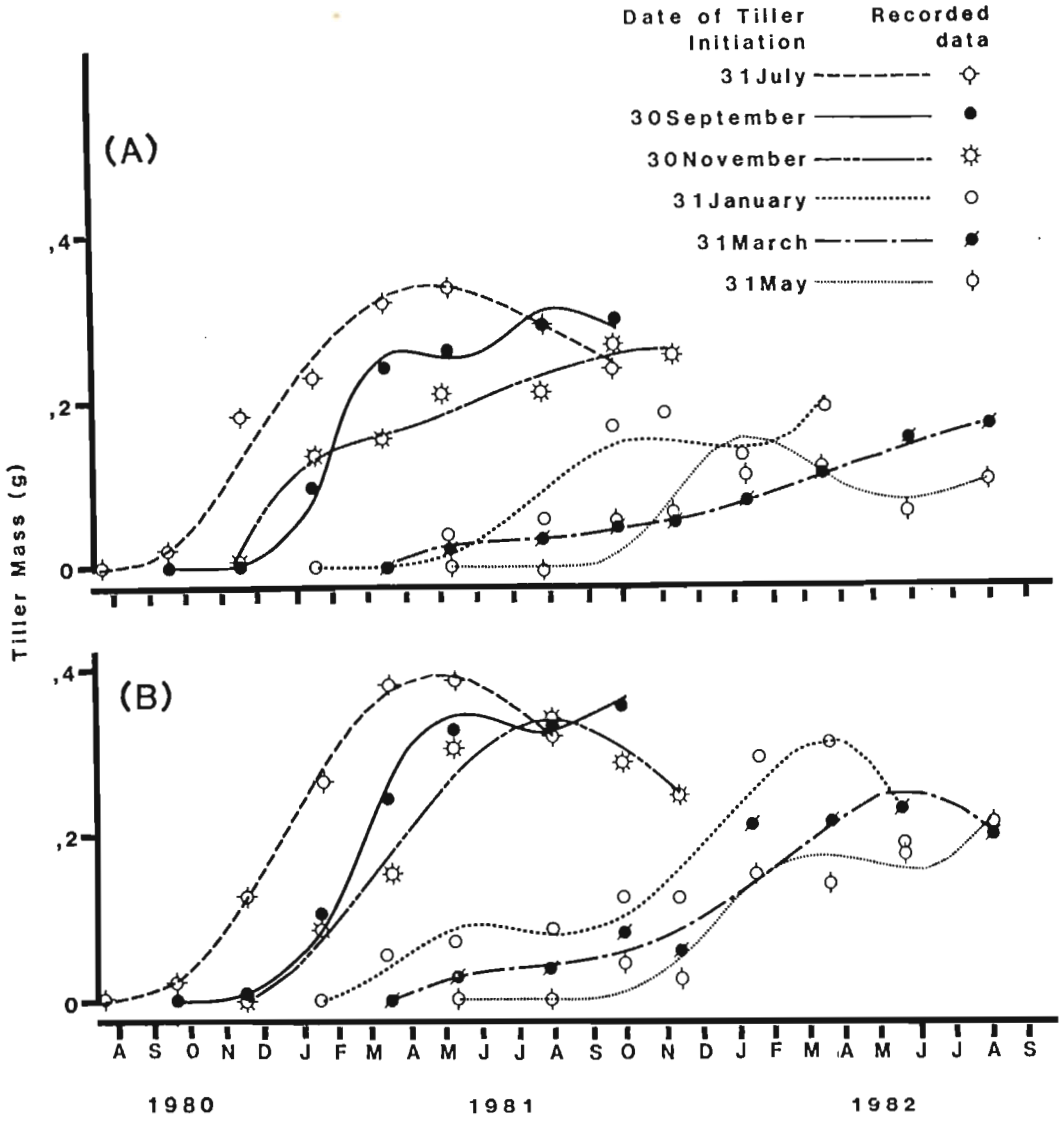

Figure 3.11 *Individual tiller mass of populations of non-irrigated (A) and irrigated (B)* Sporobolus fimbriatus *tillers initiated progressively during the 1980/81 season (experiment 2). Symbols represent recorded mean tiller mass.*

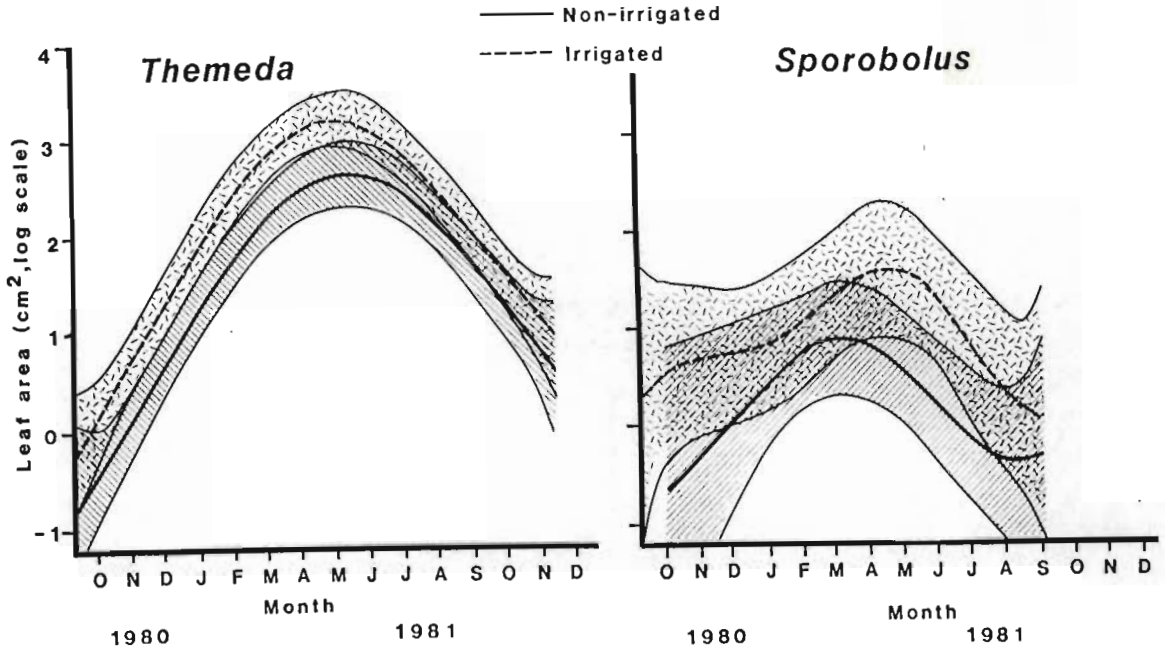

Figure 3.12 *Green leaf area (log scale) of irrigated and non-irrigated* Themeda triandra *and* Sporobolus fimbriatus *tillers initiated in spring 1980 (experiment 1). Shaded areas represent 95 °/o confidence intervals.*

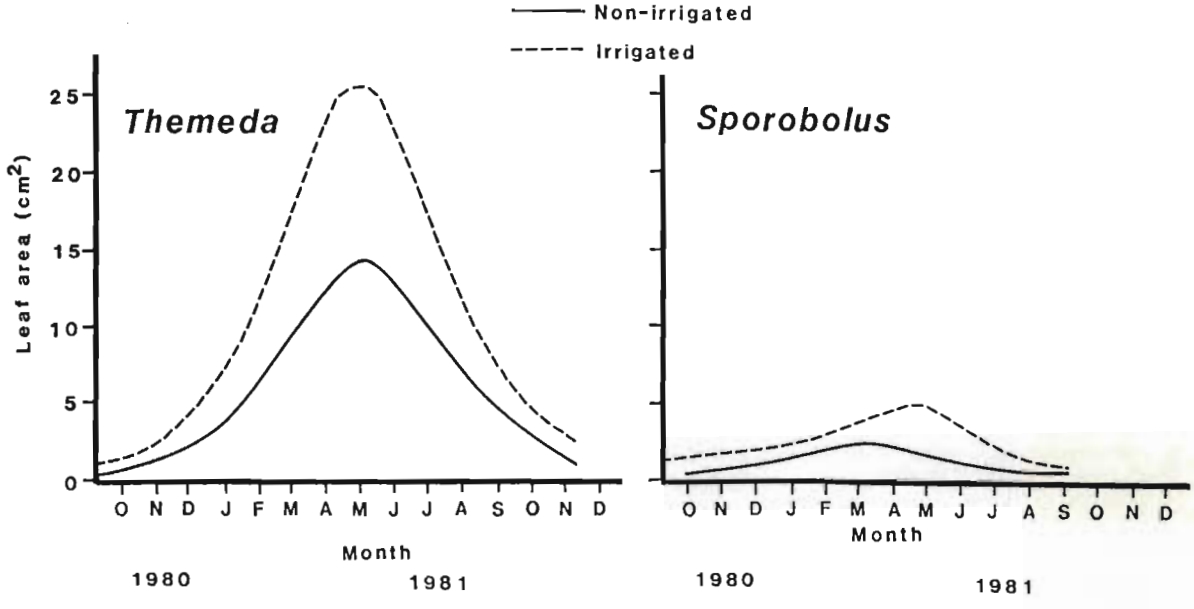

Figure 3.13 *Green leaf area (arithmetic scale) of irrigated and non-irrigated* Themeda triandra *and* Sporobolus fimbriatus *tillers initiated in spring 1980 (experiment 1).*

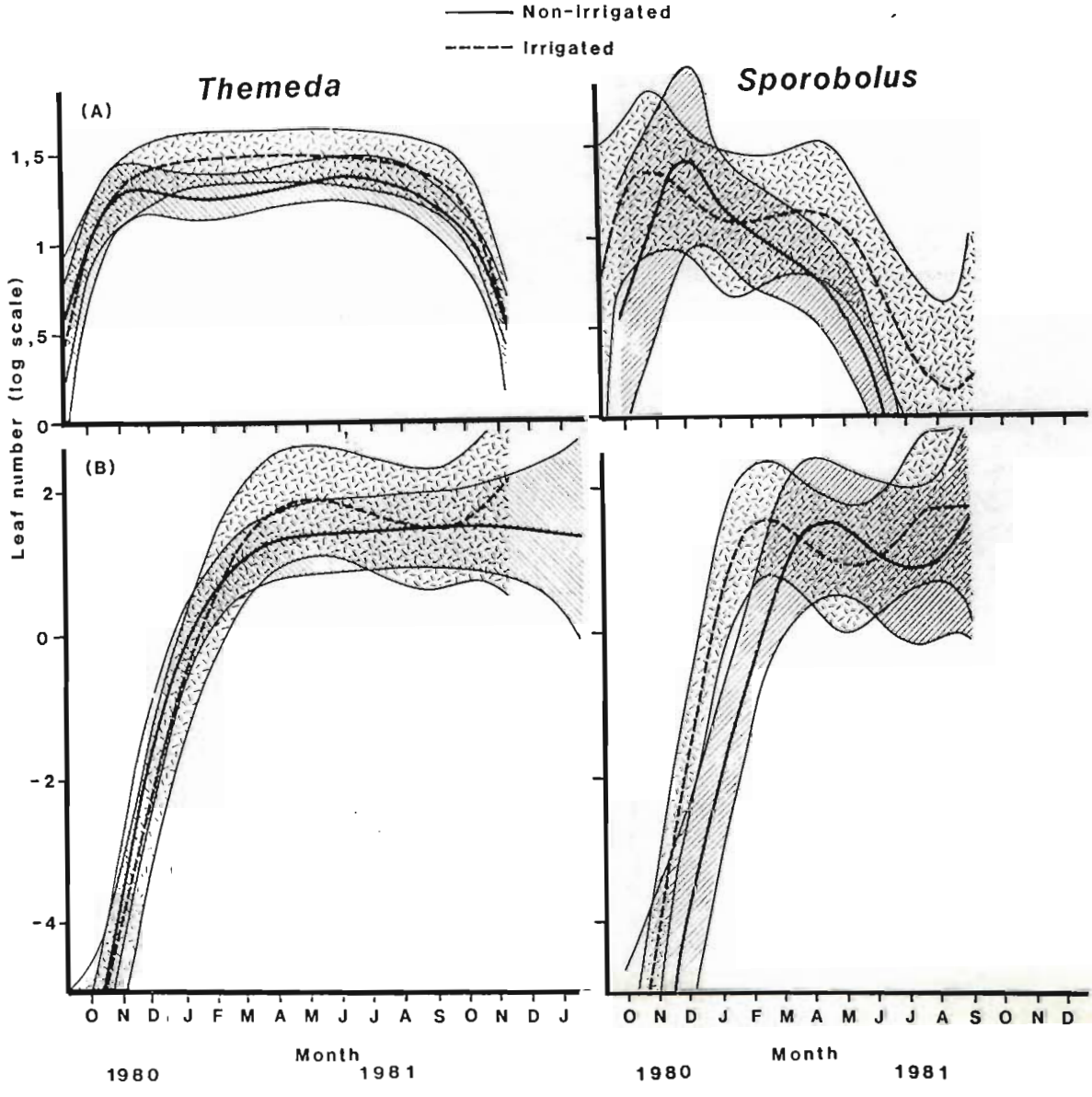

Figure 3.14 *Number of emerged green leaves (A) and number of dead leaves (B) (log scale) attached to irrigated and non-irrigated* Themeda triandra *and* Sporobolus fimbriatus *tillers initiated during spring 1980 (experiment 1). Shaded areas represent 95 % confidence intervals.*

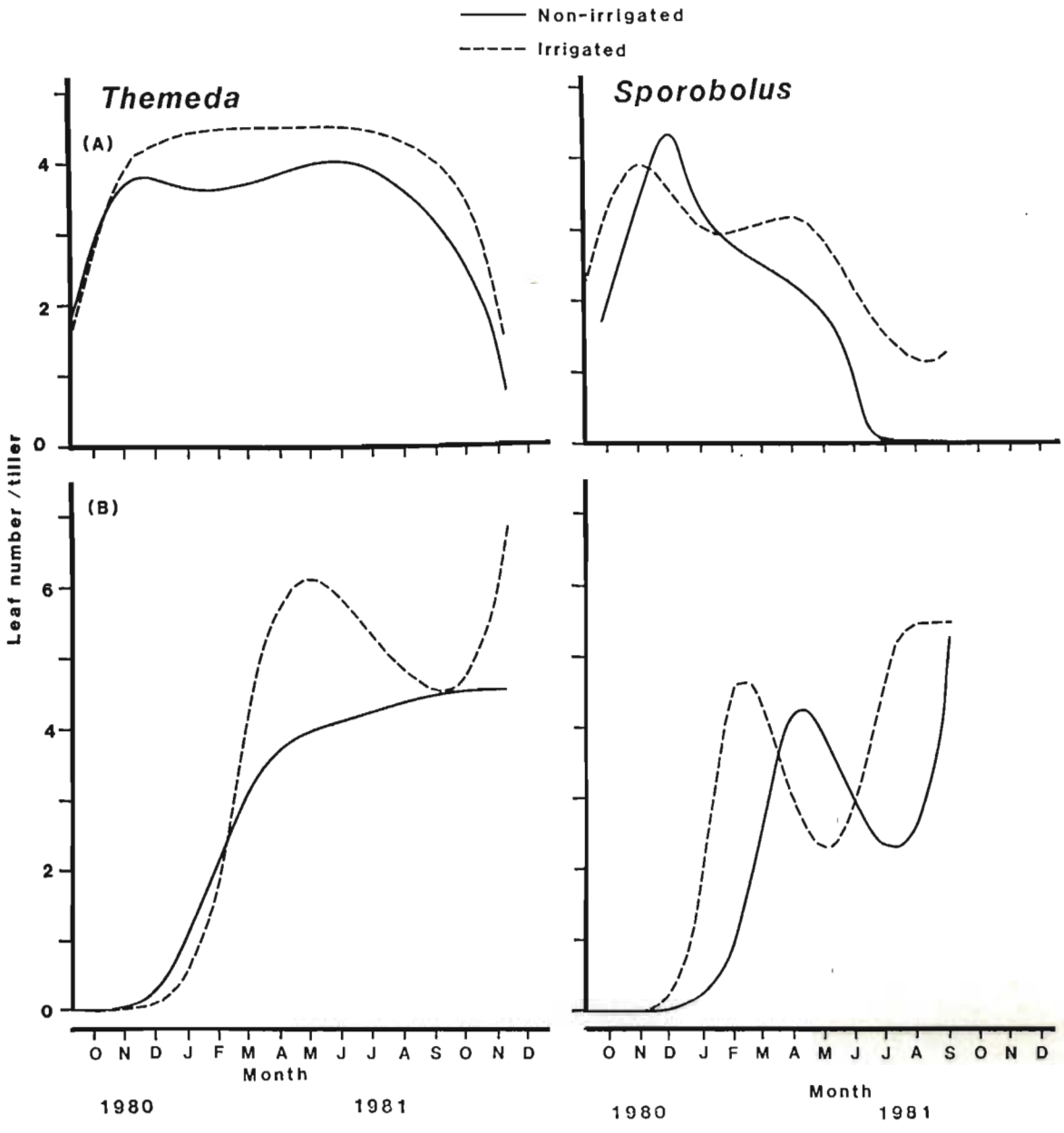

Figure 3.15 *Number of emerged green leaves (A) and number of dead leaves (B) (arithmetic scale) attached to irrigated and non-irrigated* Themeda triandra *and* Sporobolus fimbriatus *tillers initiated during spring 1980 (experiment 1).*

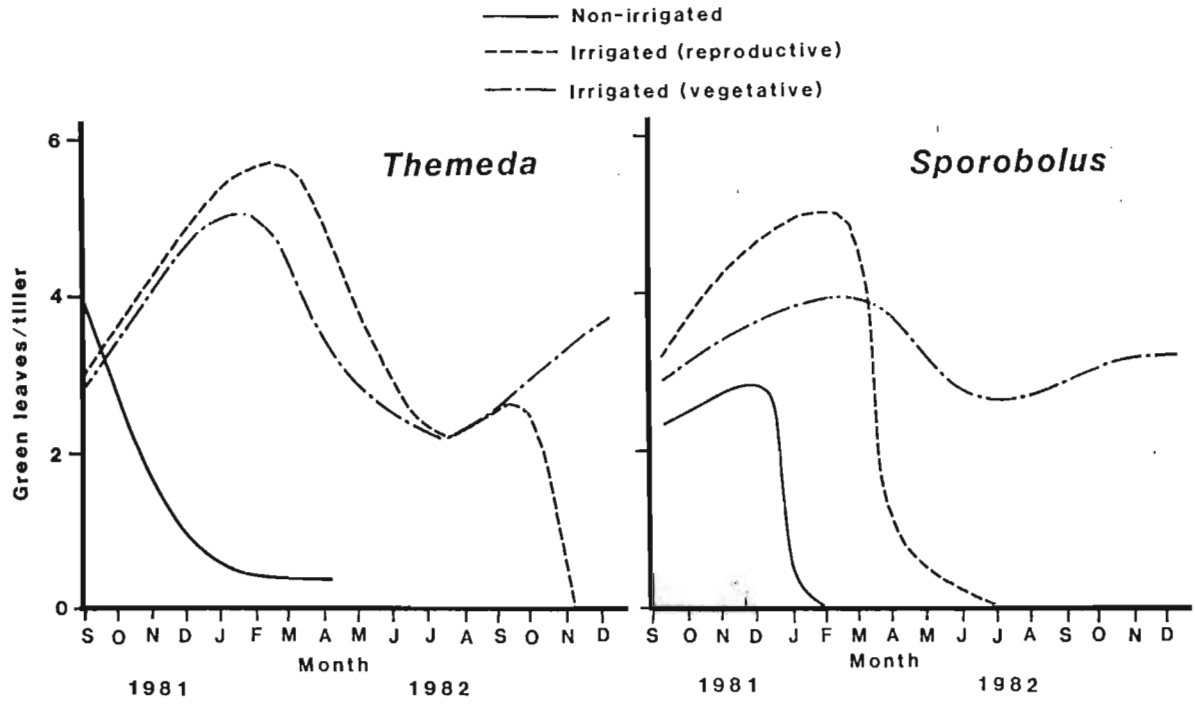

Figure 3.16 *Number of emerged green leaves per tiller in the various sub-populations of permanently marked and non-destructively sampled* Themeda triandra *and* Sporobolus fimbriatus *tillers initiated in spring 1981 (experiment 3).*

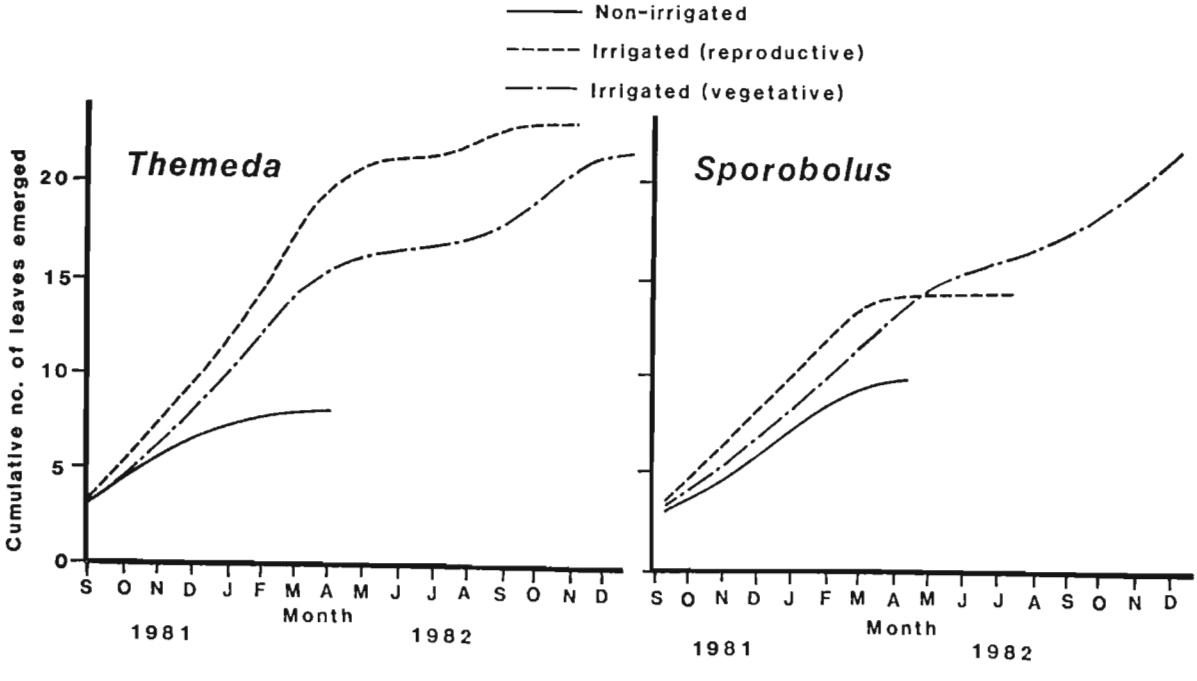

Figure 3.17 *Cumulative total number of emerged leaves per tiller in the various sub-populations of permanently marked and non-destructively sampled* Themeda triandra *and* Sporobolus fimbriatus *tillers initiated in spring 1981 (experiment 3).*

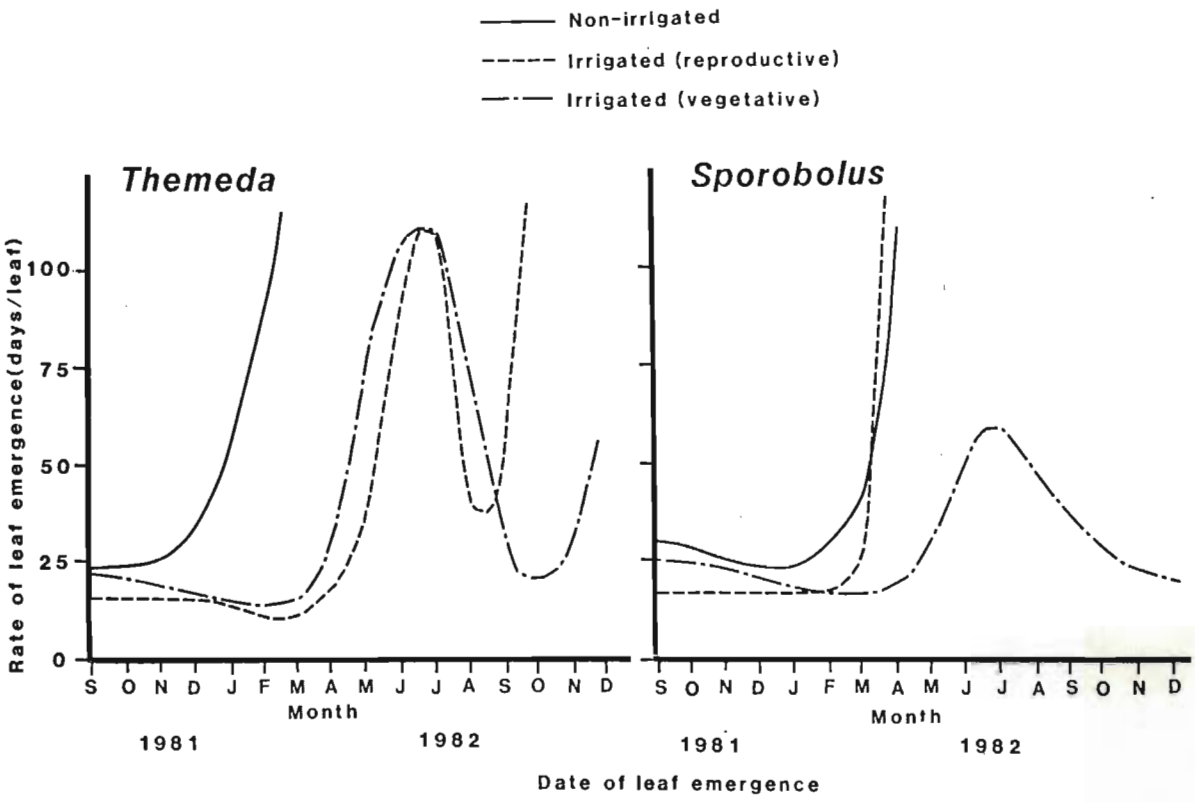

Figure 3.18 *Rate of leaf emergence (days per leaf) in the various sub-populations of permanently marked and non-destructively sampled* Themeda triandra *and* Sporobolus fimbriatus *tillers initiated in spring 1981 (experiment 3).*

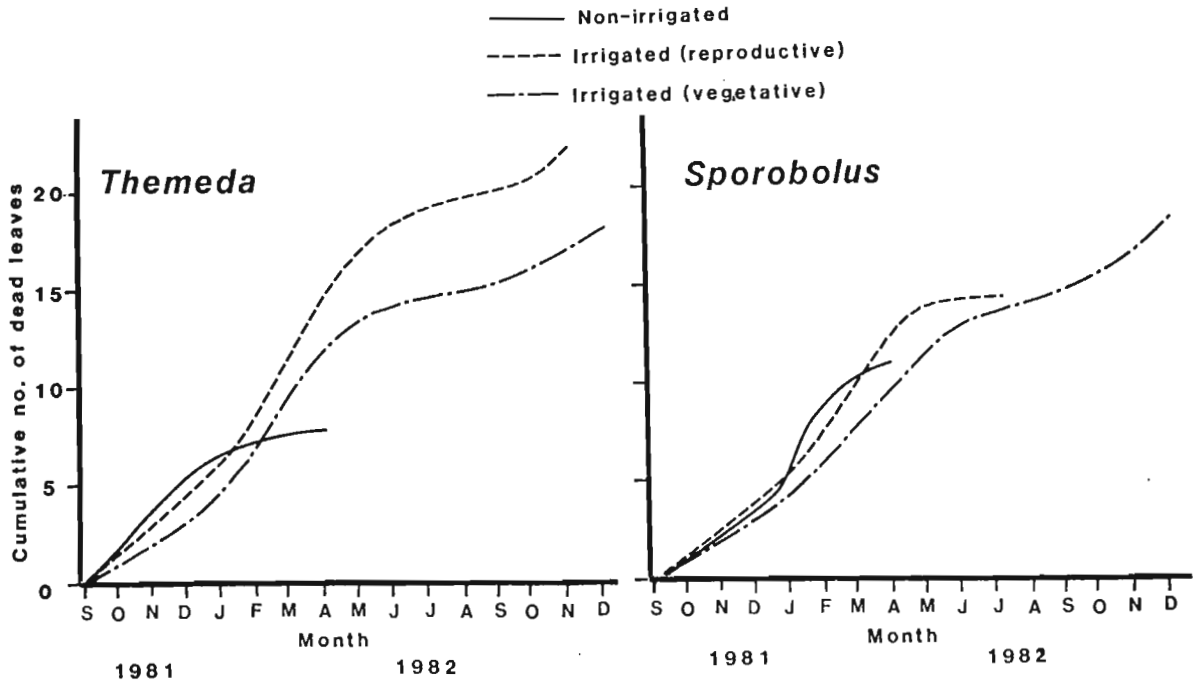

Figure 3.19 *Cumulative total number of dead leaves per tiller in the various sub-populations of permanently marked and non-destructively sampled* Themeda triandra *and* Sporobolus fimbriatus *tillers initiated in spring 1981 (experiment 3).*

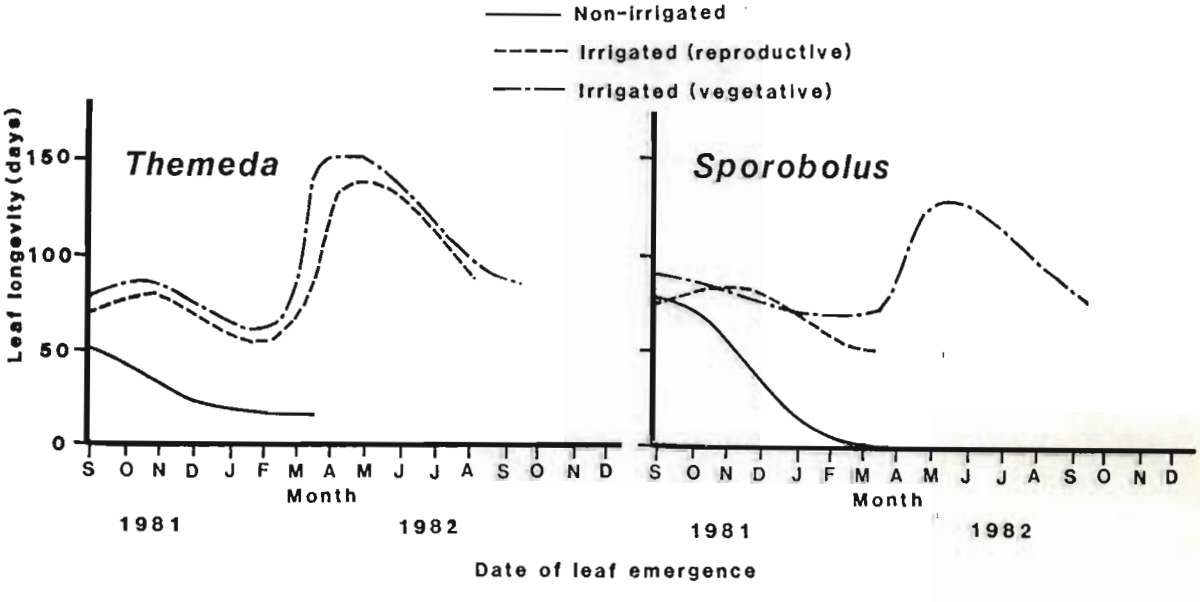

Figure 3.20 *Longevity of green leaves emerging at various times of the year in the sub-populations of permanently marked and non-destructively sampled* Themeda triandra *and* Sporobolus fimbriatus *tillers initiated in spring 1981 (experiment 3).*

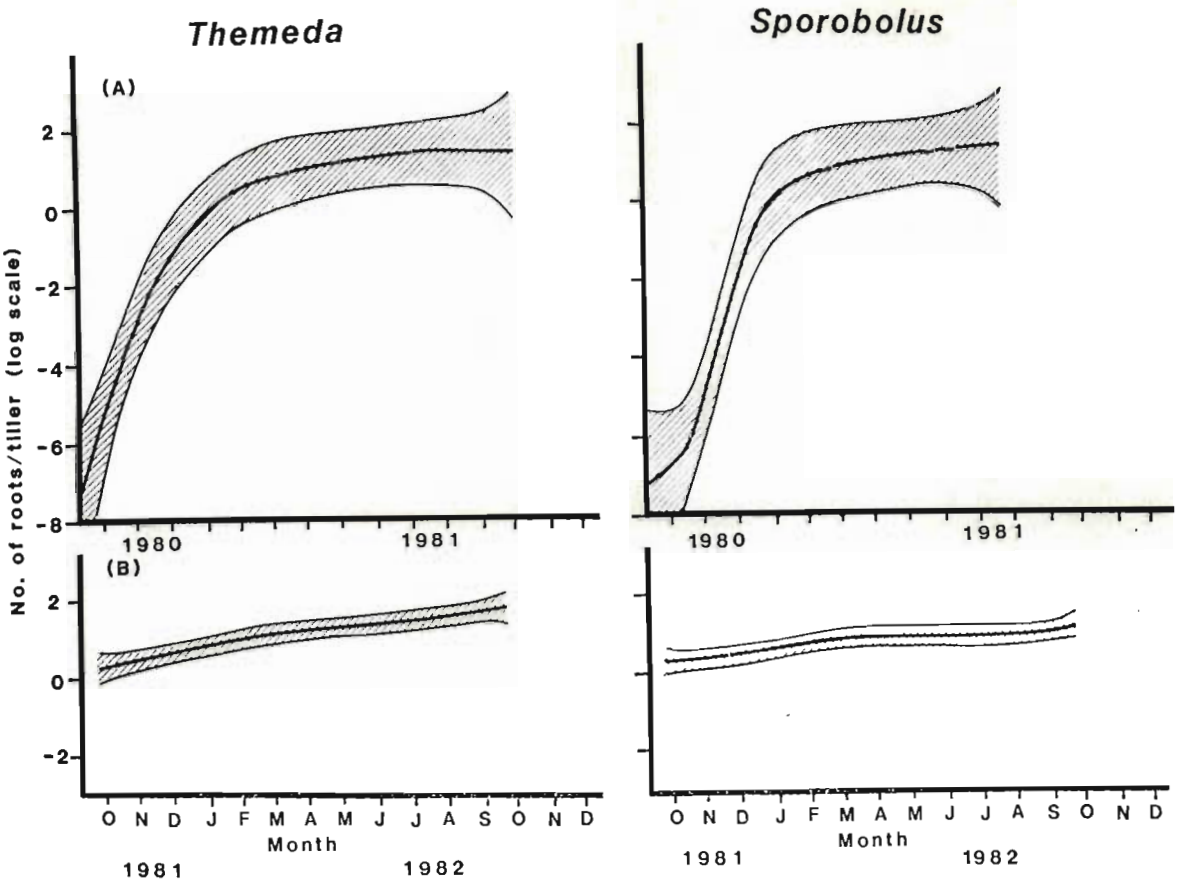

Figure 3.21 *Number of roots (log scale) attached to spring initiated tillers of* Themeda triandra *and* Sporobolus fimbriatus *growing in pots in the greenhouse (A) (experiment 4) and under irrigation in the field (B) (experiment 5). Shaded areas represent 95 % confidence intervals.*

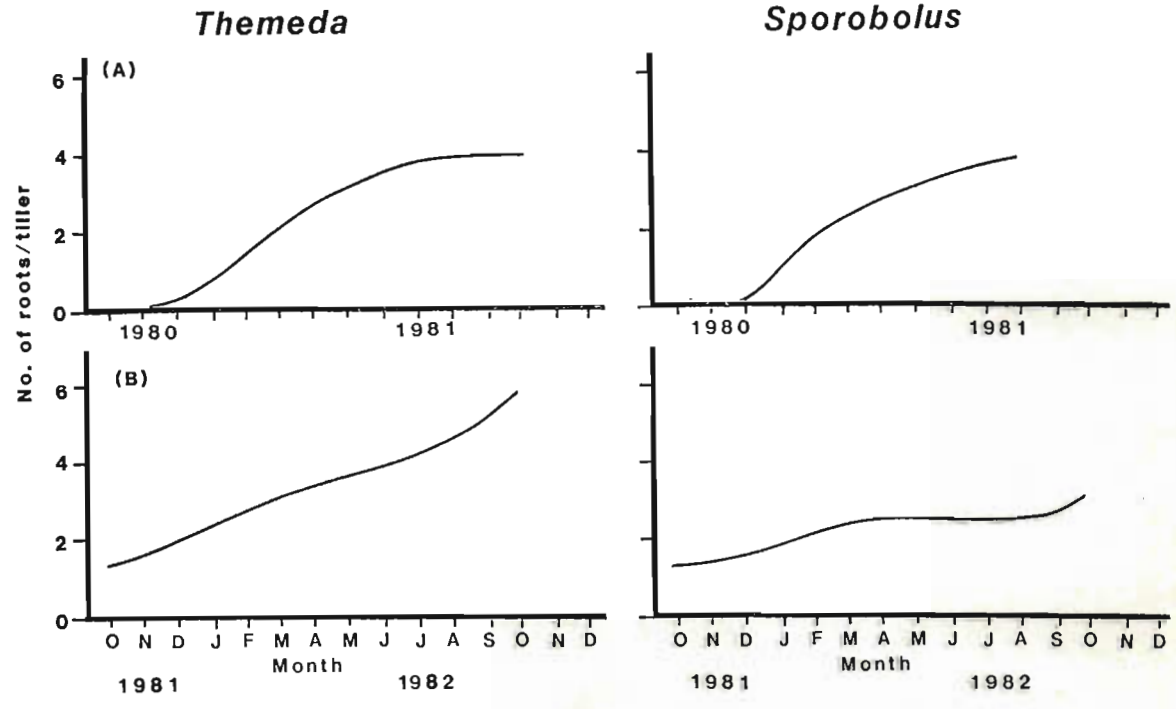

Figure 3.22 *Number of roots (arithmetic scale) attached to spring initiated tillers of* Themeda triandra *and* Sporobolus fimbriatus *growing in pots in the greenhouse (A) (experiment 4) and under irrigation in the field (B) (experiment 5).*

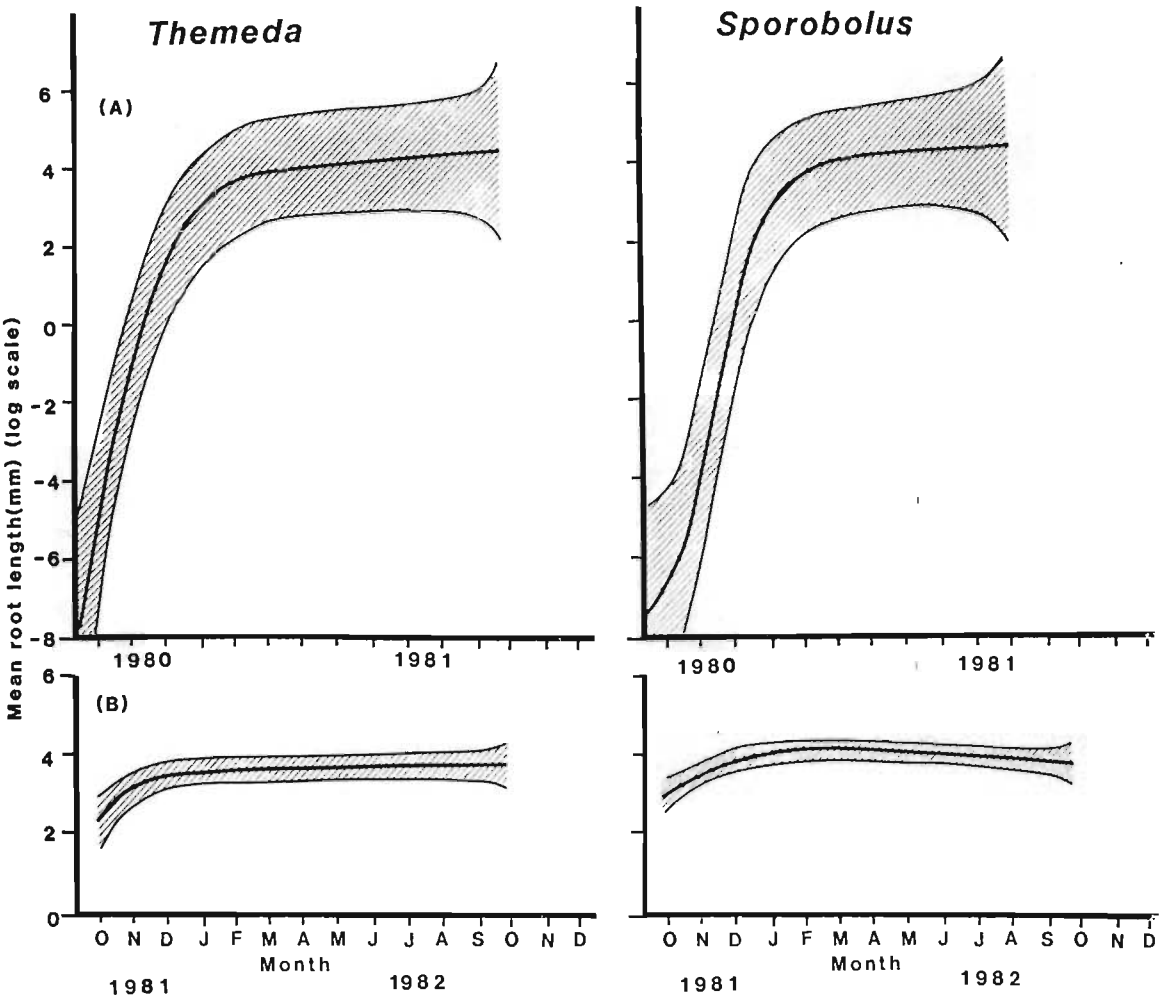

Figure 3.23 *Mean root length (log scale) on spring initiated tillers of* Themeda triandra *and* Sporobolus fimbriatus *growing in pots in the greenhouse (A) (experiment 4) and under irrigation in the field (B) (experiment 5). Shaded areas represent 95 °/o confidence intervals.*

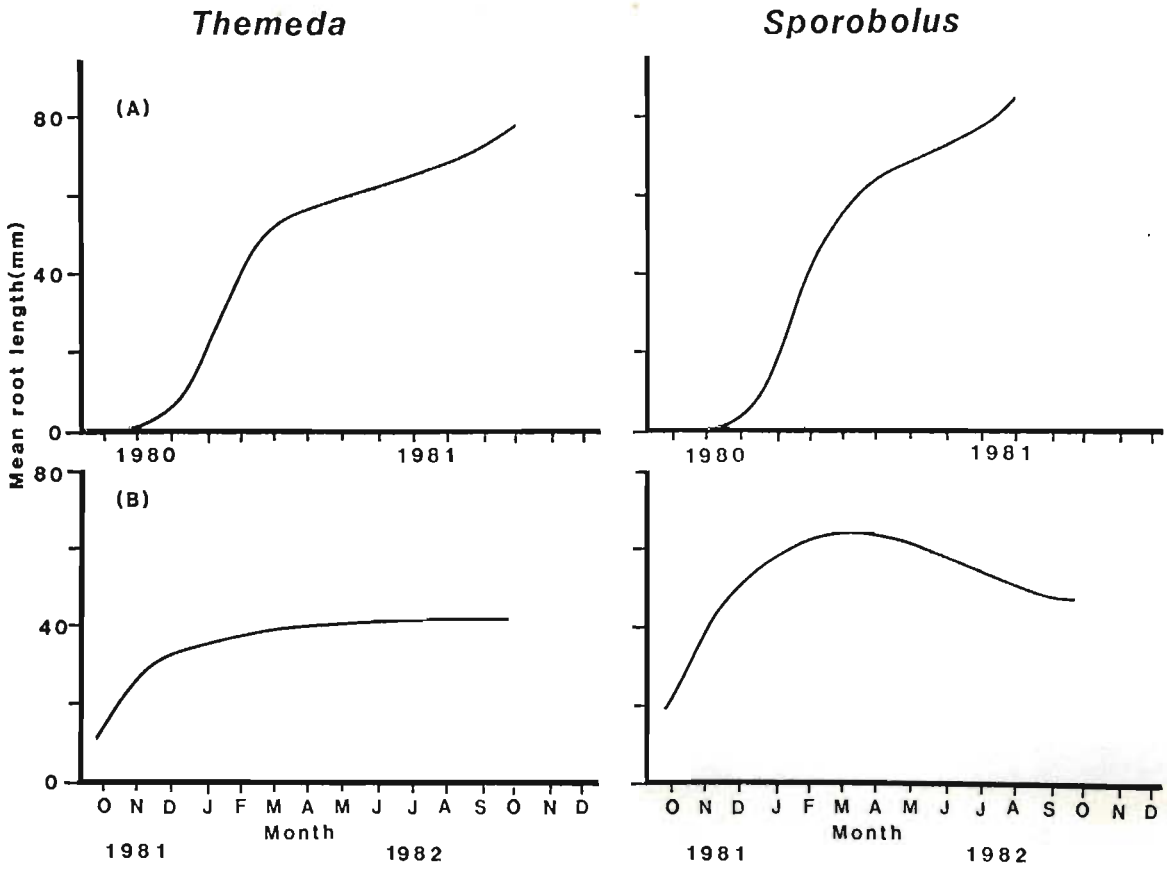

Figure 3.24 *Mean root length (arithmetic scale) on spring initiated tillers of* Themeda triandra *and* Sporobolus fimbriatus *growing in pots in the greenhouse (A) (experiment 4) and under irrigation in the field (B) (experiment 5).*

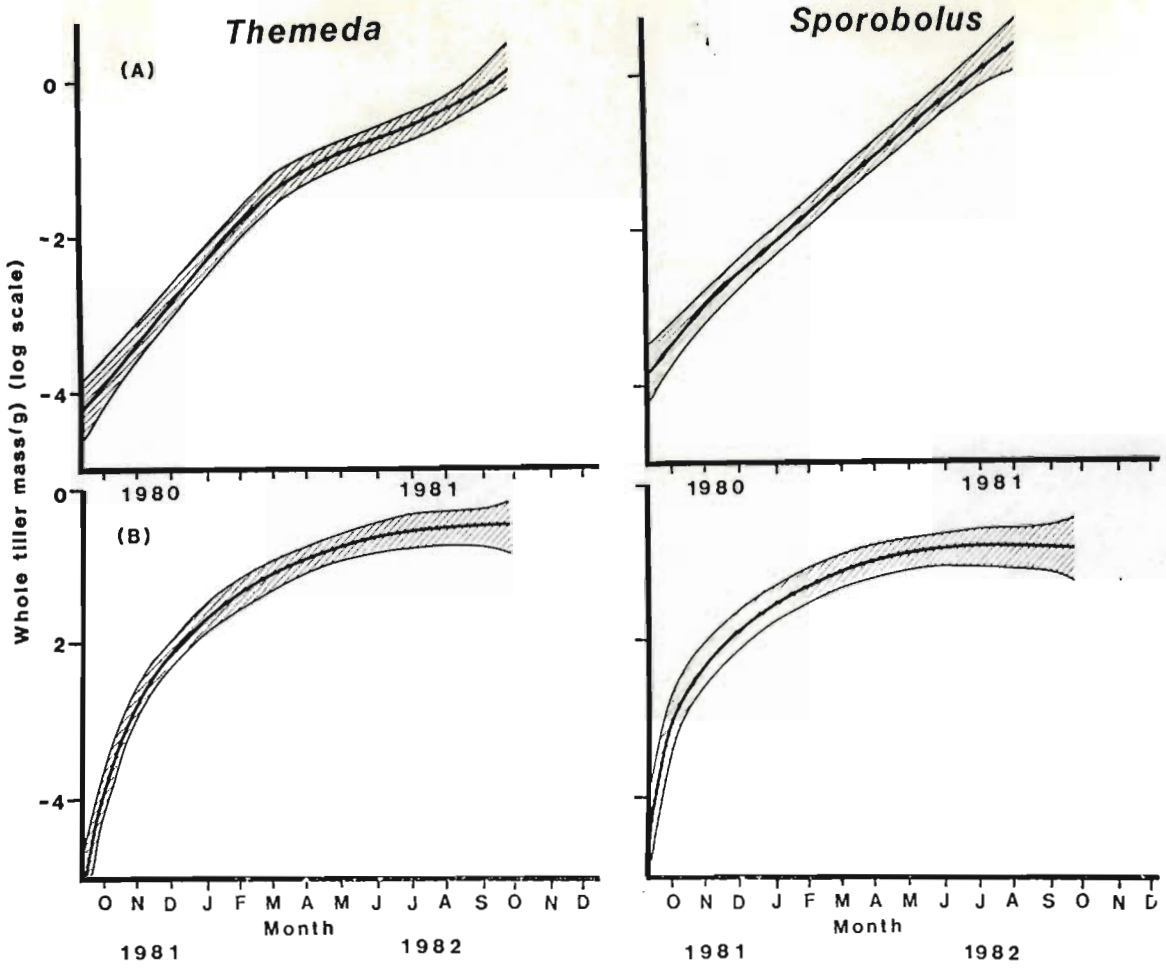

Figure 3.25 *Total mass (log scale) of spring initiated tillers of* Themeda triandra *and* Sporobolus fimbriatus *growing in pots in the greenhouse (A) (experiment 4) and under irrigation in the field (B) (experiment 5). Shaded areas represent 95 °/o confidence intervals.*

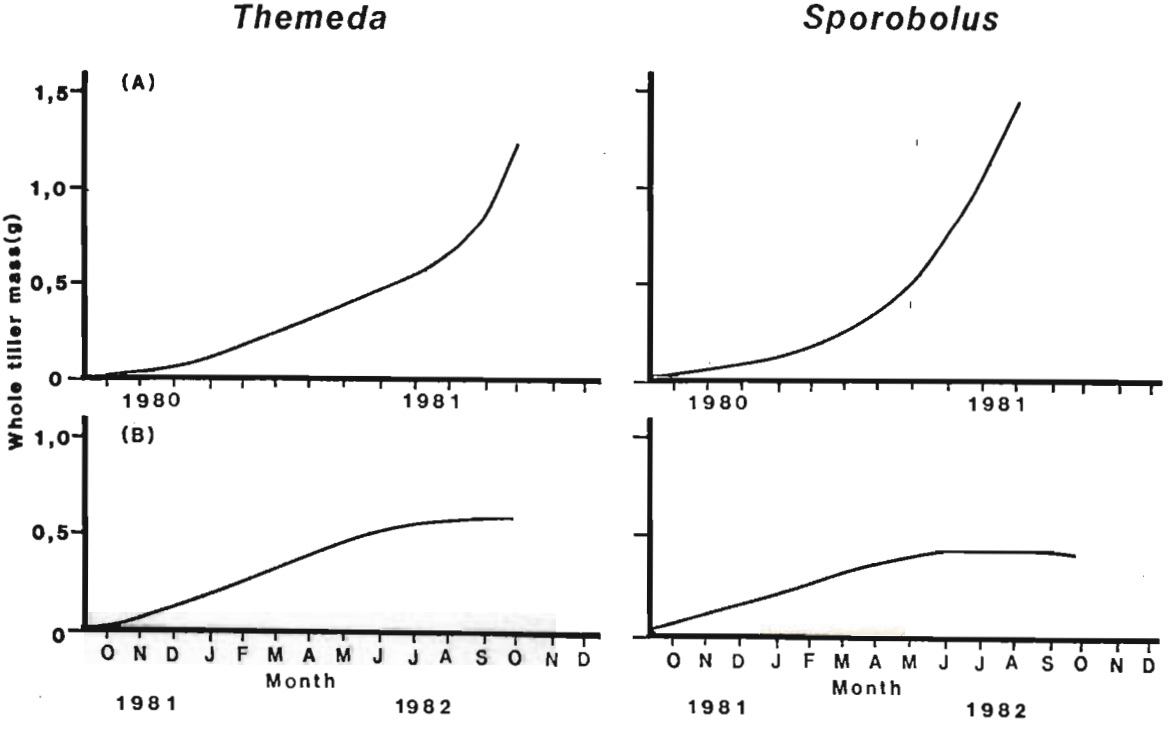

Figure 3.26 *Total mass (arithmetic scale) of spring initiated tillers of* Themeda triandra *and* Sporobolus fimbriatus *growing in pots in the greenhouse (A) (experiment 4) and under irrigation in the field (B) (experiment 5).*

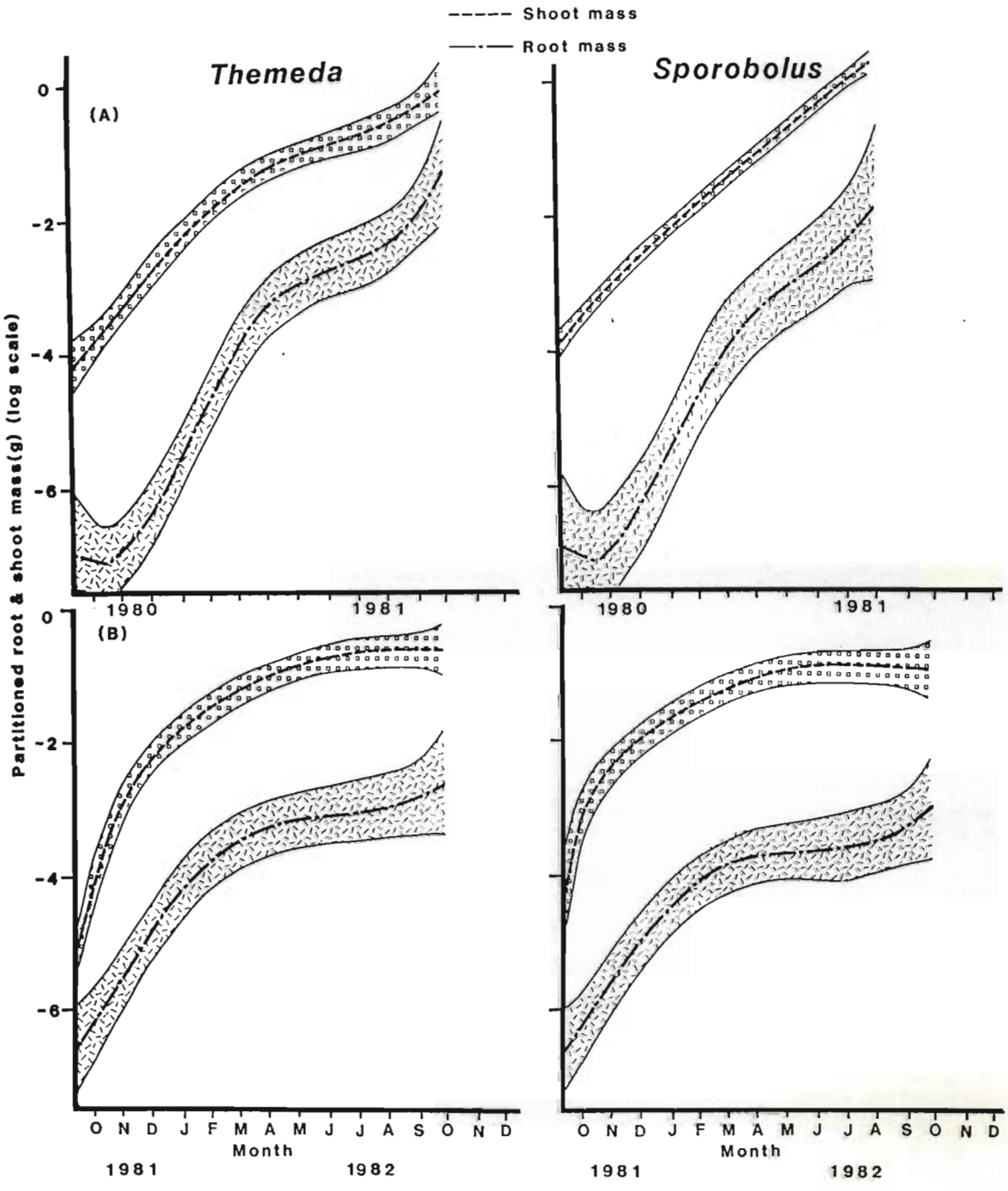

Figure 3.27 *Partitioned root mass and shoot mass (log scale) of spring initiated tillers of* Themeda triandra *and* Sporobolus fimbriatus *growing in pots in the greenhouse (A) (experiment 4) and under irrigation in the field (B) (experiment 5). Shaded areas represent 95 °/o confidence intervals.*

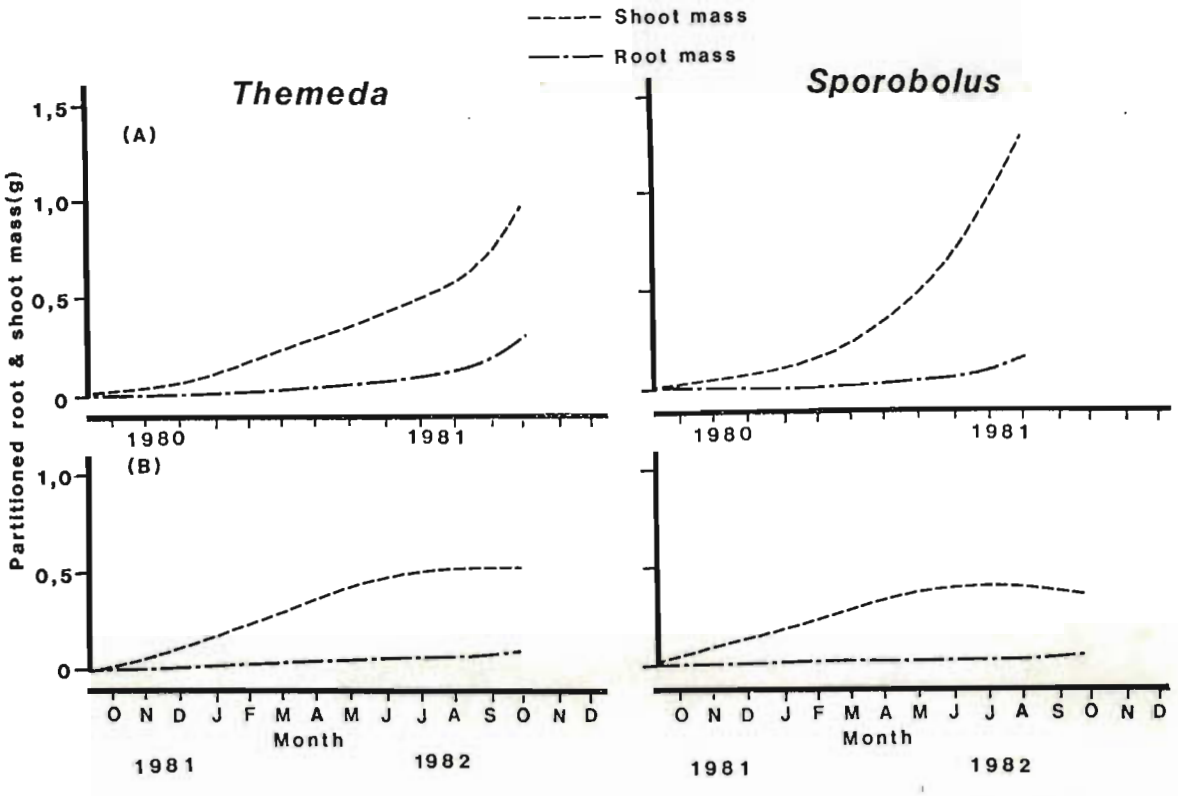

Figure 3.28 *Partitioned root mass and shoot mass (arithmetic scale) of spring initiated tillers of* Themeda triandra *and* Sporobolus fimbriatus *growing in pots in the greenhouse (A) (experiment 4) and under irrigation in the field (B) (experiment 5).*

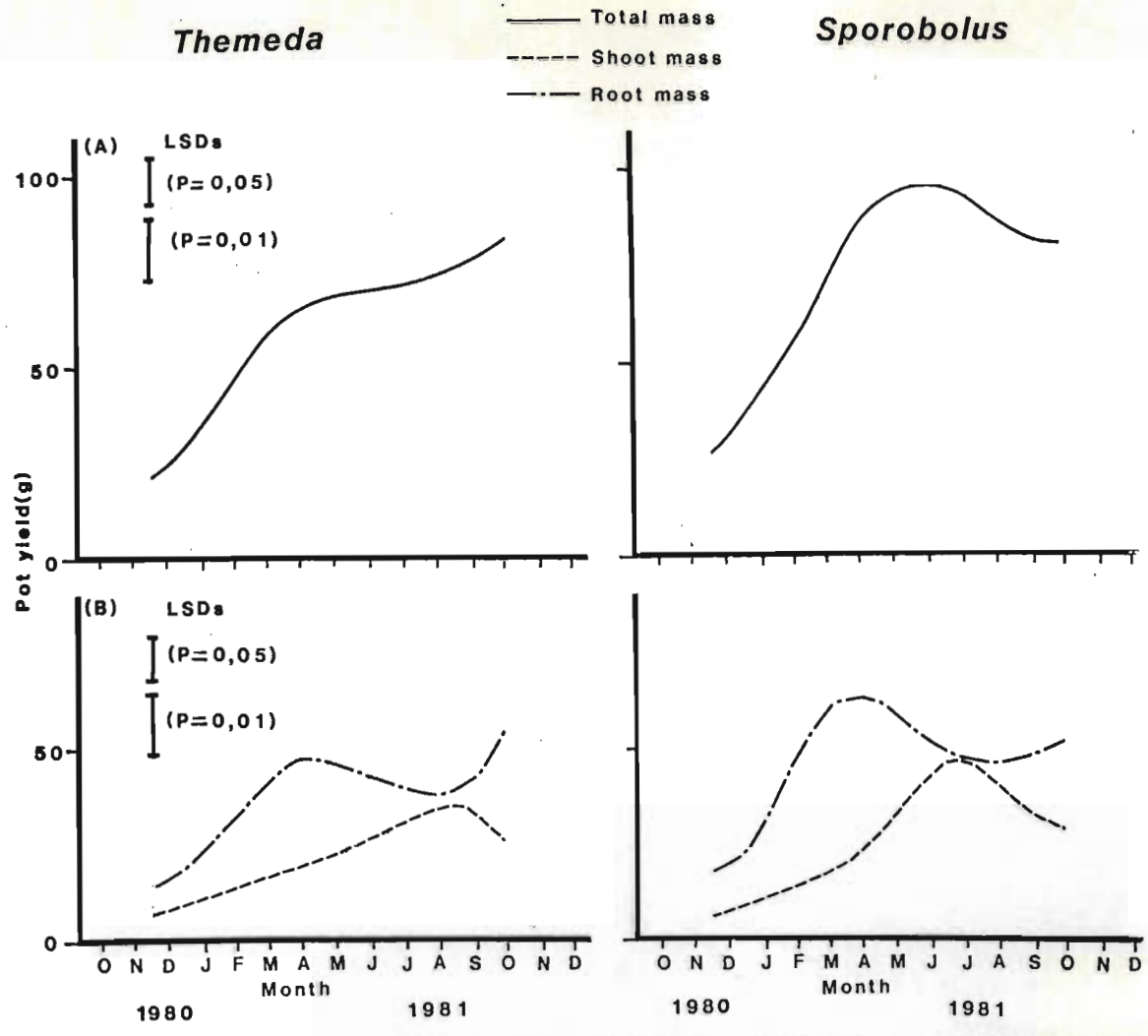

Figure 3.29 *Total plant yield (A), root yield and shoot yield (B) of sequentially harvested pots of* Themeda triandra *and* Sporobolus fimbriatus *growing in the greenhouse after intense defoliation during spring 1980 (experiment 4). LSD represents least significant difference between means.*

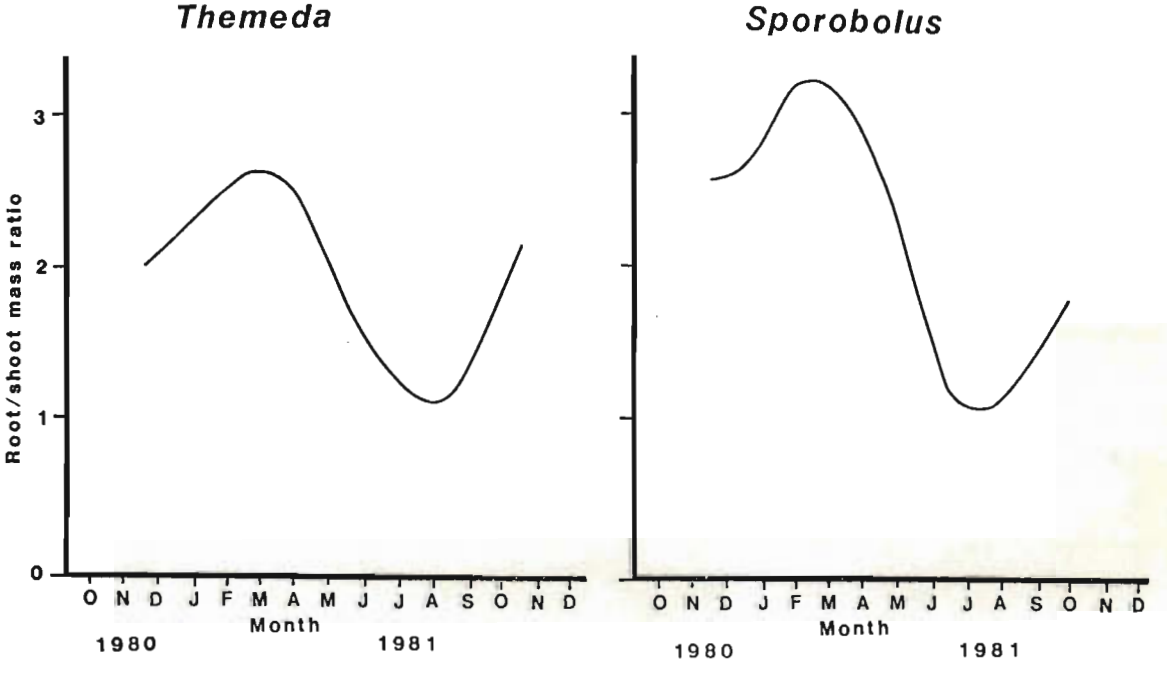

Figure 3.30 *Root:shoot mass ratio in sequentially harvested pots of* Themeda triandra *and* Sporobolus fimbriatus *growing in the greenhouse after intense defoliation during spring 1980 (experiment 4).*

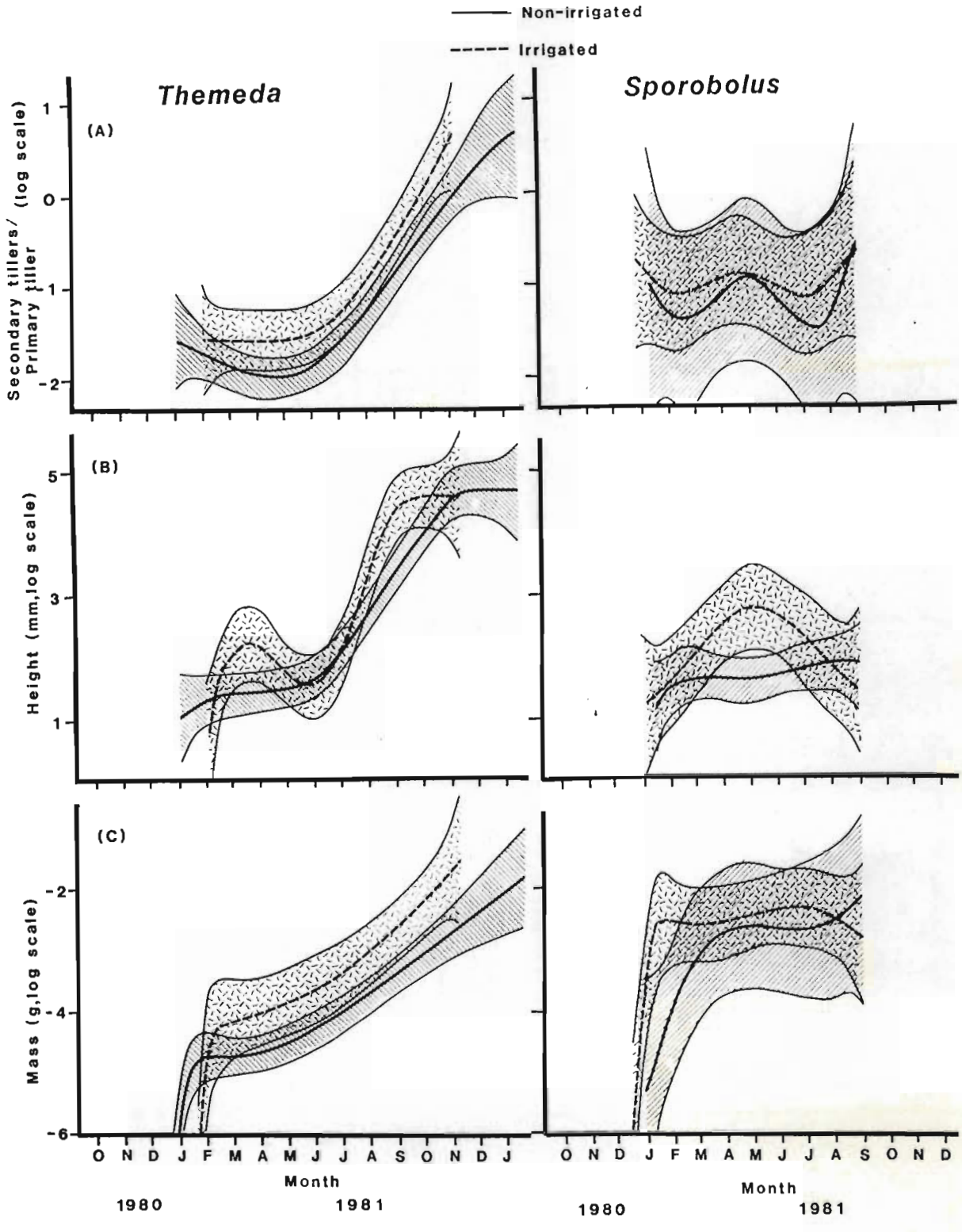

Figure 3.31 *Number of secondary tillers per primary tiller (A), mean height of lateral tillering (B) and mass of secondary tillers per primary tiller (C) (log scale) on irrigated and non-irrigated* Themeda triandra *and* Sporobolus fimbriatus *tillers initiated in spring 1980 (experiment 1). Shaded areas represent 95 % confidence intervals.*

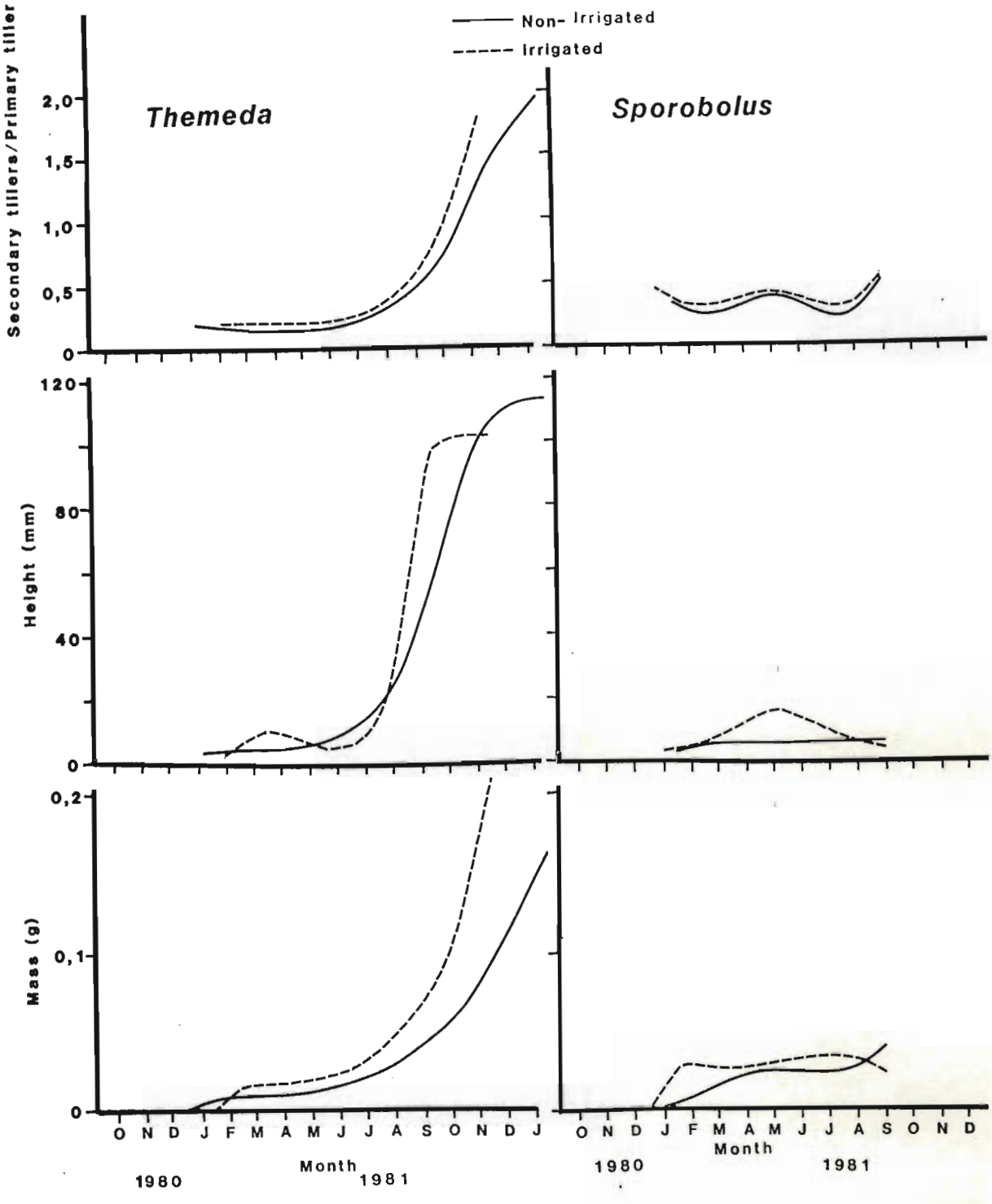

Figure 3.32 *Number of secondary tillers per primary tiller (A), mean height of lateral tillering (B) and mass of secondary tillers per primary tiller (C) (arithmetic scale) on irrigated and non-irrigated* Themeda triandra *and* Sporobolus fimbriatus *tillers initiated in spring 1980 (experiment 1).*

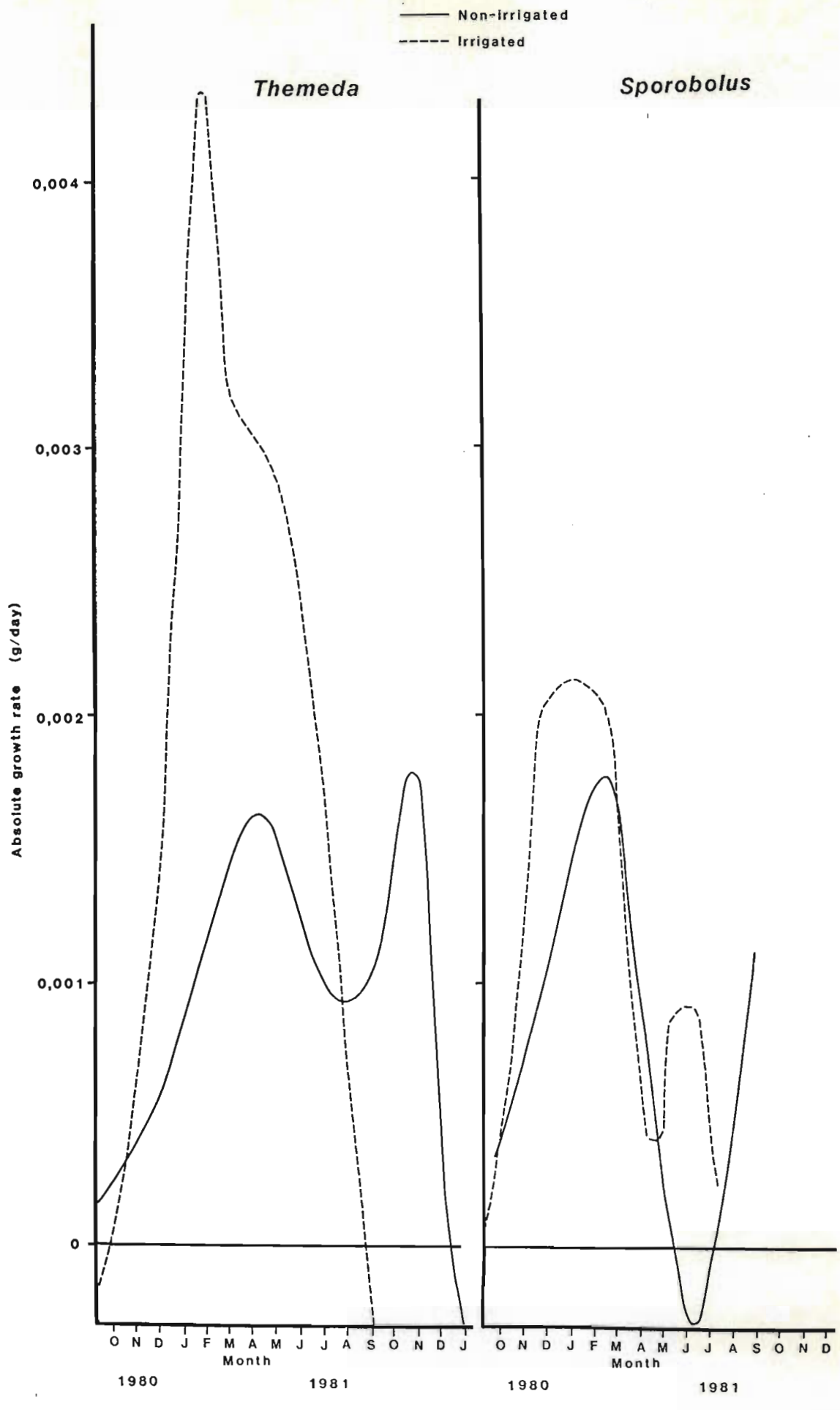

Figure 4.1 *Absolute growth rates of irrigated and non-irrigated* Themeda triandra *and* Sporobolus fimbriatus *tillers initiated in spring 1980.*

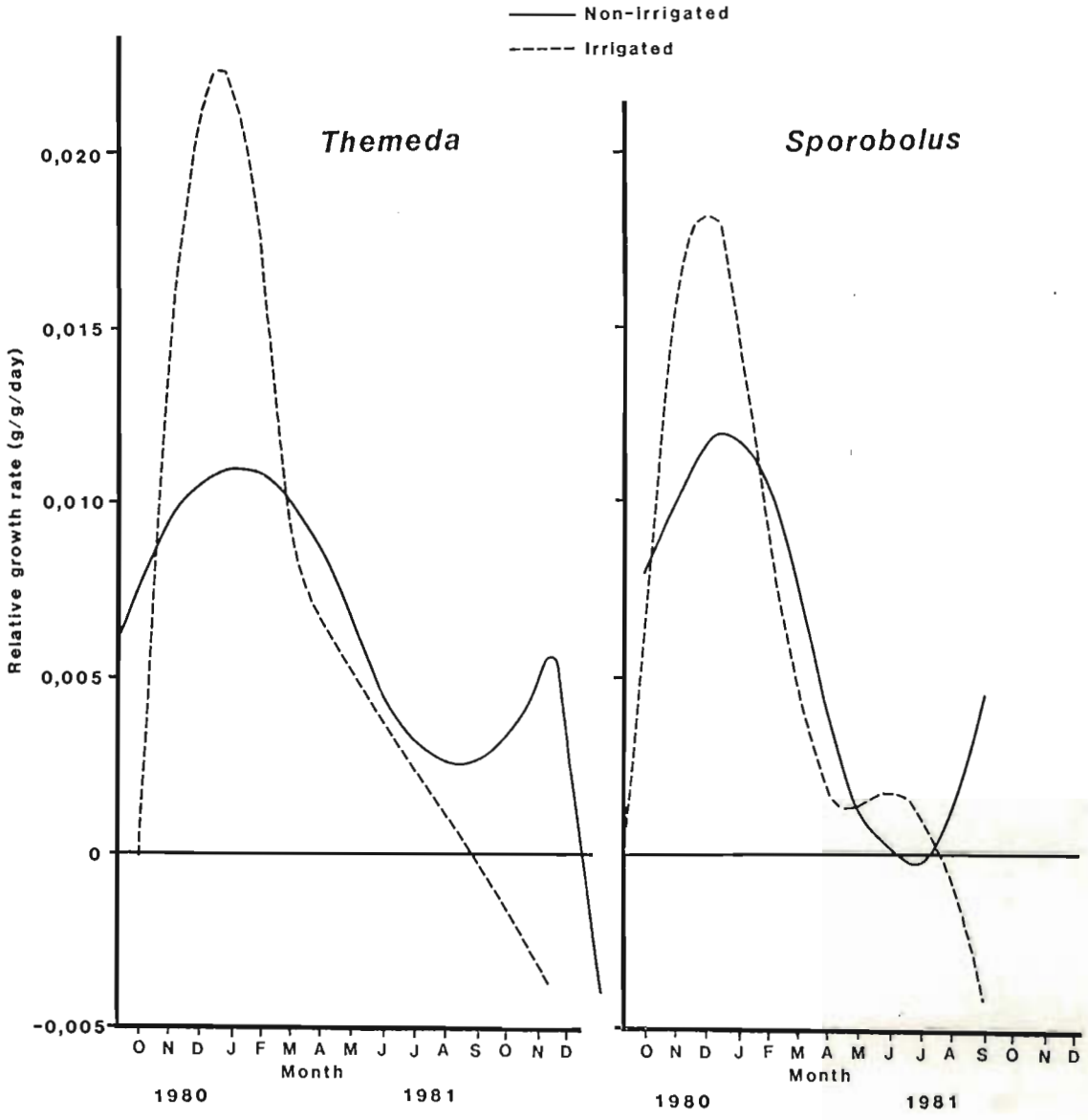

Figure 4.2 *Relative growth rates of irrigated and non-irrigated* Themeda triandra *and* Sporobolus fimbriatus *tillers initiated in spring 1980.*

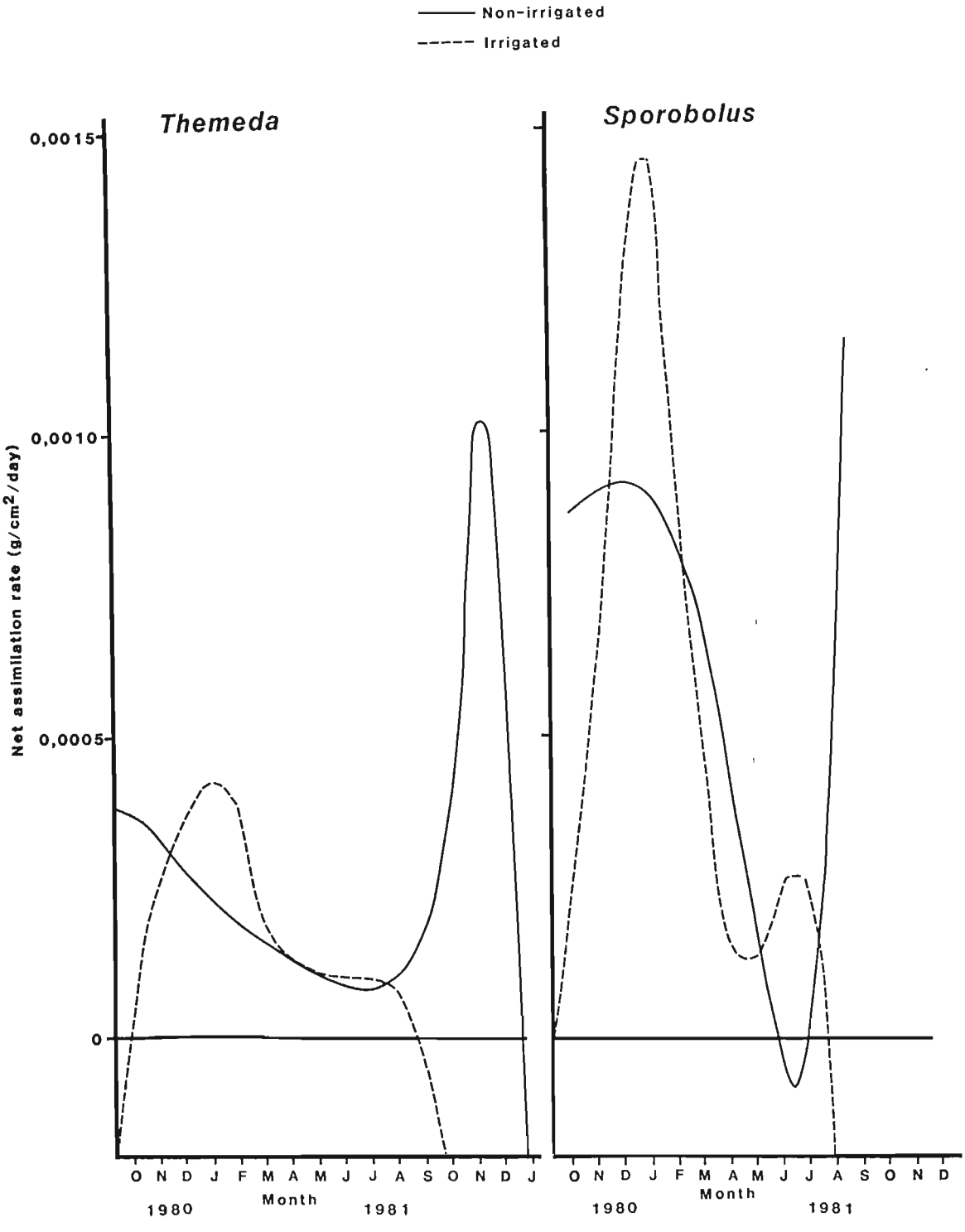

Figure 4.3 *Net assimilation rates of irrigated and non-irrigated* Themeda triandra *and* Sporobolus fimbriatus *tillers initiated in spring 1980.*

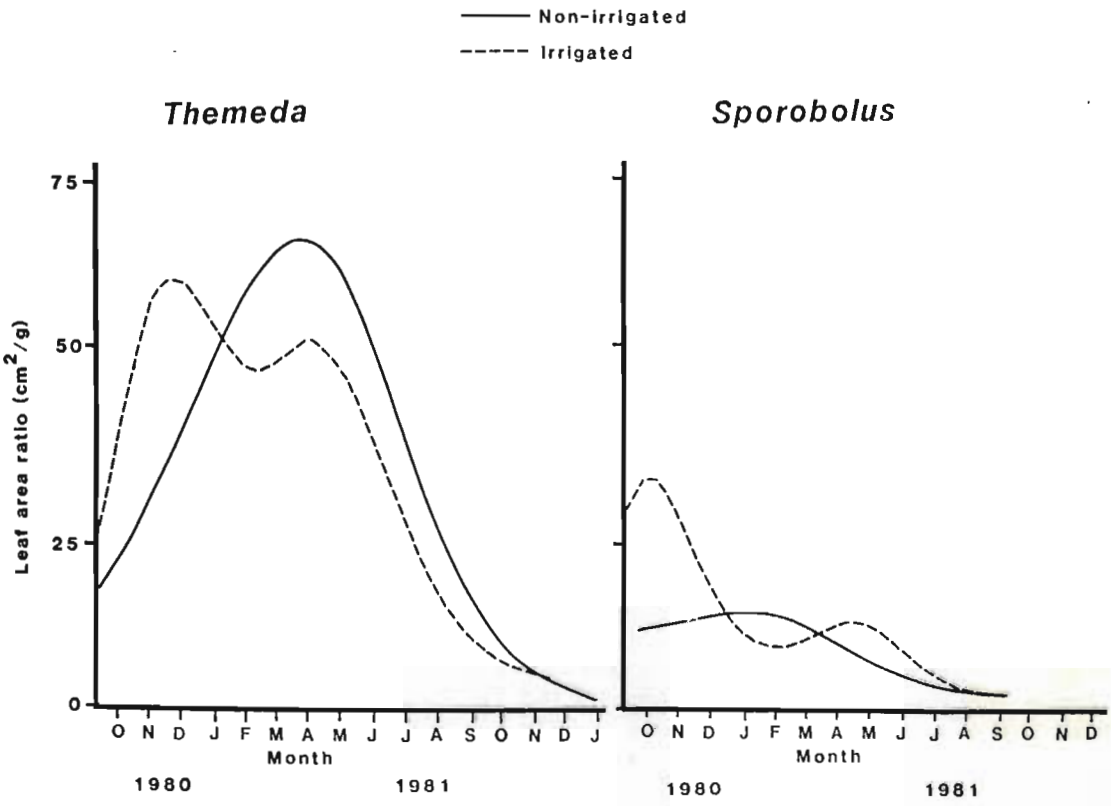

Figure 4.4 *Leaf area ratios of irrigated and non-irrigated* Themeda triandra *and* Sporobolus fimbriatus *tillers initiated in spring 1980.*

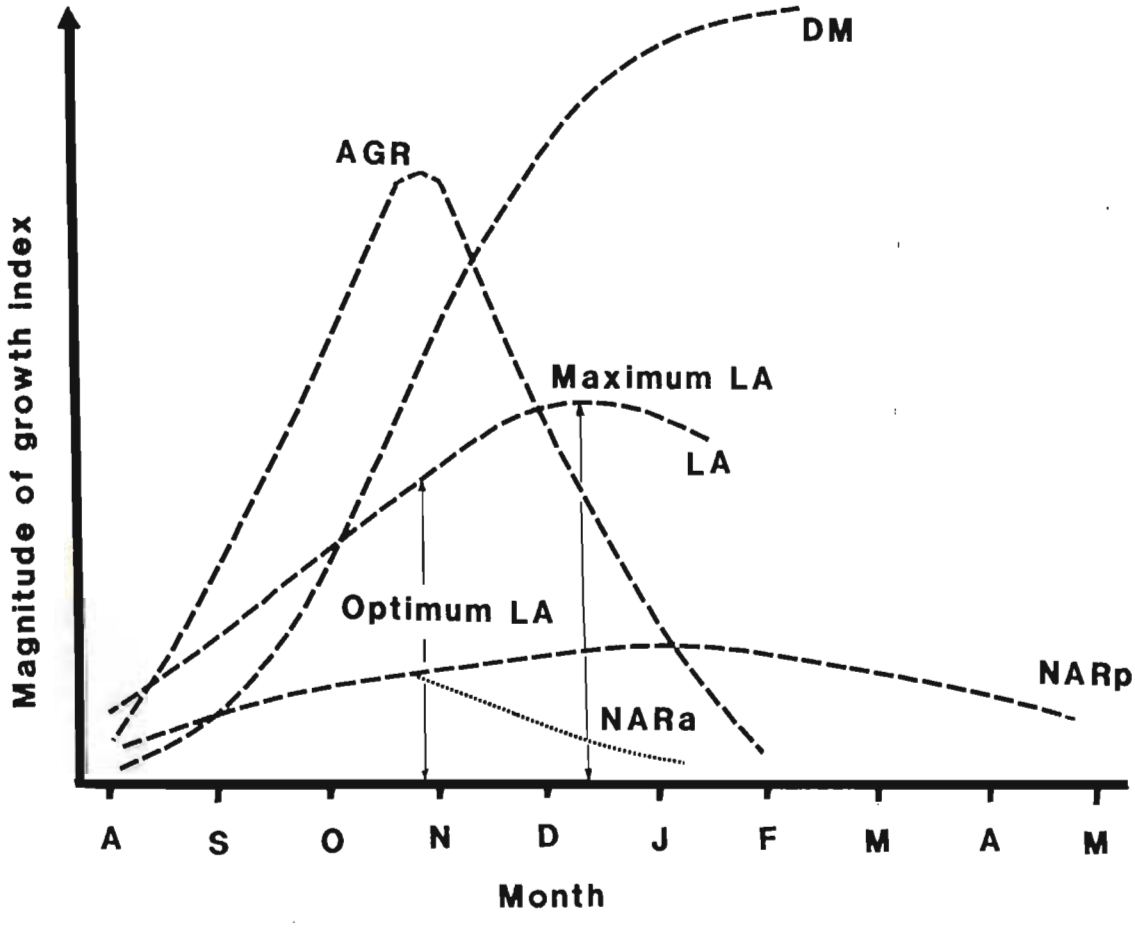

Figure 4.5 *Hypothetical relationships of cumulative dry matter (DM), absolute growth rate (AGR), leaf area (LA) and net assimilation rate as affected by the environment (NARp) and as affected by plant age (NARa) with time (after Booysen, 1966).*

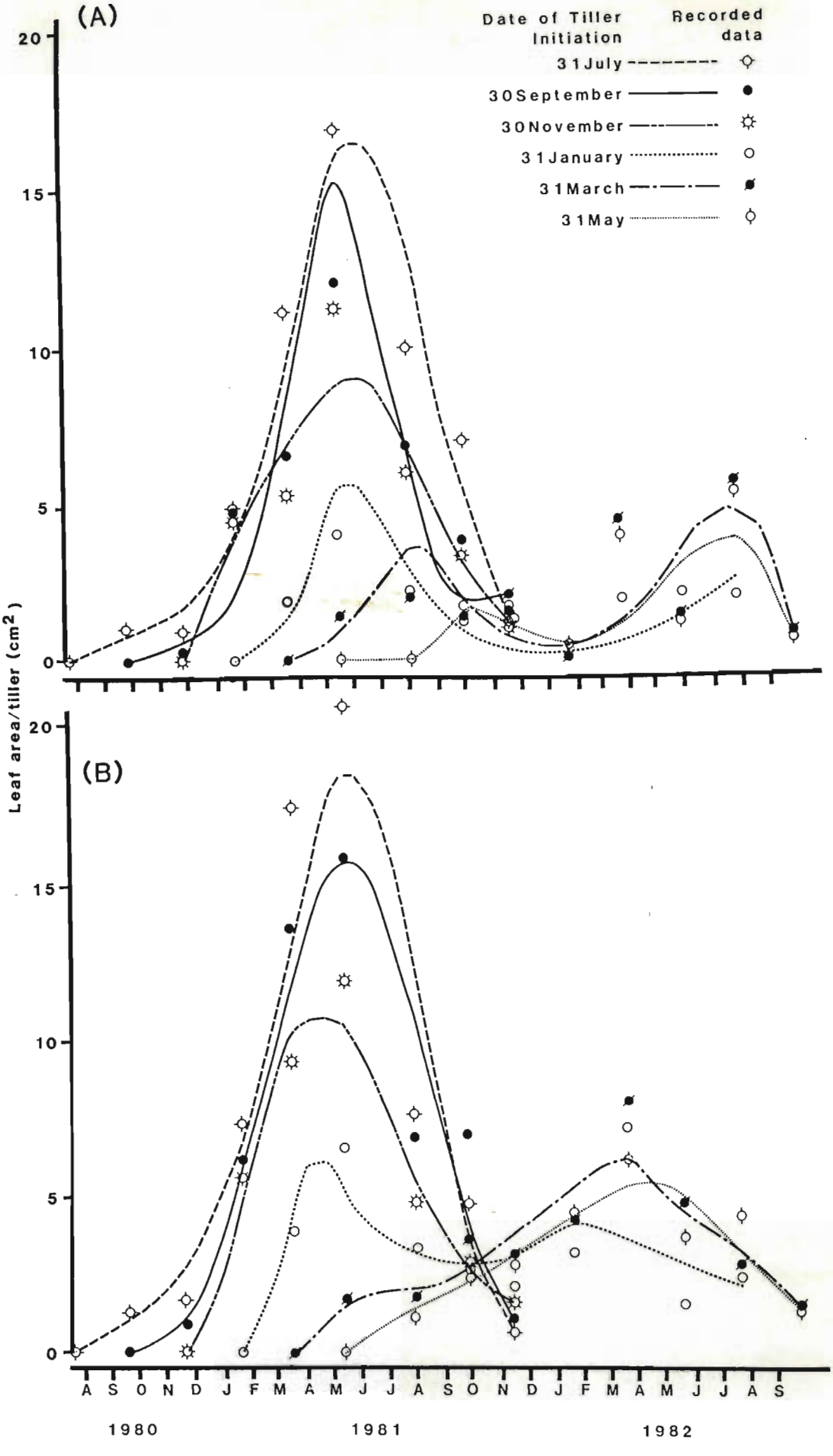

Figure 4.6 *Individual tiller leaf areas in populations of non-irrigated (A) and irrigated (B)* Themeda triandra *tillers initiated progressively during the 1980/81 season. Symbols represent recorded mean tiller leaf area.*

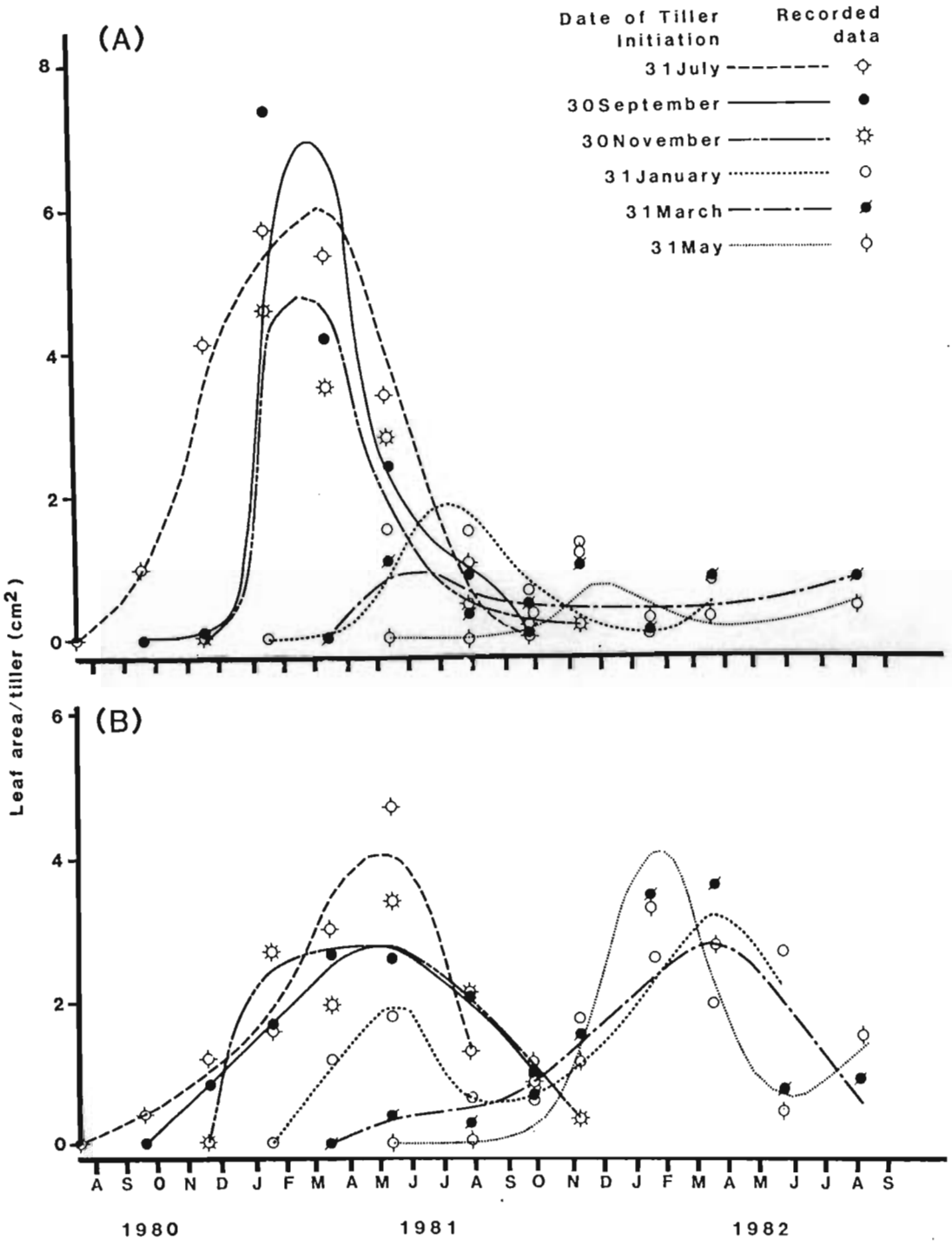

Figure 4.7 *Individual tiller leaf area in populations of non-irrigated (A) and irrigated (B)* Sporobolus fimbriatus *tillers initiated progressively during the 1980/81 season. Symbols represent recorded mean tiller leaf area.*

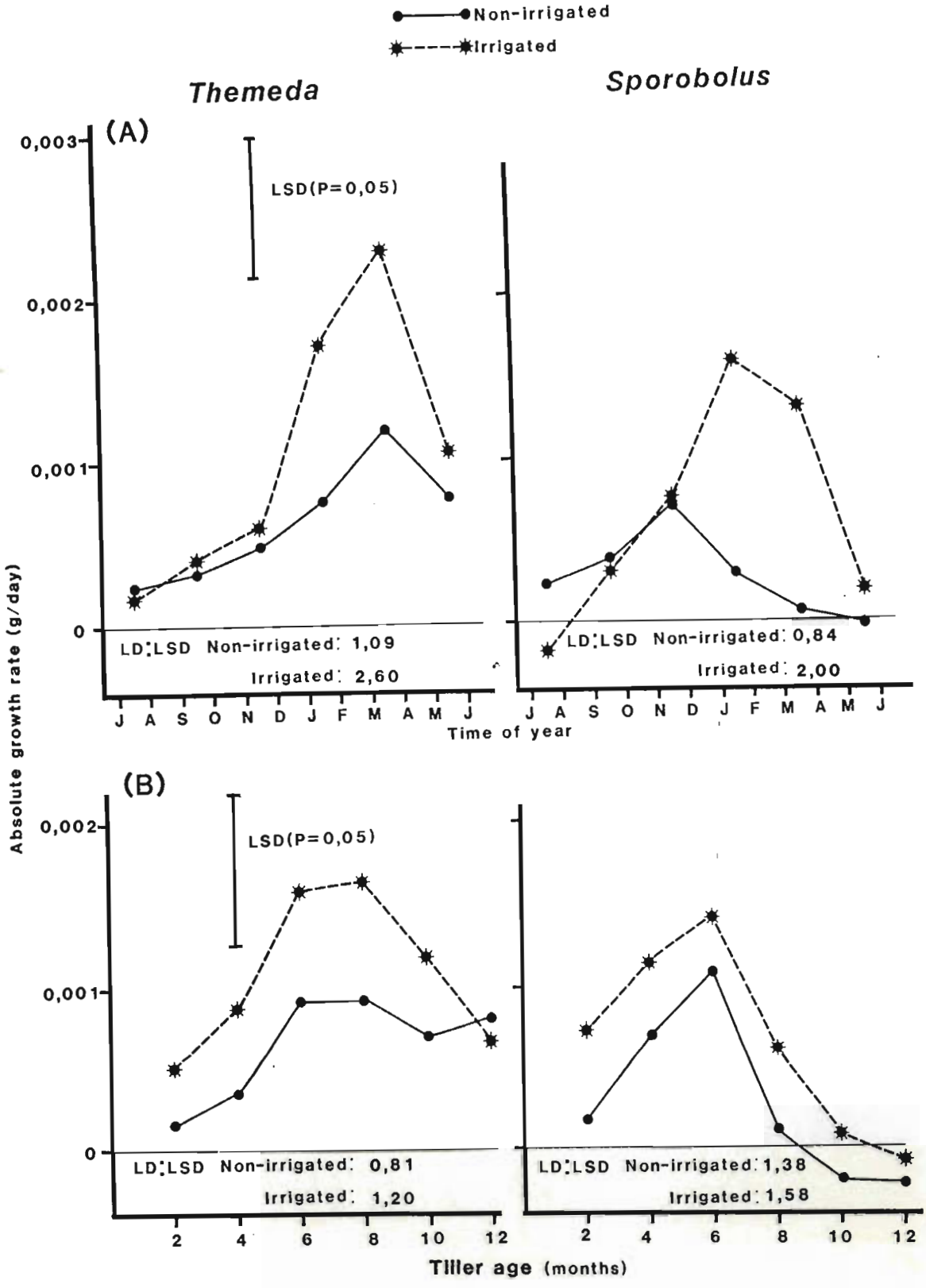

Figure 4.8 *Effect of time of year (A) and tiller age (B) on the absolute growth rate of irrigated and non-irrigated tillers of* Themeda triandra *and* Sporobolus fimbriatus. *Symbols represent means and* LSD *denotes the least significant difference between two means.* LD : LSD *is the ratio between the largest difference between two means within a treatment and the* LSD.

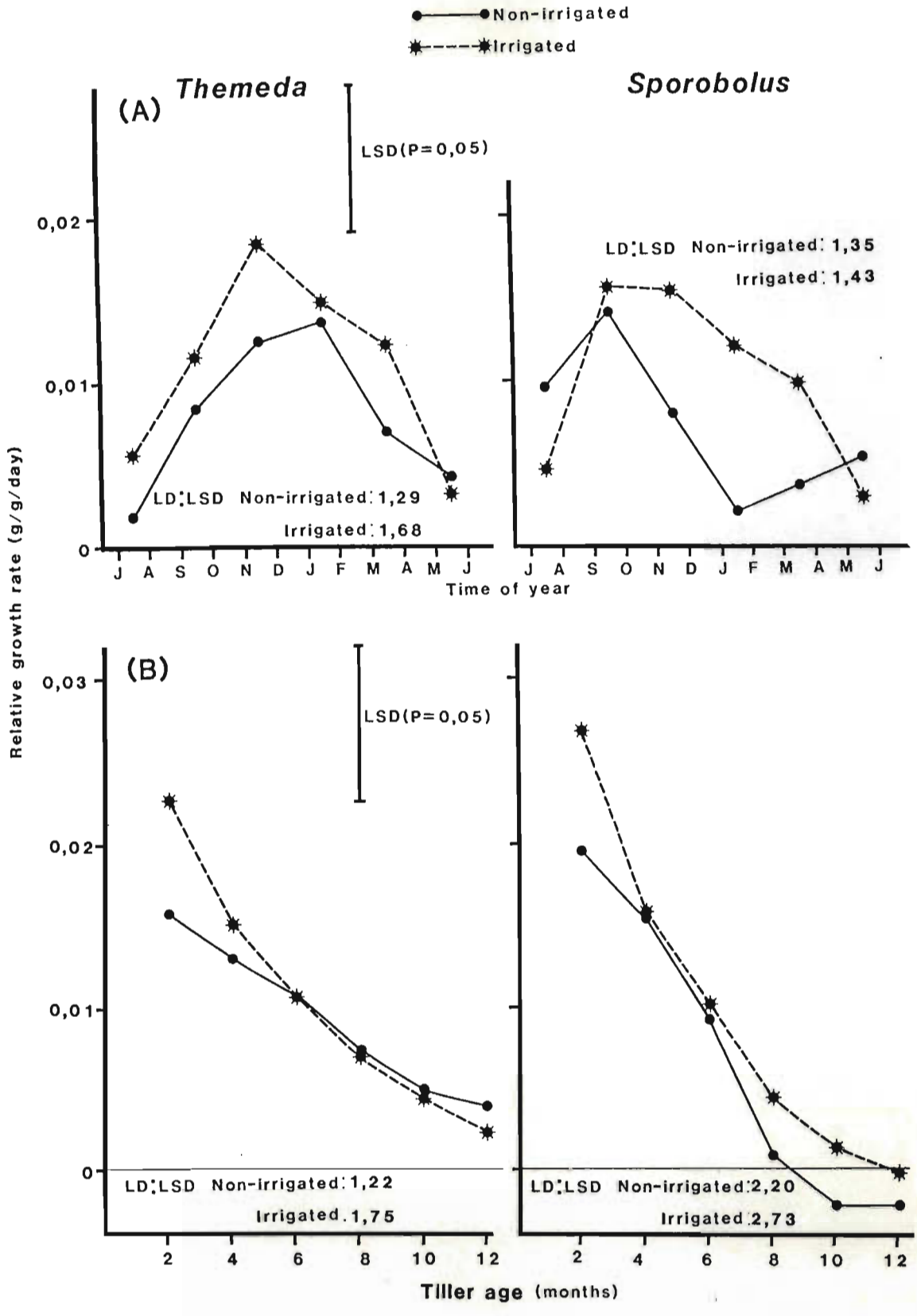

Figure 4.9 *The effect of time of year (A) and tiller age (B) on the relative growth rate of irrigated and non-irrigated tillers of* Themeda triandra *and* Sporobolus fimbriatus. *Symbols represent means and* LSD *is the least significant difference between two means.* LD : LSD *is the ratio between the largest difference between two means within a treatment and the* LSD.

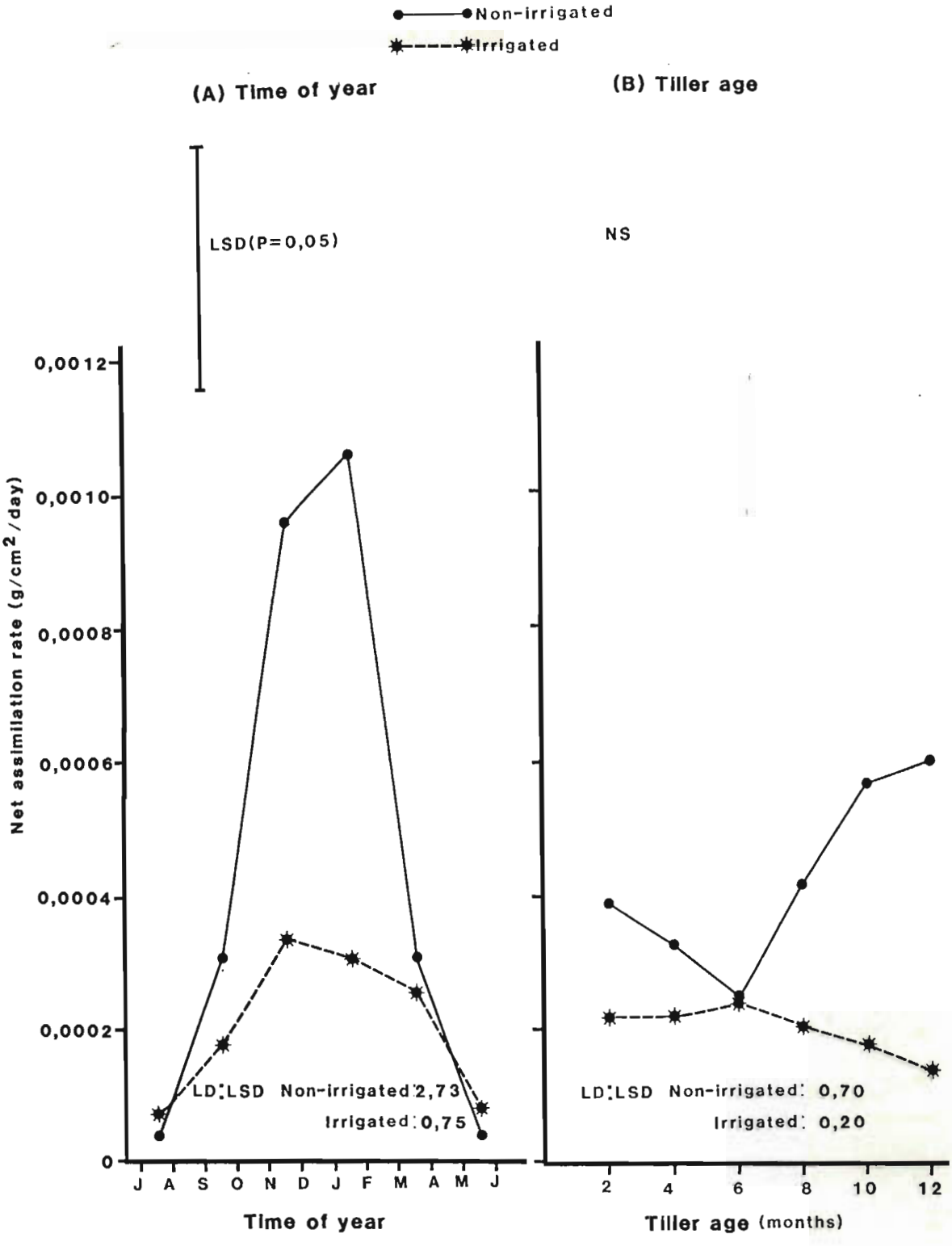

Figure 4.10 *The effect of time of year (A) and tiller age (B) on the net assimilation rate of irrigated and non-irrigated* Themeda triandra *tillers. Symbols represent means and* LSD *is the least significant difference between two means.* NS *denotes no significant difference.*
LD : LSD *is the ratio between the largest difference between two means within a treatment and the* LSD.

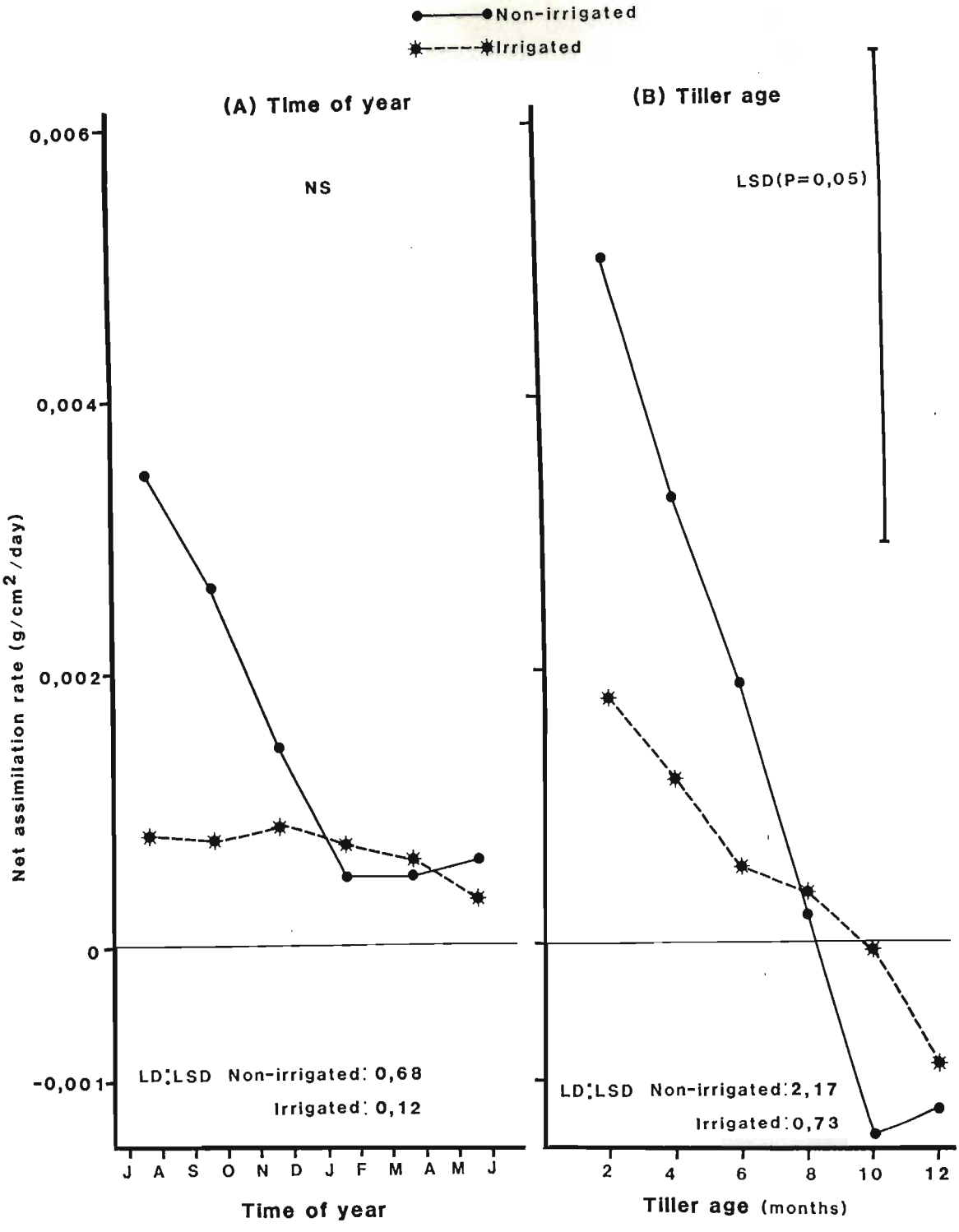

Figure 4.11 *The effect of time of year (A) and tiller age (B) in the net assimilation rate of irrigated and non-irrigated* Sporobolus fimbriatus *tillers. Symbols represent means and* LSD *is the least significant difference between two means.* NS *denotes no significant difference.* LD : LSD *is the ratio between the largest difference between two means within a treatment and the* LSD.

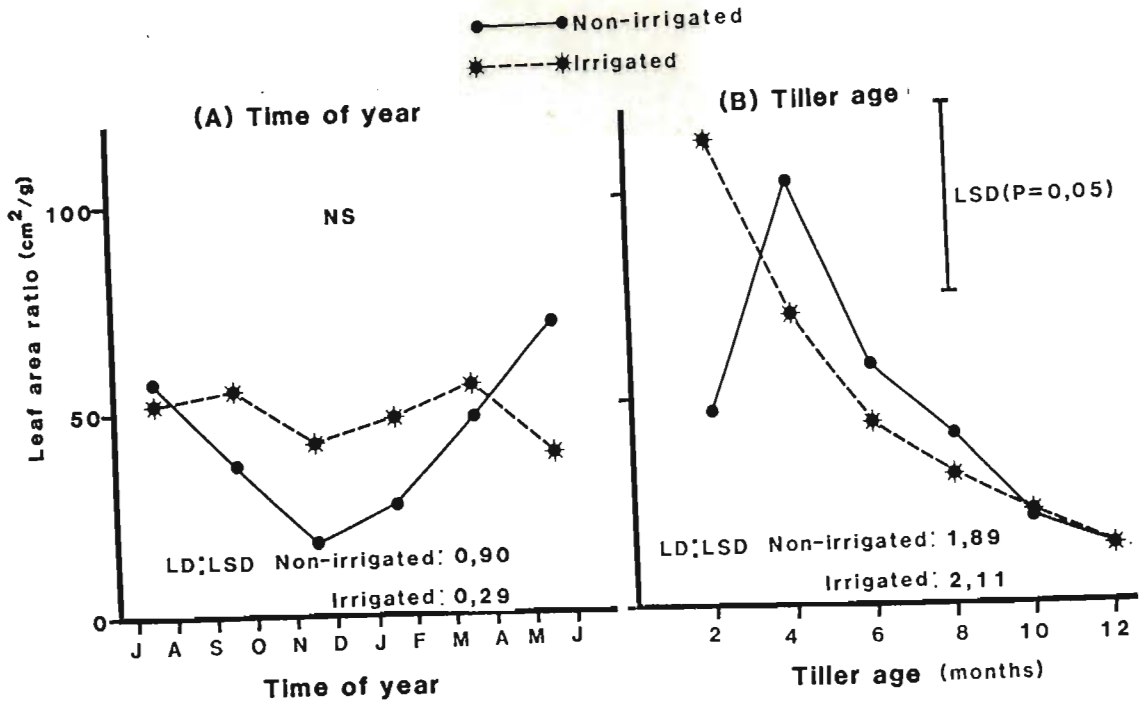

Figure 4.12 *The effect of time of year (A) and tiller age (B) on the leaf area ratio of irrigated and non-irrigated* Themeda triandra *tillers. Symbols represent means and* LSD *is the least significant difference between two means.* NS *denotes no significant difference.* LD : LSD *is the ratio between the largest difference between two means within a treatment and the* LSD.

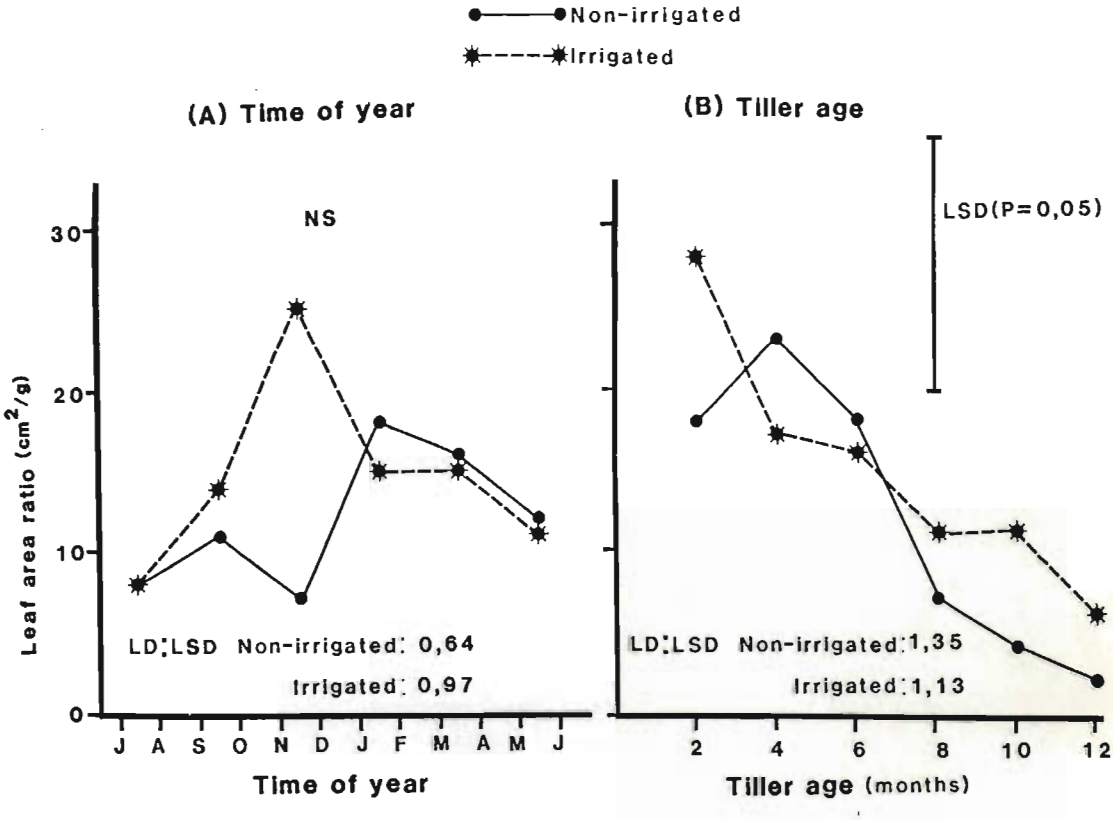

Figure 4.13 *The effect of time of year (A) and tiller age (B) on the leaf area ratio of irrigated and non-irrigated* Sporobolus fimbriatus *tillers. Symbols represent means and* LSD *is the least significant difference between two means.* NS *denotes no significant difference.* LD : LSD *is the ratio between the largest difference between two means within a treatment and the* LSD.

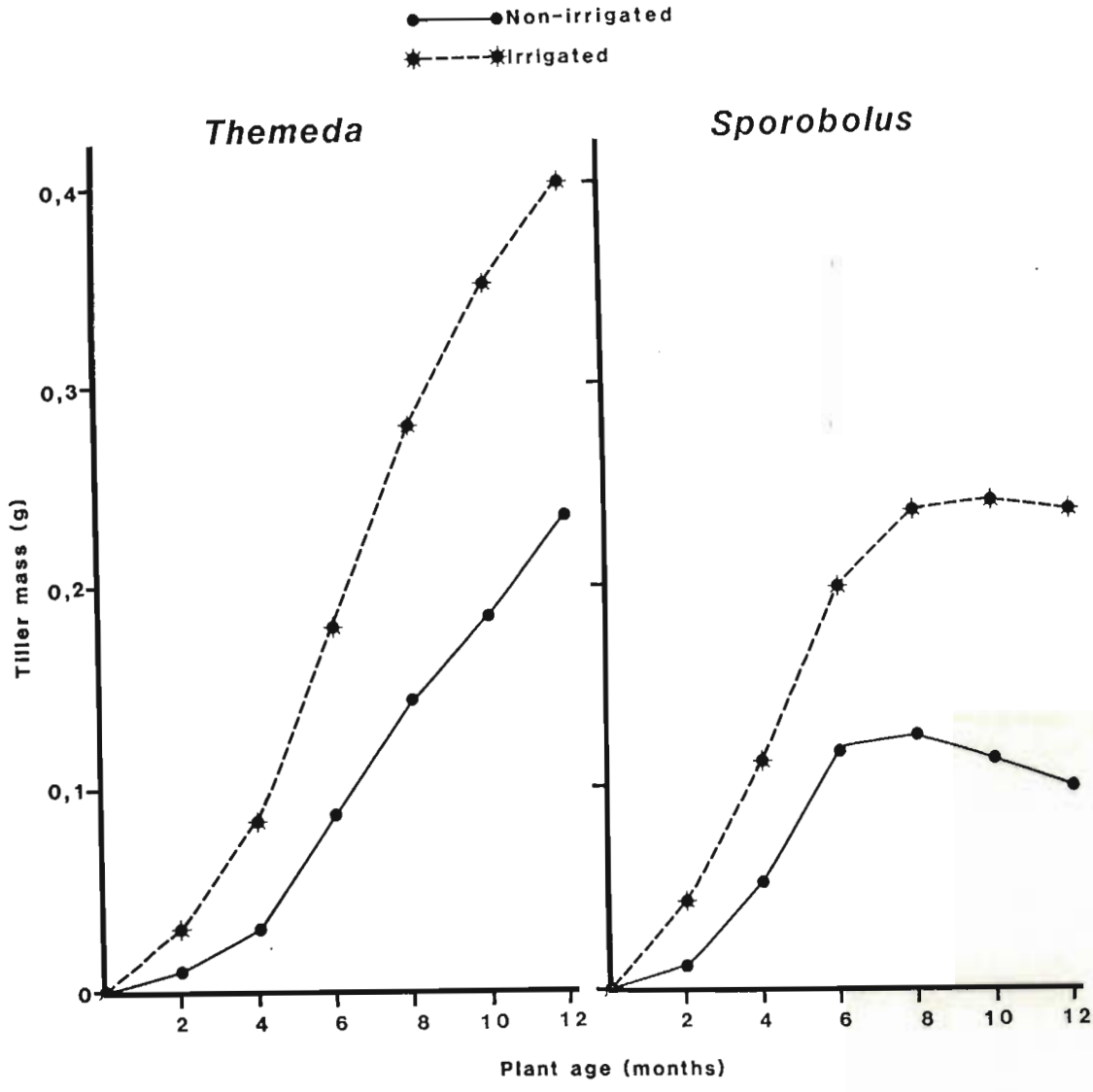

Figure 4.14 *Mean effect of plant age on the cumulative mass of irrigated and non-irrigated* Themeda triandra *and* Sporobolus fimbriatus *tillers at all times of the year.*

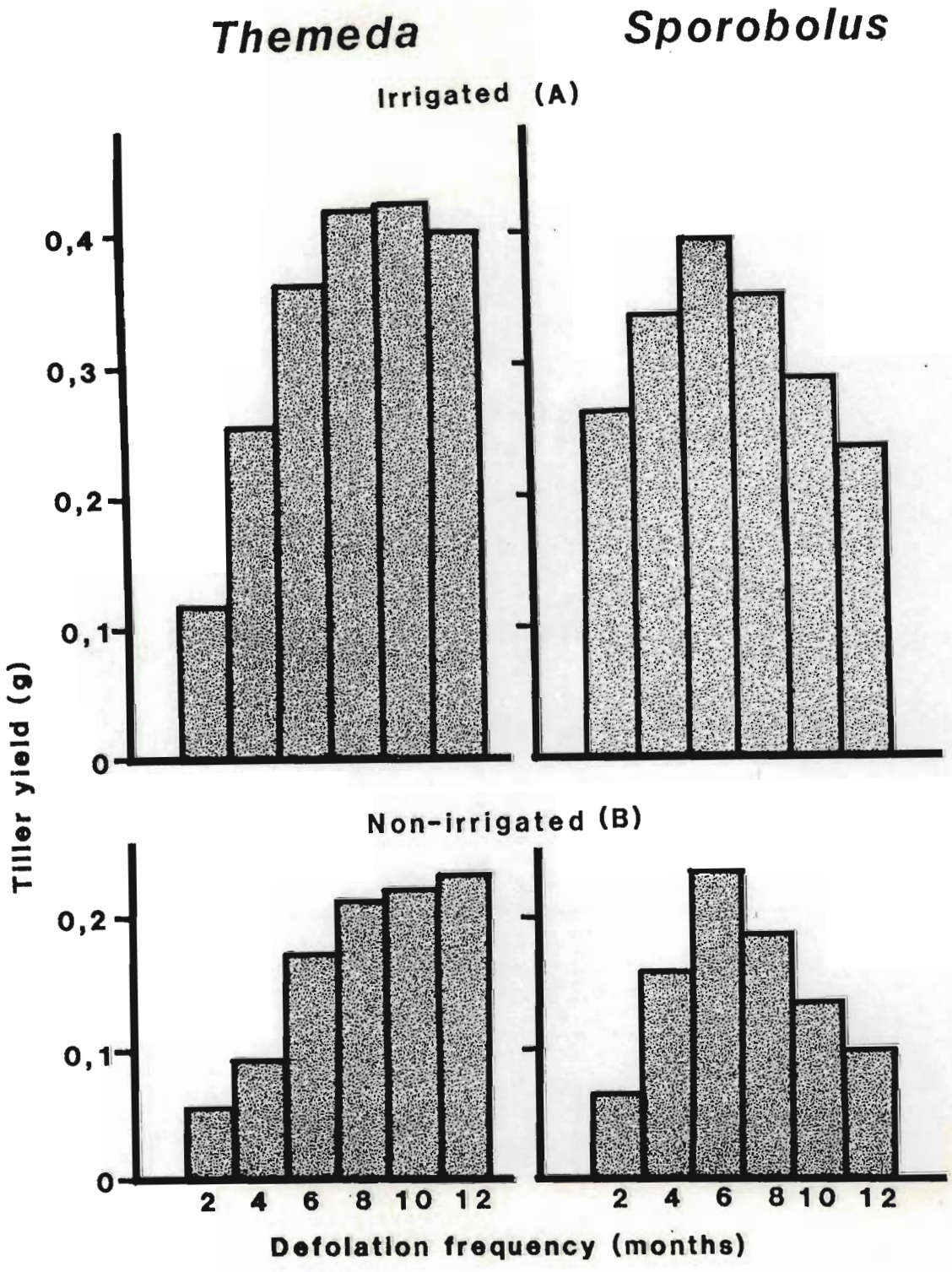

Figure 4.15 *Extrapolated effect of frequency of complete defoliation of all above ground material on production of irrigated (A) and non-irrigated (B)* Themeda triandra *and* Sporobolus fimbriatus *tillers.*

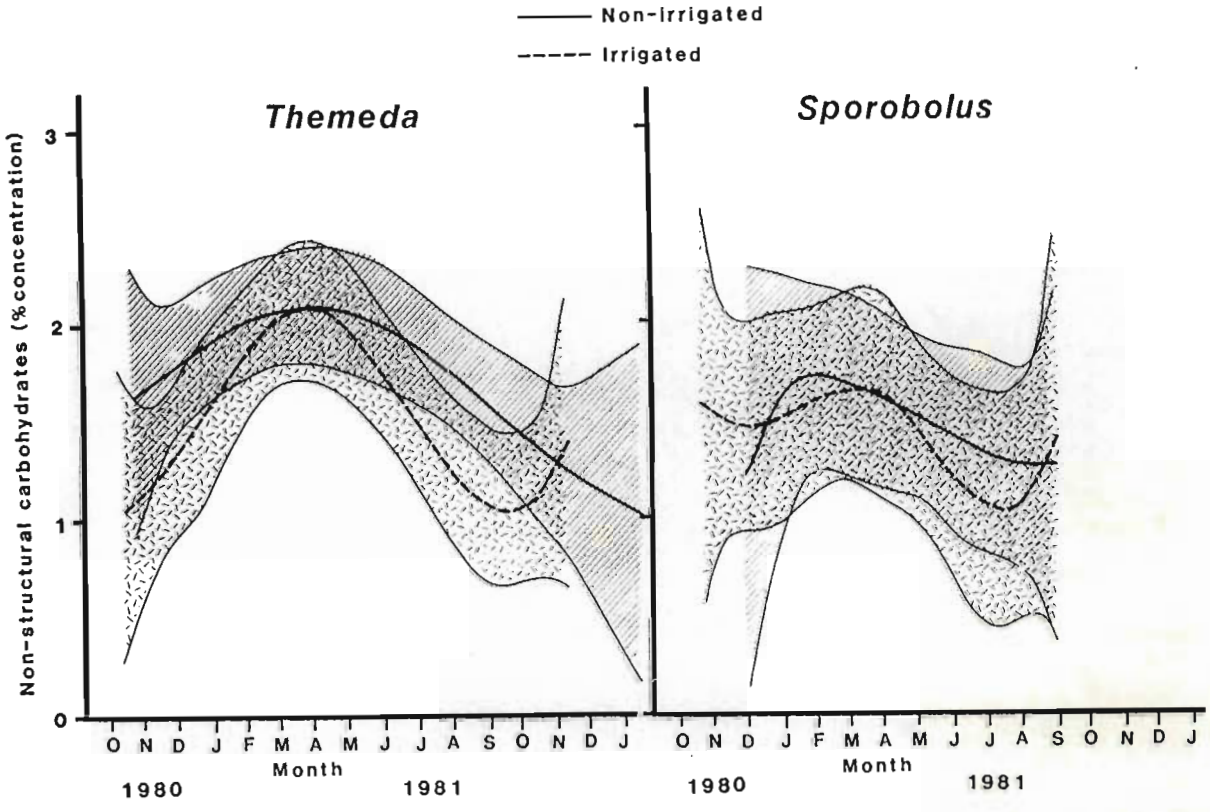

Figure 5.1 *Percentage non-structural carbohydrates in leaves of irrigated and non-irrigated* Themeda triandra *and* Sporobolus fimbriatus *tillers growing in the field after initiation during spring 1980. Shaded areas represent 95 % confidence intervals.*

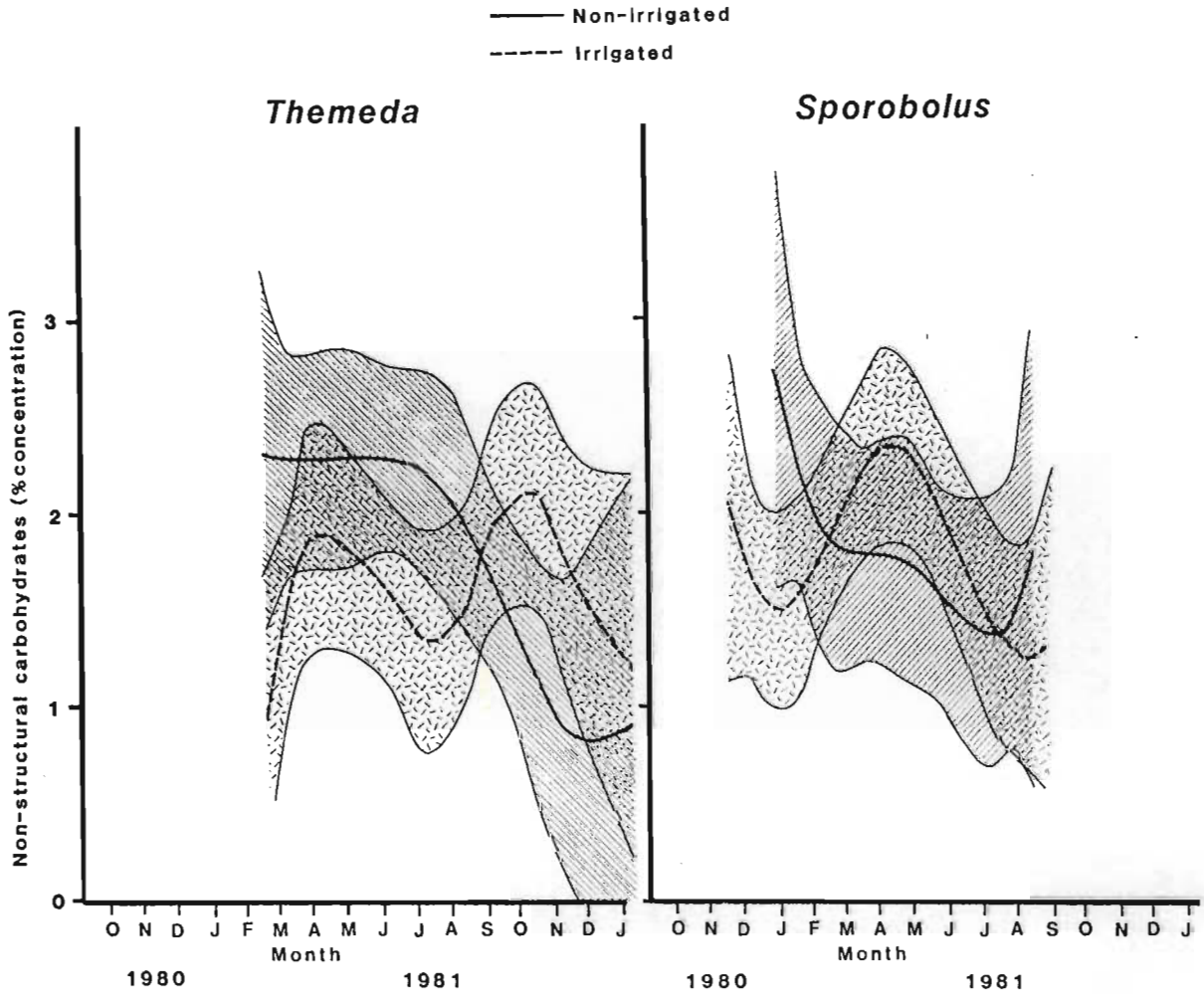

Figure 5.2 *Percentage non-structural carbohydrates in upper stems of irrigated and non-irrigated* Themeda triandra *and* Sporobolus fimbriatus *tillers growing in the field after initiation during spring 1980. Shaded areas represent 95 % confidence intervals.*

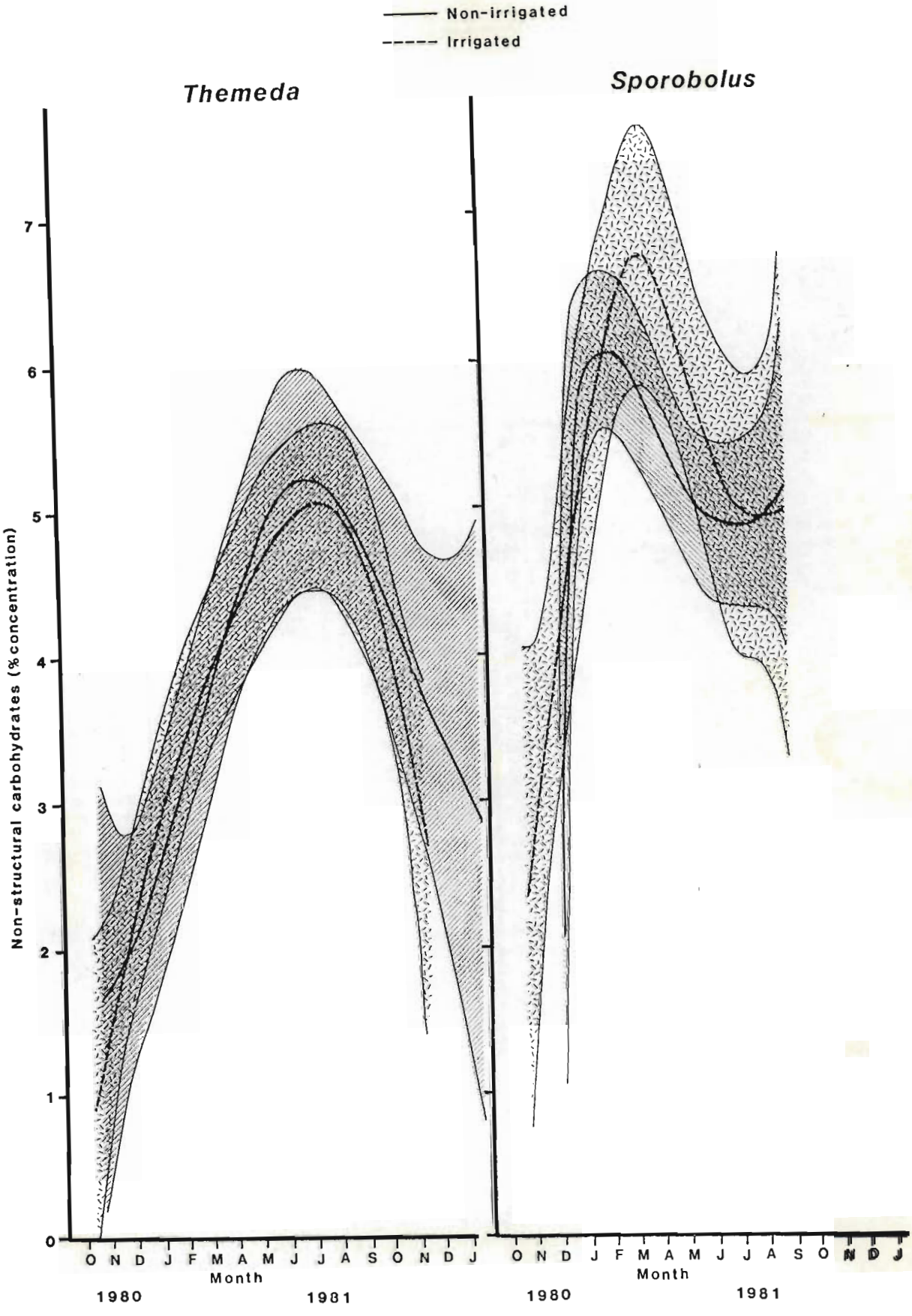

Figure 5.3 *Percentage non-structural carbohydrates in stubble of irrigated and non-irrigated* Themeda triandra *and* Sporobolus fimbriatus *tillers growing in the field after initiation during spring 1980. Shaded areas represent 95 % confidence intervals.*

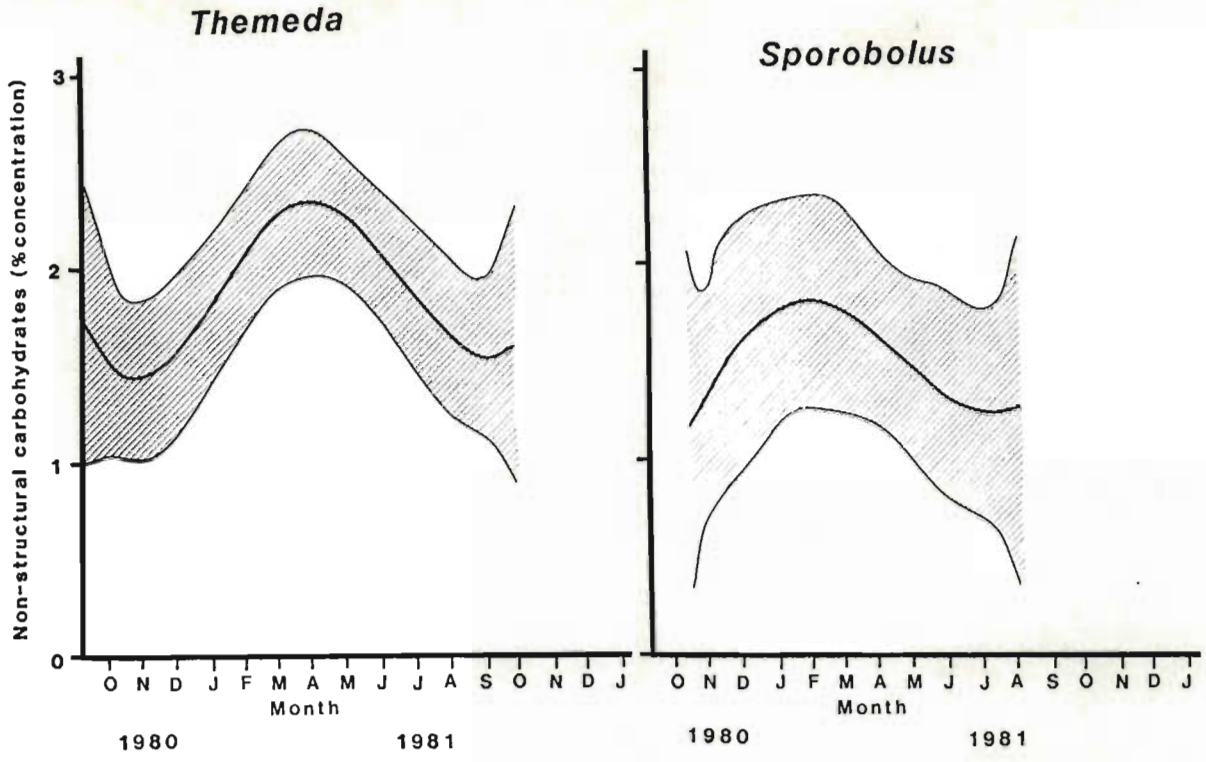

Figure 5.4 *Percentage non-structural carbohydrates in leaves of* Themeda triandra *and* Sporobolus fimbriatus *tillers growing in pots in the greenhouse. Shaded areas represent 95 % confidence intervals.*

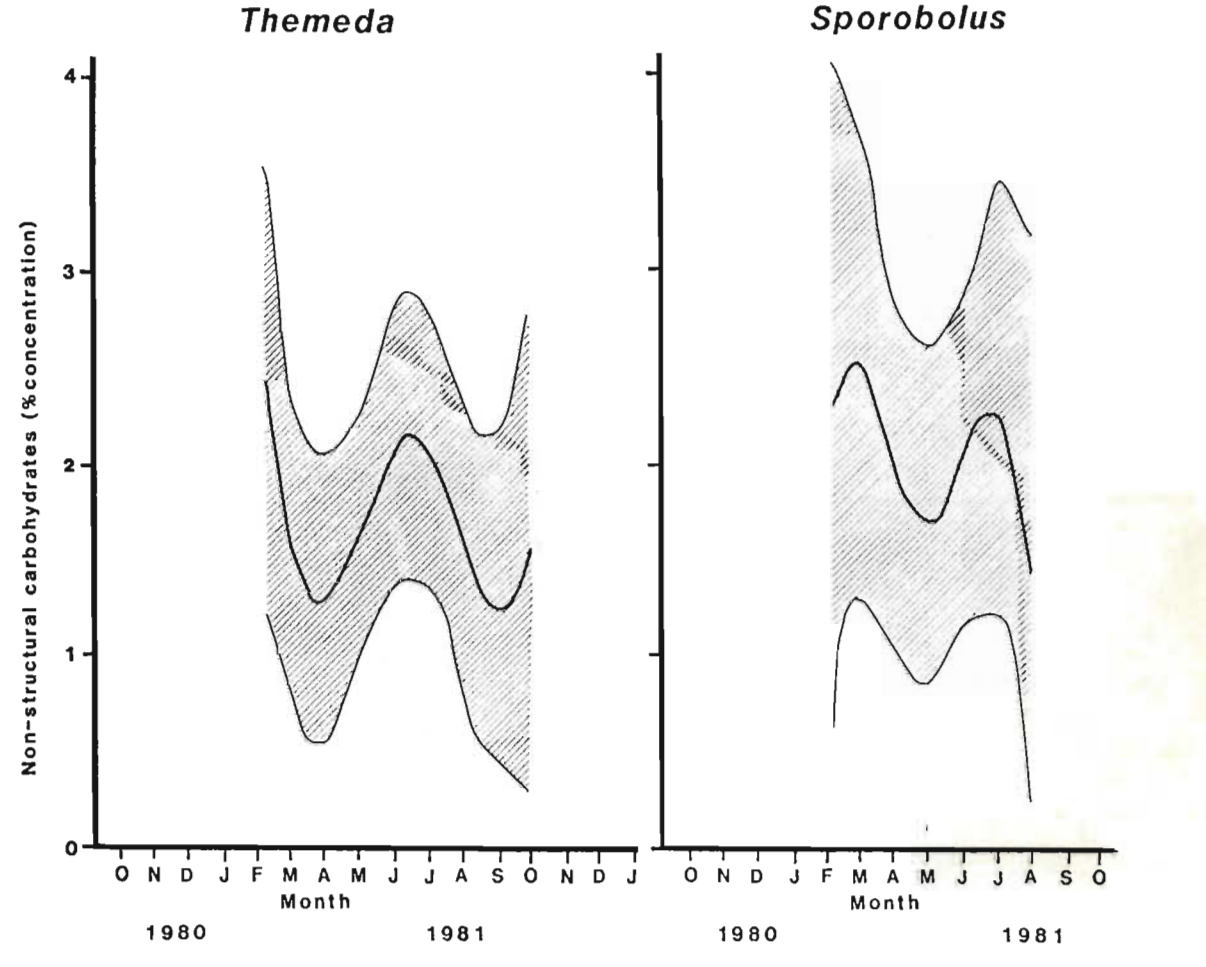

Figure 5.5 *Percentage non-structural carbohydrates in upper stems of* Themeda triandra *and* Sporobolus fimbriatus *tillers growing in pots in the greenhouse. Shaded areas represent 95 % confidence intervals.*

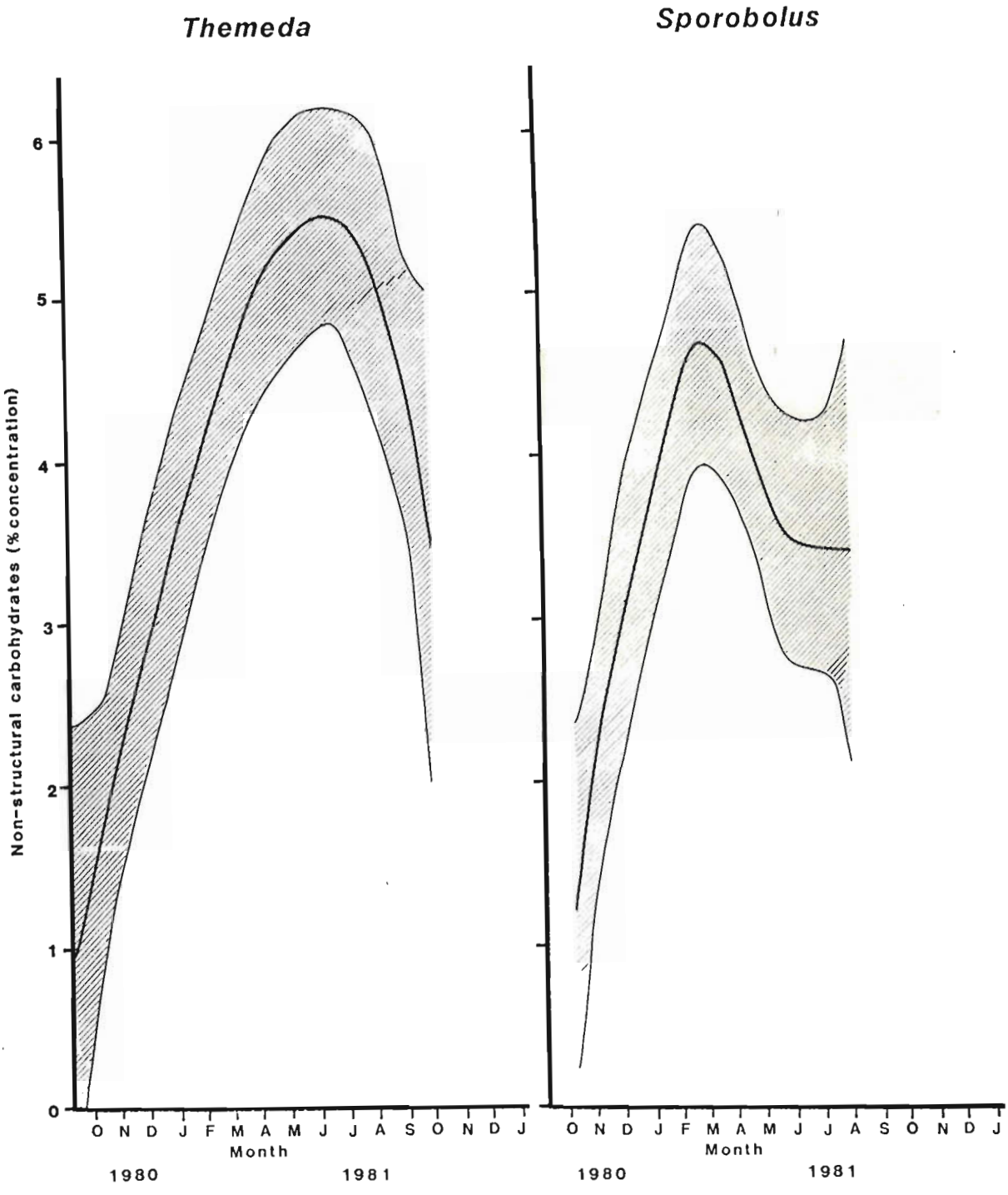

Figure 5.6 *Percentage non-structural carbohydrates in stubble of* Themeda triandra *and* Sporobolus fimbriatus *tillers growing in pots in the greenhouse. Shaded areas represent 95 % confidence intervals.*

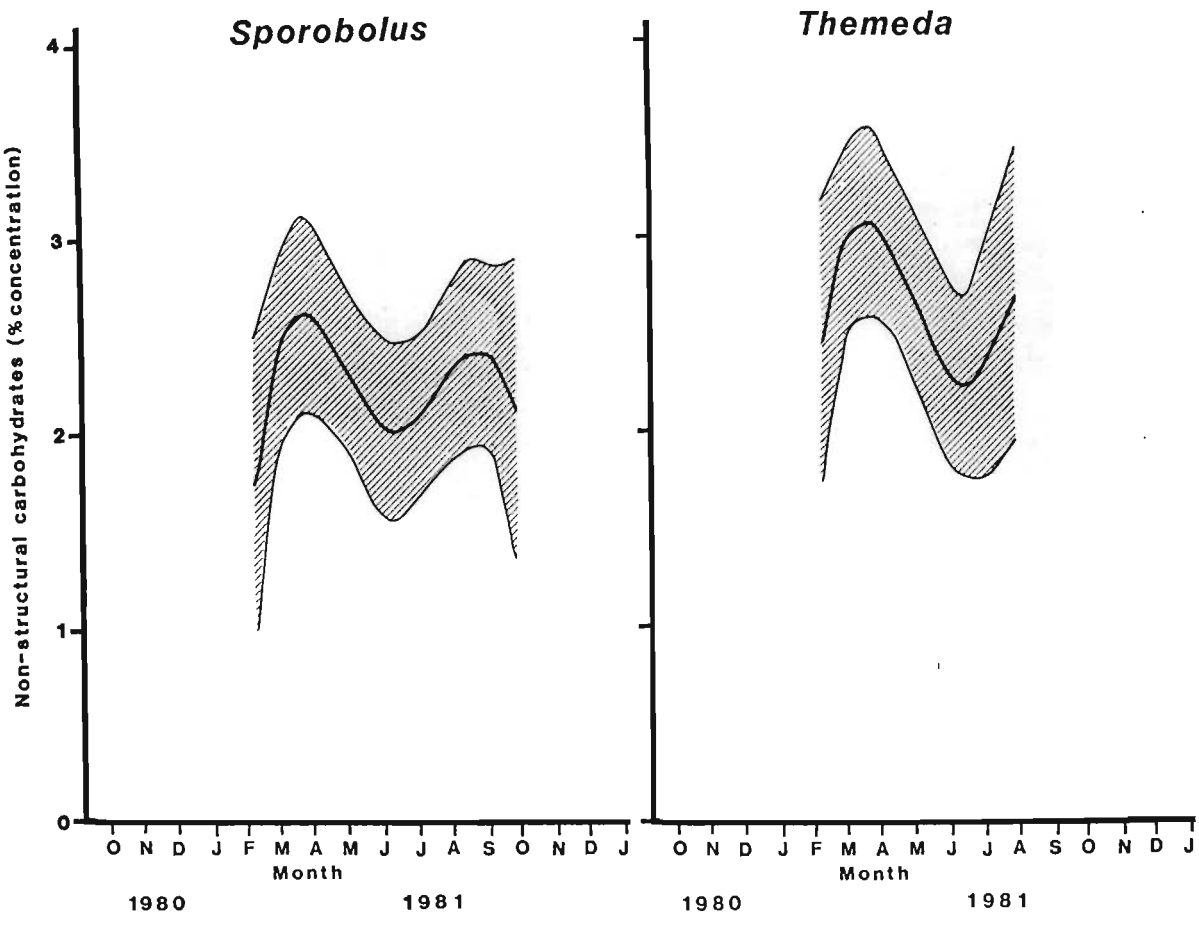

Figure 5.7 *Percentage non-structural carbohydrates in roots of* Themeda triandra *and* Sporobolus fimbriatus *tillers growing in pots in the greenhouse. Shaded areas represent 95 % confidence intervals.*

TABLE 6.1

Soil water content at field capacity (A) and at cessation of visible growth, (B) (expressed as mass of moisture as a percentage of soil dry mass), and soil water depletion at cessation of visible growth (C) (expressed as a percentage of soil moisture at field capacity) in greenhouse pots containing T. triandra *and* S. fimbriatus *tufts. S.E.'s represent standard errors of each population.*

Species	A		B		A-B		C	
	Mean	SE	Mean	SE	Mean	SE	Mean	SE
Themeda triandra	25,25	5,56	15,11	2,83	10,14	3,45	39,54	6,31
Sporobolus fimbriatus	28,40	1,67	16,65	1,49	11,75	1,84	40,44	6,15
Differences[1]	3,15	**	1,54	*	1,58	*	0,90	NS

[1] *(P<0,05); **(P<0,01); NS (difference not statistically significant)

TABLE 6.2

Mean monthly rainfall (P), class "A" pan evaporation (Eo) and estimated potential evapo-transpiration (PEt) on veld in good and moderate condition for the months September to May (growing season) in the False Thornveld of the Eastern Cape.

Month	1 P (mm)	2 Eo (mm/day)	3 PEt (mm/day) Good Condition	3 PEt (mm/day) Mod. Condition
September	27,8	5,5	3,7	3,4
October	40,5	6,7	4,5	4,1
November	38,2	7,5	5,0	4,6
December	41,5	8,6	5,8	5,3
January	41,9	8,9	6,0	5,5
February	55,7	8,0	4,1	3,7
March	72,9	6,5	3,3	3,1
April	33,9	5,1	2,6	2,4
May	26,5	4,5	2,3	2,1

1. Mean recorded over a period of 65 years at the Adelaide Police Station (Anon., 1984)

2. Mean for Adelaide Experimental Station (Anon., 1984)

3. Calculated from following PEt/Eo ratios:
   September - January: Good condition, 0,67; moderate condition, 0,62.
   February - May: Good condition, 0,51; moderate condition, 0,47 (after Snyman *et al*, 1980).

TABLE 6.3

Percentage species composition, species class totals and veld condition scores of the benchmark site (Maximum limits in parenthesis) and of the experimental sites at Adelaide and Kroomie before the 1982/83 drought (A), after a full season's rest following the drought (B) and of veld adjacent to experimental sites not rested during the season following the drought (C).

Species class	Species	Benchmark[1]	Adelaide			Kroomie		
			A	B	C	A	B	C
Decreaser	*Heteropogon contortus*	(10)				2,6	0,2	
	Panicum stapfianum	8 (15)	10,2	1,0	1,0	0,2	1,8	1,5
	Setaria neglecta	1 (65)						
	Themeda triandra	50 (65)	4,4	2,0	1,0	57,8	40,6	20,5
Increaser I	*Cymbopogon plurinodis*	2 (5)	27,8	32,8	31,5		0,4	
Increaser II	*Aristida barbicollis*		0,2	0,4	1,0			
	Cynodon dactylon	1 (1)	1,0	4,2	5,5	1,0	4,6	9,0
	Digitaria eriantha	16 (16)	16,6	16,0	15,0	18,0	17,2	18,5
	Eragrostis chloromelas	1 (1)	2,2	2,4	2,0	7,0	8,4	12,5
	Eragrostis curvula	5 (5)	0,2	2,0			1,6	
	Eragrostis obtusa	1 (1)	9,8	2,0	9,0	1,0	3,6	2,5
	Eustachys mutica	3 (3)	0,2		0,5			0,5
	Karoochloa curva	1 (1)	0,2					
	Microchloa caffra		0,2		0,5	2,2	7,8	4,5
	Sporobolus africanus					0,2		
	Sporobolus fimbriatus	8 (25)	21,4	20,4	8,5	7,2	5,8	4,0
	Sporobolus nitens						0,8	
	Tragus racemosa		1,6	4,4	8,0			
	Forbs	3 (3)	4,0	12,4	16,5	2,8	7,2	26,5
Decreaser total		59,0	14,6	3,0	2,0	60,6	42,6	22,0
Increaser I total		2,0	27,8	32,8	31,5		0,4	
Increaser II total		39,0	57,6	64,2	66,5	39,4	57,0	78
Veld condition score[2]		100	63,4	52,4	37,0	89,6	72,4	48,5

[1] Benchmark as identified by Dankcwerts (1981)

[2] Veld condition score calculated according to procedure of Danckwerts (1981)

TABLE 6.4

Percentage mortality of permanently marked tufts of species under consideration at Adelaide and Kroomie after relief of the 1982/83 drought.

Species	Adelaide	Kroomie
Cymbopogon plurinodis	0	
Digitaria eriantha	33	70
Eragrostis chloromelas		70
Panicum stapfianum	43	
Sporobolus fimbriatus	53	40
Themeda triandra	30	57
Mean	31,8	47,5

TABLE 6.5

Recorded veld conditions scores and estimated grazing capacities expressed in ha/mature livestock unit (MLU) and MLU/ha at Adelaide and Kroomie before the 1982/83 drought (A), after a full season's rest following the drought (B) and on veld adjacent to the experimental sites not rested during the season following the drought (C).

Site	Adelaide			Kroomie		
Treatment	A	B	C	A	B	C
Veld Condition score	63,4	52,4	37,0	89,6	72,4	48,5
Grazing[1] ha/MLU	5,8	7,7	14,3	3,7	4,8	8,7
Capacity MLU/ha	0,17	0,13	0,07	0,27	0,21	0,12

[1] Calculated using the model developed for the False Thornveld of the Eastern Cape by Danckwerts (1982*a*) and assuming mean annual rainfall = 435,5mm.

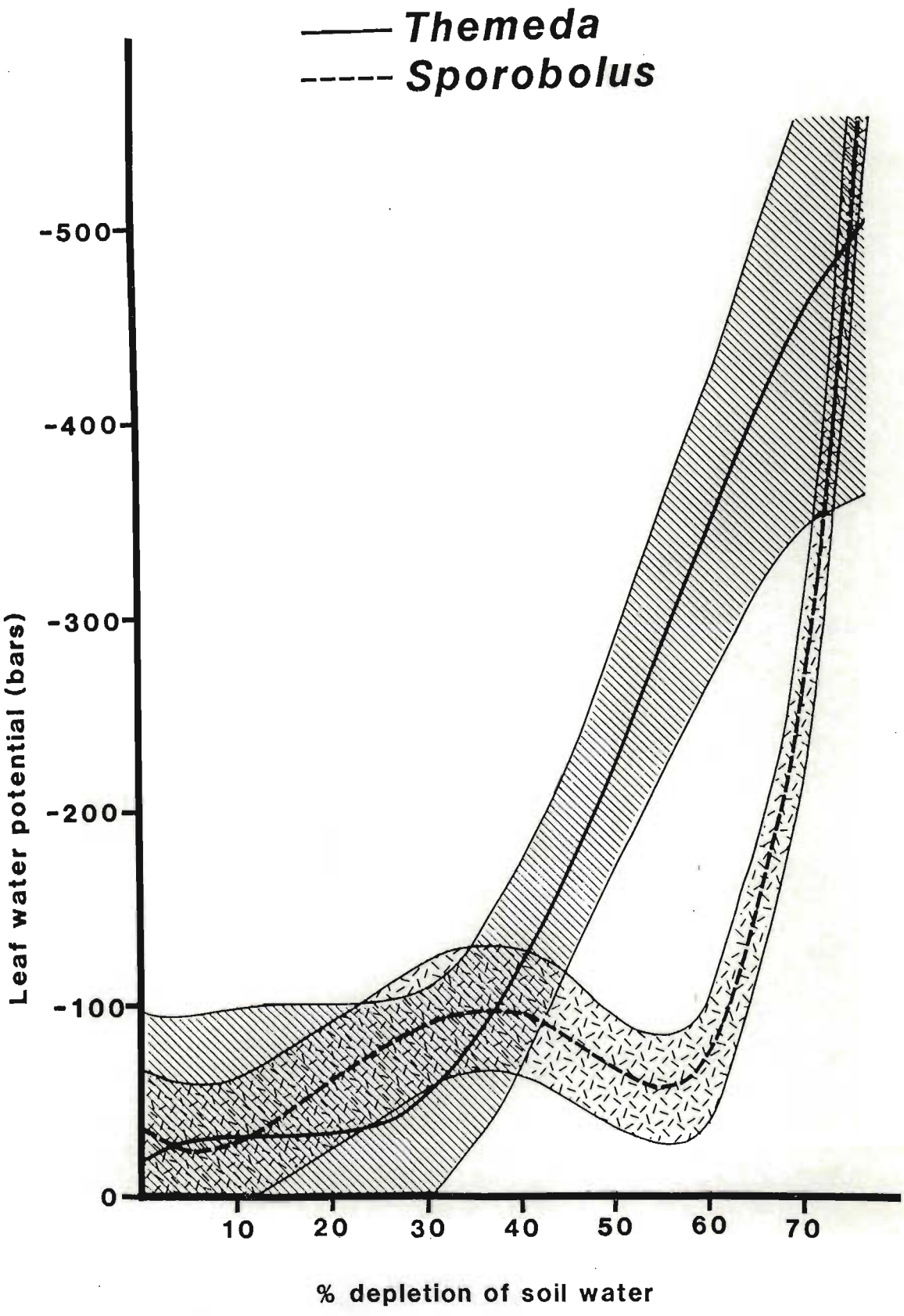

Figure 6.1 *The relation between leaf water potential and soil water depletion in greenhouse pots containing tufts of* Themeda triandra *and* Sporobolus fimbriatus. *The shaded areas represent 95 °/o confidence intervals.*

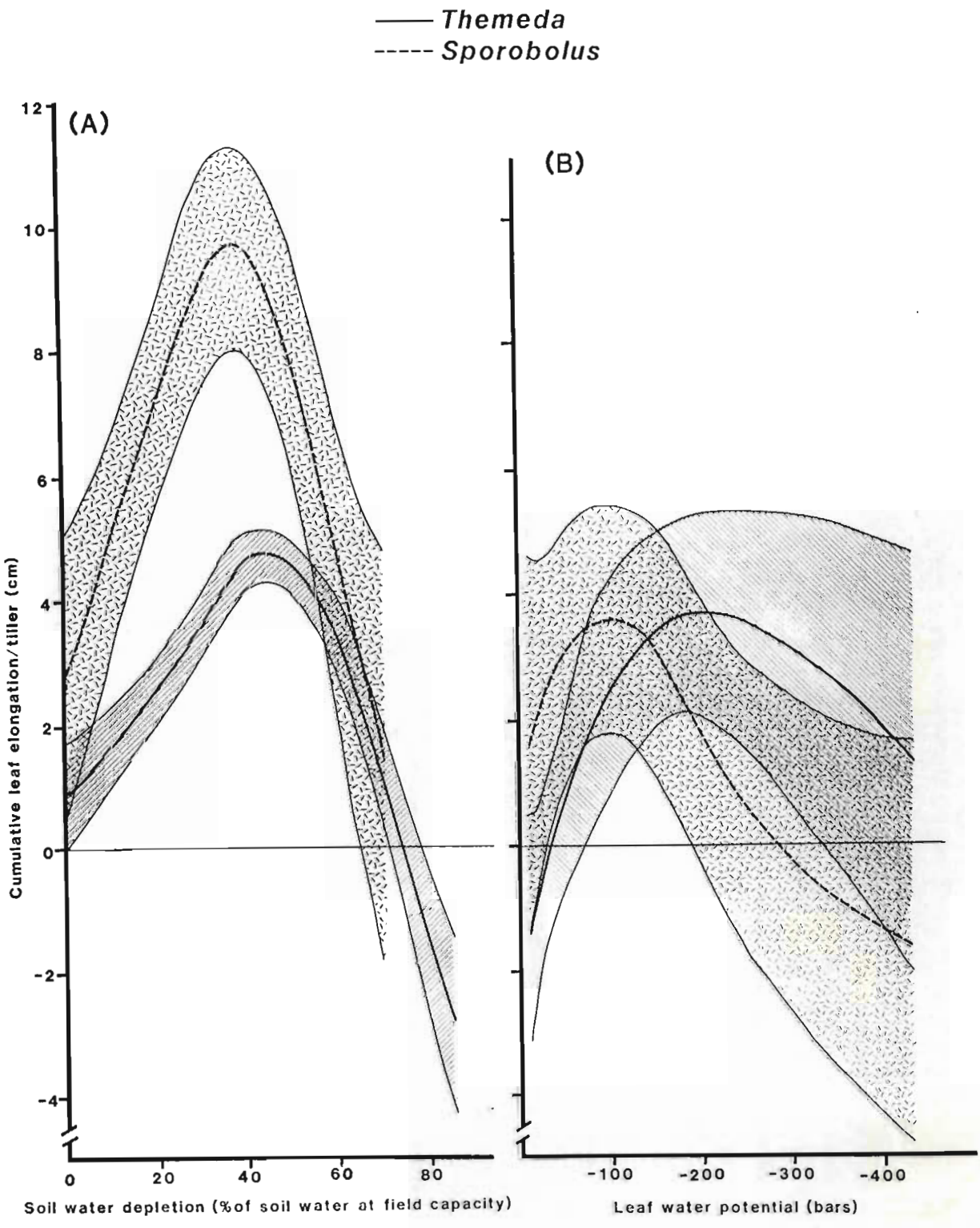

Figure 6.2 *The relations between cumulative total green leaf elongation per tiller and percentage soil water depletion (A) and leaf water potential (B) in pots containing* Themeda triandra *and* Sporobolus fimbriatus *in the greenhouse. Shaded areas represent 95 % confidence intervals.*

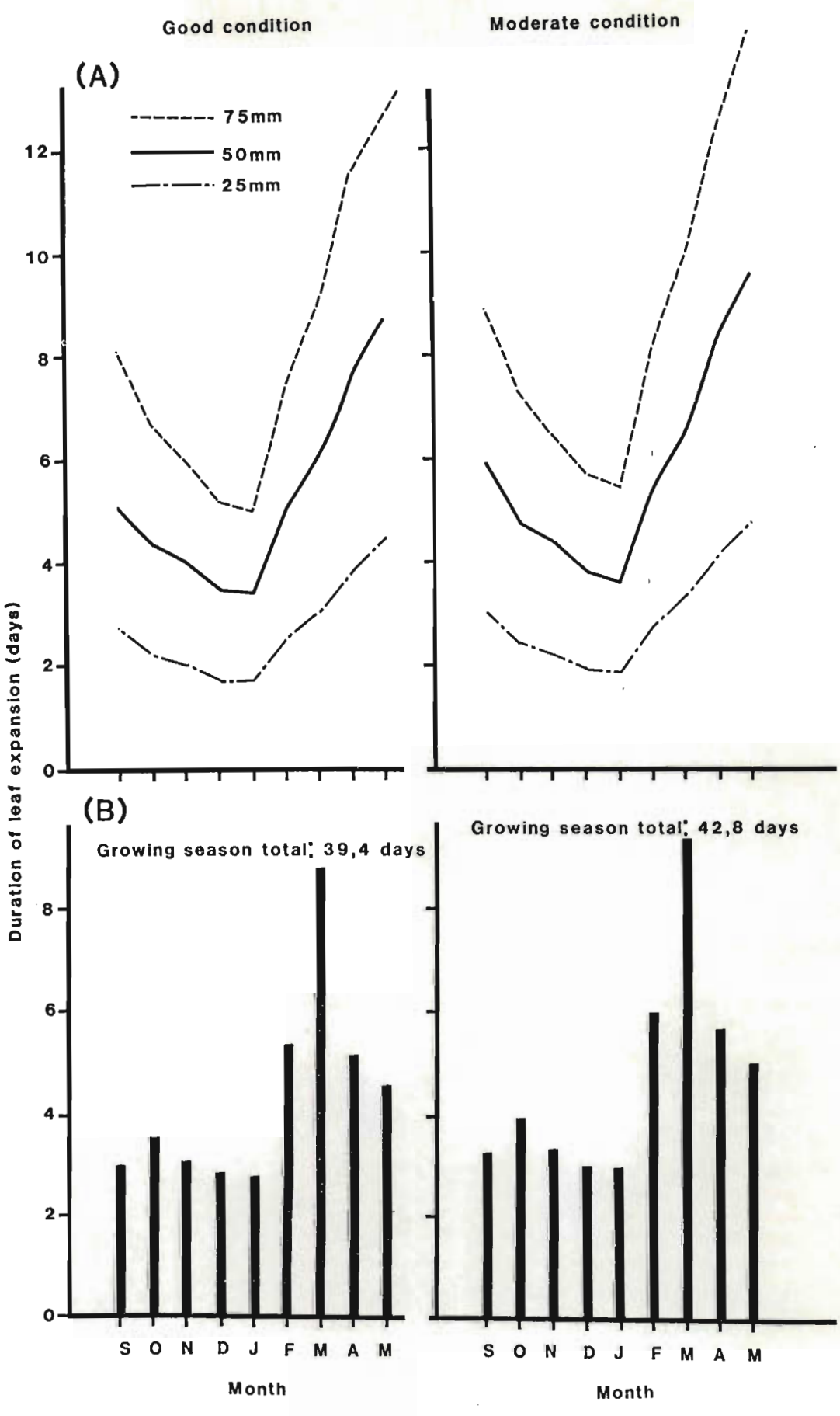

Figure 6.3 *Estimated duration of net green leaf expansion after rains of 25, 50 and 75 mm respectively at different times of the year (A) and the long term average monthly duration of leaf expansion (B) in the False Thornveld of the Eastern Cape. Results are presented for veld in both good and moderate condition.*

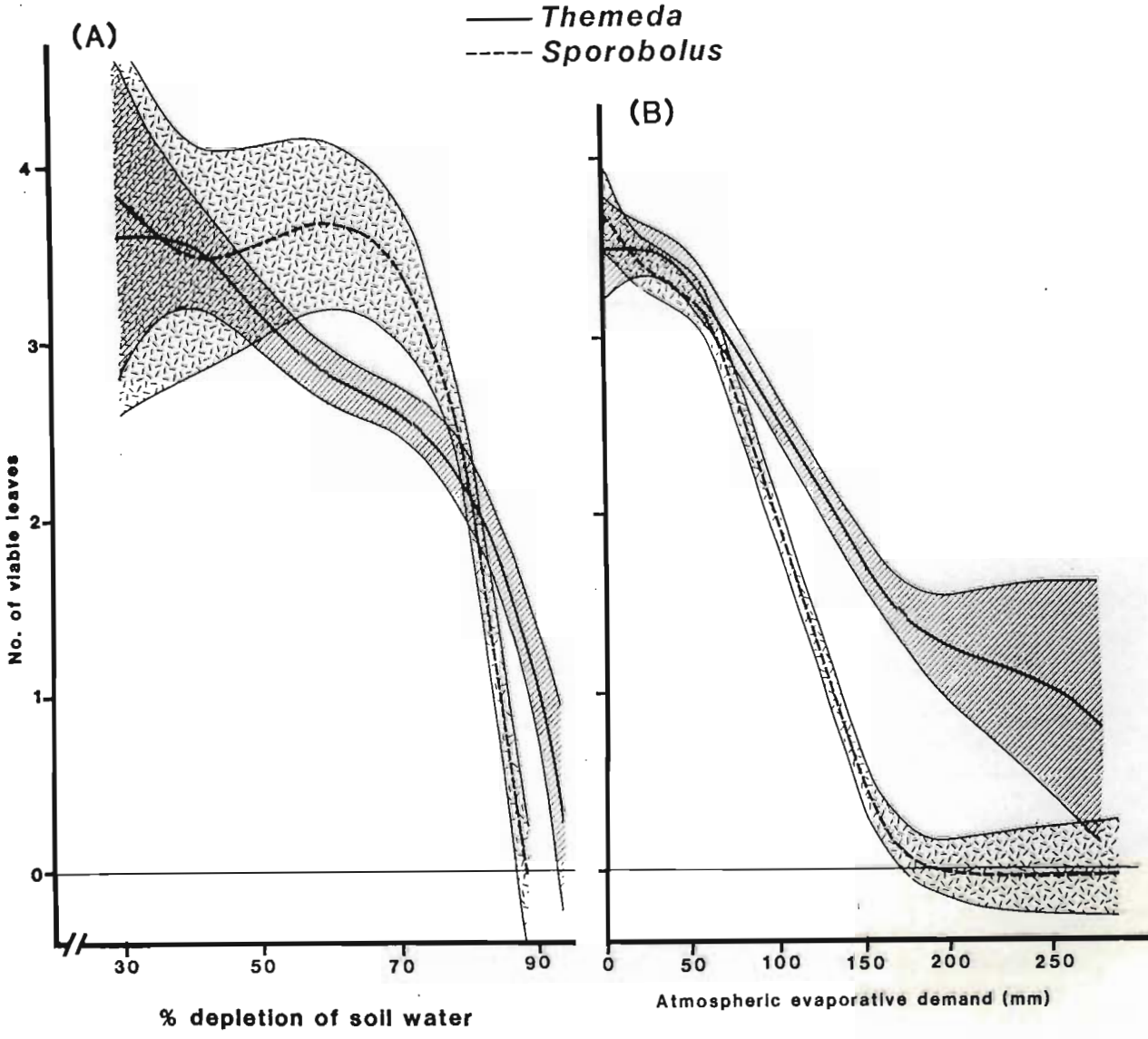

Figure 6.4 *The relations between the number of viable green leaves per tiller and progressively severe moisture stress after cessation of leaf expansion growth for the species* Themeda triandra *and* Sporobolus fimbriatus *growing in pots in the greenhouse. Moisture stress is expressed in terms of soil water depletion (A) and atmospheric evaporative demand after cessation of growth (B). Shaded areas represent 95 °/o confidence intervals.*

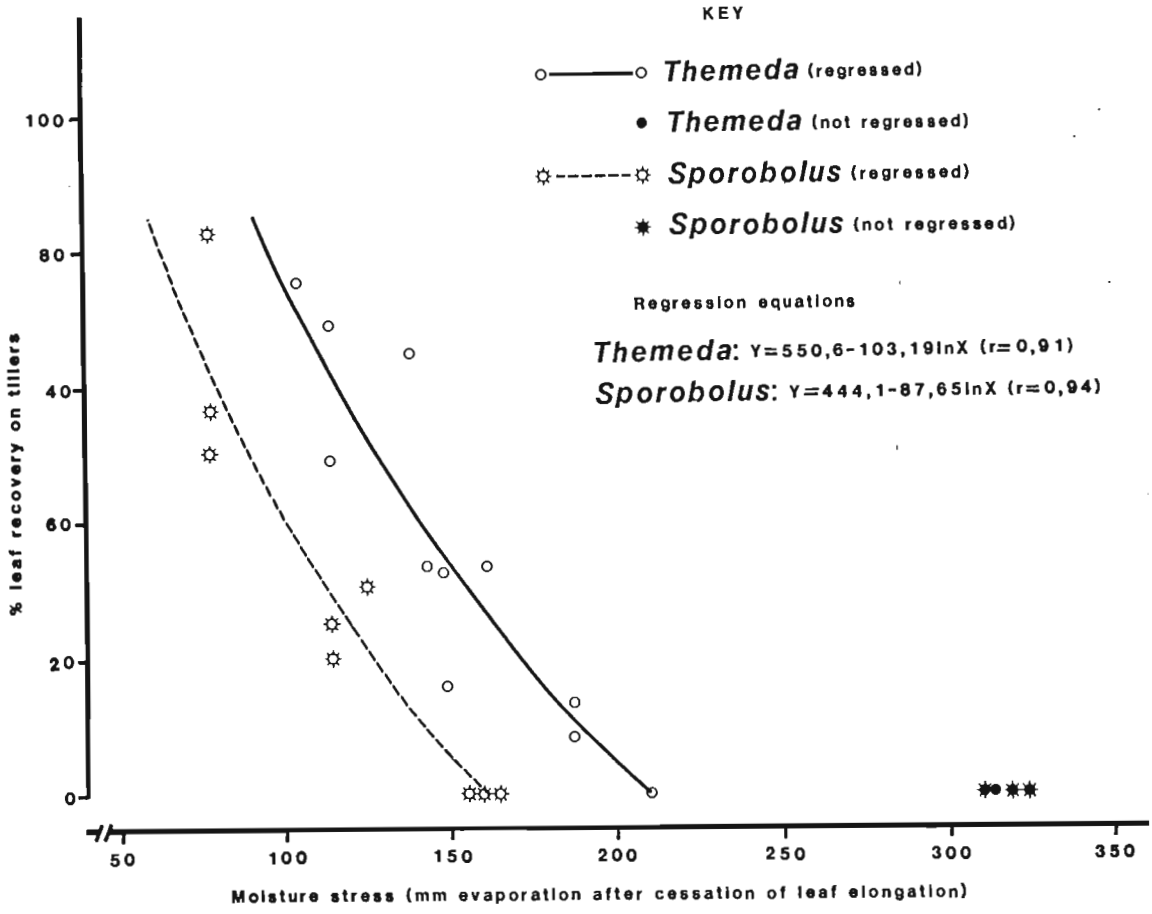

Figure 6.5 *Percentage recovery of leaves of marked tillers in individual pots of* Themeda triandra *and* Sporobolus fimbriatus *after increasingly severe levels of stress. Data not used for regression analyses are presented as bold symbols.*

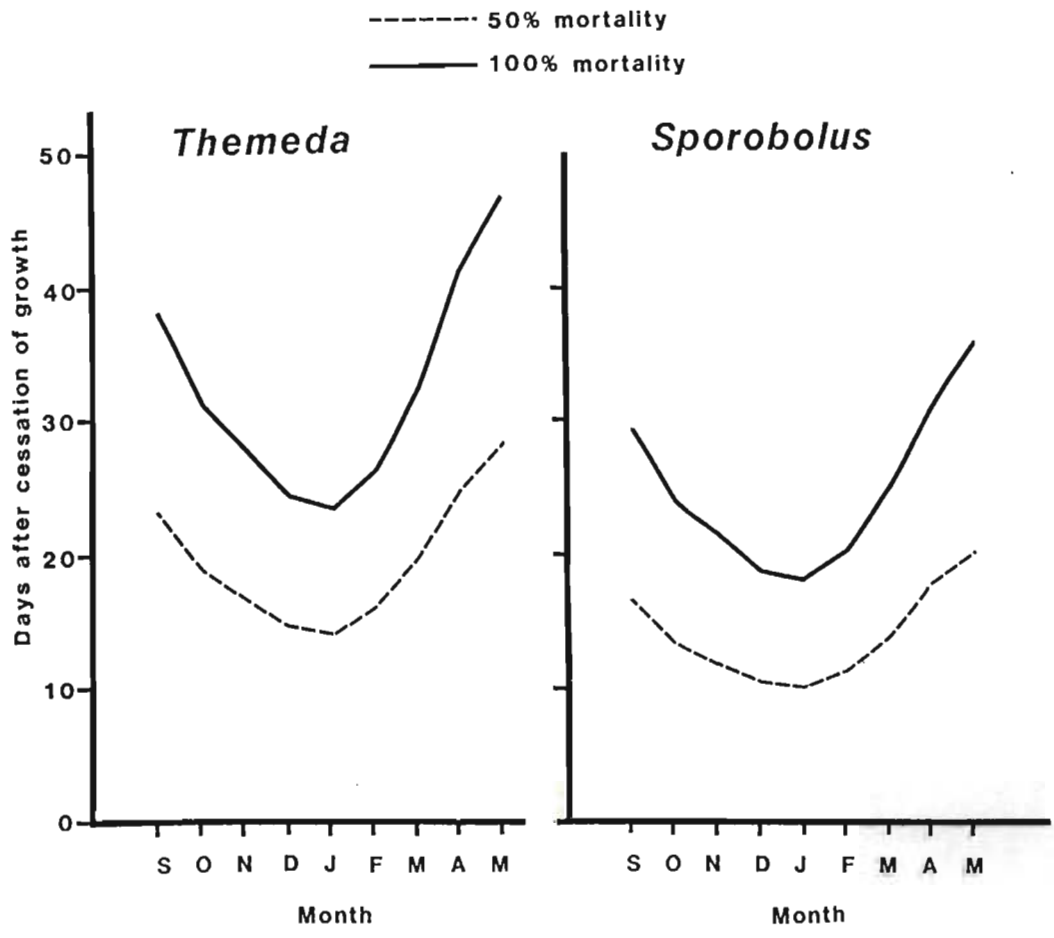

Figure 6.6 *Estimated durations of periods of no rainfall once leaf expansion has ceased after which 50 % and 100 % mortality of leaves of* Themeda triandra *and* Sporobolus fimbriatus *are expected to take place in the False Thornveld of the Eastern Cape at different times of the year.*

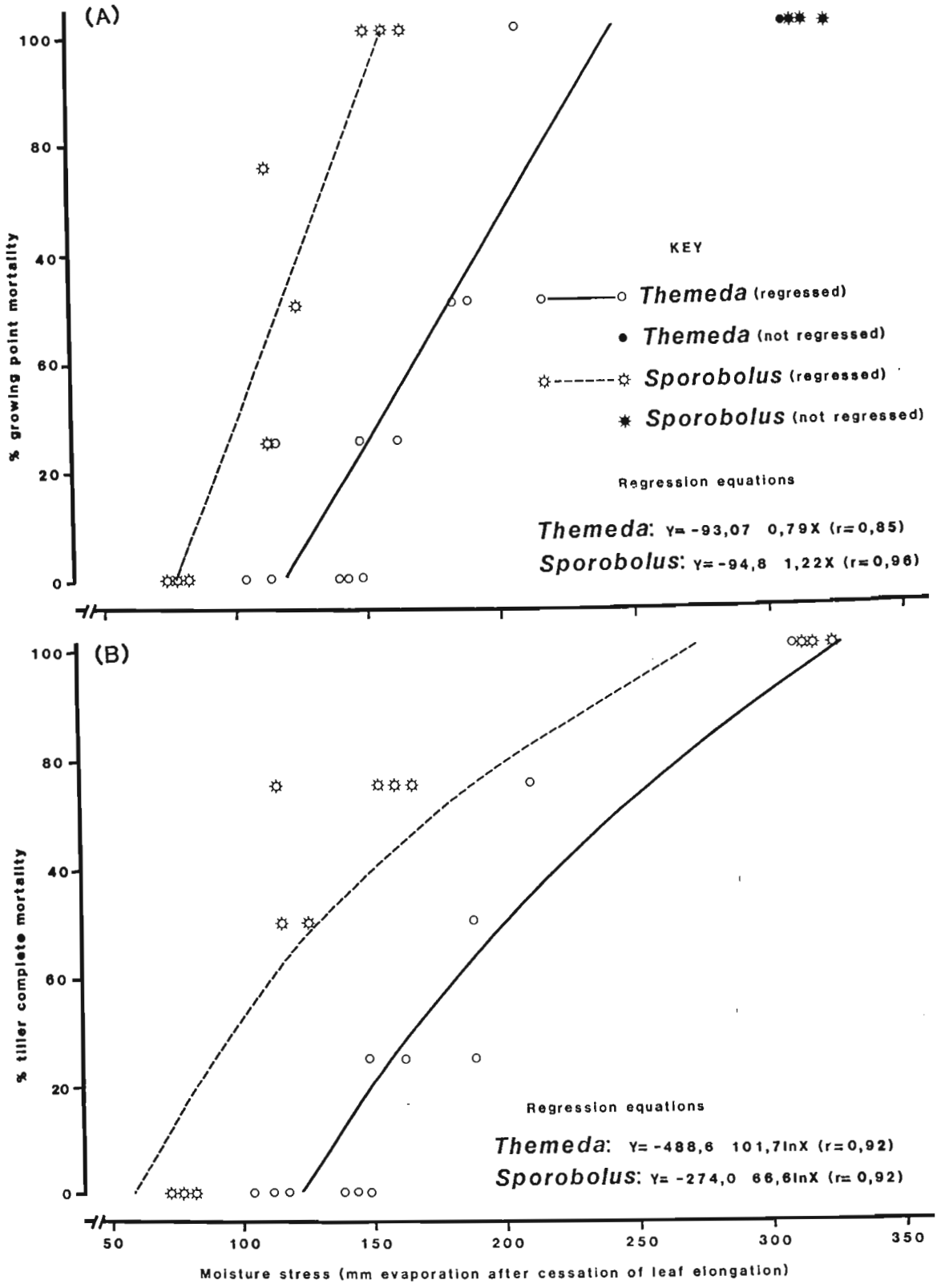

Figure 6.7 *Percentage growing point mortality (A) and percentage complete mortality (including lateral buds) (B) of marked tillers in individual pots of* Themeda triandra *and* Sporobolus fimbriatus *after increasingly severe levels of moisture stress. Data not used for regression analyses (A) are presented as bold symbols.*

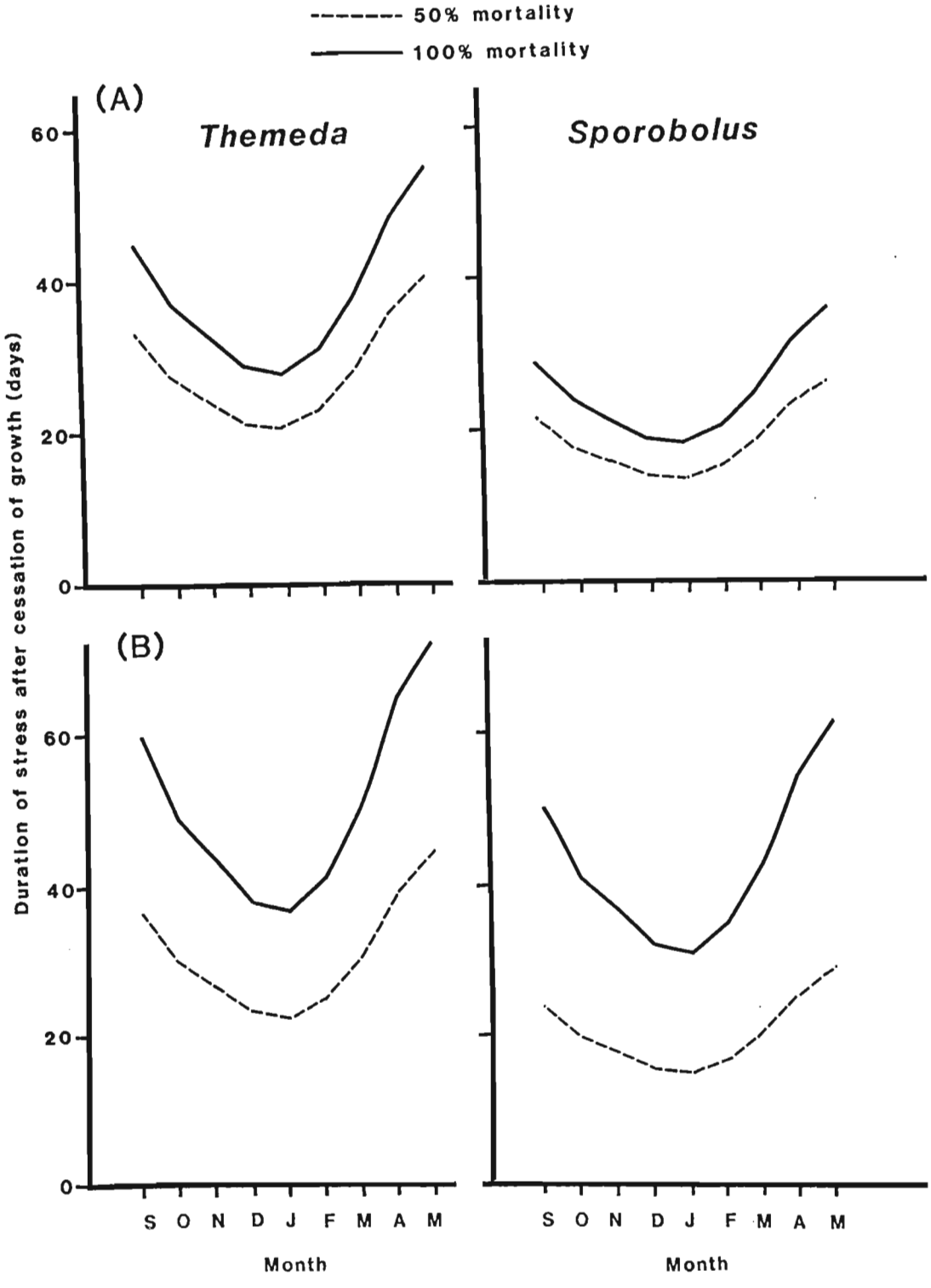

Figure 6.8 *Estimated durations of periods of no rainfall once leaf expansion has ceased after which 50 °/o and 100 °/o growing point mortality (A) and complete mortality (including lateral buds) (B) of tillers of* Themeda triandra *and* Sporobolus fimbriatus *are expected to take place in the False Thornveld of the Eastern Cape at different times of the year.*

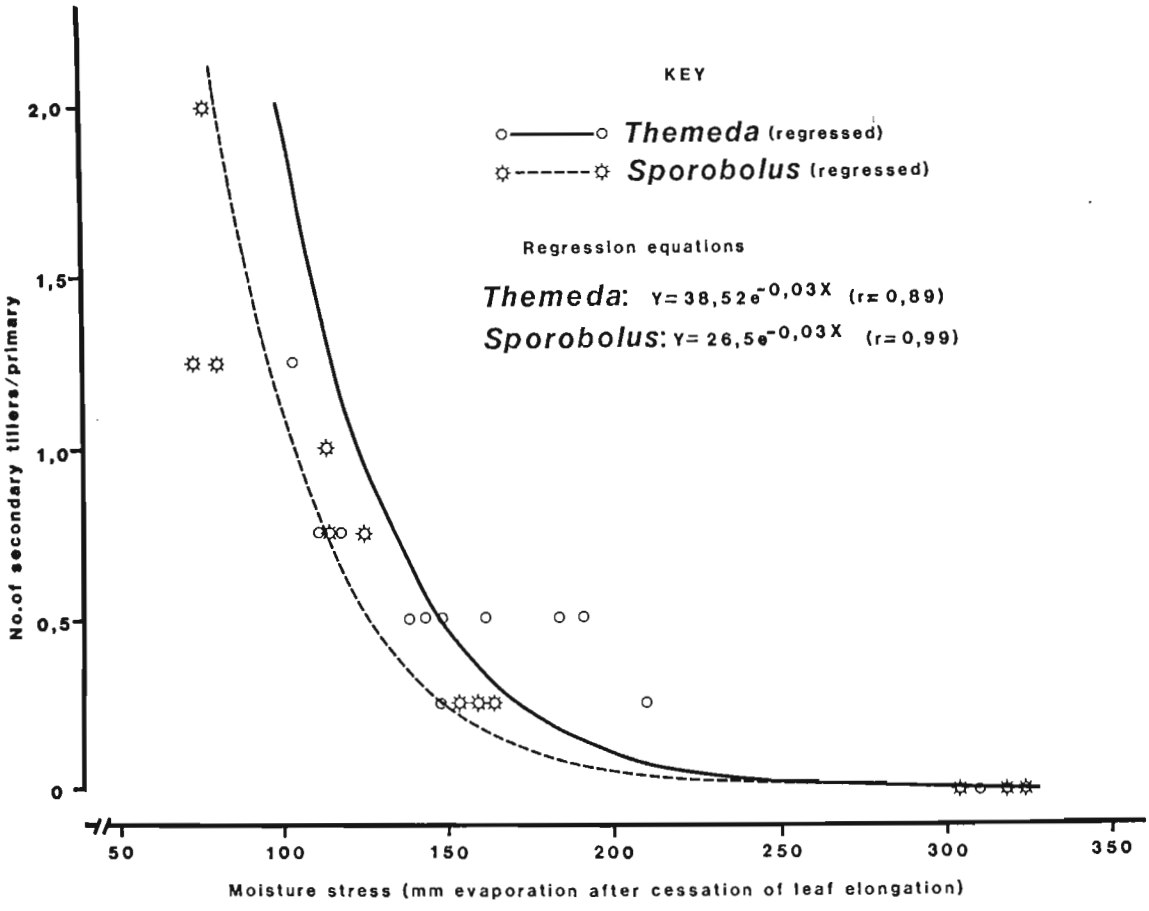

Figure 6.9 *Mean number of secondary tillers produced per marked tiller within each individual pot of* Themeda triandra *and* Sporobolus fimbriatus *at the end of four weeks after water replenishment following progressively severe levels of stress.*

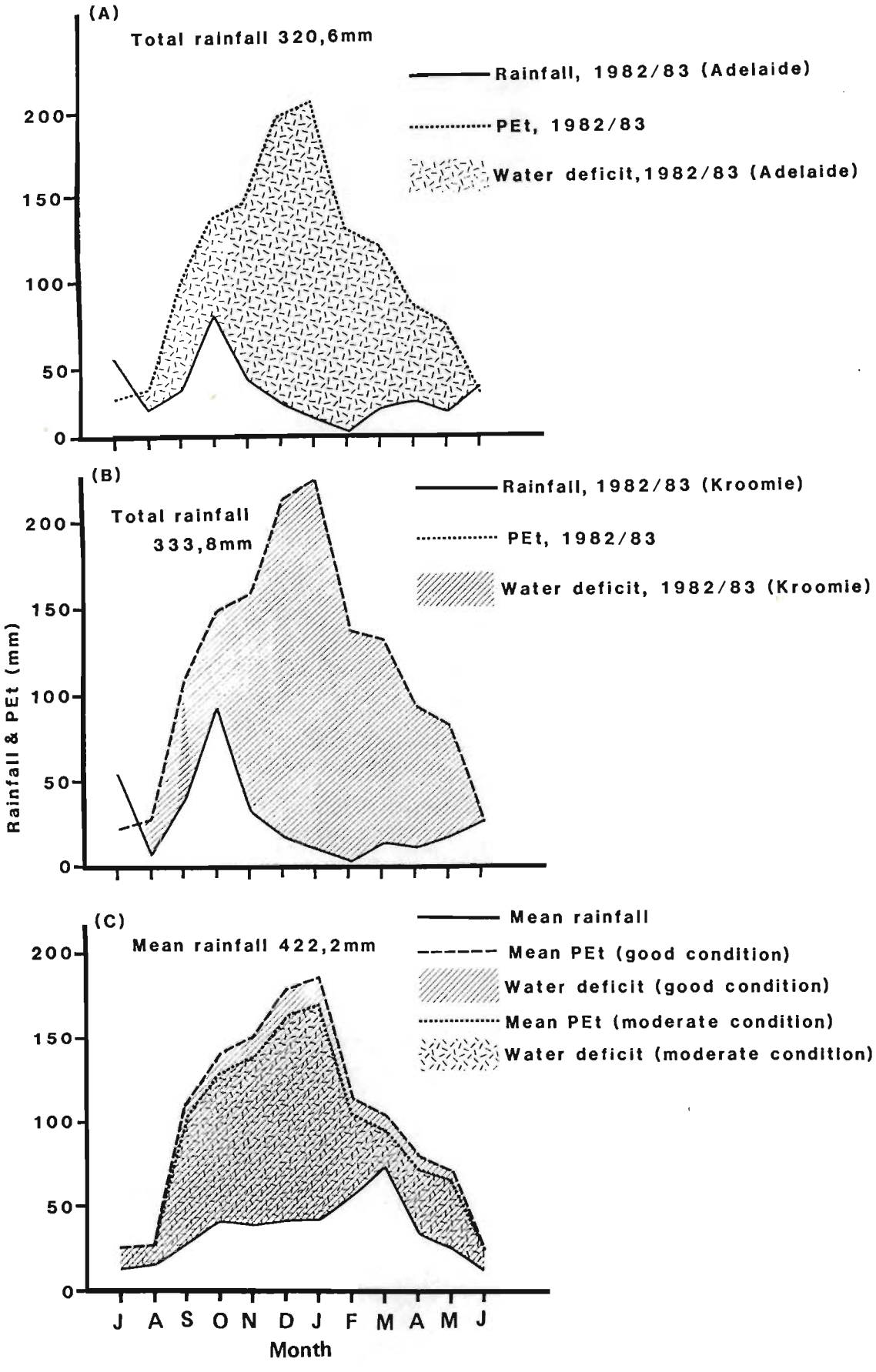

Figure 6.10 *Water budgets compiled for Adelaide (A) and Kroomie (B) during the 1982/83 season, and the mean long term water budget at Adelaide for veld in both good and moderate condition (C). PEt is Potential evaptranspiration and shaded areas represent water deficits.*

TABLE 7.1

Percentage species composition, species class totals and veld condition scores of the Themeda triandra *(Site A) and* Sporobolus fimbriatus *(Site B) dominated sites.*

Species class	Species	Site A	Site B
Decreaser	*Panicum maximum*	3,2	
	Panicum stapfianum	5,2	7,6
	Setaria neglecta	0,8	0,2
	Themeda triandra	39,6	
Increaser I	*Cymbopogon plurinodis*	21,2	0,2
Increaser II	*Cynodon dactylon*	0,2	34,4
	Cyperus spp.		0,4
	Digitaria eriantha	10,8	1,0
	Eragrostis capensis	1,2	
	Eragrostis chloromelas	0,2	1,4
	Eragrostis curvula	0,8	1,8
	Eustachys mutica	0,6	
	Helictotrichon sp.	0,2	
	Karoochloa curva		1,0
	Michrochloa caffra	0,2	
	Sporobolus fimbriatus	10,8	41,0
	Forbs	5,0	11,0
Decreaser total		48,8	7,8
Increaser I total		21,2	0,2
Increaser II total		30	92,0
Veld condition score		80,2	41,8

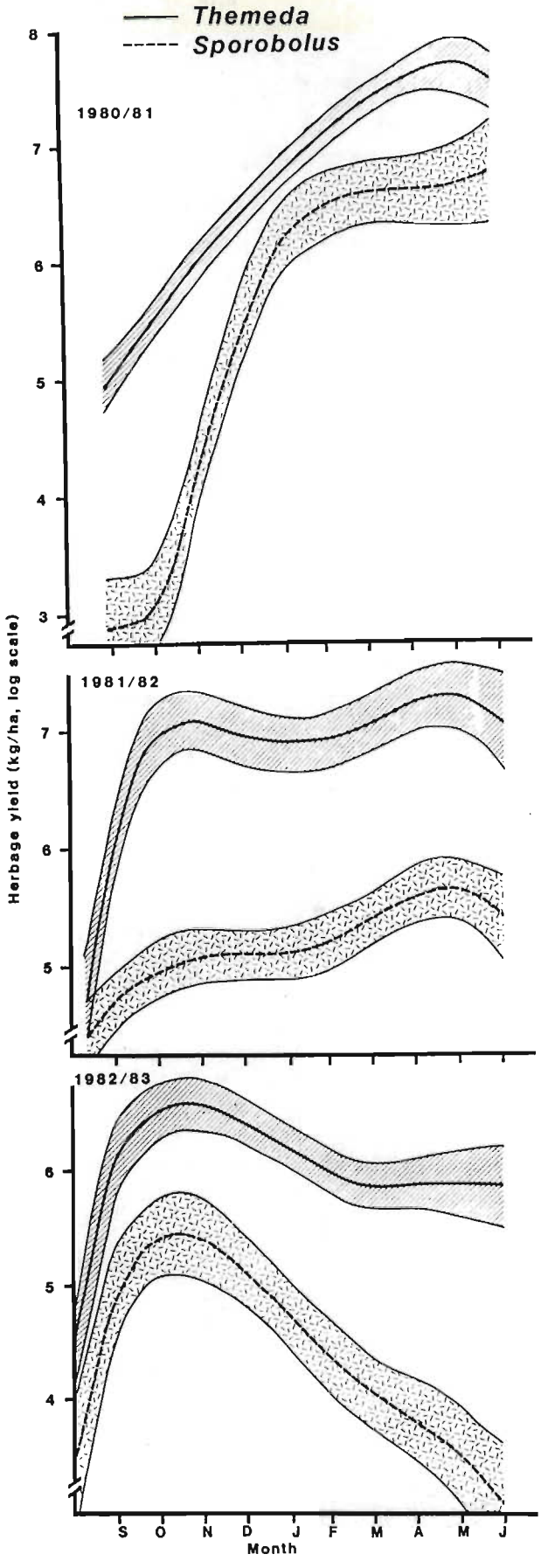

Figure 7.1 *Cumulative herbage production (log scale) at sites dominated by* Themeda triandra *(site A) and* Sporobolus fimbriatus *(site B) over three consecutive growing seasons. Shaded areas represent 95 % confidence intervals.*

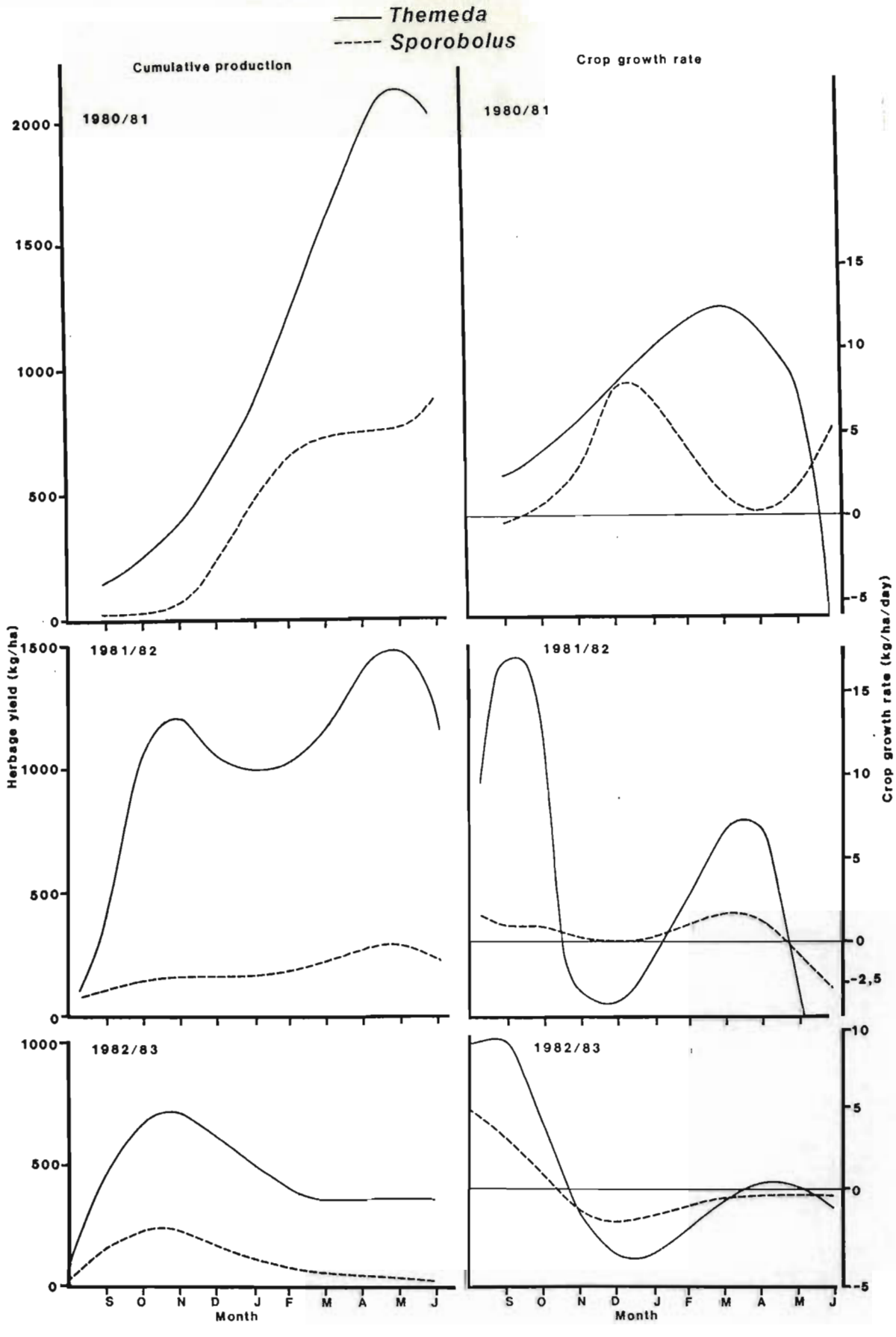

Figure 7.2 *Cumulative herbage production (arithmetic scale) and crop growth rate at sites dominated by* Themeda triandra *(site A) and* Sporobolus fimbriatus *(site B) over three consecutive growing seasons.*

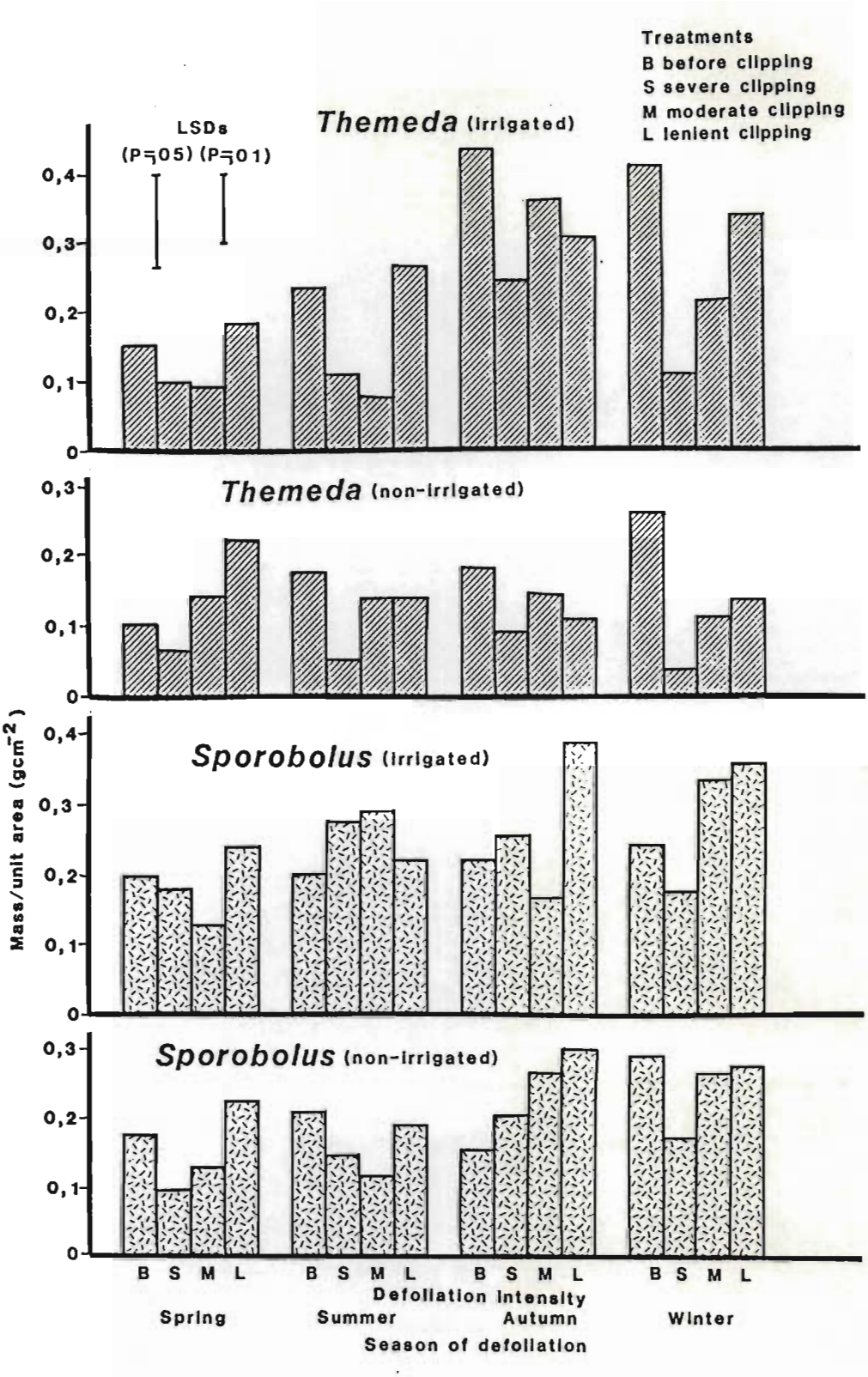

Figure 8.1 *Above ground mass per unit area of irrigated and non-irrigated* Themeda triandra *and* Sporobolus fimbriatus *tufts before defoliation and two months after three different intensities of clipping at different times of the year. Least significant differences (LSD's) are those between any two treatment means.*

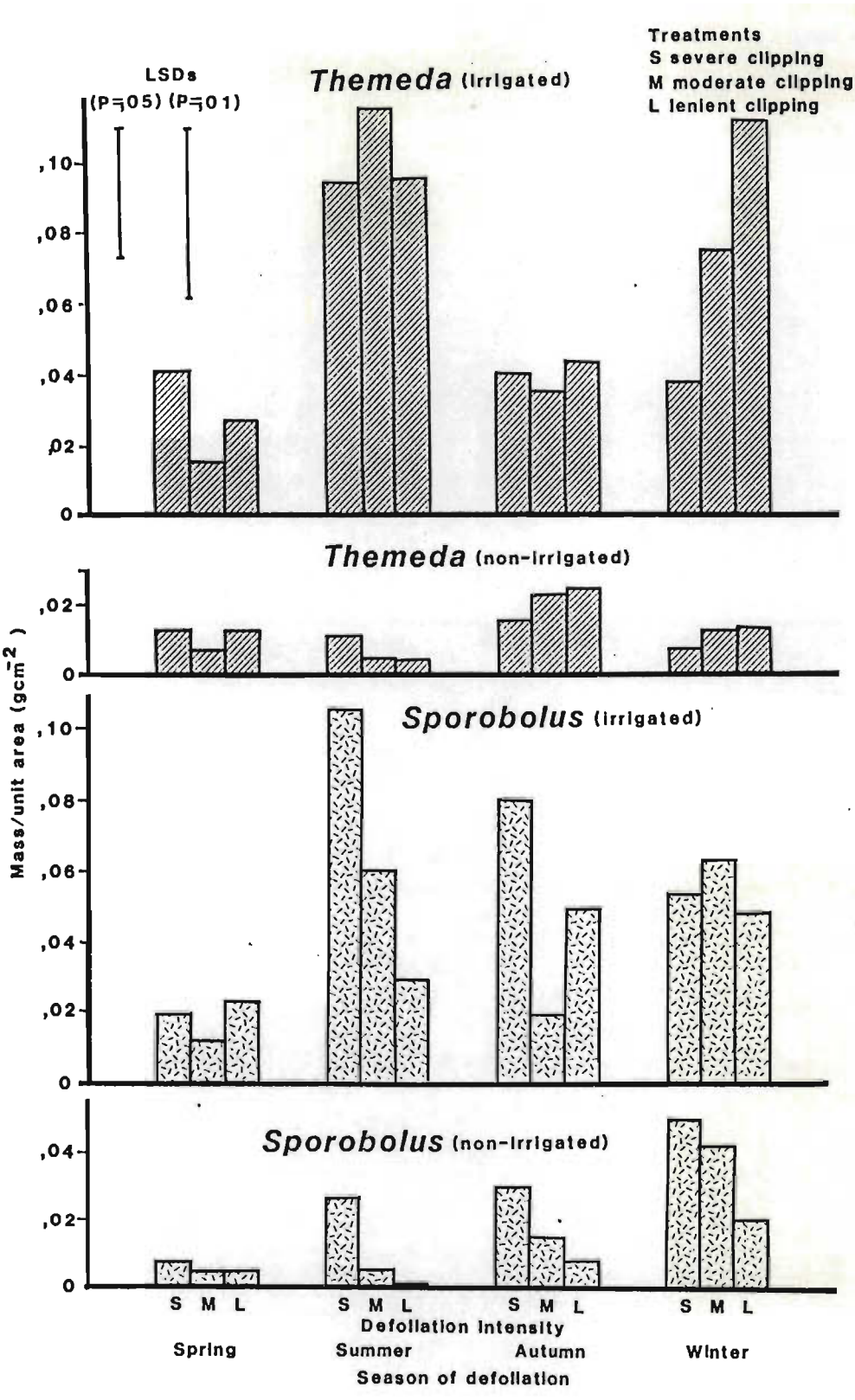

Figure 8.2 *Mass per unit area above clipping height of irrigated and non-irrigated* Themeda triandra *and* Sporobolus fimbriatus *tufts two months after three different intensities of clipping at different times of the year. Least significant differences (LSD's) are those between any two treatment means.*

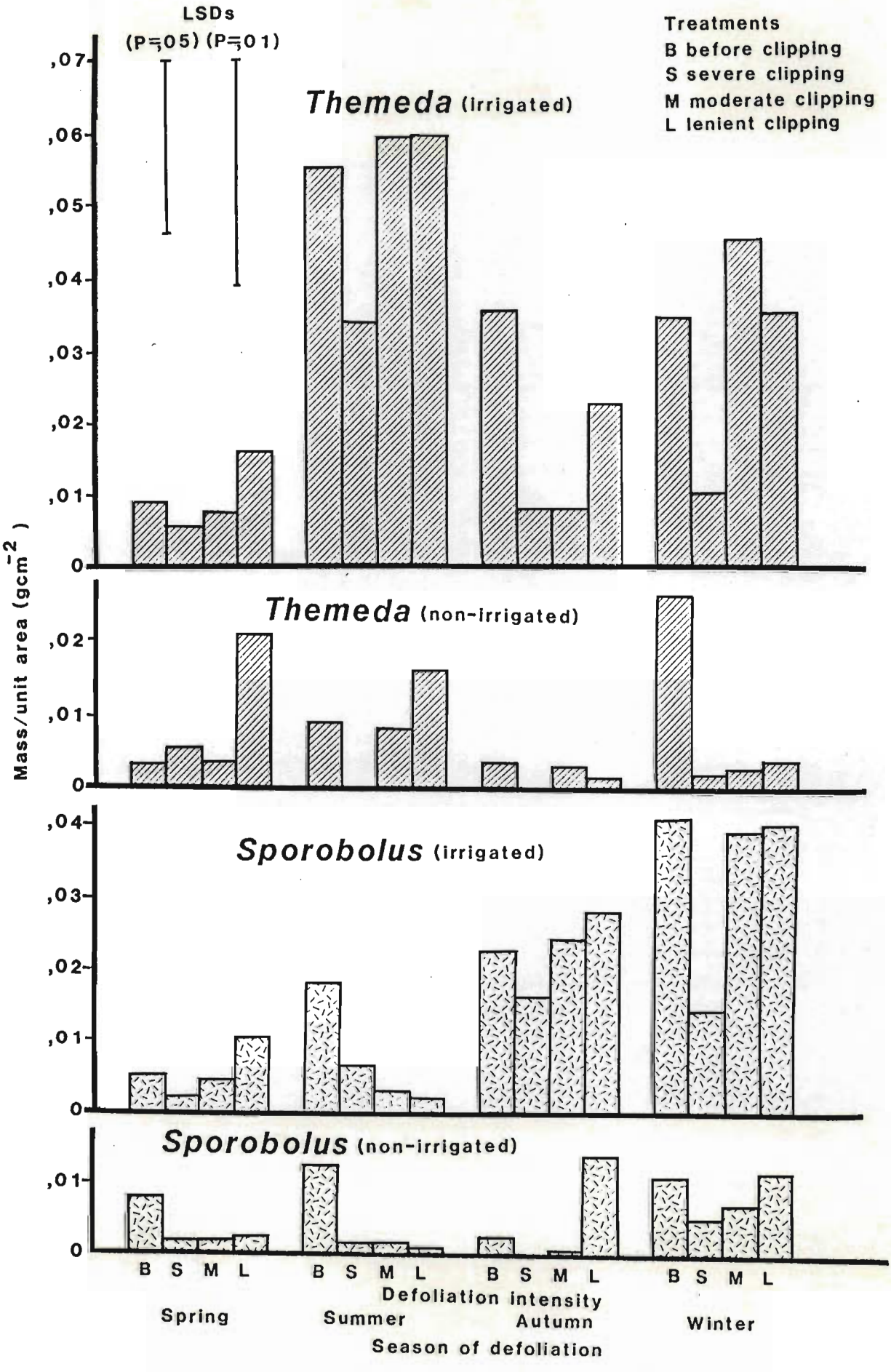

Figure 8.3 *Mass of roots attached to living tillers per unit basal tuft area before defoliation and two months after three different intensities of defoliation of irrigated and non-irrigated* Themeda triandra *and* Sporobolus fimbriatus *tufts at different times of the year. Least significant differences (LSD's) are those between any two treatment means.*

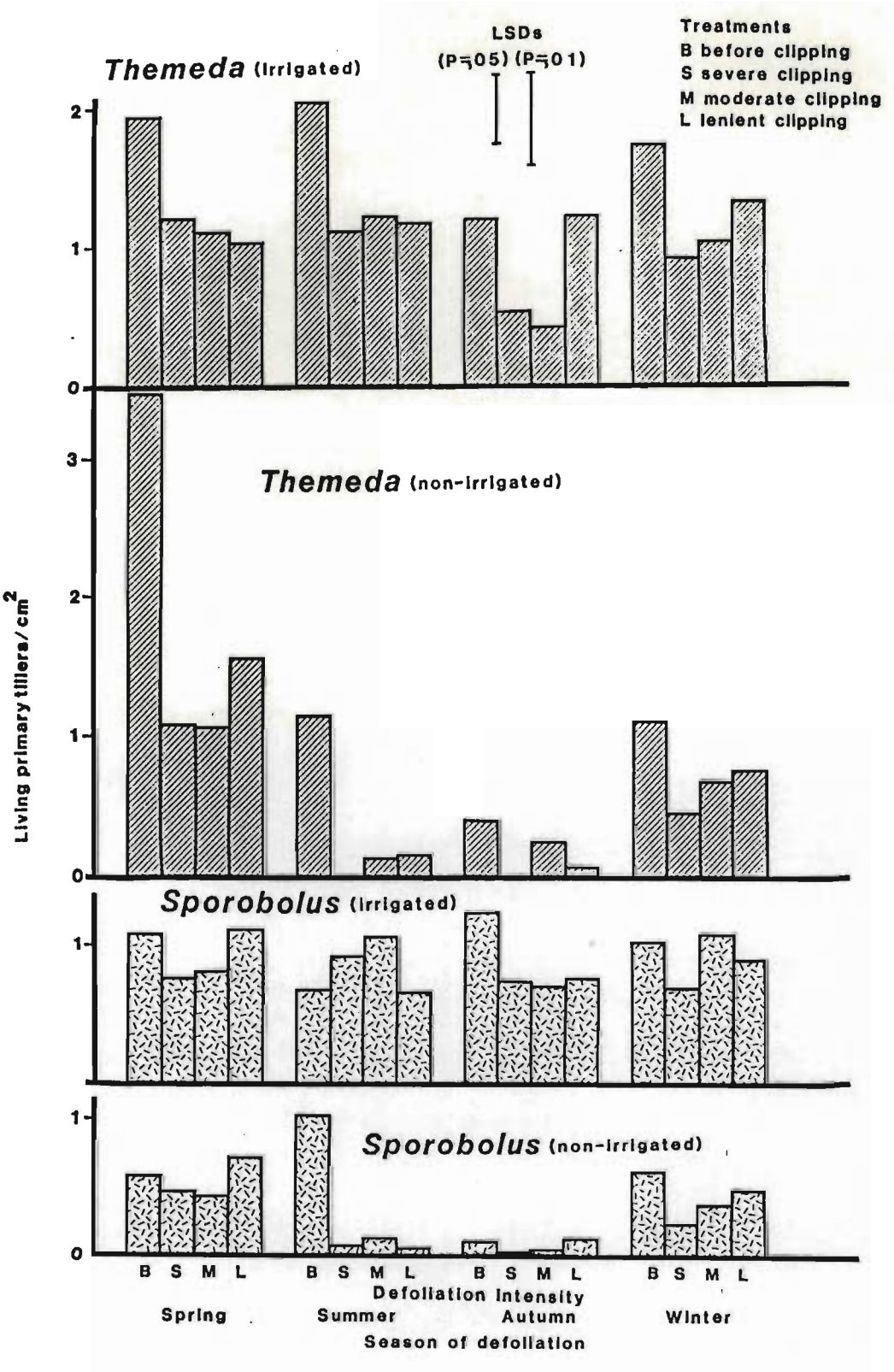

Figure 8.4 *Number of living primary tillers (all living tillers present before clipping took place) per unit area in irrigated and non-irrigated* Themeda triandra *and* Sporobolus fimbriatus *tufts before defoliation and two months after three different intensities of clipping at different times of the year. Least significant differences (LSD's) are those between any two treatment means.*

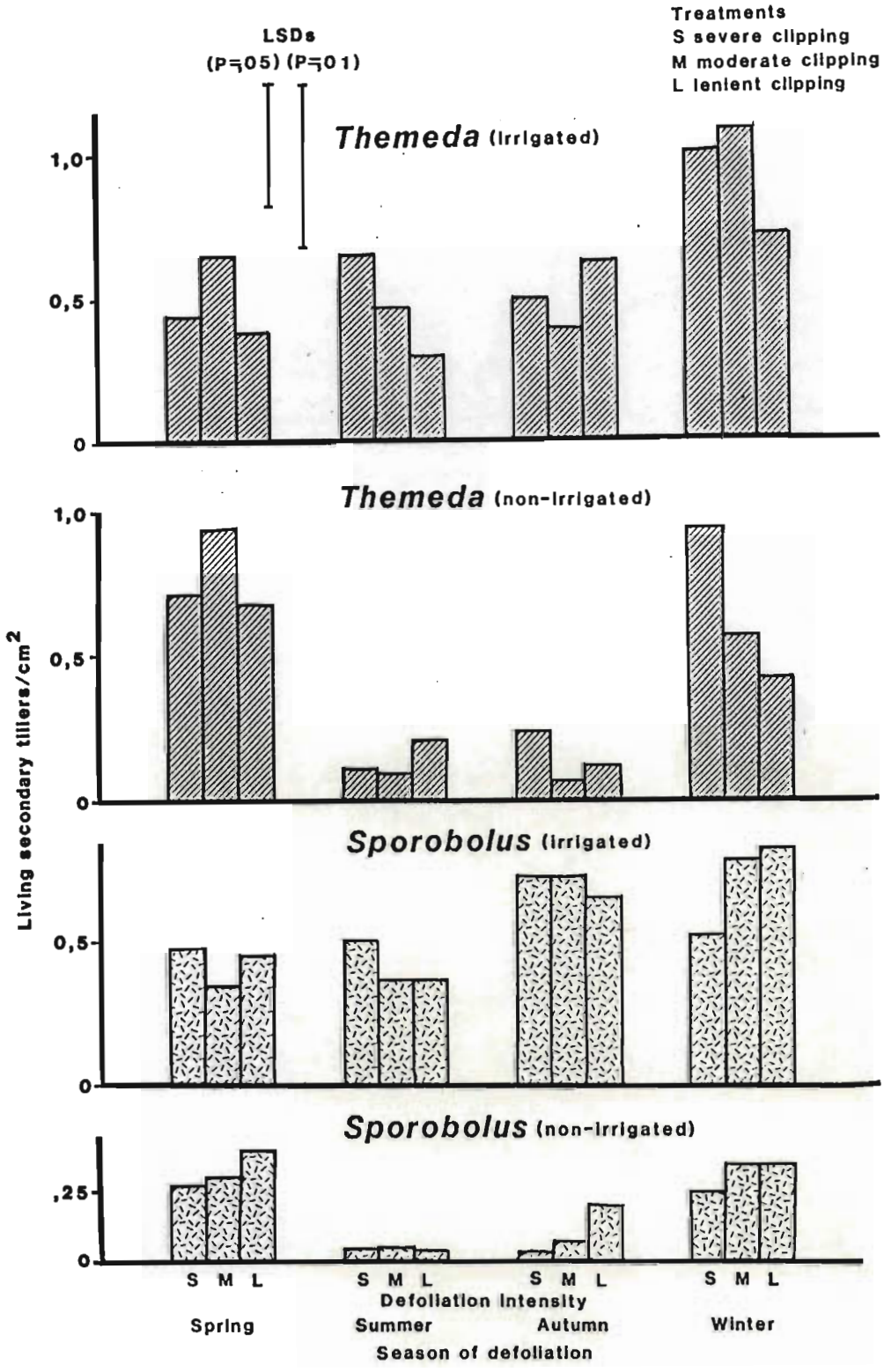

Figure 8.5 *The number of secondary tillers that emerged per unit area and were still alive within two months after three different intensities of defoliation of irrigated and non-irrigated* Themeda triandra *and* Sporobolus fimbriatus *tufts at different times of the year. Least significant differences (LSD's) are those between any two treatment means.*

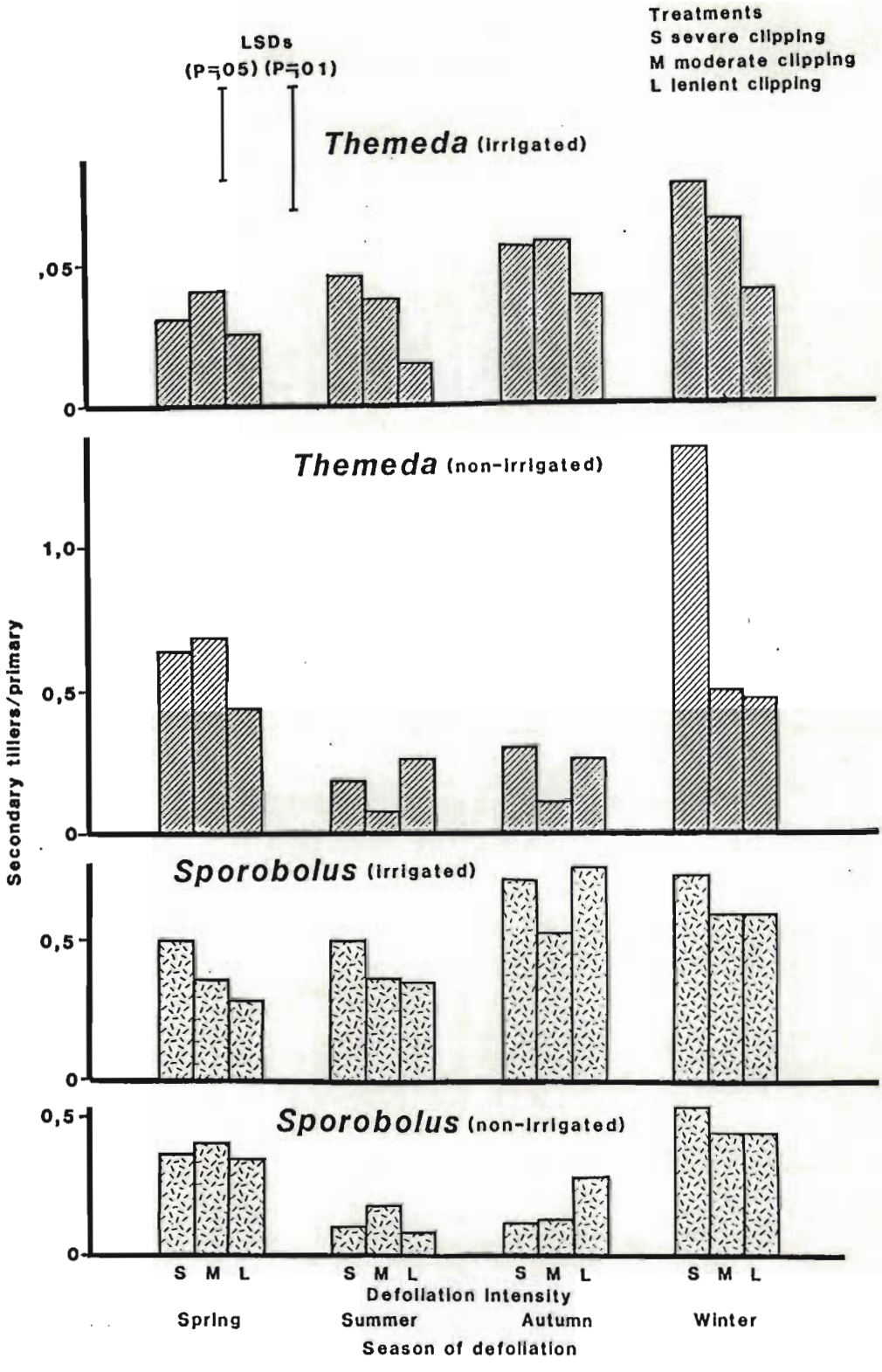

Figure 8.6 *The number of secondary tillers that emerged per unit primary tiller (alive and dead) and were still alive two months after three different intensities of clipping of irrigated and non-irrigated* Themeda triandra *and* Sporobolus fimbriatus *tufts at different times of the year. Least significant differences (LSD's) are those between any two treatment means.*

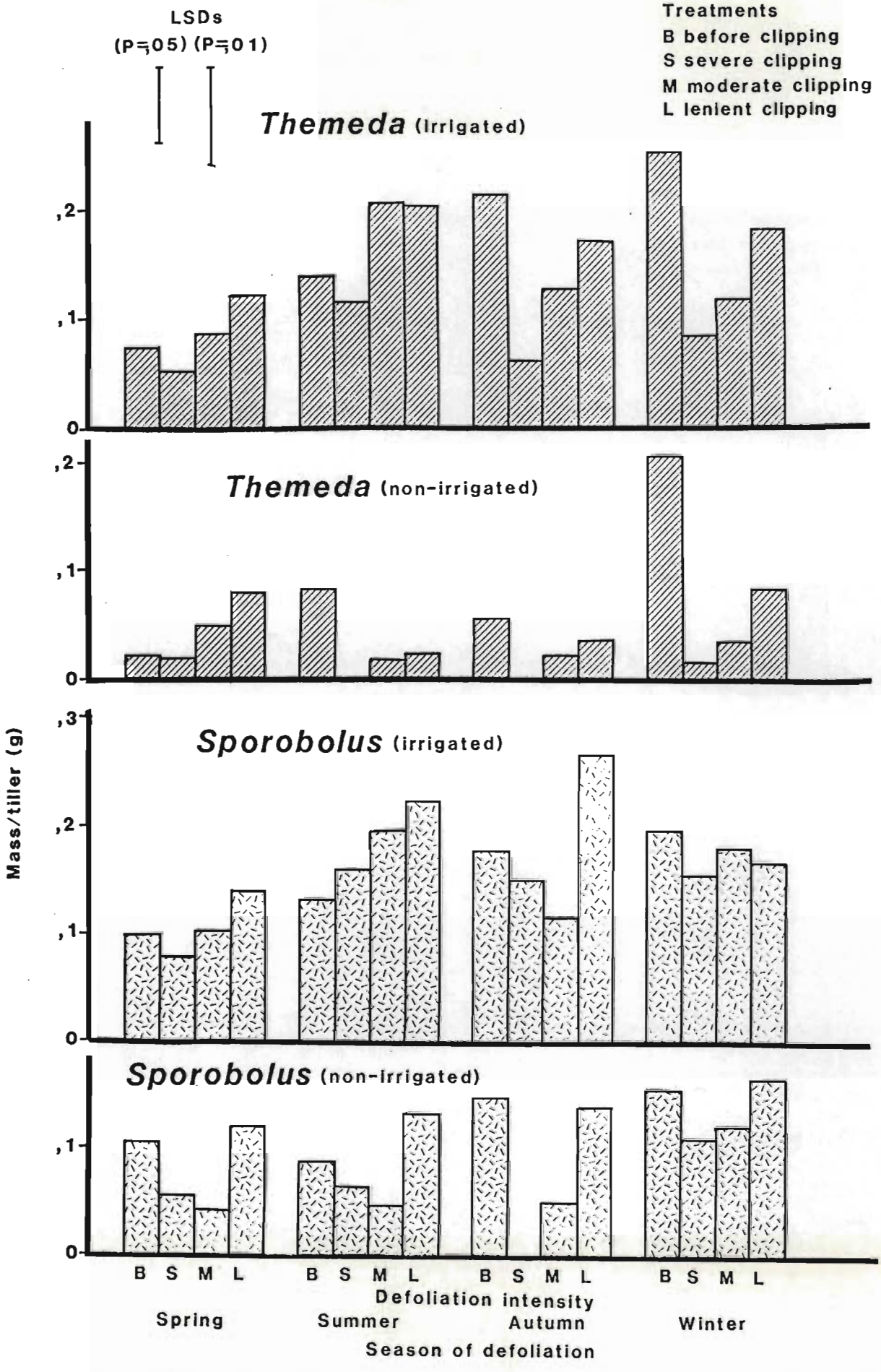

Figure 8.7 *Above-ground mass of living primary tillers in irrigated and non-irrigated tufts of* Themeda triandra *and* Sporobolus fimbriatus *before defoliation and two months after three different intensities of clipping at different times of the year. Least significant differences (LSD's) are those between any two treatment months.*

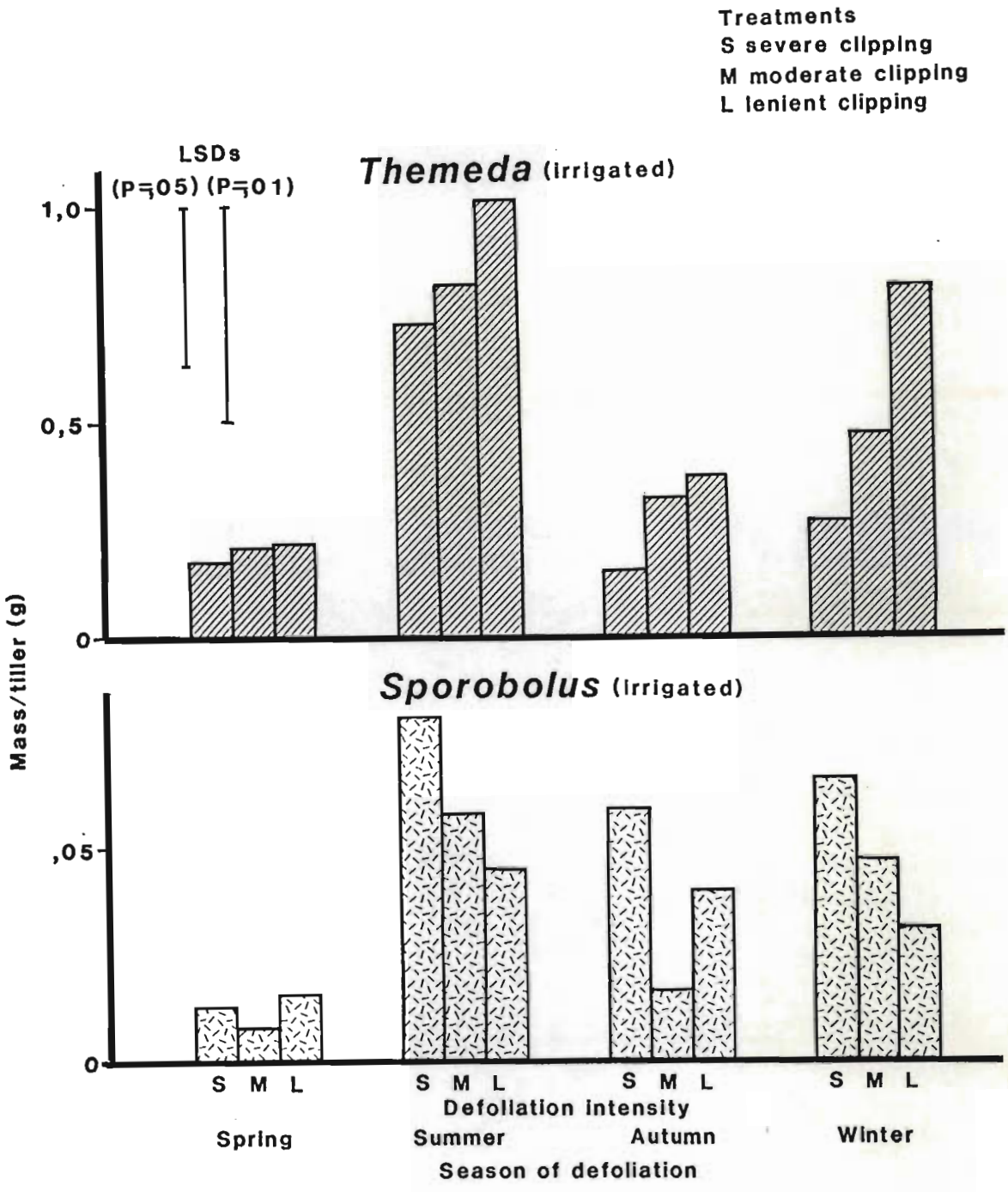

Figure 8.8 *Above-ground mass above clipping height of primary tillers in irrigated and non-irrigated* Themeda triandra *and* Sporobolus fimbriatus *tufts two months after three different intensities of defoliation at different times of the year. Least significant differences (LSD's) are those between any two treatment means.*

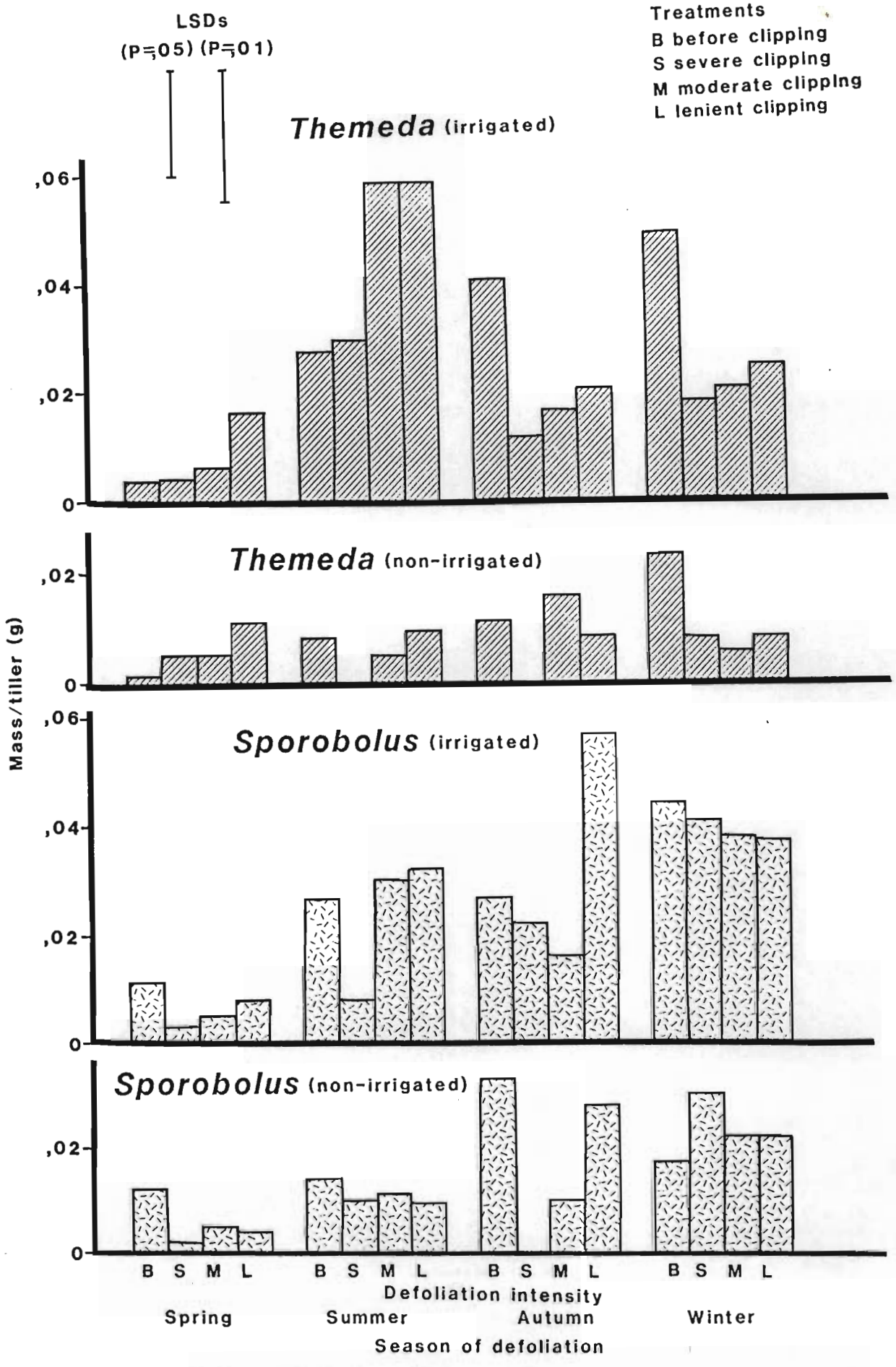

Figure 8.9 *Mass of roots per living primary tiller in irrigated and non-irrigated* Themeda triandra *and* Sporobolus fimbriatus *tufts before defoliation and two months after three different intensities of clipping at different times of the year. Least significant differences (LSD's) are those between any two treatment means.*

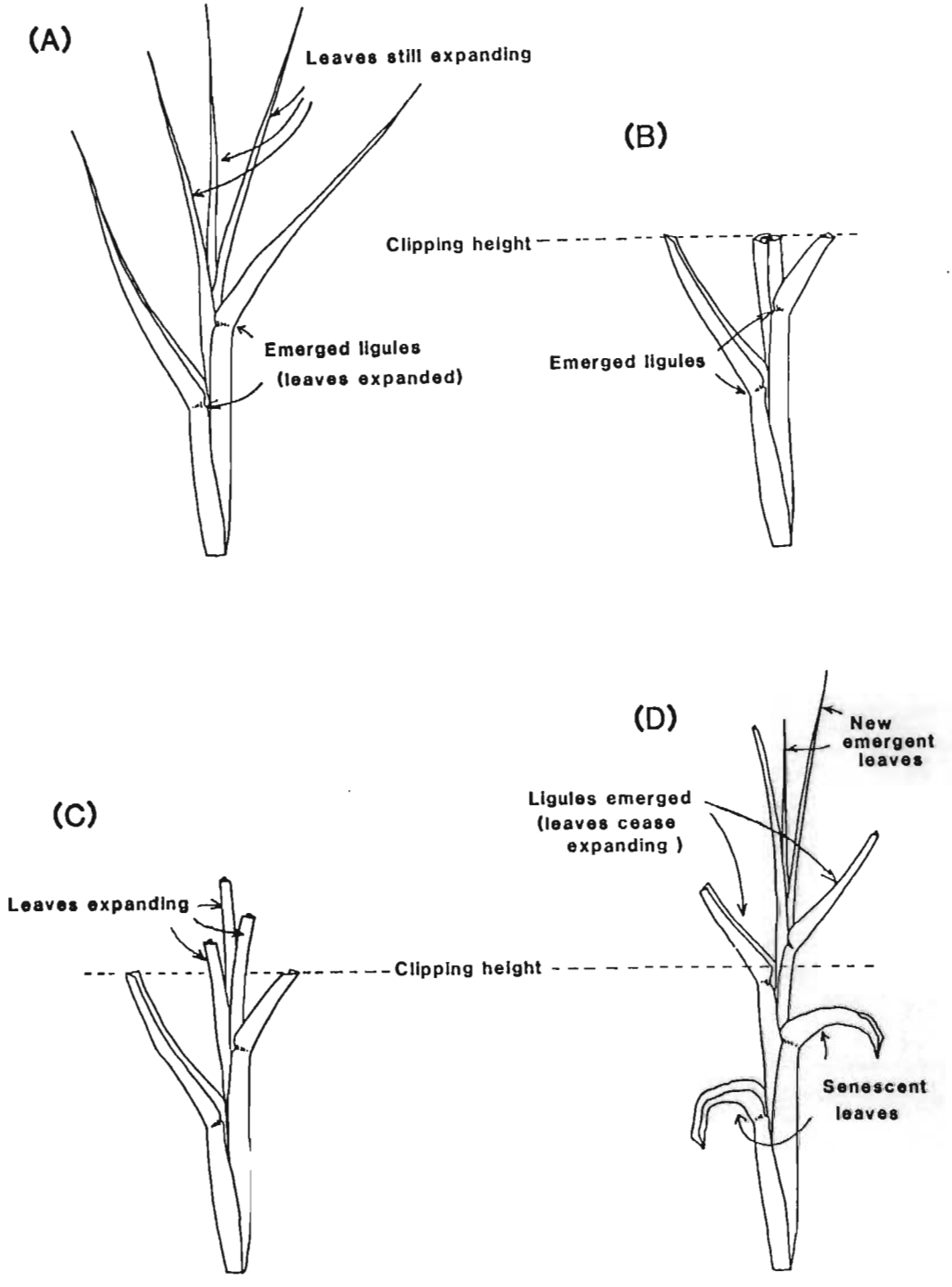

Figure 8.10 *Diagramatic representation of a vegetative* Themeda triandra *tiller before clipping (A), immediately after moderate clipping (B), two weeks after clipping (C), and four to six weeks after clipping (D).*

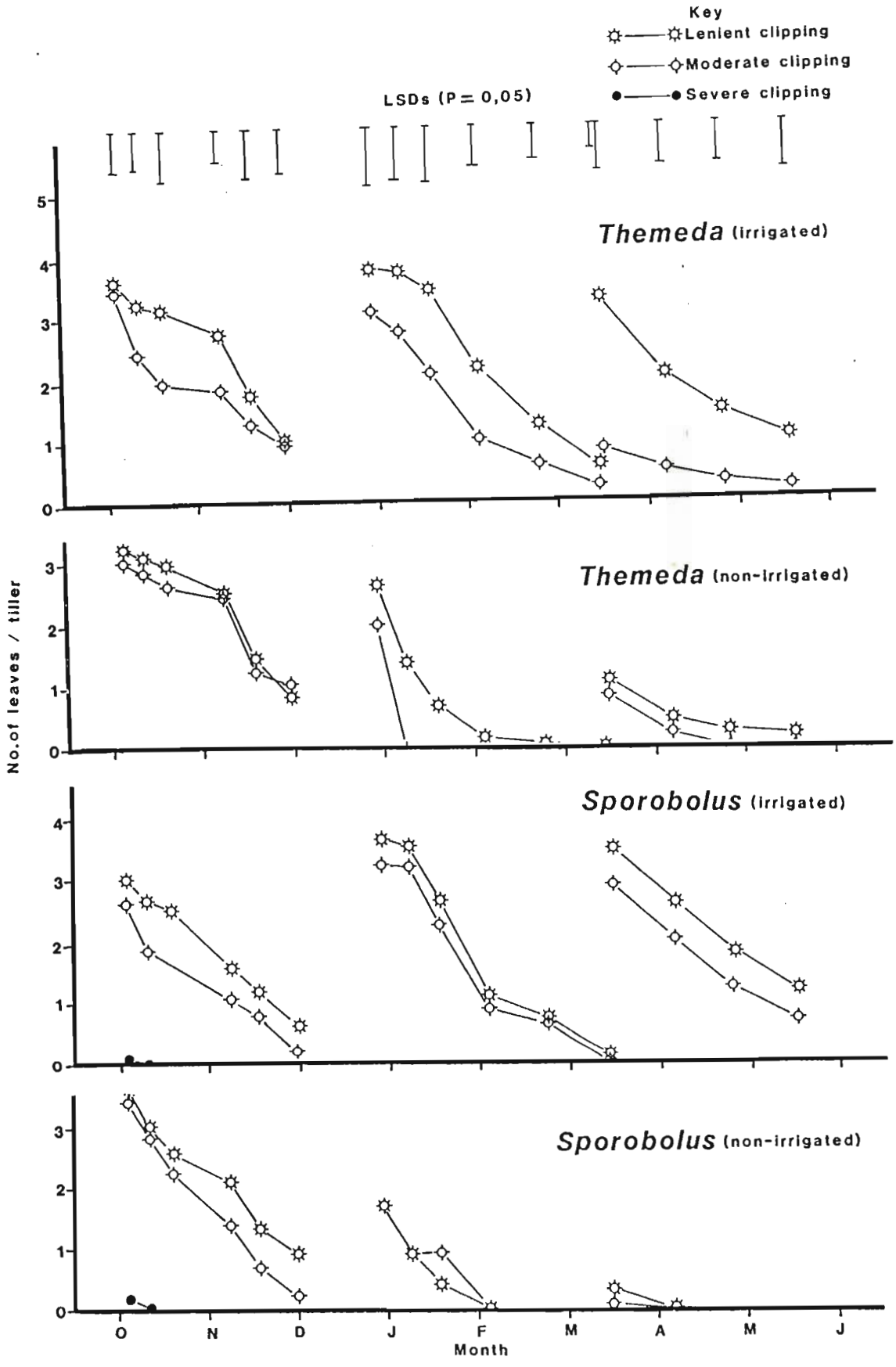

Figure 8.11 *The mean number of green leaves that were still present on marked tillers immediately after defoliation, and the number of these leaves that remained alive at successive sampling dates after three intensities of defoliation of irrigated and non-irrigated* Themeda triandra *and* Sporobolus fimbriatus *tufts, and at subsequent sampling dates thereafter in spring, summer and autumn. The least significant differences (LSD's) are those between any two treatment means at each individual sampling date.*

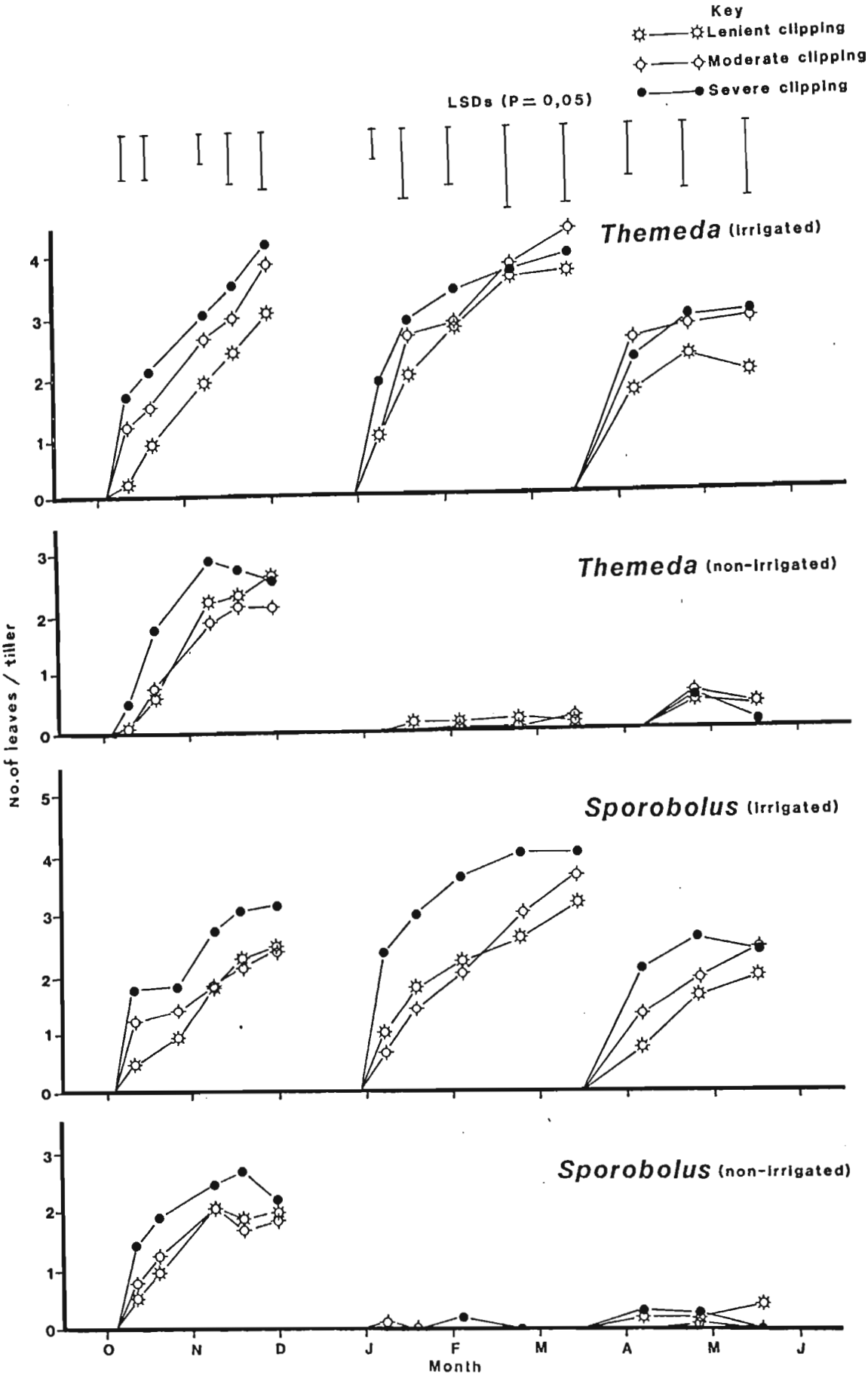

Figure 8.12 *The mean number of living green leaf blades that emerged per marked tiller after three different intensities of defoliation of irrigated and non-irrigated* Themeda triandra *and* Sporobolus fimbriatus *tufts, and at subsequent sampling dates thereafter in spring, summer and autumn. Least significant differences are those between any two treatment means at each individual sampling date.*

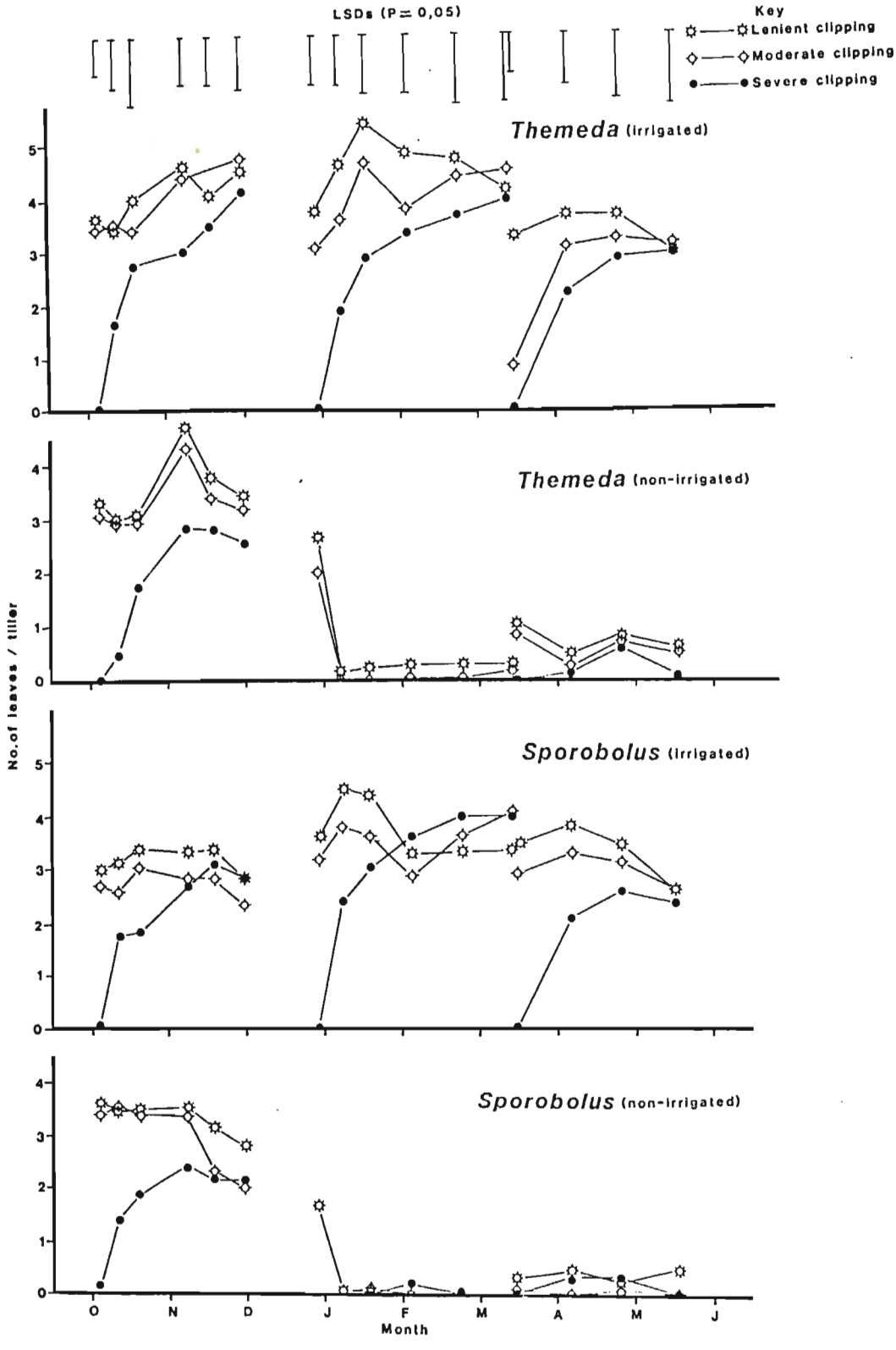

Figure 8.13 *The total number of living leaves per marked tiller after three different intensities of defoliation of irrigated and non-irrigated* Themeda triandra *and* Sporobolus fimbriatus *tufts, and at subsequent sampling dates thereafter in spring, summer and autumn. Least significant differences (LSD's) are those between any two treatment means at each individual sampling date.*

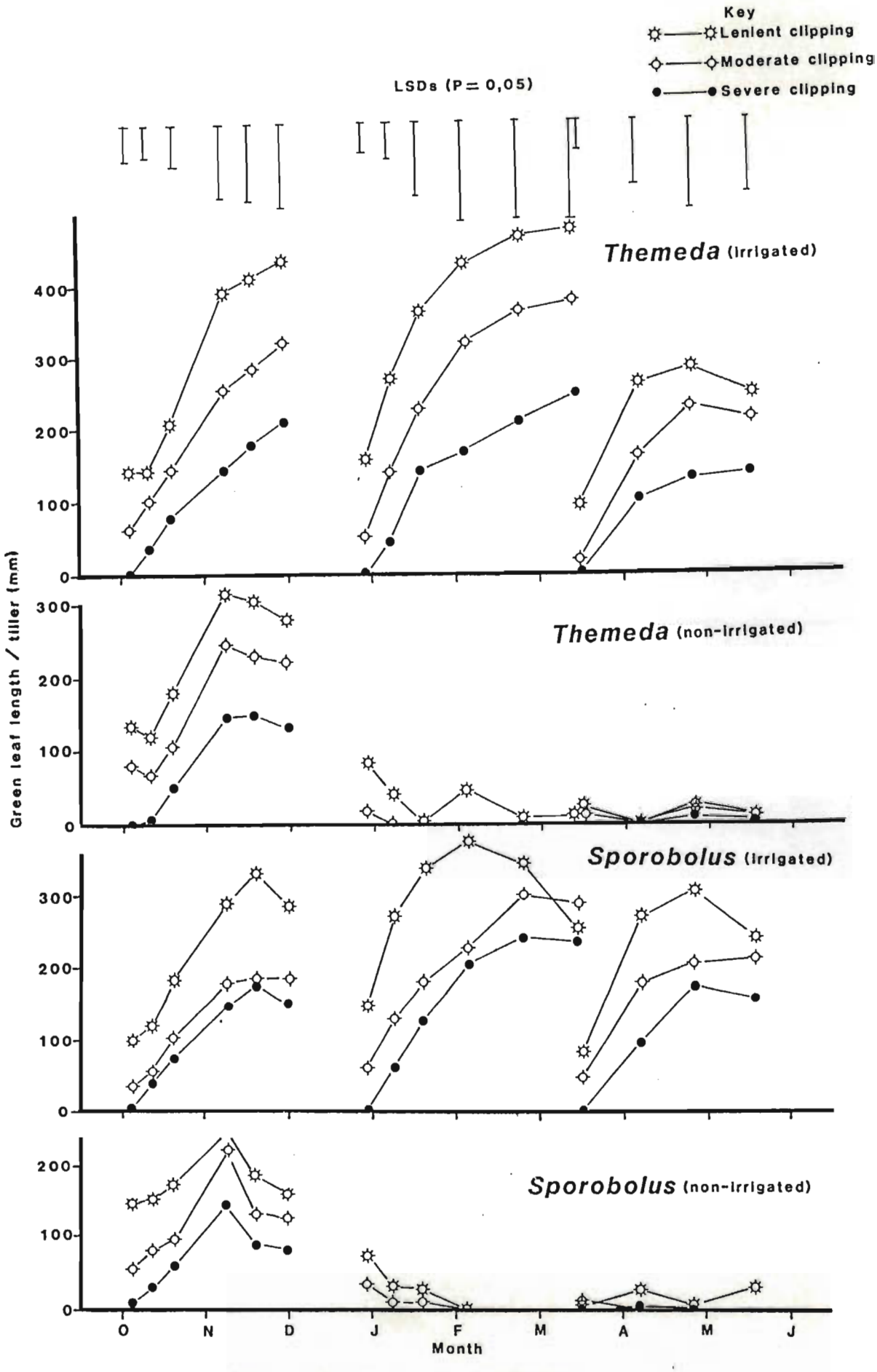

Figure 8.14 *Green leaf length per marked tiller after three different intensities of clipping of irrigated and non-irrigated* Themeda triandra *and* Sporobolus fimbriatus *tufts, and at subsequent sampling dates thereafter in spring, summer and autumn. Least significant differences (LSD'S) are those between any two treatment means at each sampling date.*

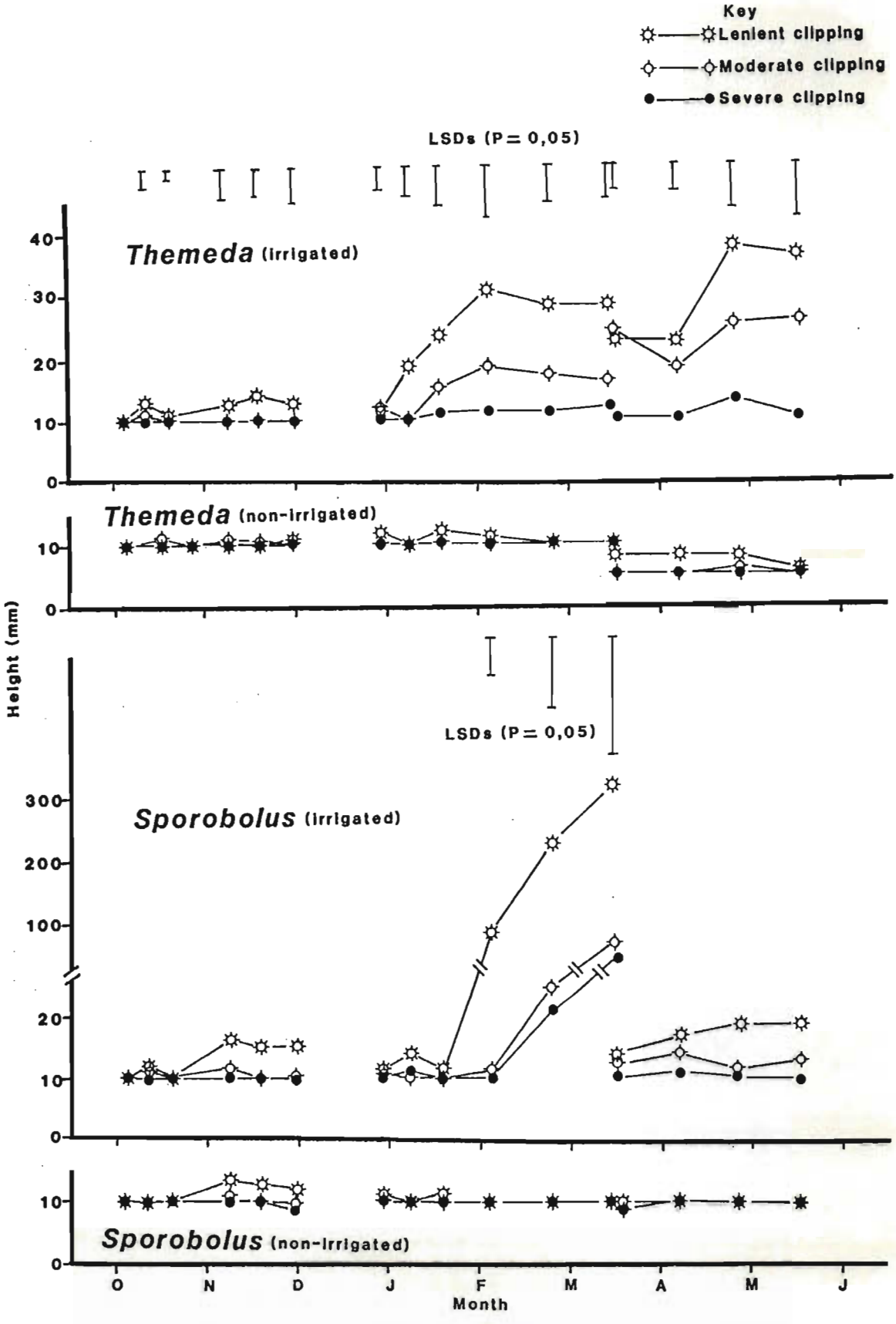

Figure 8.15 *Mean heights of shoot apices of marked tillers after three different intensities of clipping of irrigated and non-irrigated* Themeda triandra *and* Sporobolus fimbriatus *tufts, and at subsequent sampling dates thereafter in Spring, Summer and Autumn. Least significant differences (LSD's) are those three between any two tretment means at each sampling date.*

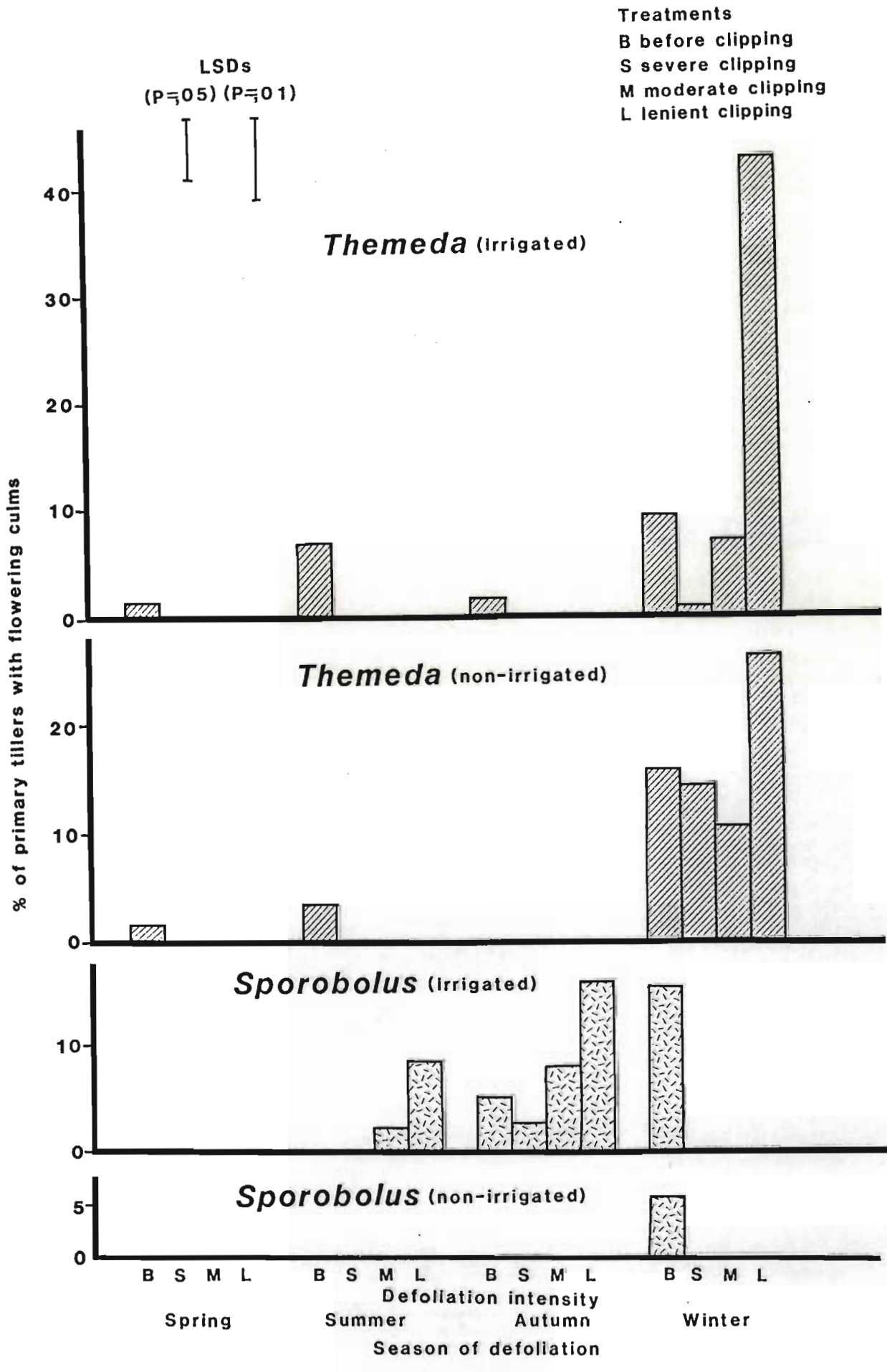

Figure 8.16 *The percentage of flowering primary tillers in irrigated and non-irrigated* Themeda triandra *and* Sporobolus fimbriatus *tufts before defoliation and two months after three different intensities of clipping at different times of the year. Least significant differences are those between any two treatment means.*

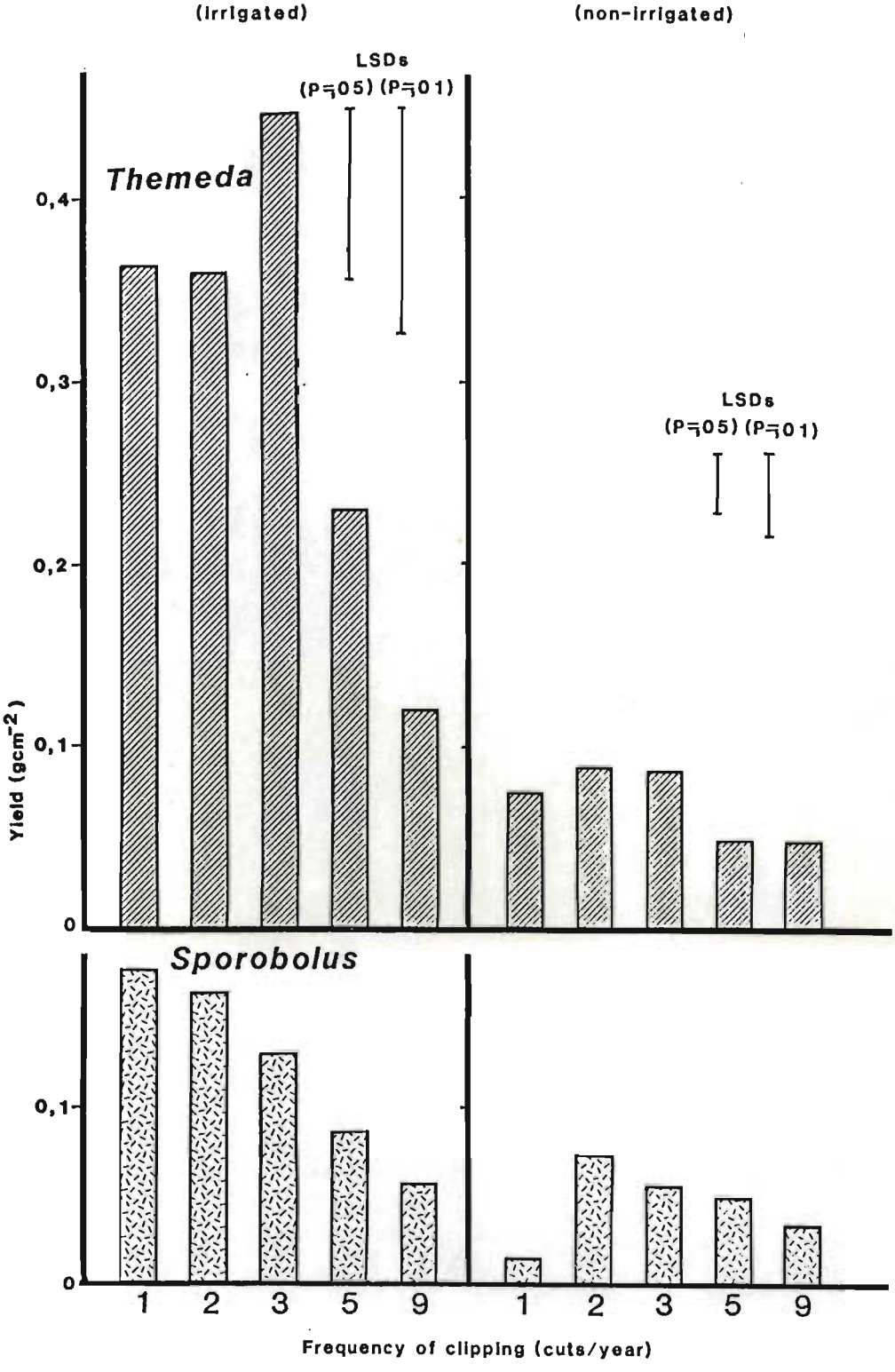

Figure 8.17 *Total yields per unit area of irrigated and non-irrigated* Themeda triandra *and* Sporobolus fimbriatus *tufts subjected to different frequencies of defoliation within the 1982/83 season. Least significant differences (LSD's) are those between any two treatment means within irrigation treatments.*

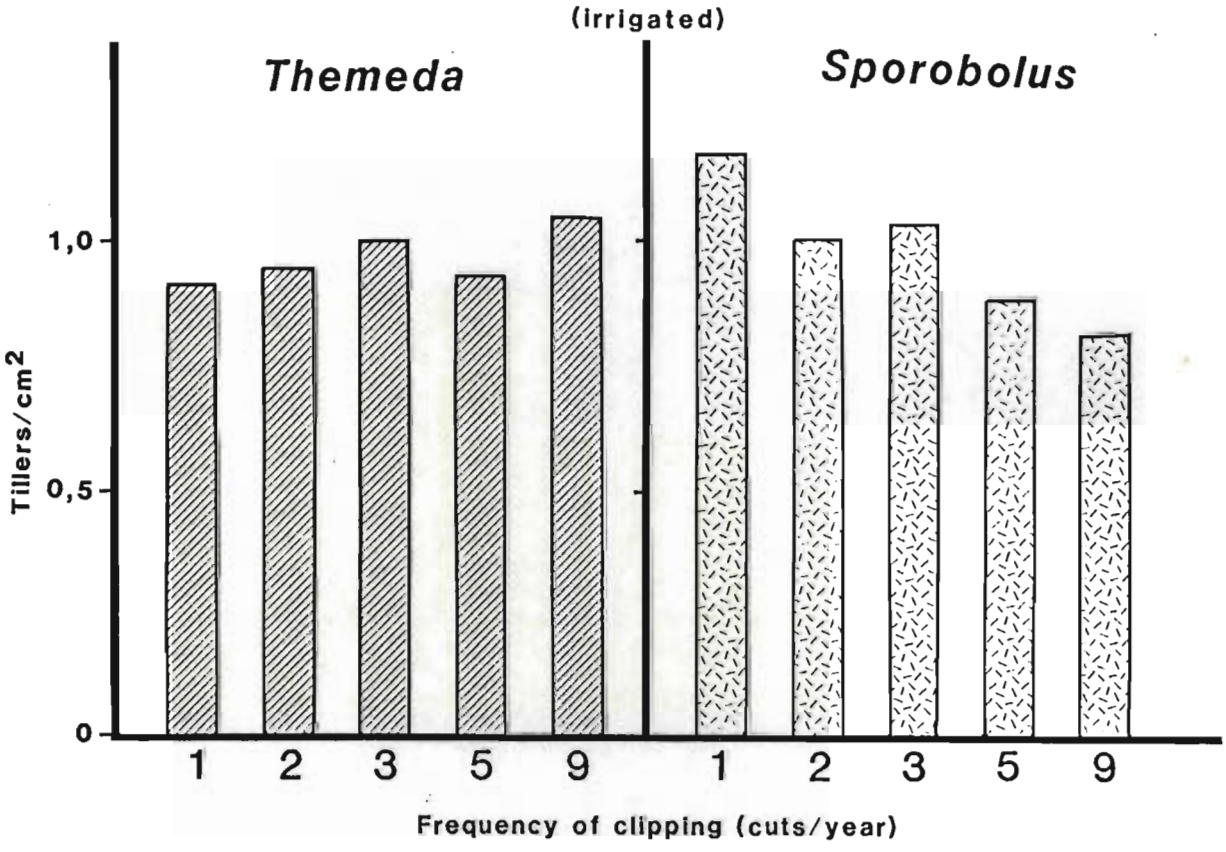

Figure 8.18 *Number of living tillers per unit tuft basal area of irrigated* Themeda triandra *and* Sporobolus fimbriatus *tufts in June 1983 after having experienced different frequences of defoliation during the 1982/83 growing season. Least significant differences (LSD's) are those between any two treatment means.*

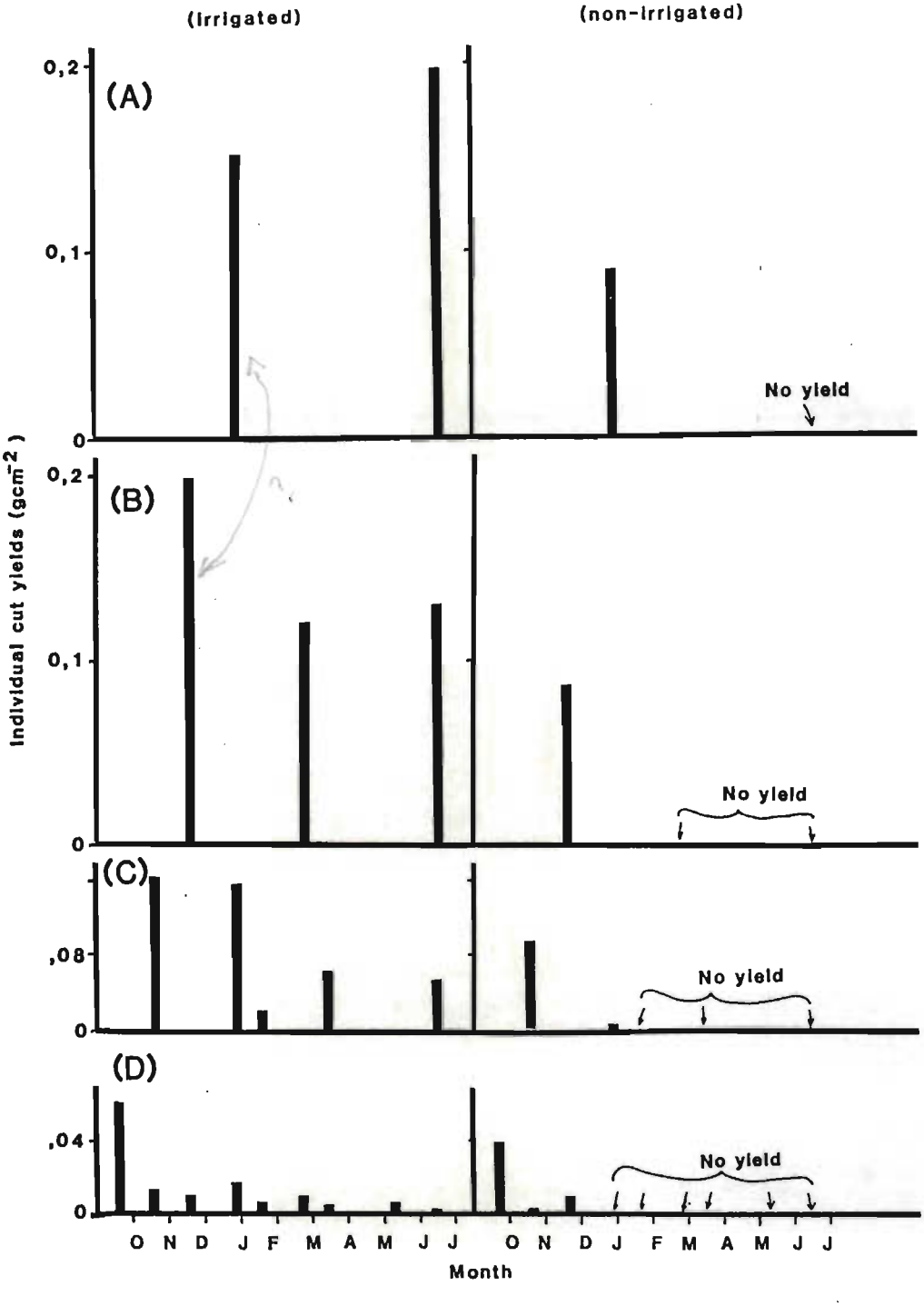

Figure 8.19 *Individual cut yields per unit area of irrigated and non-irrigated* Themeda triandra *tufts subjected to two (A), three (B), five (C), and nine (D), cuts during the 1982/83 season.*

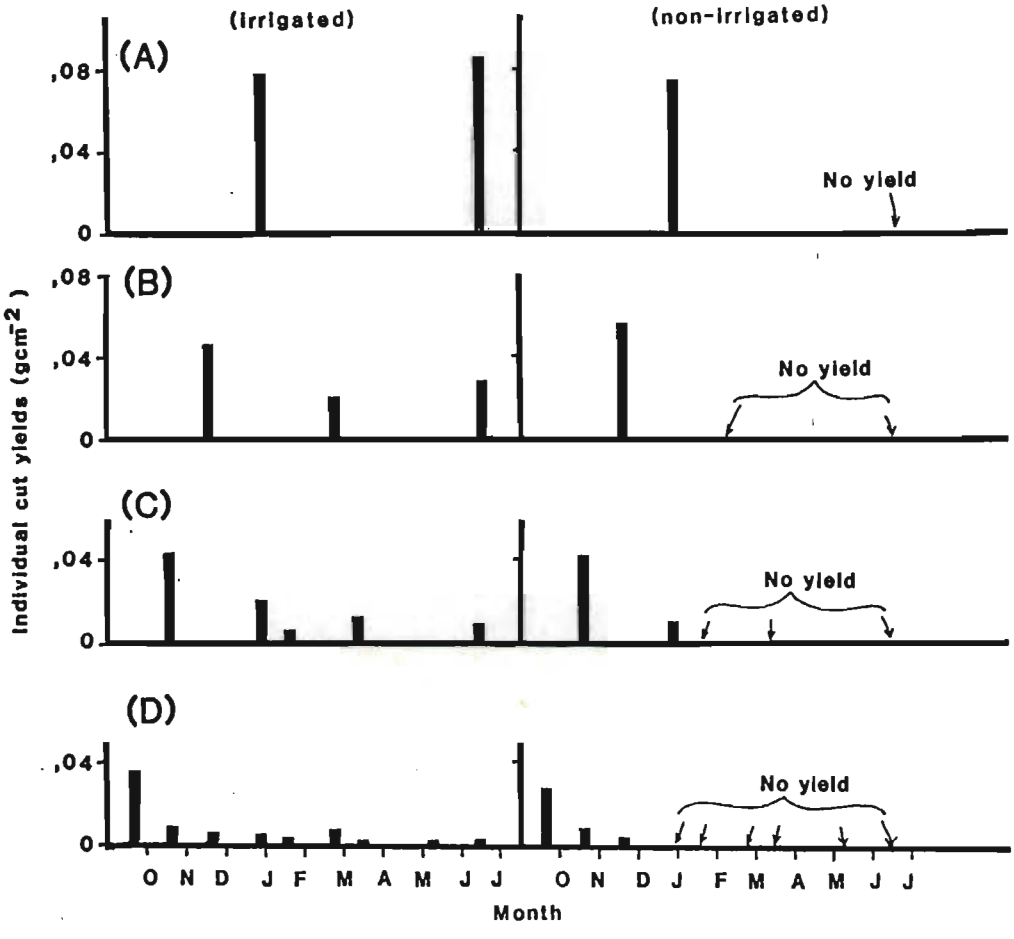

Figure 8.20 *Individual cut yields per unit area of irrigated and non-irrigated* Sporobolus fimbriatus *tufts subjected to two (A), three (B), five (C), and nine (D) cuts during the 1982/83 season.*

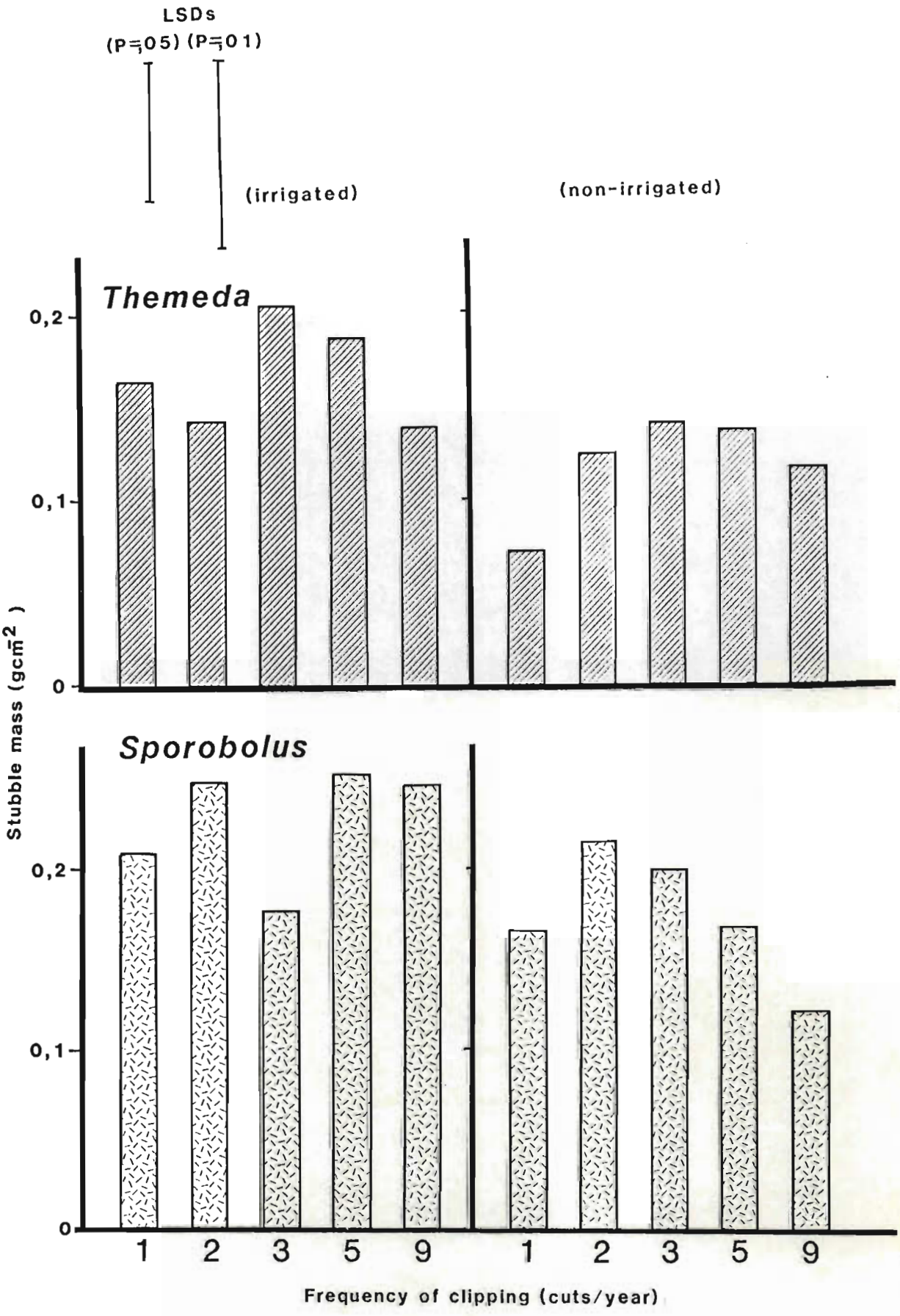

Figure 8.21 *Stubble mass per unit basal area of irrigated and non-irrigated* Themeda triandra *and* Sporobolus fimbriatus *tufts in June 1983 after being subjected to different frequencies of defoliation during the 1982/83 season. Least significant differences (LSD's) are those between any two treatment means.*

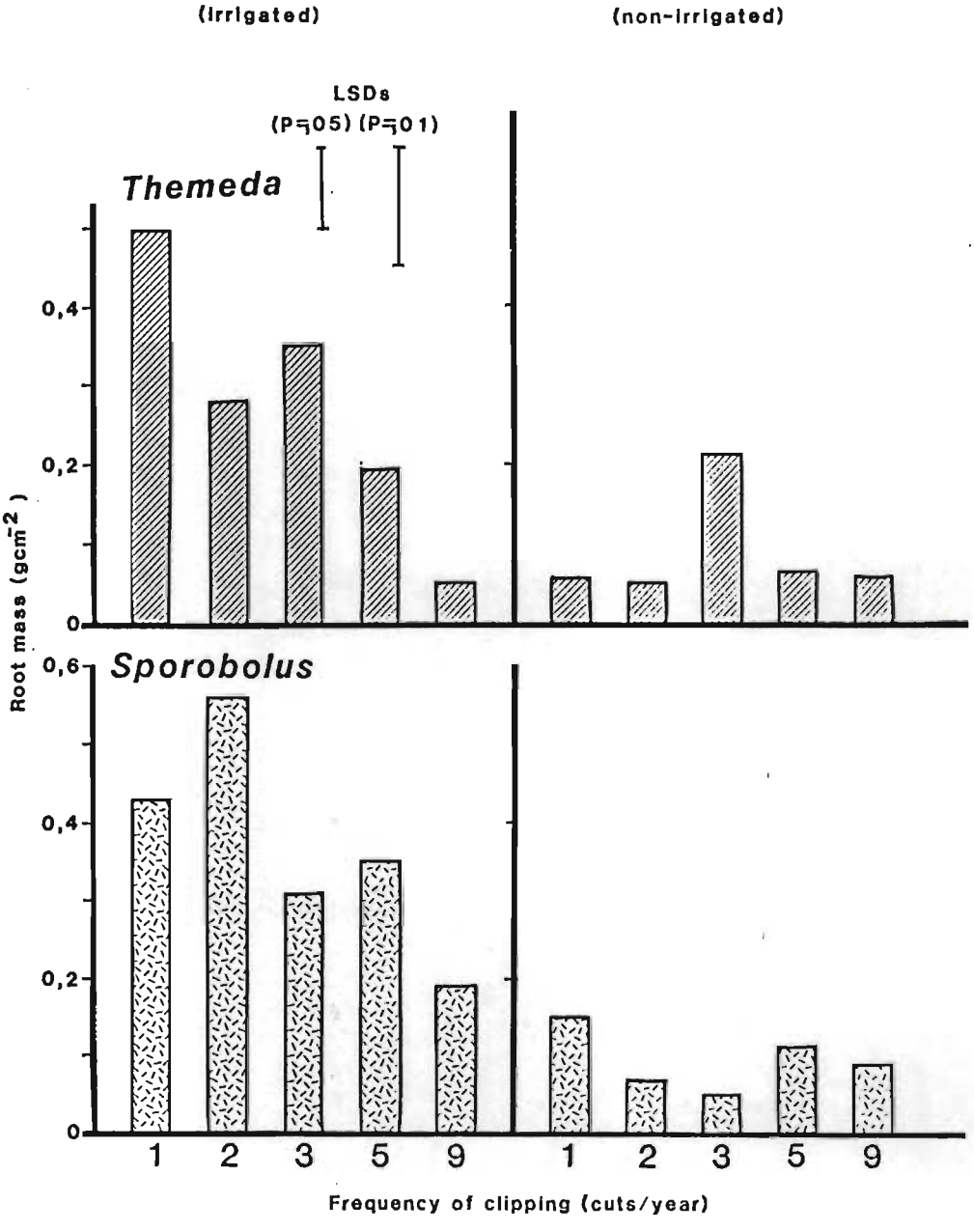

Figure 8.22 *Root mass per unit basal area of irrigated and non-irrigated* Themeda triandra *and* Sporobolus fimbriatus *tufts in June 1983 after being subjected to different frequencies of defoliation during the 1982/83 season. Least significance differences (LSD's) are those between any two treatment seasons.*

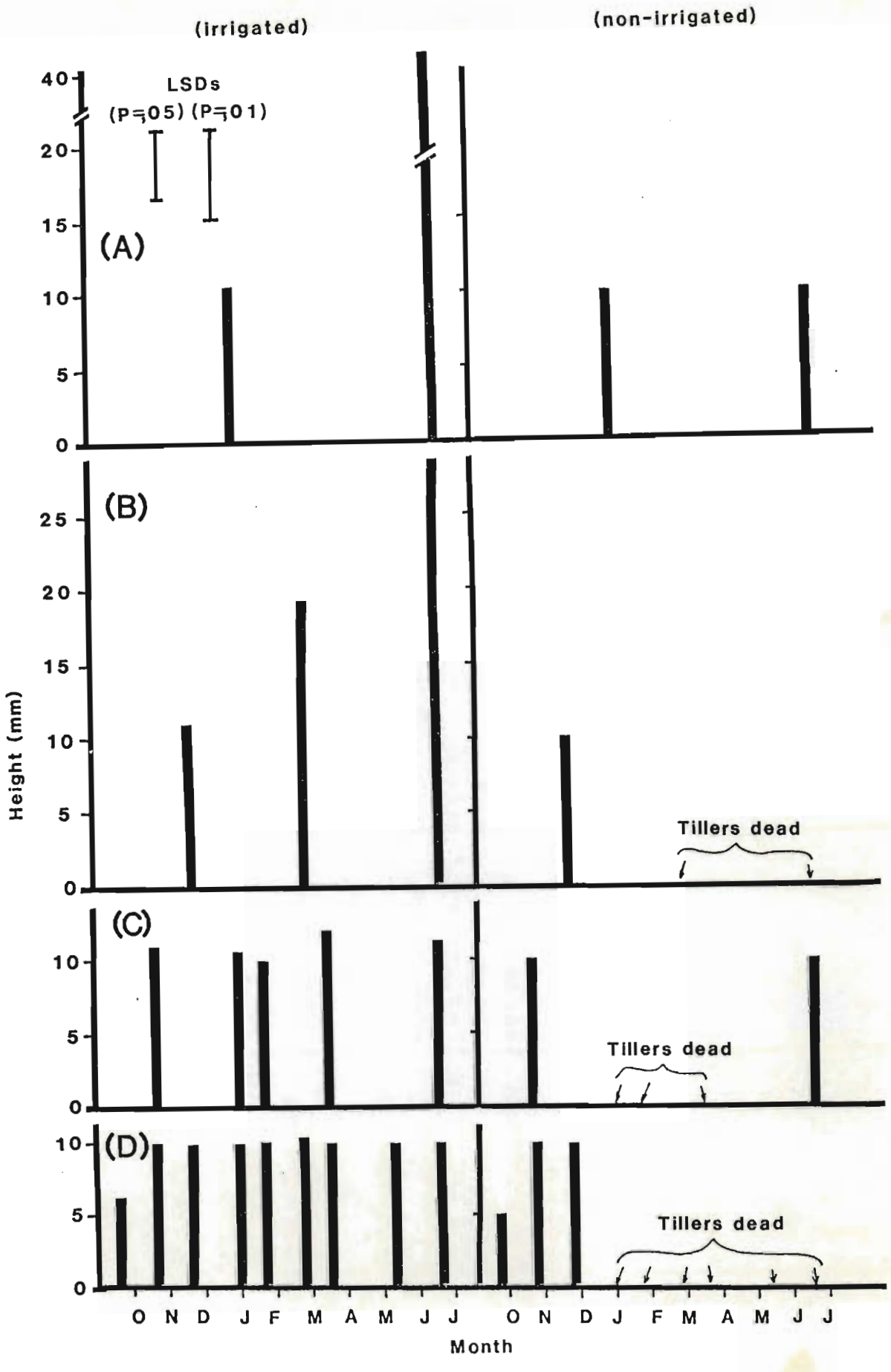

Figure 8.23 *Mean heights of shoot apices of marked tillers before each individual cut of irrigated and non-irrigated* Themeda triandra *tufts clipped twice (A), three times (B), five times (C), and nine times (D), during the 1982/83 season. Least significant differences (LSD's) were those between any two means.*

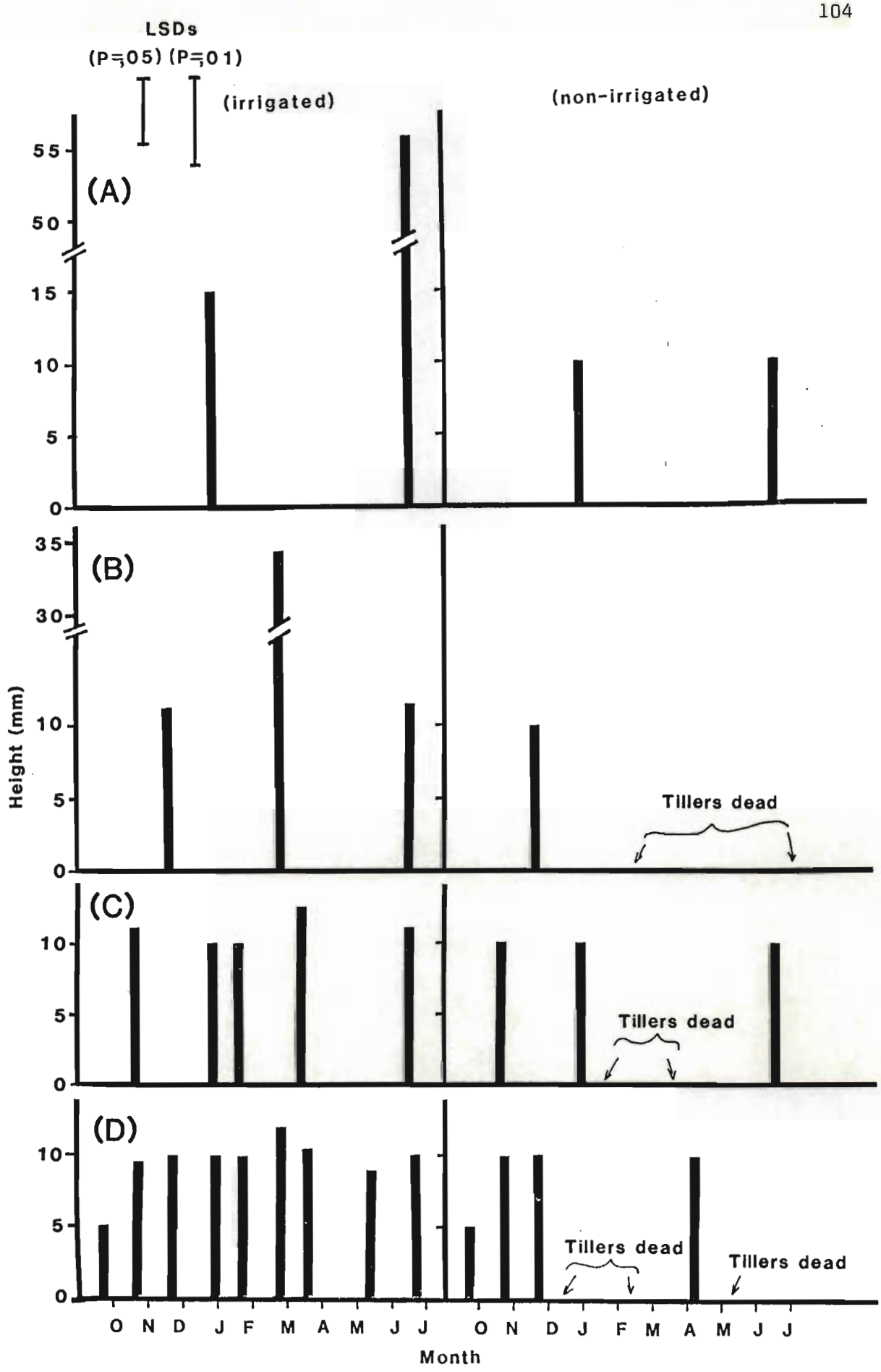

Figure 8.24 *Mean heights of shoot apices of marked tillers before each individual cut of irrigated and non-irrigated* Sporobolus fimbriatus *tufts clipped twice (A), three times (B), five times (C), and nine times (D) , during the 1982/83 season. Least significant differences (LSD's) are those between any two means, excluding the means of the second cuts of treatments clipped twice (A), and three times (B) per year.*

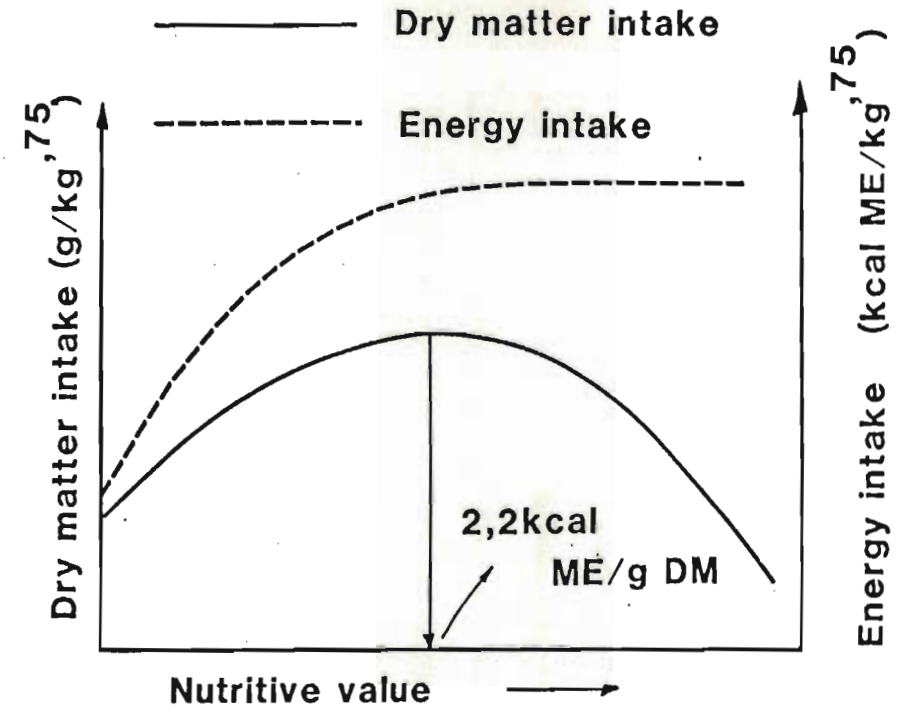

Figure 10.1 *The relations between daily dry matter intake and daily energy intake with changing nutritive value (after Ulyatt 1973).*

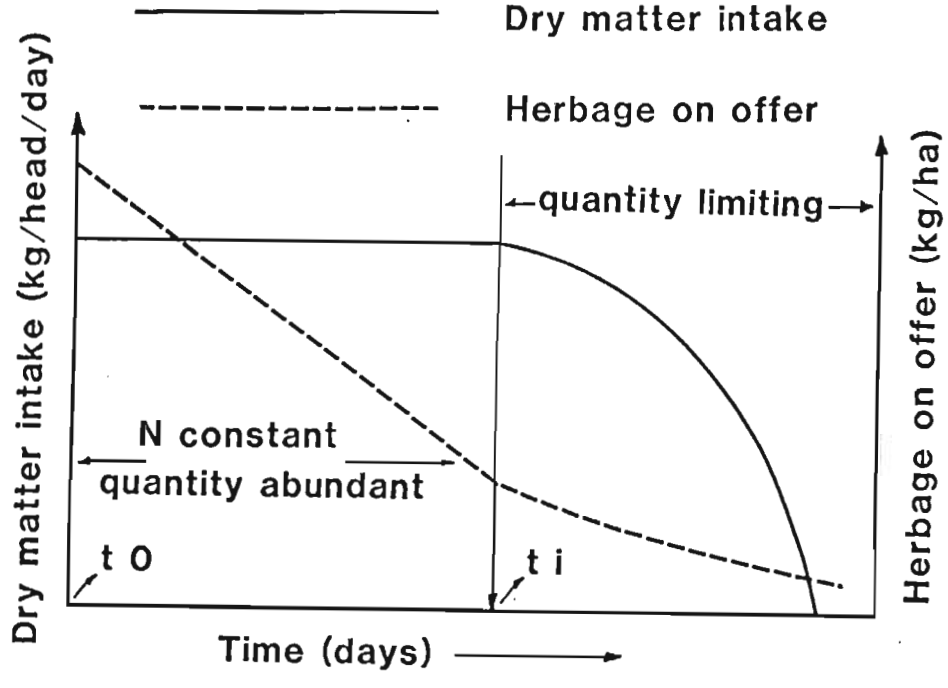

Figure 10.2 *Hypothetical relationships between intake per head and time, and herbage on offer and time during a period of occupation on a sward where nutritive value (N) remains constant up to, or after the point where an insufficient quantity of herbage on offer limits intake per head.*

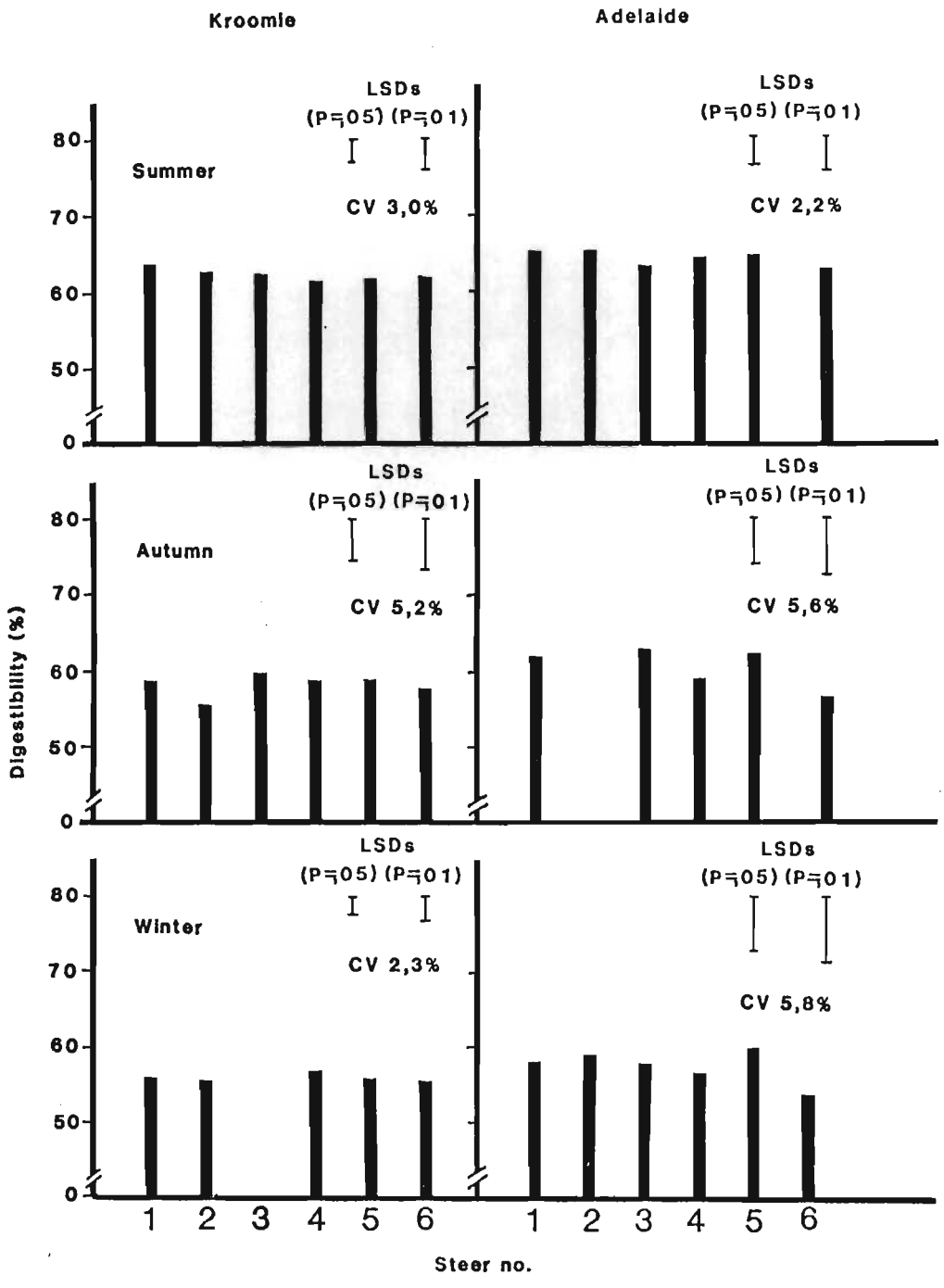

Figure 10.3 *Organic matter digestibility of samples collected by individual fistulated steers during each period of occupation at Kroomie and Adelaide in 1981/82 season. Least significant differences (LSD's) between steers and coefficients of variation (CV) are presented for each period of occupation.*

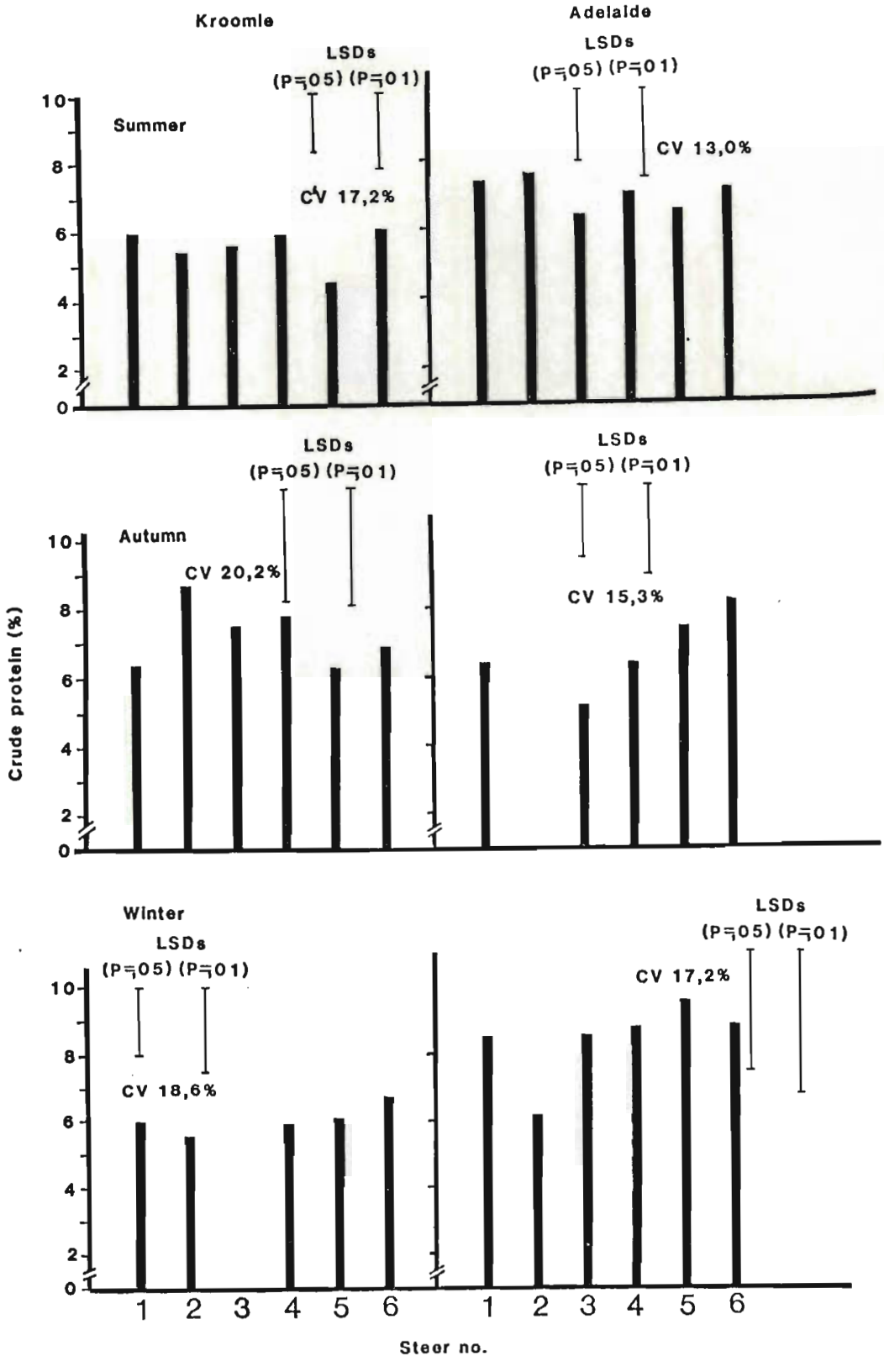

Figure 10.4 *Crude protein contents of samples collected by individual fistulated steers during each period of occupation at Kroomie and Adelaide in the 1981/82 season. Least significant differences (LSD's) between steers and coefficients of variation (CV) are presented for each period of occupation.*

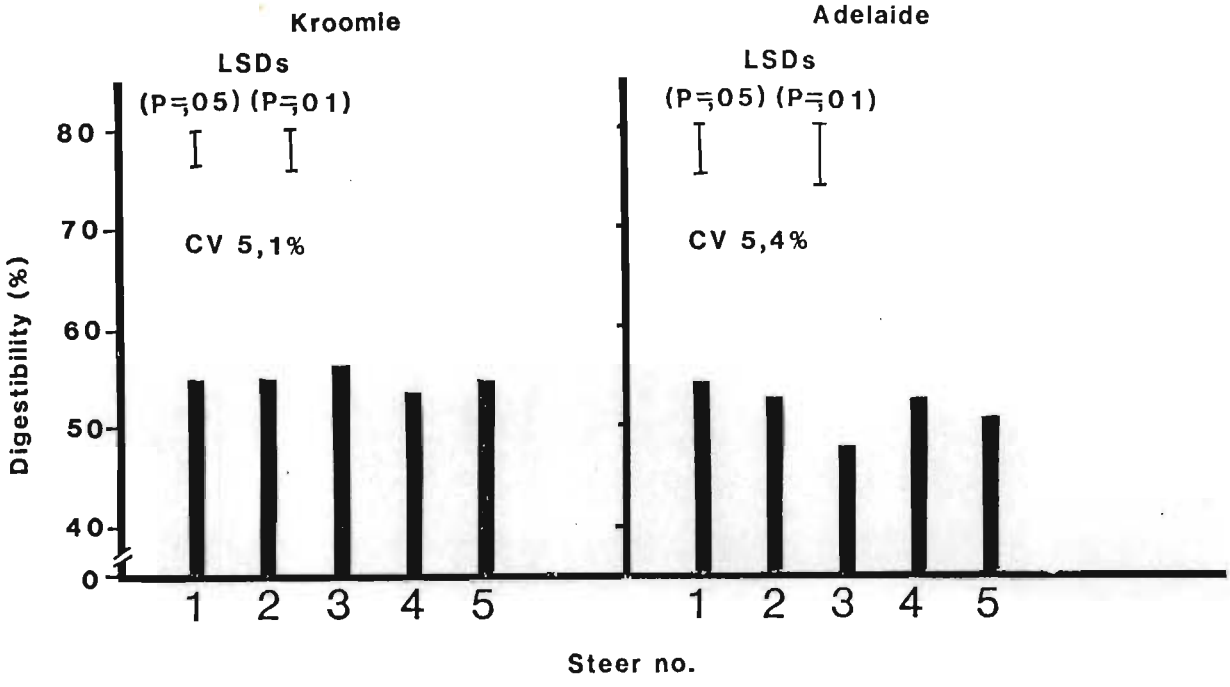

Figure 10.5 *Organic matter digestibility of samples collected by individual fistulated steers during winter 1983 at Kroonie and Adelaide. Least significant differences (LSD's) between steers and coefficients of variation (CV) are presented for each site.*

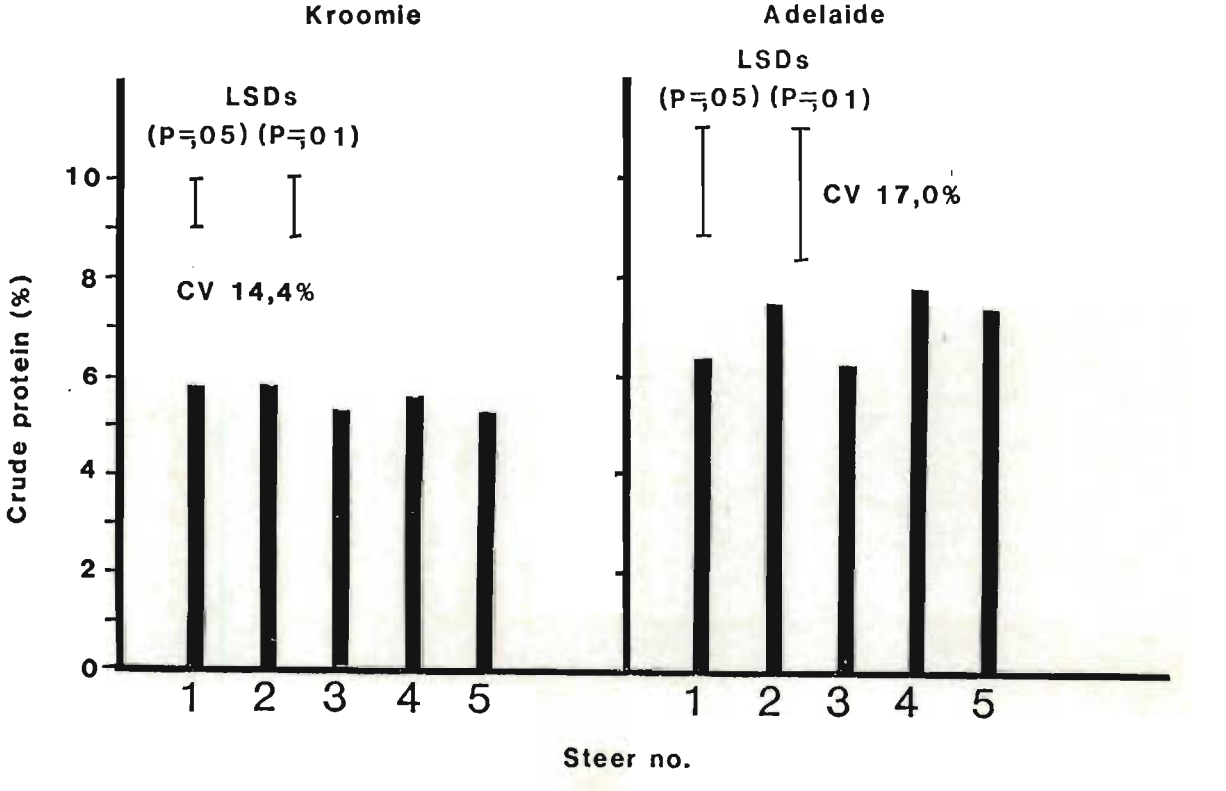

Figure 10.6 *Crude protein contents of samples collected by individual fistulated steers during winter 1983 at Kroomie and Adelaide. Least significant differences (LSD's) between steers and coefficients of variation. (CV) are presented for each site.*

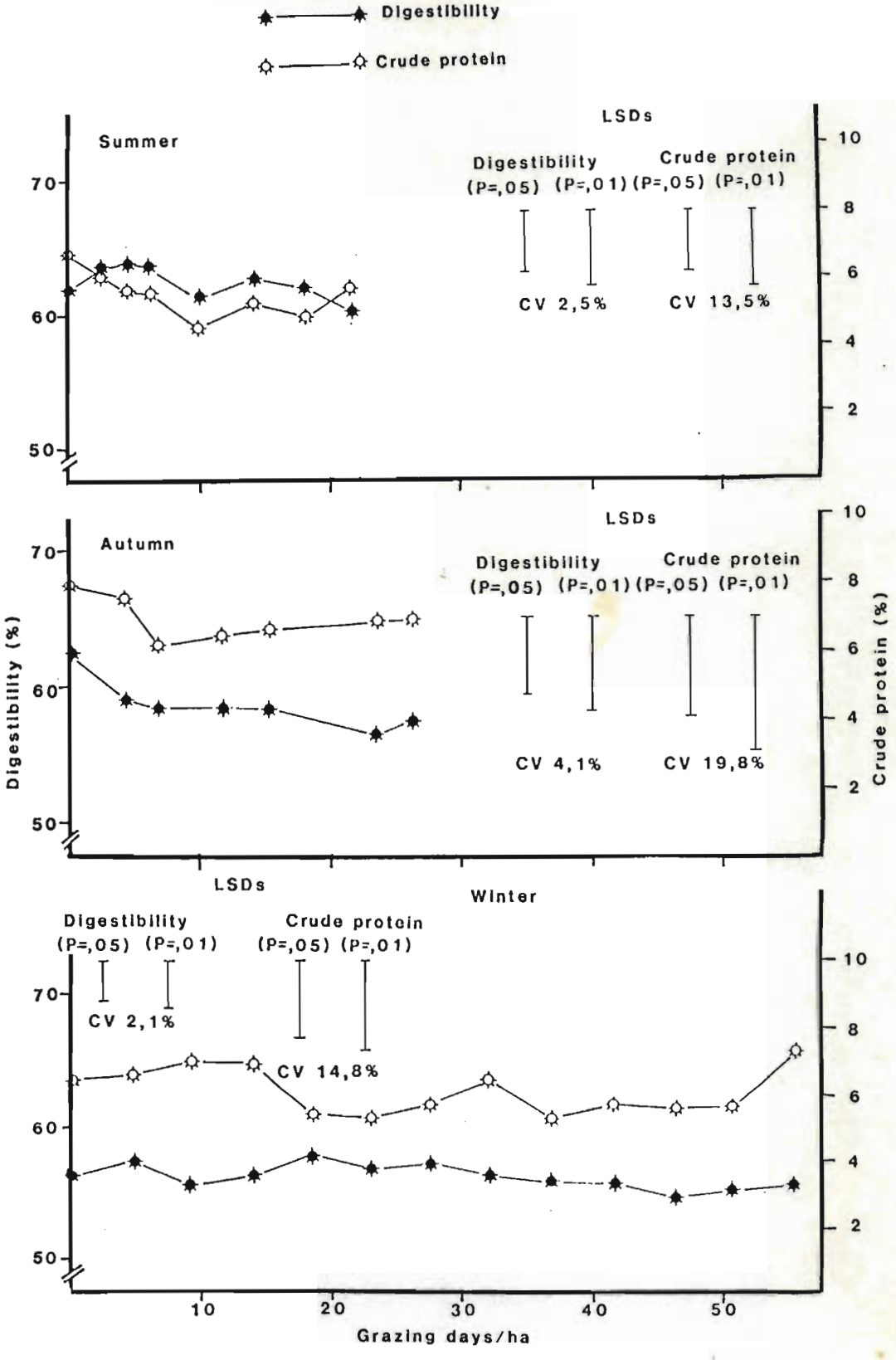

Figure 10.7 *Digestibility of organic matter and crude protein contents of fistula samples at each sampling date within periods of occupation at Kroomie during the 1981/82 season. Least significant differences (LSD's) between sampling dates and coefficients of variation (CV) are presented for each period of occupation.*

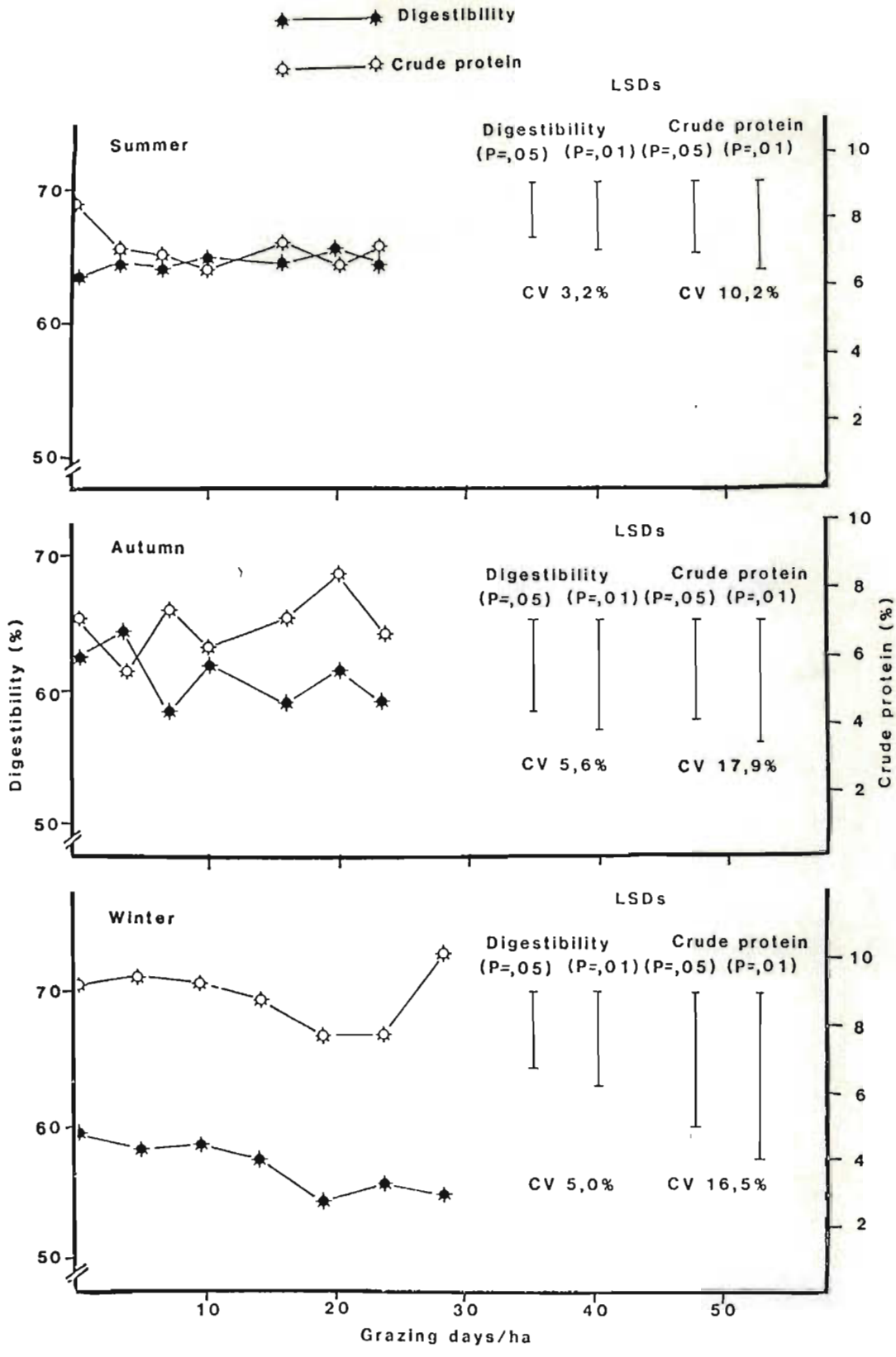

Figure 10.8 *Digestibility of organic matter and crude protein content of fistula samples collected at each sampling date within periods of occupation at Adelaide during the 1981/82 growing season. Least significant differences (LSD's) between sampling dates and coefficients of variation (CV) are presented for each period of occupation.*

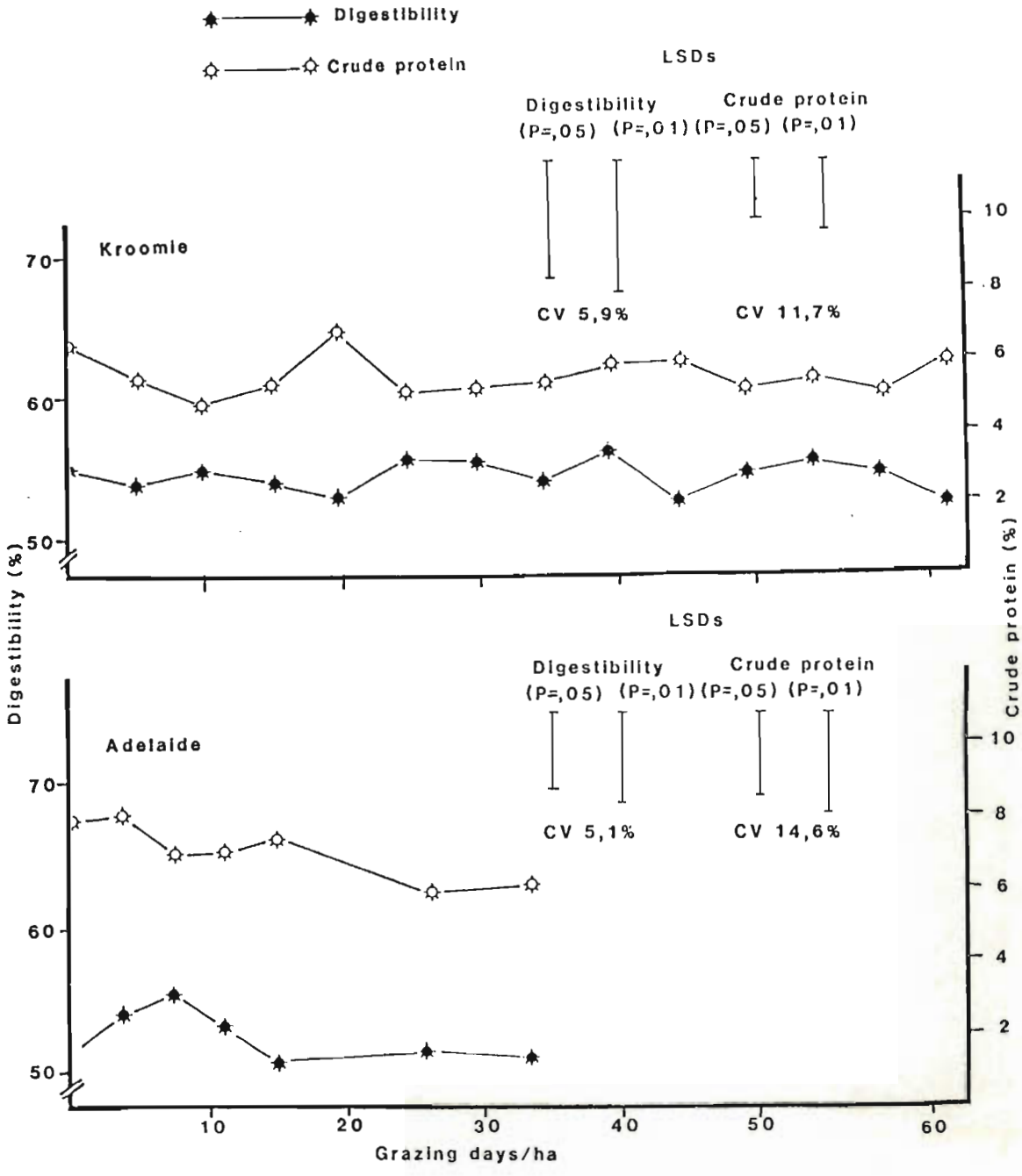

Figure 10.9 *Digestibility of organic matter and crude protein content of fistula samples collected at each sampling date within periods of occupation at Kroomie and Adelaide during winter 1983. Least significant differences (LSD's) between sampling dates and coefficients of variation (CV) are presented separately for each site.*

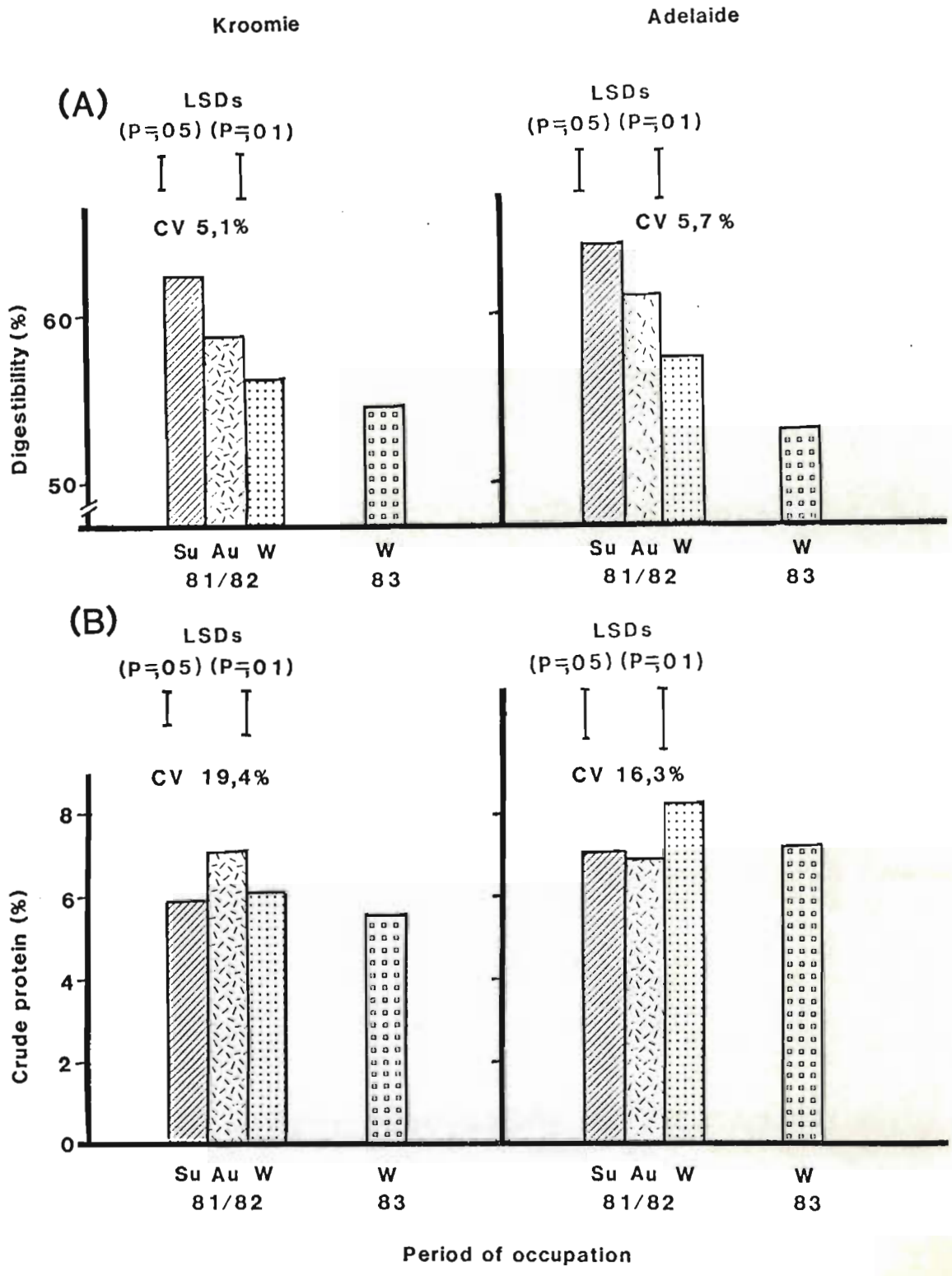

Figure 10.10 *Mean digestibility of organic matter (A) and crude protein content (B) collected during each period of (summer (Su); autumn (Au) and winter (W) of the 1981/82 season, and in winter (W) of 1983) at Kroomie and Adelaide. Least significant differences between periods of occupation (LSD) and coefficients of variation (CV) are presented separately for each site.*

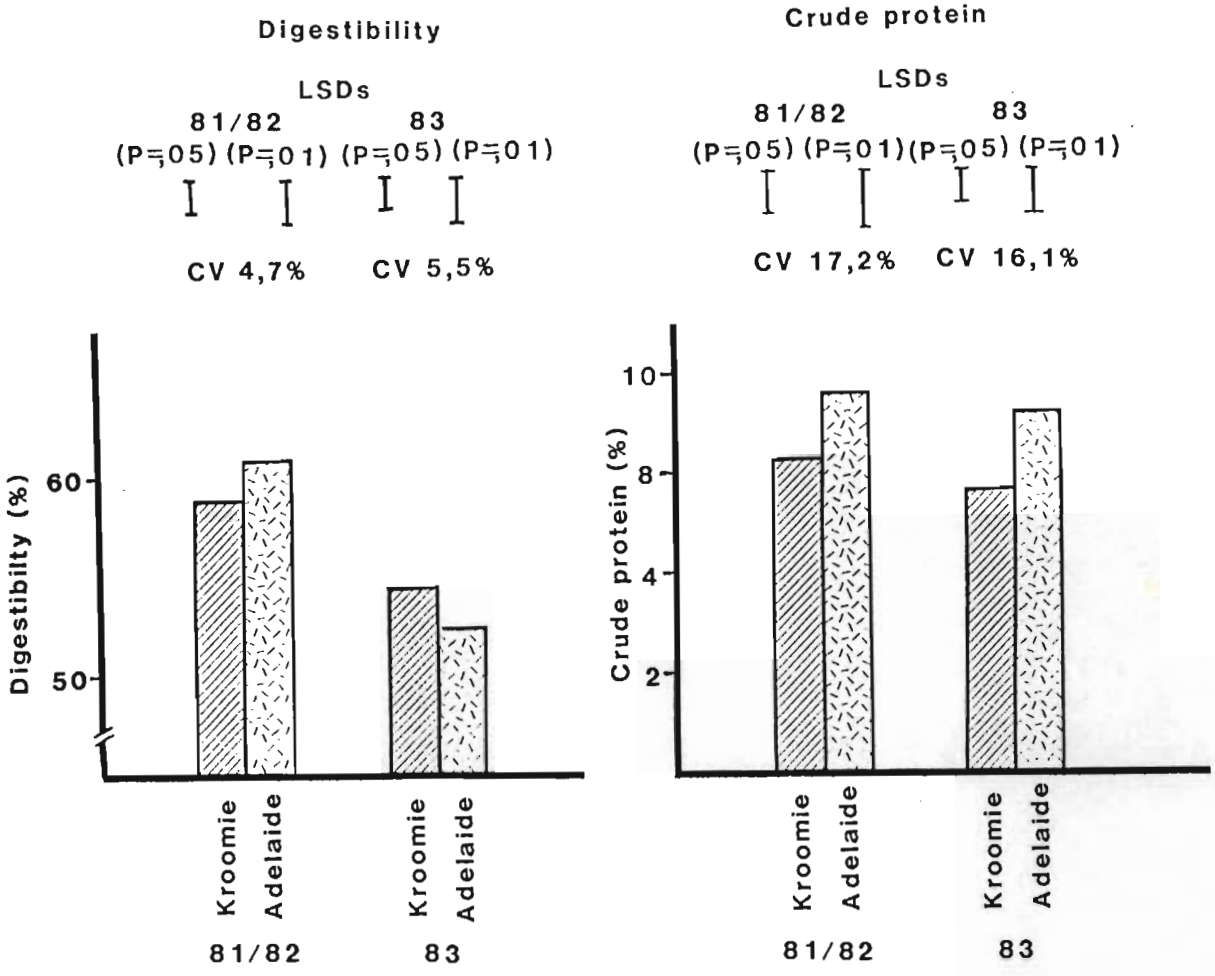

Figure 10.11 *Mean organic matter digestibility and crude protein content of fistula samples collected at Kroomie and Adelaide du the 1981/82 season and during winter 1983. Least significant differences between sites (LSD's) and co-efficients of variation (CV) are presented separately for each year.*

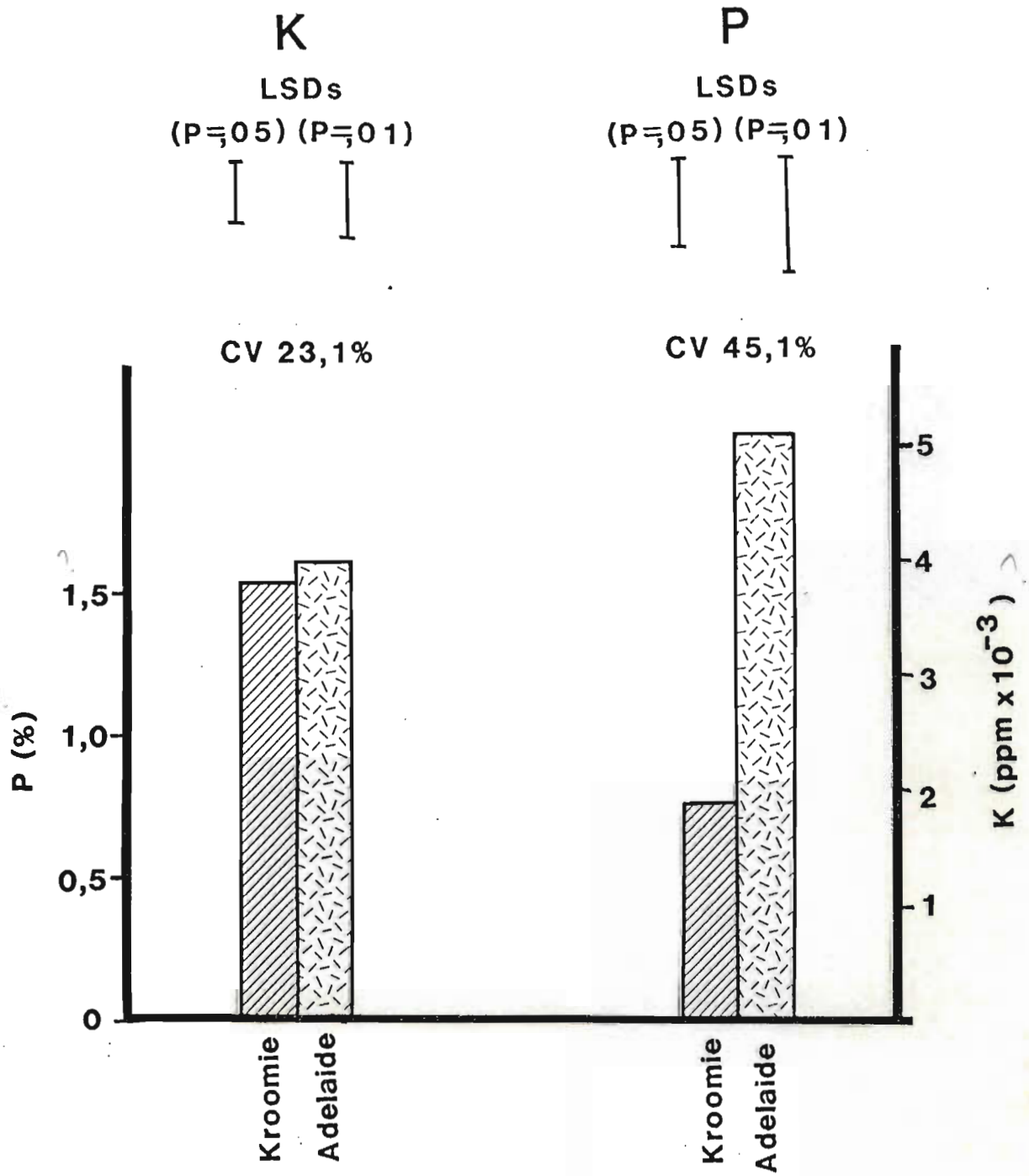

Figure 10.12 *Mean phosphorus (P) and potassium (K) concentration in herbage samples collected at Kroomie (Kr) and Adelaide (Ad) during winter 1983. Least significant differences between sites (LSD's) and coefficients of variation (CV) are presented for each of the two respective minerals.*

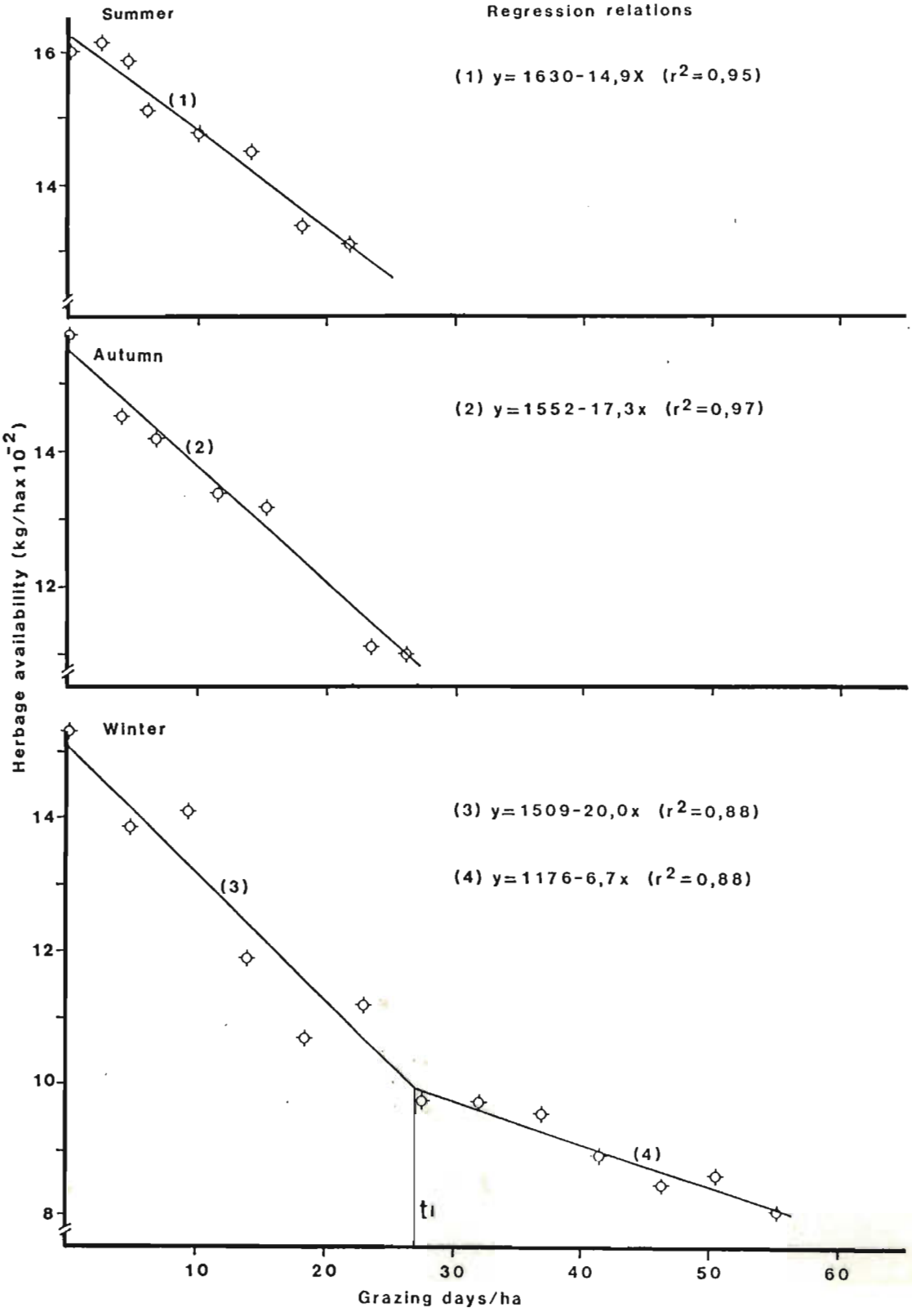

Figure 10.13 *Relationships between herbage availability (y) and grazing days per ha (x) during periods of occupation at Kroomie in the 1981/82 season. Time ti represents point where insufficient forage availability restricted intake per head.*

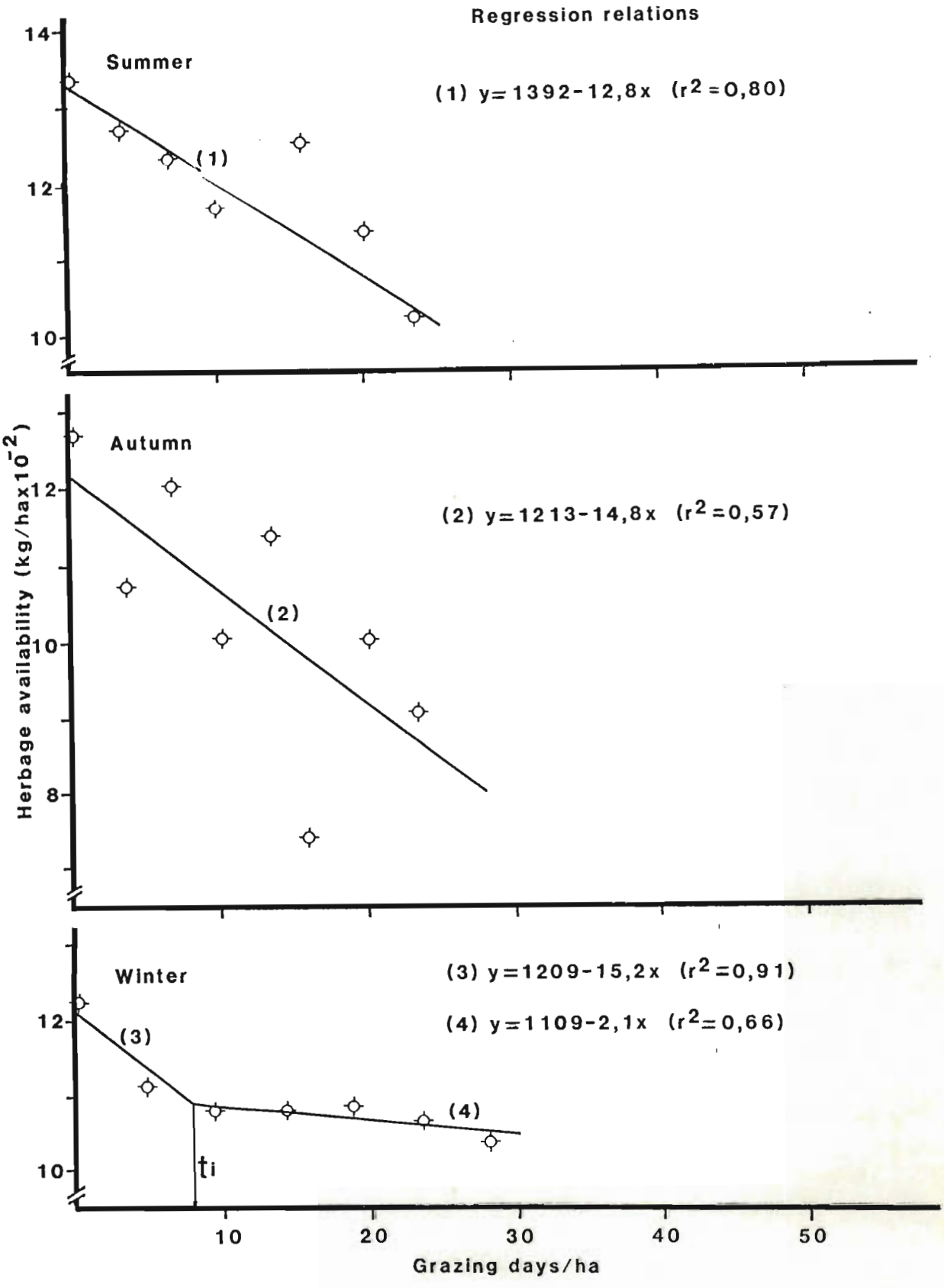

Figure 10.14 *Relationships between herbage availability (y) and grazing days per ha (x) during periods of occupation at Adelaide in the 1981/82 season. Time ti represents point where insufficient forage availability restricted intake per head.*

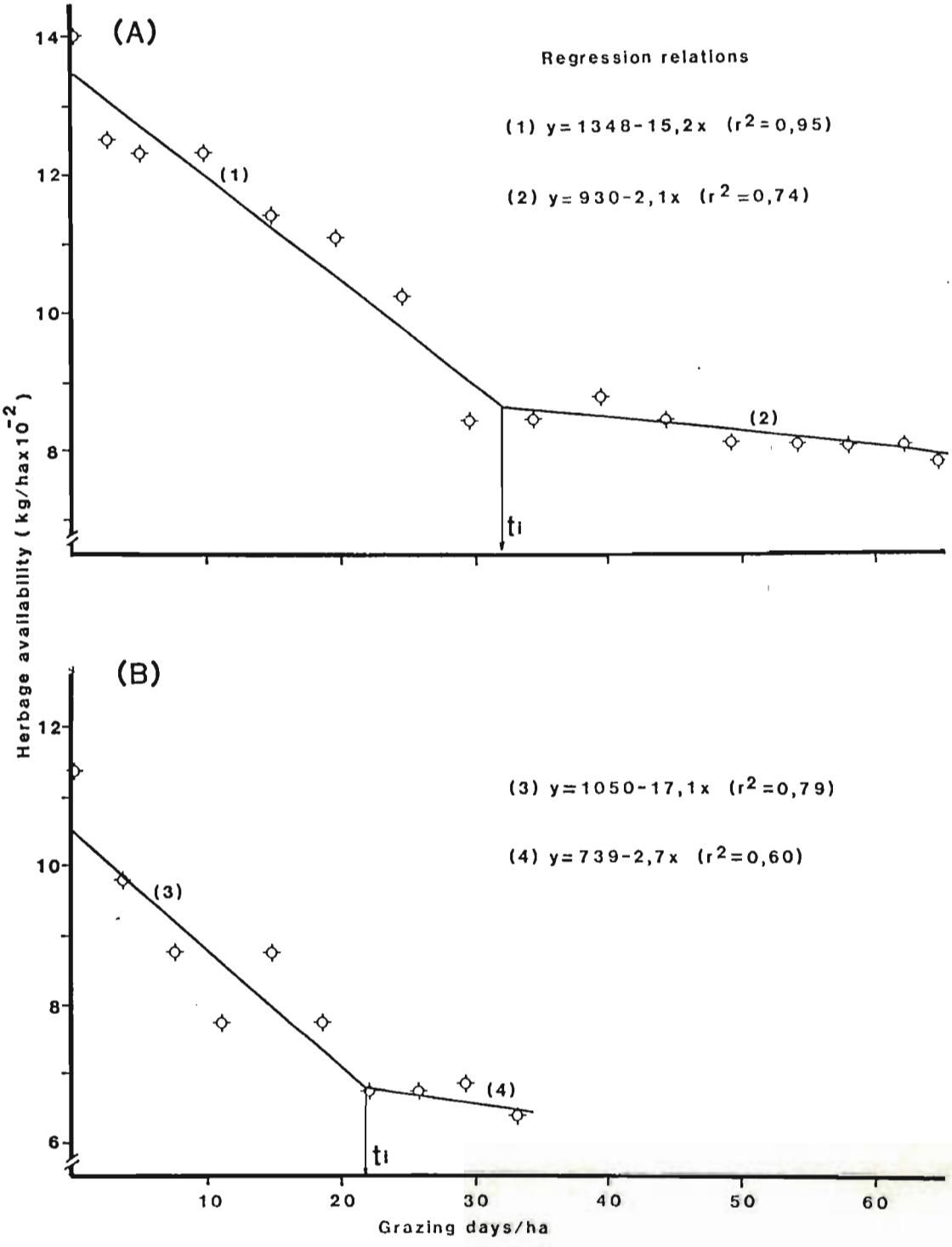

Figure 10.15 *Relationships between herbage availability (x) and grazing days per ha (y) during periods of occupation at Kroomie (A) and Adelaide (B) in winter 1983. Time ti represents point where insufficient forage availability restricted intake per head.*

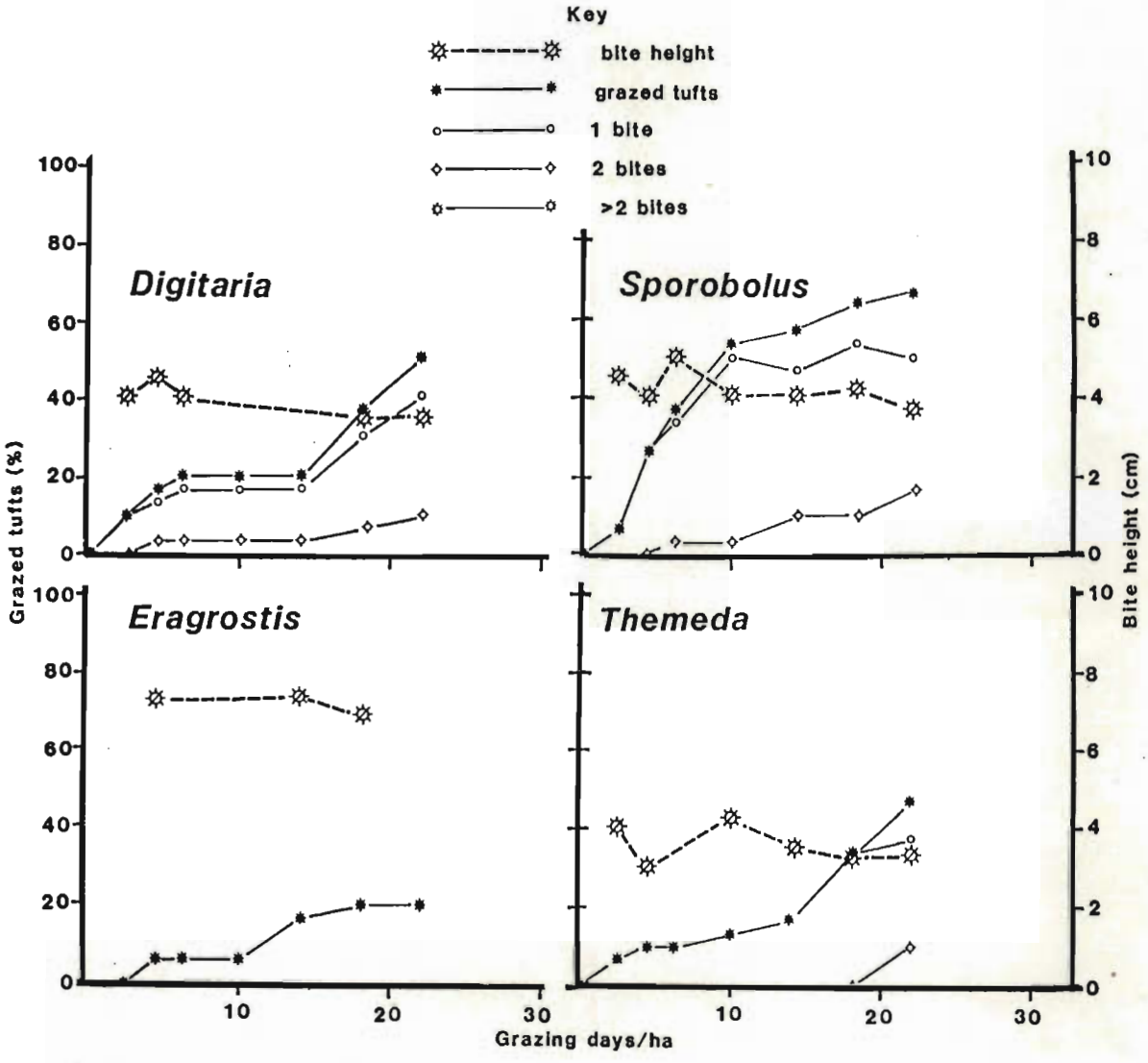

Figure 10.16 *Mean daily bite heights and the percentage of marked tufts of* Digitaria eriantha, Eragrostis chloromelas, Sporobolus fimbriatus *and* Themeda triandra *grazed once, twice or more than two times during the first period of occupation at Kroomie in the 1981/82 season.*

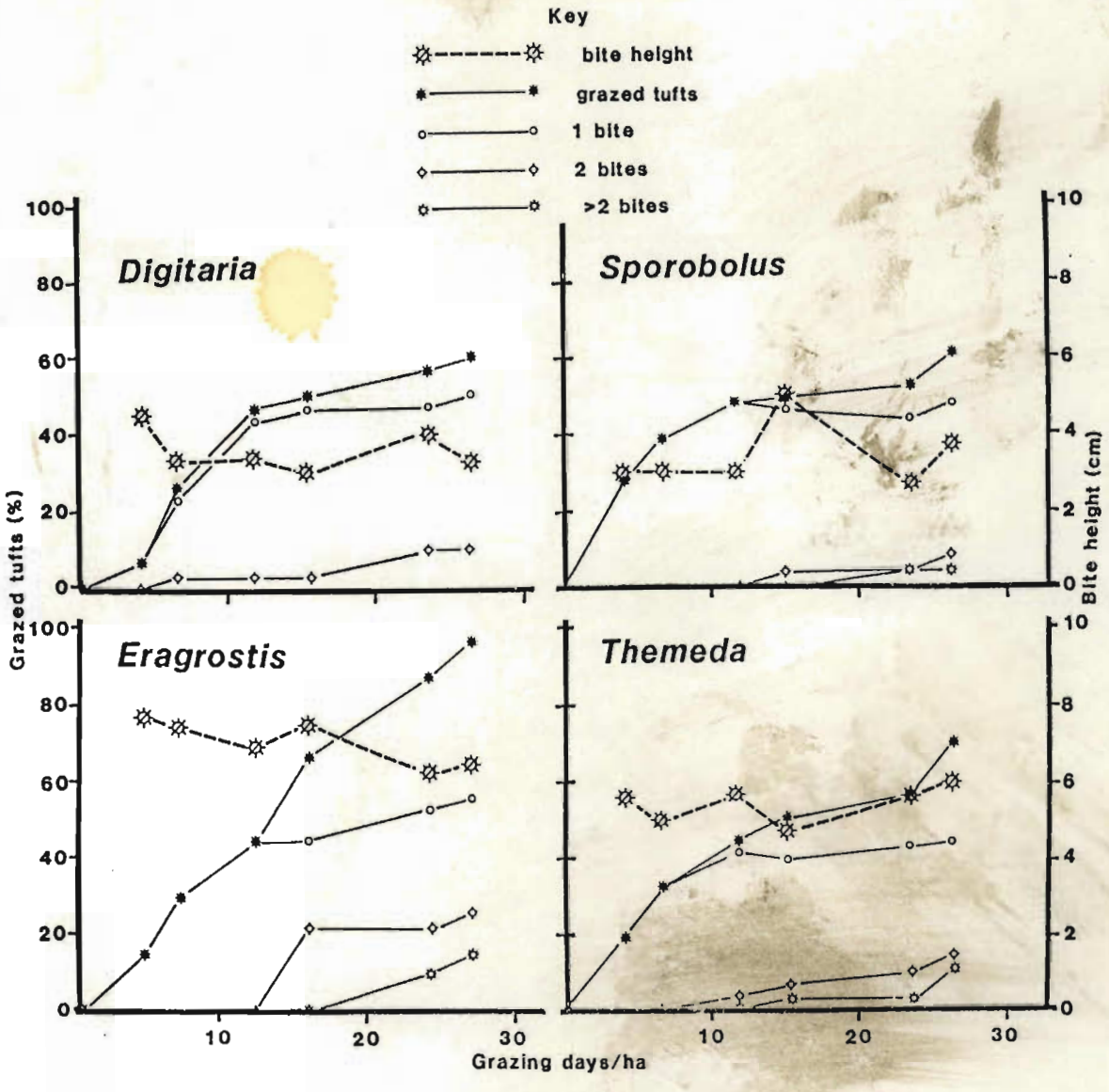

Figure 10.17 *Mean daily bite heights and the percentage of marked tufts of* Digitaria eriantha, Eragrostis chloromelas, Sporobolus fimbriatus *and* Themeda triandra *grazed once, twice or more than two times during the second period of occupation at Kroomie in the 1981/82 season.*

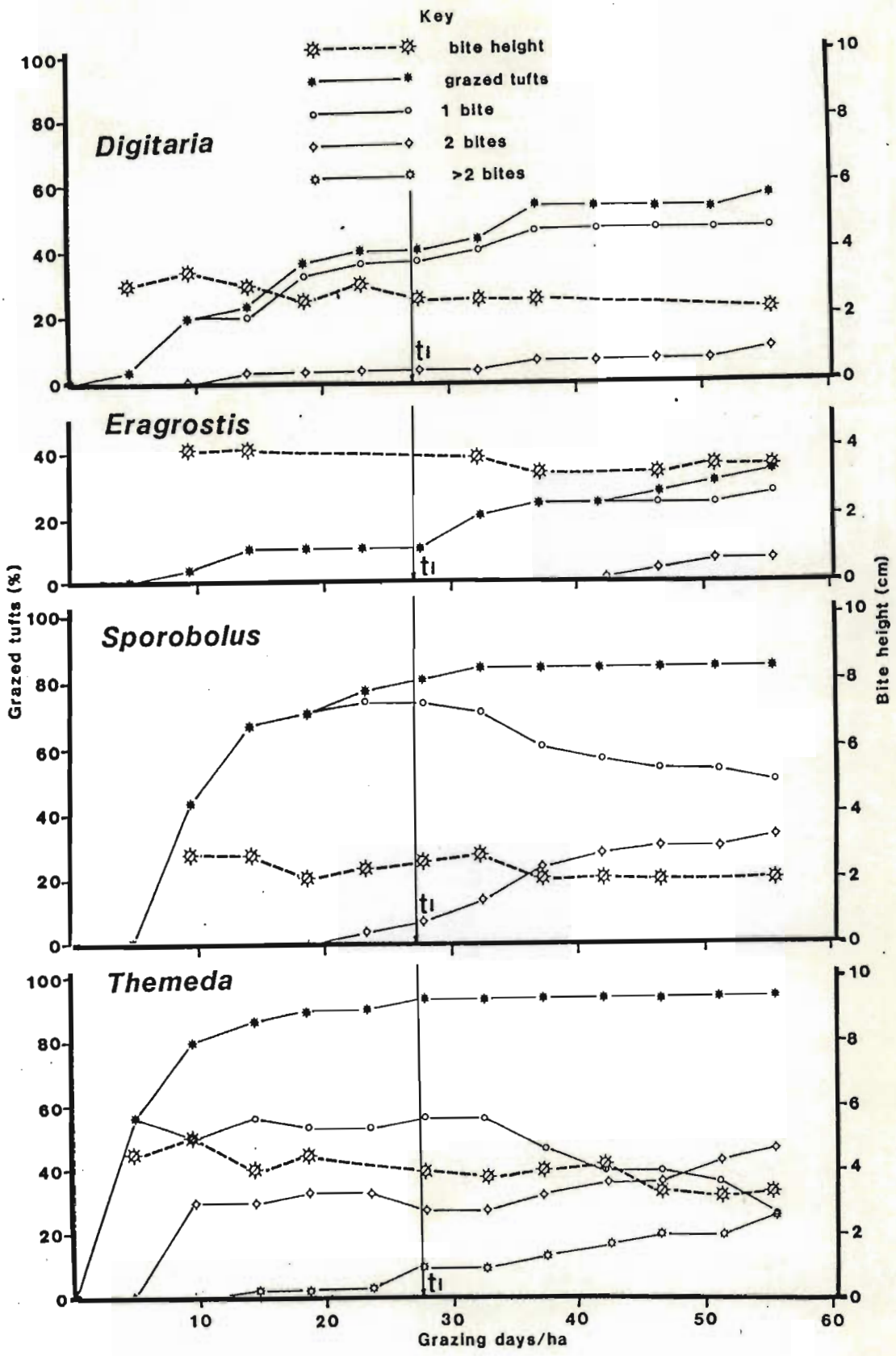

Figure 10.18 *Mean daily bite heights and the percentage of marked tufts of* Digitaria eriantha, Eragrostis chloromelas, Sporobolus fimbriatus *and* Themeda triandra *grazed once, twice or more than two times during the third period of occupation at Kroomie in the 1981/82 season. Time* t_i *is when insufficient herbage availability restricted intake per head.*

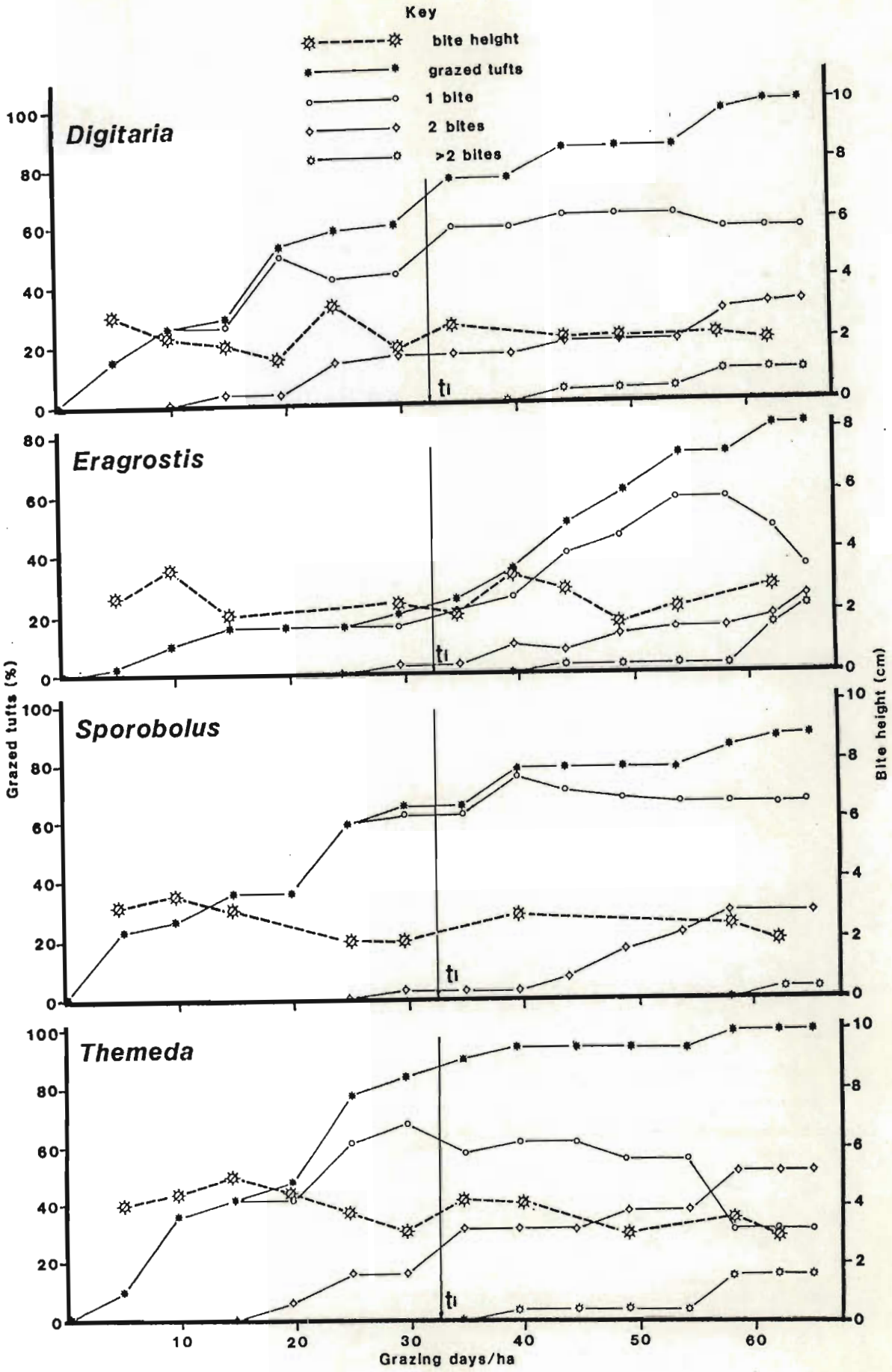

Figure 10.19 *Mean daily bite heights and the percentage of marked tufts of* Digitaria eriantha, Eragrostis chloromelas, Sporobolus fimbriatus *and* Themeda triandra *grazed once, twice or more than two times during winter 1983 at Kroomie. Time* t_i *is when insufficient herbage availability restricted intake per head.*

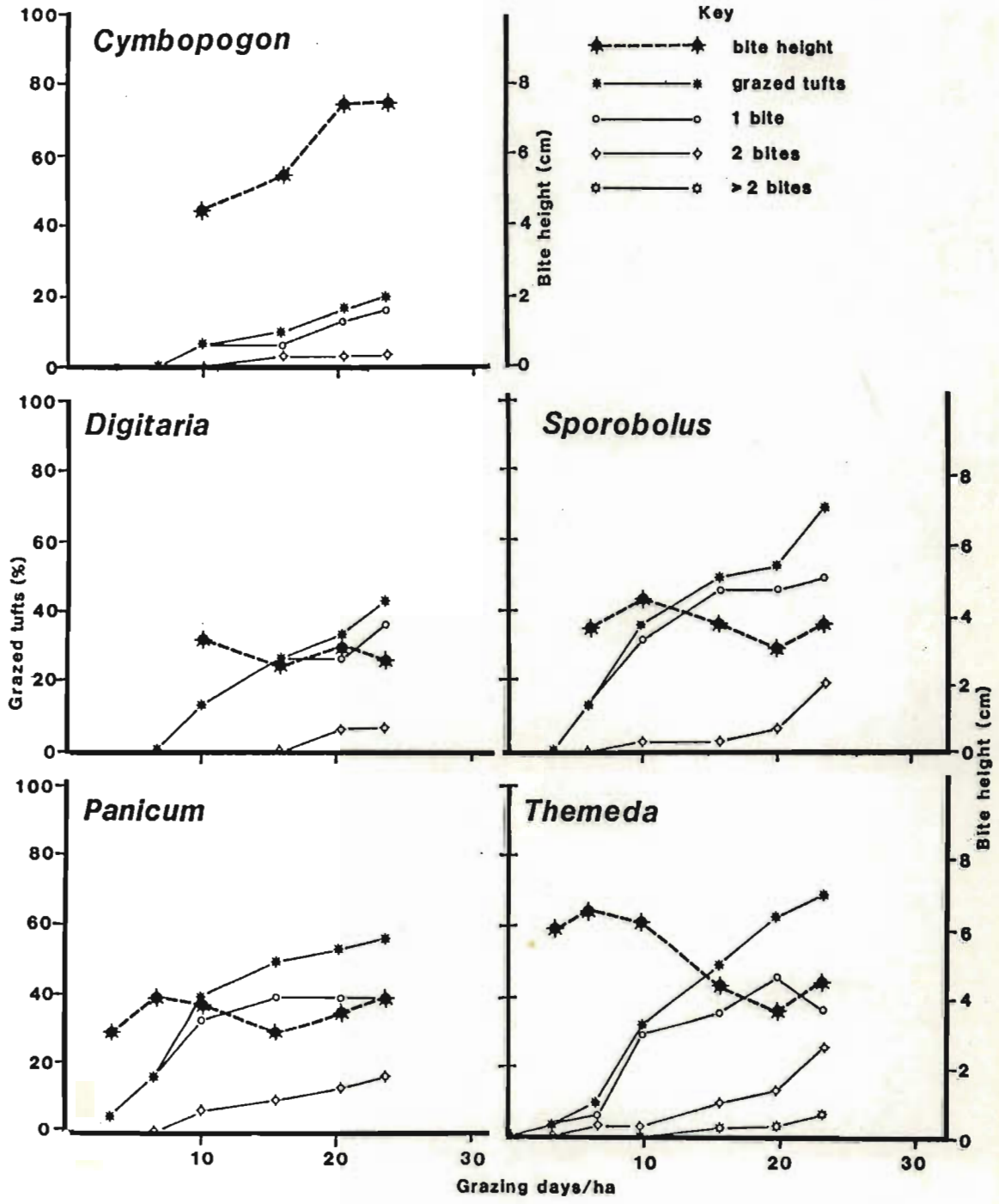

Figure 10.20 *Mean daily bite height and the percentage of marked tufts of* Cymbopogon plurinodis, Digitaria eriantha, Panicum stapfianum, Sporobolus fimbriatus *and* Themeda triandra *grazed once, twice or more than two times during the first period of occupation at Adelaide in the 1981/82 season.*

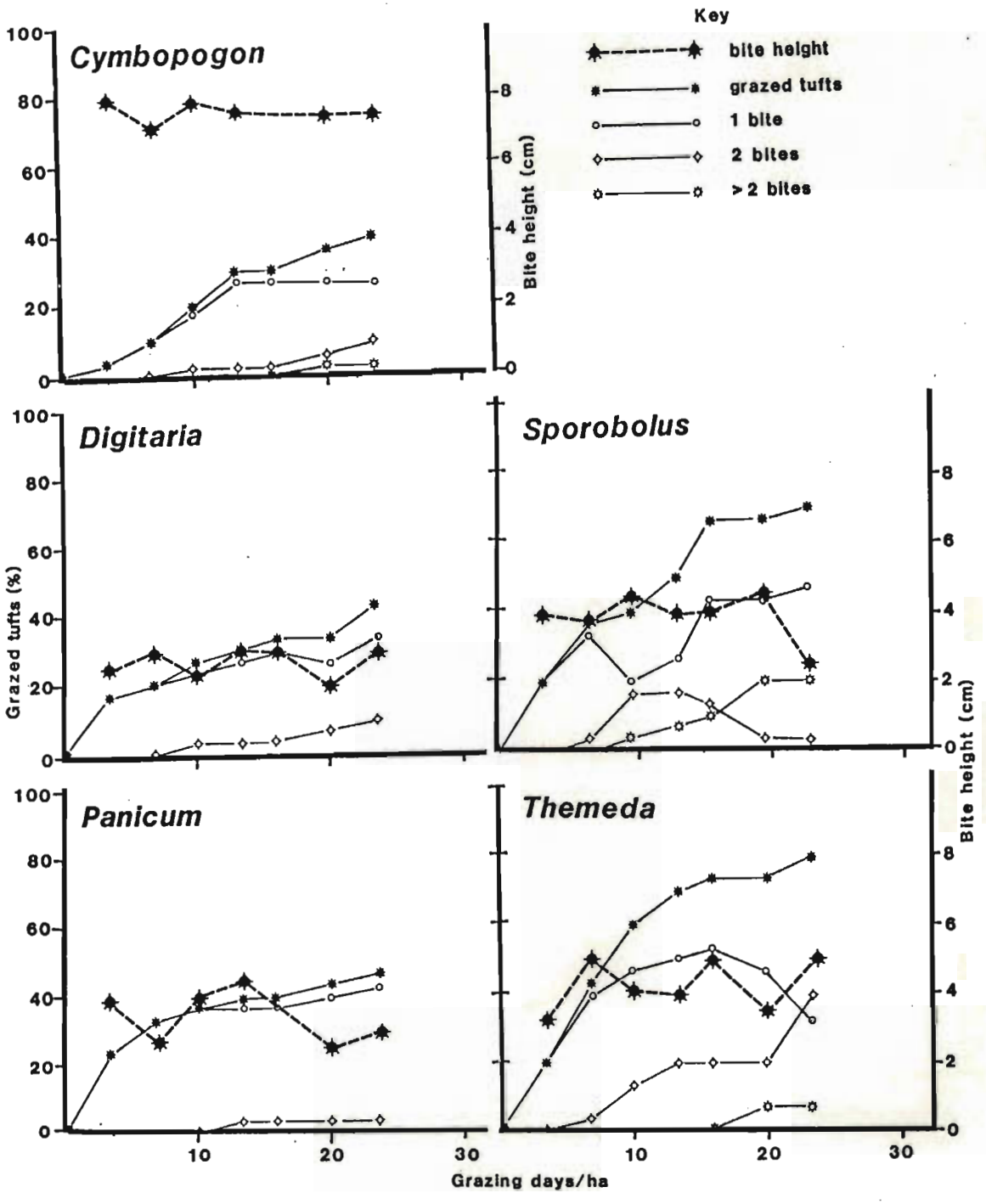

Figure 10.21 *Mean daily bite height and the percentage of marked tufts of* Cymbopogon plurinodis, Digitaria eriantha, Panicum stapfianum, Sporobolus fimbriatus *and* Themeda triandra *grazed once, twice or more than two times during the second period of occupation at Adelaide in the 1981/82 season.*

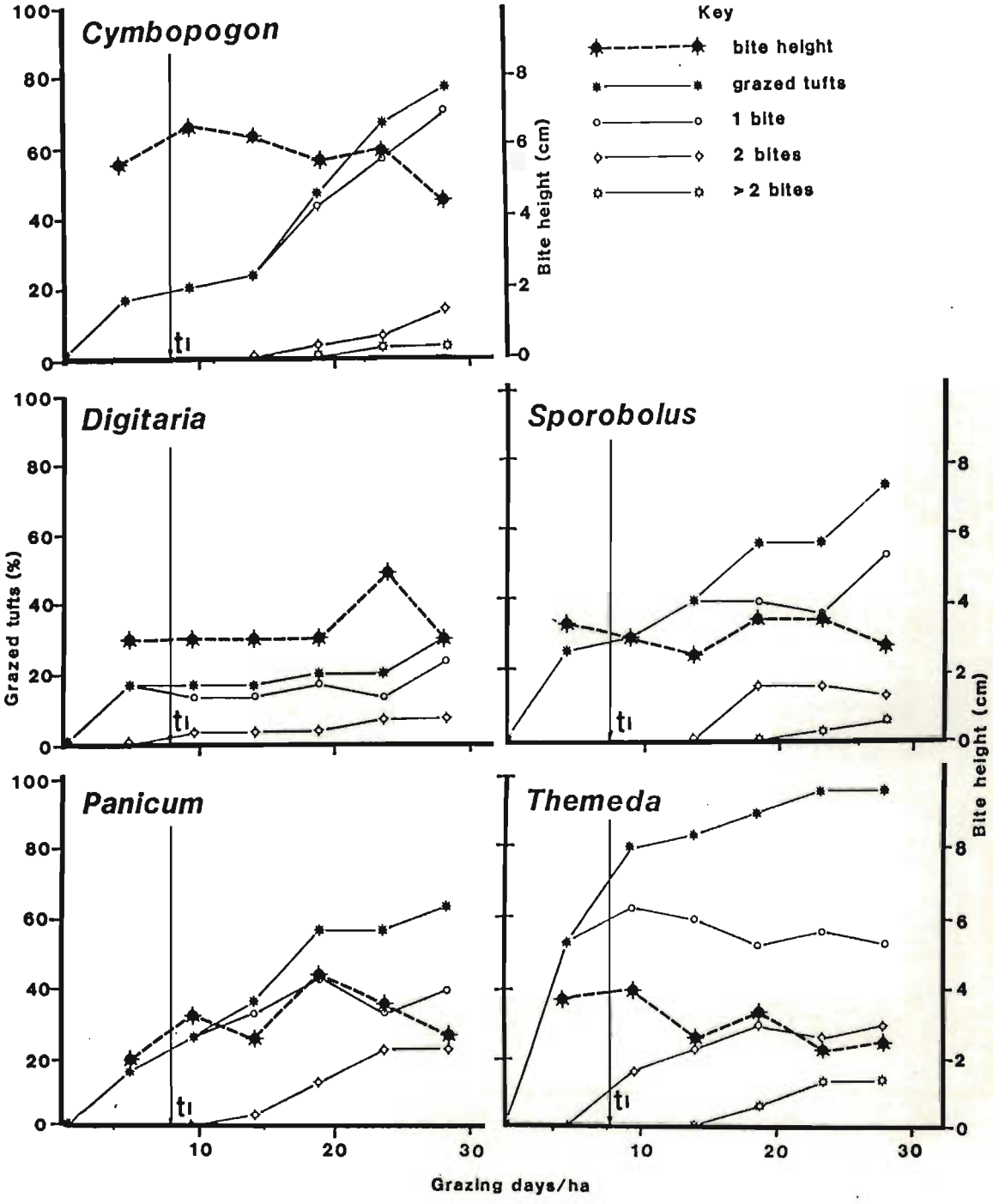

Figure 10.22 *Mean daily bite height and the percentage of marked tufts of* Cymbopogon plurinodis, Digitaria eriantha, Panicum stapfianum, Sporobolus fimbriatus *and* Themeda triandra *grazed once, twice or more than two times during the third period of occupation at Adelaide in the 1981/82 season. Time* t_i *is when insufficient herbage availability restricted intake per head.*

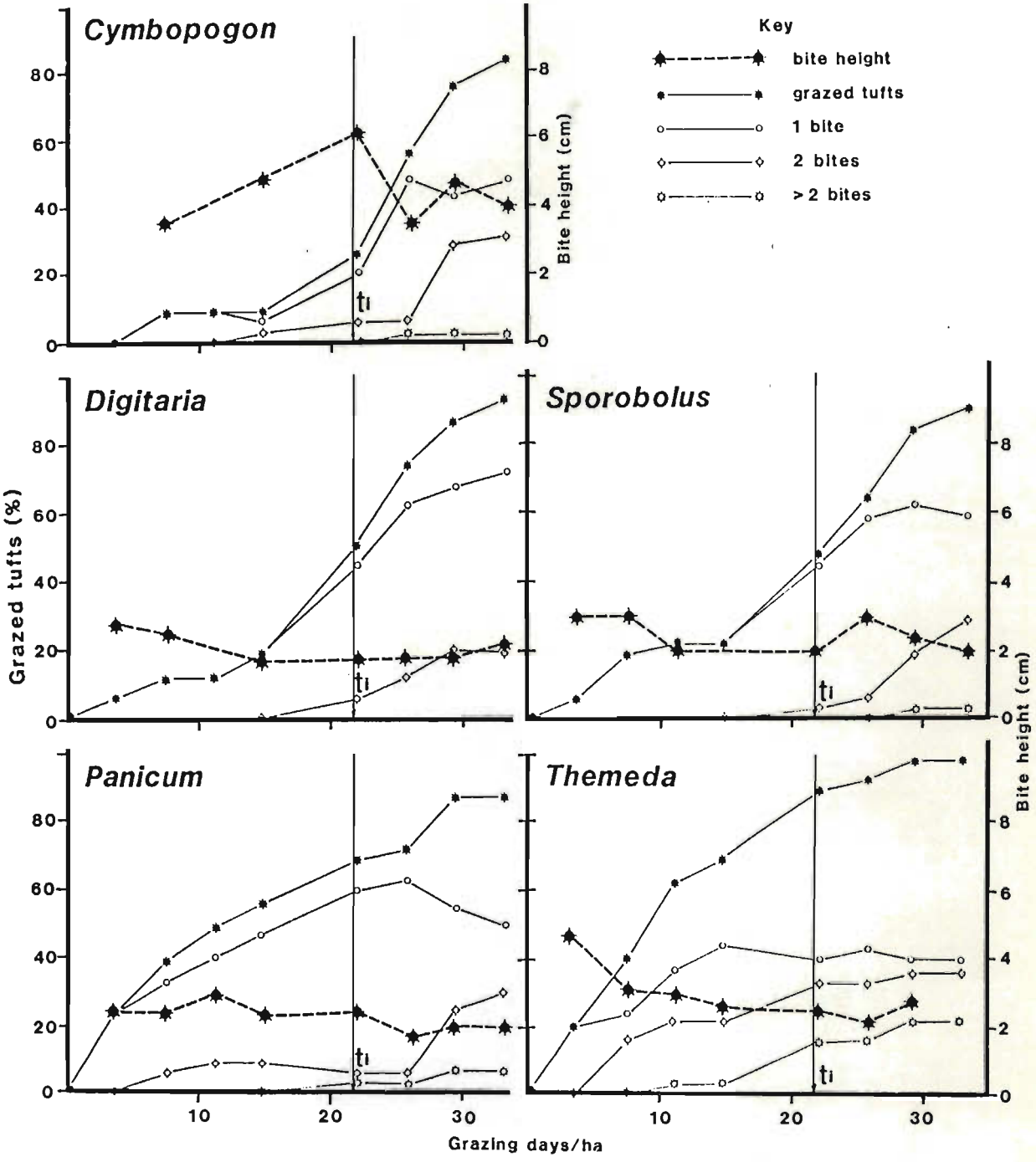

Figure 10.23 *Mean daily bite height and the percentage of marked tufts of* Cymbopogon plurinodis, Digitaria eriantha, Panicum stapfianum, Sporobolus fimbriatus *and* Themeda triandra *grazed once, twice or more than two times during winter 1983 at Adelaide. Time* t_i *is when insufficient herbage availability restricted intake per head.*

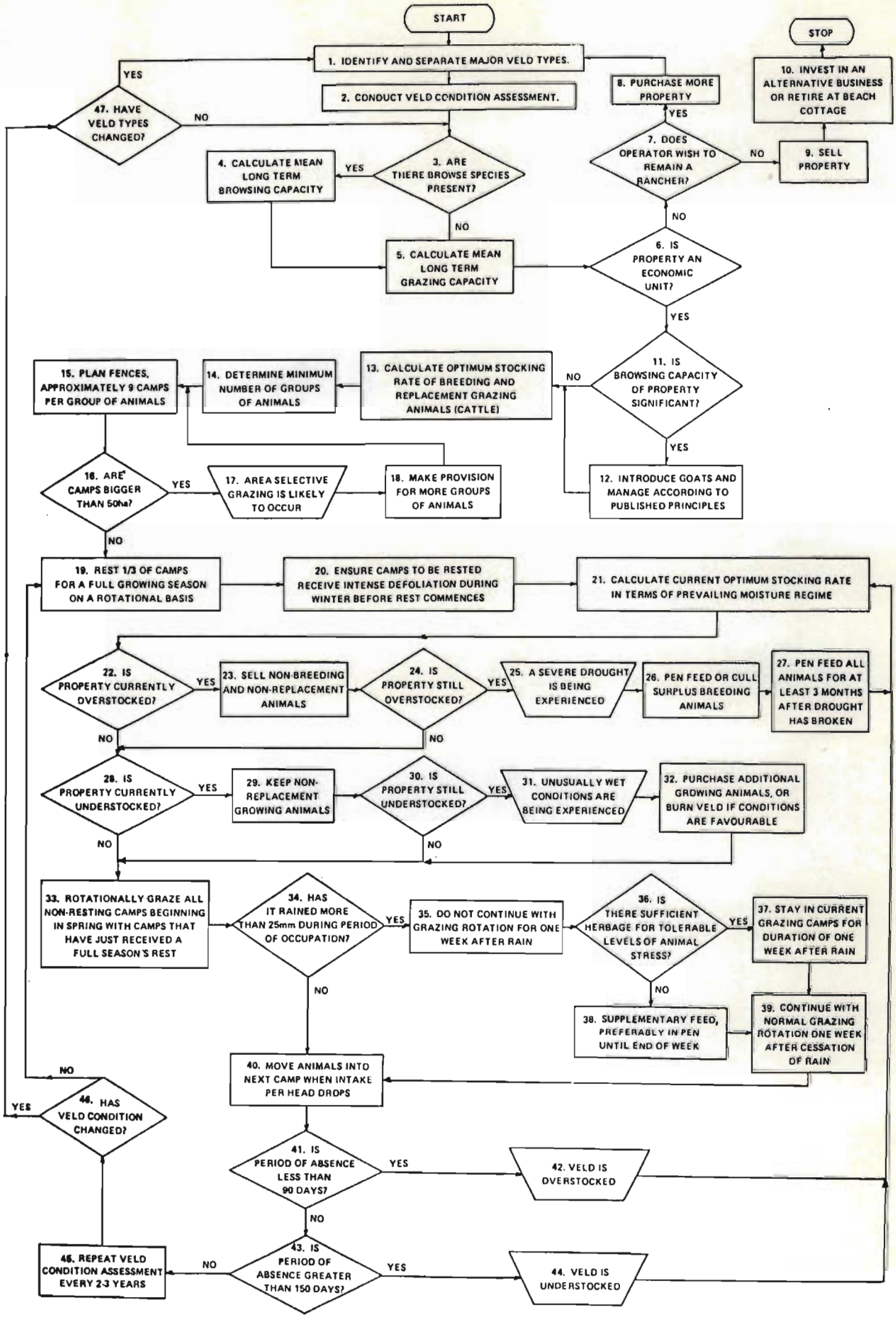

Figure 11.1 *Algorithm showing suggested means towards improved livestock production in the False Thornveld of the Eastern Cape.*