GROWTH AND REACTION TO GRAZING IN *DANTHONIA BIPARTITA* AND *NEURACHNE MITCHELLIANA*

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ABSTRACT

The productivity of Danthonia bipartita and Neurachne mitchelliana in response to defoliation and rainfall is described. Both species exhibit peaks of growth and regrowth following summer and winter rains.

Grazing these pastures during winter and spelling during summer at a sheep to two hectares and a sheep to four hectares promoted the growth of Neurachne. There was no identifiable response to summer use and winter spelling in this species. Neither summer nor winter use affected the numbers of Danthonia plants in the pasture.

INTRODUCTION

Danthonia bipartita (Danthonia) and *Neurachne mitchelliana* (Neurachne) are two drought-tolerant perennial grasses common in mulga (*Acacia aneura*) communities in Western Australia. They are restricted to sandy loams and loamy sands over hardpan where the total soil depth to the ferricrete is over 30 cm. They form a sparse cover beneath scattered mulga trees and associated shrubs such as *Eremophila, Rhagodia* and *Kochia.*

In the southern Eremean Province (Gardner, 1942) mulga forms dense thickets in response to a generally heavier and more reliable rainfall. The available pasture on the sandy soils beneath these heavy canopies is restricted to very sparse *Danthonia* and *Neurachne* with scattered forbs following winter rain. When the canopy is felled by chaining, and this is followed by summer rain, the perennial grasses are stimulated to provide a dense cover of grass which is readily available to sheep and cattle. The investigation reported in this paper forms part of a study in the southern mulga zone which aims at determining the appropriate grazing technique for pastures characterised by these two perennial grasses. The study is in two parts. The first investigates the effects of defoliation upon subsequent regrowth of the two species in two successive twelve month periods. The second investigates the effects of seasonal usage upon production and persistence of the two species.

MATERIALS AND METHODS

Location

The site is located on Barnong Station about 500 kilometres north of Perth and well within the boundaries of the winter rainfall shrub zone. The rainfall is approximately 250 mm per annum, the most reliable and effective segment occurring during winter. However, summer rains associated with cyclonic disturbances occur regularly enough to be part of the expected pattern of rainfall distribution. No summer rain had fallen for two years prior to the commencement of this study in December 1966. The summers of 1966-67 and 1967-68 were characterised by heavy rains. Table 1 shows the rainfall received during the period under study as well as expected maximum and minimum temperatures.

The soil is a loamy to sandy loam about 1 metre deep above a laminated hardpan. It has a pH range of 4.5 to 5.5 and retains 4% moisture in the range, field capacity to —15 bars. Nitrogen content ranges from 0.015 to 0.027%, with acid soluble potassium and phosphorus approximately 0.04 and 0.01% respectively. The soils are essentially of low fertility.

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TABLE 1

Climatic data for the study site

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
						Rainfall (mm)							
1967	63	3.5	—*	11.9	47.7	41.1	28.4	21.8	6.6	—	16.2	8.3	248.9
1968	92.7	2	31.5	13.9	19.0	42.6	68	13.2	4.0	13.4	7.8	—	310.8
1969	6.3	7.6	—	—	64.5	34.7	25.4	11.9	3.0	—	7.3	3.8	164.8
1970	3.3	120.9	—	16.7	19.5	80	16	10	34.5	9.3	—	18.5	301.4
1971	4.5	—	64.5	—	14.2	23	42.4	34.3	13.2	—	—	—	196.1
						Temperature (Average daily) °C							
Mean Max	37	35	33	30	23	21	18	19	25	31	32	34	
Mean Min	21	21	17	16	11	9	5	5	9	13	15	18	

* = no rain.

Defoliation and regrowth study

This study was continued over two successive years, 1967 and 1968, during which the rainfall pattern was similar. Three groups of 12 plants each were selected for uniformity within three size classes, large, medium and small, at the beginning of the growth cycles in December 1966 and 1967. The plants within each group were similar in terms of basal area, height of vegetative growth and in the number and height of the reproductive culms.

In successive months 1 plant of each group was defoliated to a height of 7 cm above the ground. Fresh herbage was weighed. At the end of the twelve month period all plants were again defoliated to determine the amount of regrowth produced and remaining since the initial cutting. The sequence of defoliation patterns was repeated on different plants in the following twelve months beginning in December 1967.

Grazing study

A grazing study was initiated in November 1968 to investigate aspects of plant survival under different systems of usage.

Two rates of utilisation, 1 sheep to 2 ha and 1 sheep to 4 ha per annum were combined with two seasons of use, summer and winter, to give a total of four treatments. Problems of sociological behaviour were avoided by using 4 sheep per group. The higher rate of stocking therefore required 4 ha per treatment and the lower rate 8 ha per treatment. These large areas, 24 hectares per block, involved problems of uniformity. The investigation, therefore, was limited to one replication per treatment.

Counts were made of the number of plants of each species occurring in a series of size classes. The size classes were: seedlings, established post-seedling plants, young plants of basal crown circumference 15 to 20 cm, mature plants of basal crown circumference 20 to 30 cm and old plants of basal crown circumference greater than 30 cm. Production levels and plant counts were made in each enclosure in November and May of each year.

The number of plants per treatment was chosen as a measure of performance because of a need to overcome variations in the productivity of forage on offer arising from erratic rainfall. These departures would tend to mask any effect of grazing treatment in the short term, whereas plant numbers in size classes can be expected to be more reliably expressive of treatment effect.

RESULTS AND DISCUSSION

Defoliation and growth study

Total dry matter yields and regrowth yields over the two years are shown in Figure 1. The effect of treatment on medium size plants is shown for 1967 and on

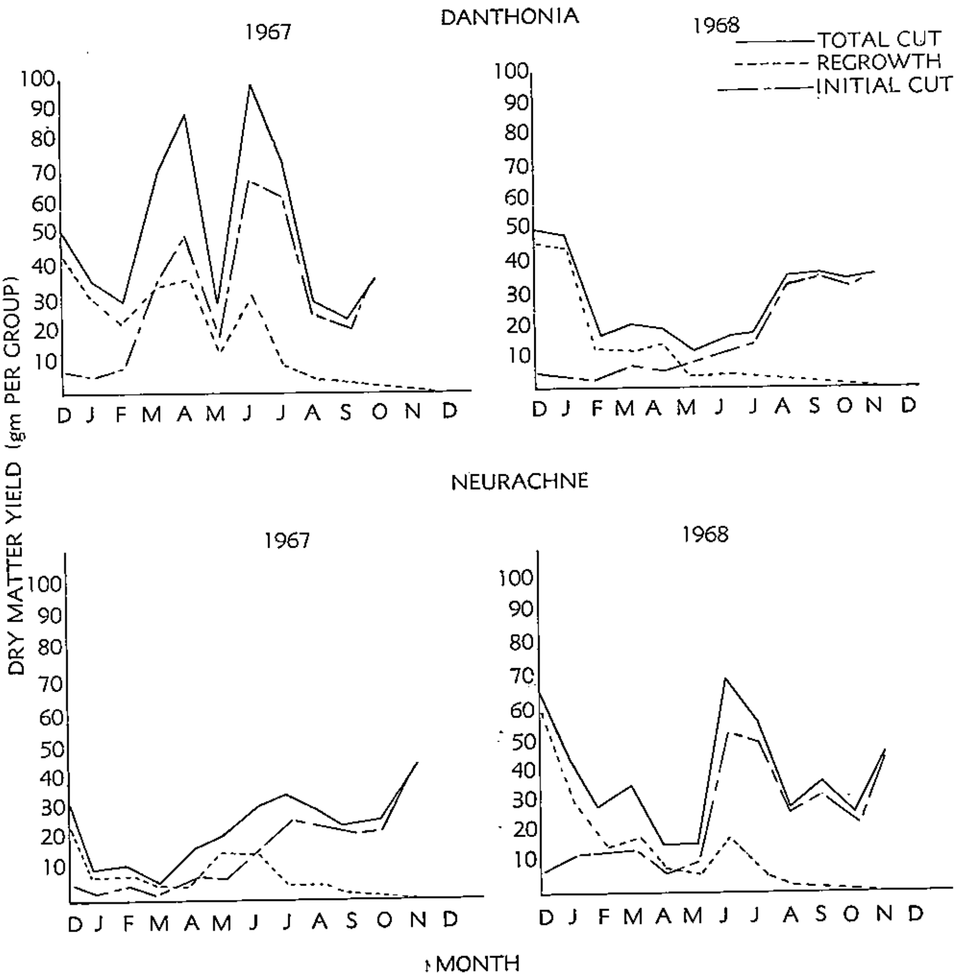

FIGURE 1

Monthly dry matter yeild of *Danthonia* and *Neurachne* subject to defoliation.

small plants is shown in 1968. Other classes of plants responded in a similar fashion in each of the years. Both species exhibit a capacity to respond to rain in winter and summer through a wide temperature range. Defoliation stimulated *Danthonia* to produce more in either season compared with plants which were not defoliated. There was no consistency in this response in *Neurachne.*

Regrowth of both species stopped in September of each year when moisture was exhausted. No attempt was made to simulate rainfall in the September-October period since this is outside the normally expected rainfall pattern. Regrowth following defoliation at the beginning of winter was much lower in both species than that following defoliation at the beginning of summer even though adequate rainfall for growth was received in both seasons in each year. Plants grazed during winter and allowed to regrow with summer rains appeared to have an opportunity to exploit a potential for greater regrowth than plants grazed during the summer or at the end of the summer rain period. The grazing trial was initiated to obtain more information on this regrowth pattern.

Grazing trial

The results of three years of grazing in terms of changes in plant numbers are presented. The percentage change on the original number of plants per ha in two grouped size classes are shown in Table 2. The small group includes plants of less than 15 cm basal crown circumference and the large group those with a basal crown circumference greater than 15 cm. The initial and final figures in each case are shown in terms of hundreds of plants per ha. The results indicate no substantial changes in the abundance of *Danthonia* at any stocking rate or season of use. There is, however, a marked seasonal fluctuation due to the abnormally low rainfall in 1969.

TABLE 2

Percentage change in plant numbers in response to seasonal grazing at 1 sheep/2 ha or 1 sheep/4 ha in summer or winter only

	Stocking rate and season of use							
	1/2 Winter		1/2 Summer		1/4 Winter		1/4 Summer	
	Small (a) plants	Large (b) plants	Small plants	Large plants	Small plants	Large plants	Small plants	Large plants
Danthonia bipartita								
Nov. 1968	100(596†)	100(104†)	100(689†)	100(171†)	100(415†)	100(62†)	100(578†)	100(62†)
Nov. 1969	78	130	42	68	82	117	56	90
Nov. 1970	19	180	75	102	142	250	136	260
Nov. 1971	190	260	114	118	95	250	59	250
Neurachne mitchelliana								
Nov. 1968	100(63†)	100(3†)	100(81†)	100(11†)	100(88†)	100(6†)	100(90†)	100(3†)
Nov. 1969	71	130	26	9	65	130	45	42
Nov. 1970	270	1230	77	100	350	1400	77	400
Nov. 1971	369	700	316	18	198	460	156	28

(a) Small plants included seedlings and had a basal crown circumference of less than 15 cm.
(b) Large plants had a basal crown circumference of greater than 15 cm.
† Plant numbers ('00/ha).

Winter use and summer spelling of *Neurachne* resulted in a clear trend towards an increase in numbers at both stocking rates. It was not possible to define any change in numbers with summer use and winter spelling at either stocking level.

Table 2 shows that *Neurachne* is a minor component in the stand. It is therefore unlikely to be important in the total grazing situation. Special grazing systems to encourage growth of this species appear to be unwarranted since the major component *Danthonia*, was unaffected by treatment. Optimum use of the pasture would be gained by grazing at the higher stocking rate at any season of the year. There was no evidence on the basis of seedling and small plant numbers presented that the stand was being depleted by the treatments imposed nor that year long use at either stocking rate would be an advantage.

REFERENCES

GARDNER, C. A. (1942)—The vegetation of Western Australia with special reference to to the climate and soils. *Journal of the Proceedings of the Royal Society of Western Australia* 28: xl-lxxxvii.