GRAZING OF *BASSIA BIRCHII* AS A METHOD OF CONTROL

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ABSTRACT

Bassia birchii, *galvanised burr, is a widespread weed of semi-arid eastern Australia. Mature plants are not usually grazed by sheep because of spines on fruiting perianths along their woody stems and control of the species is difficult due to re-infestation from buried seeds. The possibility of controlling seedlings by grazing was examined. Seedlings had a crude protein content of* 18.9 *per cent, relatively low levels of salt and oxalate and in vitro digestibility of* 46.5 *per cent. Under glasshouse conditions it was necessary to defoliate close to ground level to kill a high proportion of* 6-8 *week old seedlings. In the field, high density rotational grazing of an infested area which had been sown to lucerne, kept the number of* B. birchii *seedlings in check and restricted the growth of large bushes.*

INTRODUCTION

Bassia birchii (F. Muell.) F. Muell., galvanised burr, a native shrub, is widespread as a weed in semi-arid grazing areas of New South Wales and Queensland (Auld and Martin, 1975). It is not usually eaten by stock because of the spines on the fruiting perianths which occur along its stems. Its woodiness is another deterrent to grazing; however, shoot tips are sometimes grazed by sheep, especially when other pasturage is scarce. Control of the species is difficult due to the possibility of re-invasion by seedlings from buried seeds in any season (Auld, 1976). The seedlings develop spines on juvenile perianths six weeks after germination and become increasingly unattractive as grazing plants with age.

The aim of the work reported was to examine the suitability of seedlings for fodder, assess their susceptibility to defoliation and observe the practical application of grazing as a control method in the field.

MATERIALS AND METHODS

Analytical

In vitro digestibility was measured using Minson and McLeod's (1972) method. Sodium, potassium and chloride contents were determined using Wilson's (1966) method, except that chloride was measured with a Aminco-Cotlove automatic chloride titrator. Oxalate content was measured using Moir's (1953) method. Proximate analyses were performed at the Veterinary Research Station, Glenfield, New South Wales, using material collected in the field.

Defoliation Experiment

Seedlings were raised as described for previous experiments (Auld, 1976). At five weeks of age plants were selected for uniformity and transferred to a glasshouse where daily temperatures were in the range of 18°C to 30°C and watered daily. Defoliation treatments were applied at 6, 8, 10, 12 weeks of age. At 6 and 8 weeks, ten plants were defoliated to ground level, ten to a height of 3 mm and ten to a height of 20 mm, at 10 and 12 weeks defoliation was to 3 mm only; twenty plants were retained as controls; ten of these were harvested at 10 weeks and ten at 12 weeks. One month after each defoliation the number of survivors was noted and a harvest was made using methods described in a previous paper (Auld, 1976).

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Field Observations

Observations were made from December, 1971 to July, 1973 at "Monivae", Gulargambone, New South Wales. The original *Eucalyptus populnea-Casurina* spp. woodland vegetation had been entirely removed several years previously and an area of 100 ha had been densely infested by *B. birchii* for some years. The soil is a red-brown earth (Dr.2.33) (Northcote, 1960) and the average annual rainfall at Gilgandra, 35 km south, is 578 mm. In 1969 the area was ploughed, subdivided into eight paddocks and sown to wheat with 50 kg ha^{-1} of superphosphate. In 1970 a second wheat crop with fertilizer was sown and lucerne, *Medicago sativa* L. cv. Hunter River, was sown under the crop at 1.5 kg ha^{-1}. Following the harvest of the wheat crop, a flock of 1,200 wethers grazed the eight paddocks on a rotational system. Each paddock of 10 to 16 ha was grazed for seven days and rested for seven weeks throughout the year. Three adjacent paddocks were selected for further observation, on the basis of similar *B. birchii* and lucerne densities (Fig. 1) in December, 1971. Two were approximately 12 ha in area (paddocks "1" and "2") and the other (paddock "3") 16 ha. An ungrazed control area (approximately 0.05 ha) was fenced off in paddock 2. Records of plant numbers were made in fifty 2 m × 2 m quadrats in each paddock on five inspections, and 50 individual plants taller than 10 cm were marked in two paddocks and observed at more frequent intervals. Lucerne density was measured at the start and completion of the observations in 50 2 m × 2 m quadrats. The seven day grazing and seven week resting schedule was maintained for each paddock throughout the period of observations with one exception. In March, 1972, paddocks 1 and 2 were grazed and the flock was then moved to another area for shearing and not returned to paddock 3 until after six weeks when this paddock was then grazed for 14 days. Rainfall was collected at the site by the landholder using a standard Snowdon pattern rain gauge.

RESULTS

Fodder Analysis

The seedlings had the following composition, expressed as a percentage of dry weight: crude protein 18.9, acid detergent fibre 37.7, lignin 7.8, total oxalate 1.6, sodium 0.2, potassium 3.2, chloride 1.0; in vitro digestibility was 46.5 per cent.

TABLE 1

Effect of defoliation on seedlings

Age (wk) at time of defoliation	Treatment: length of shoot remaining (cm)	% Survival after 4 wk	Total dry wt 4 wk after treatment (g)	Standard error of mean
6	Control	100	0·19	0·03
6	0	0	—	—
6	0·3	30	—	—
6	2·0	100	0·14	0·04
8	Control	100	0·29	0·05
8	0	0	—	—
8	0·3	20	—	—
8	2·0	100	0·17	0·06
10	0·3	30	—	—
12	0·3	20	—	—

Defoliation

Defoliation to ground level killed plants of 6 and 8 weeks and defoliation to 3 mm killed a proportion of treated plants up to 12 weeks of age (Table 1). All plants survived defoliation to 2 cm. Six week old plants did not differ significantly from untreated controls after one month, nor from plants treated at eight weeks but the variability within treatments was high (Table 1).

FIG. 1

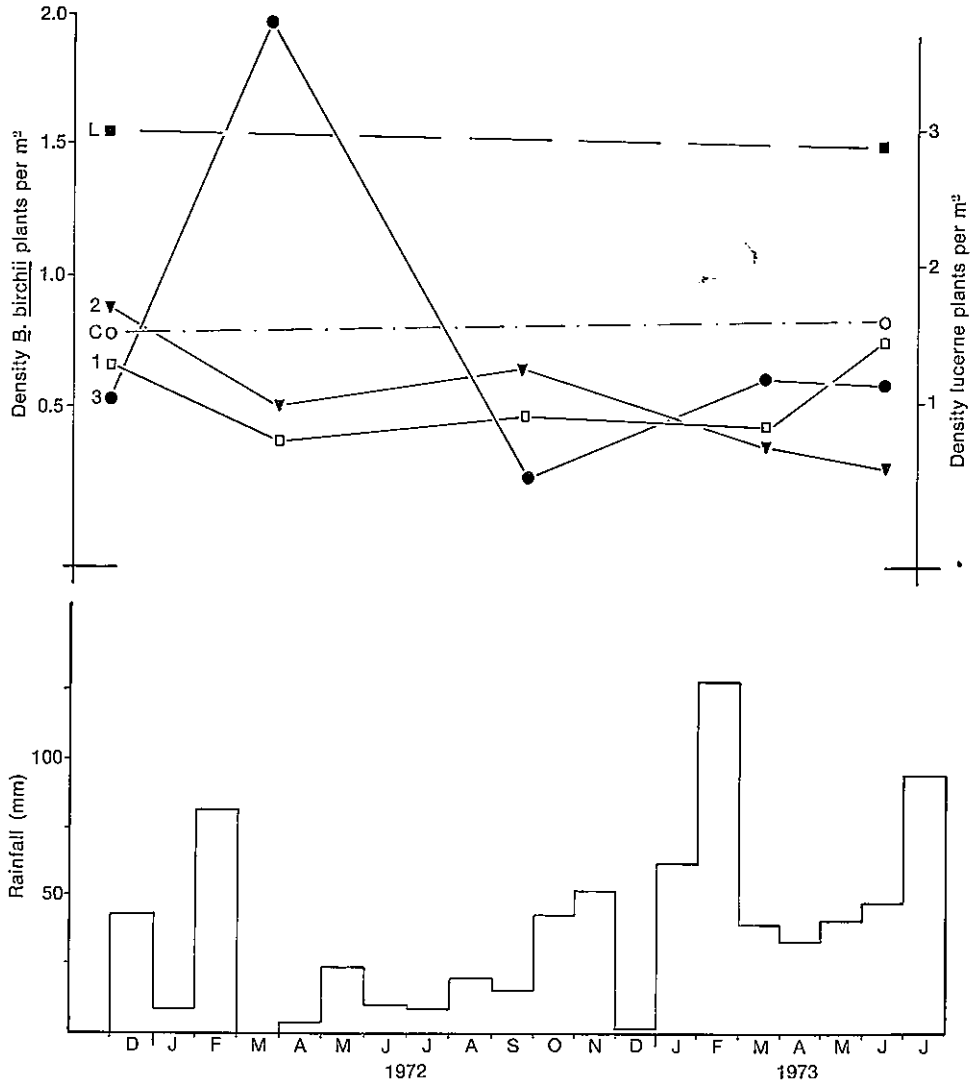

FIGURE 1

Density of *B. birchii* and lucerne in three paddocks under rotational grazing at "Monivae", Gulargambone. L. Lucerne; C. Control; 1, 2, 3 refer to paddock numbers (see text).

Field Observations

Sheep generally preferentially grazed lucerne, then shoot tips of mature bushes, and then seedlings of *B. birchii*. During a period of low rainfall during mid-1972 (Fig. 1) sheep ate woody stems of diameter up to 0.24 cm as other food became increasingly unavailable. Mechanical damage to mature bushes was considerable. Only 16 per cent of bushes marked in December, 1971 survived throughout the 20 months of observations.

Although the mean density of *B. birchii* was similar at the first observation and the last, there were fluctuations within the three paddocks (Fig. 1). The steep rise in

numbers in early 1972 in paddock 3 was due to the fact that seedlings which emerged after heavy rain in February (which were grazed in paddocks 1 and 2 in March) were not grazed until May. Subsequent grazing for 14 days dramatically reduced numbers of *B. birchii*. The steady decline in numbers in paddock 2 from spring, 1972, was partly due to the activity of two species of parasitic insects. An eriophyid bud mite, *Aculops bassiae* Keifer, was considered responsible for "witches broom" symptoms (Auld, 1974) in *B. birchii* in spring and summer. Many plants were weakened and some may have died as a result of attack and mechanical damage caused by sheep. An undescribed termite attacked the roots of several plants in autumn, 1973, and most affected plants died. The species* lies close to *Amitermes agrilus* Gay. but is larger and has mandibles of a different form (Watson, personal communication). Both species of insect were restricted to paddock 2 and were host specific for *B. birchii*. Plants in the control area, fenced off from paddock 2, were attacked by both species of insect and there was no net change in *B. birchii* density in this area (Fig. 1). Lucerne density, averaged over the three paddocks, showed only a slight decline (Fig. 1). Sheep grazing the area produced an estimated 4-5 kg of wool per head.

DISCUSSION

The proximate analysis indicates that the species may be useful as a protein source. In vitro digestibility closely corresponds to in vivo digestibility of 47.7 per cent obtained by Rohan-Jones (unpublished data) in sheep feeding trials on green shoots of *B. birchii* at the University of New England. Salt content was comparatively low and is unlikely to be a nutritional problem. Hindmarsh (1965) has observed calcium oxalate crystals in some *Bassia* species and Wilson (1966) has measured total oxalate of 3.5 per cent to 6.3 per cent of dry matter in seven species of Chenopodiaceae, although there are no verified cases of oxalate poisoning in this family. Total oxalate in *B. birchii* was less than for any of the species which Wilson examined.

Seedlings were quite tolerant of defoliation. Regeneration is brought about through the growth of branches from basal buds which first appear at six weeks (Auld, 1976). Defoliation to 3 mm removed all of these buds in 70-80 per cent of plants and they subsequently died. In 20-30 per cent of plants, from six to twelve weeks of age, regeneration was possible because all buds were not removed. There is difficulty in applying treatments uniformly in reference to ground level, particularly in sand. In the field, buds generally occurred more than 3 mm above the original ground level, but they often became hidden by organic debris.

Rotational grazing of dryland lucerne has been recommended for the region (Robards and Peart, 1967). The eight paddock system also provides a means of *B. birchii* control. Although the ungrazed area in paddock 2 could not be used as a valid control, the effect of removal of the grazing animals was evident in early 1972 in paddock 3 when *B. birchii* numbers increased sharply (Fig. 1). Moreover, the use of grazing to control these plants of 10-12 weeks of age was clearly demonstrated with the subsequent extension of the normal seven day grazing period to fourteen in this paddock when the animals were returned. *B. birchii* seedlings which survive to twelve weeks begin to produce seed (Auld, 1974). Complete control of the species would require that plants older than twelve weeks be removed and that the buried seed population be exhausted. Neither proposal is generally practicable on large scale grazing properties. However, the restriction of the size of *B. birchii* bushes by trampling and grazing and the maintenance of populations at tolerably low levels by grazing appears to be a worthwhile objective. The requirement for close grazing of seedlings to remove basal buds is the most critical factor in control by grazing. The lack of a

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perennial pasture, such as lucerne, which is able to withstand high density rotational grazing in all seasons is the main limitation to wide adoption of this control technique.

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