A NOTE ON THE SIGNIFICANCE OF *EUCALYPTUS POPULNEA* FOR BUFFEL GRASS PRODUCTION IN INFERTILE SEMI-ARID RANGELANDS

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ABSTRACT

The yield of Gayndah buffel grass (Cenchrus ciliaris) *growing under mature trees of poplar box* (Eucalyptus populnea) *at two sites in semi-arid Queensland was compared with the yield of native pasture in the adjacent inter-tree areas. The yield of buffel grass per tree canopy followed a similar pattern in each community with herbage yields from the tree microhabitats being much higher than from the inter-tree areas. The significance of the poplar box microhabitat for low cost development of infertile semi-arid woodlands is discussed.*

INTRODUCTION

The red earths of semi-arid Queensland (Northcote Classification Gn 2.11, Gn 2.12) which support mulga (*Acacia aneura)* shrubland in south-western Queensland, and open eucalypt (*Eucalyptus* spp.) woodlands in central-western Queensland, are characterized by their low soil fertility. Soil phosphorus concentrations are very low. (Dawson and Ahern 1973; Edye *et al.* 1964). As phosphorus has been found to be a principal nutrient limiting seedling growth and drought survival of buffel grass on red earths (Humphreys 1958; Christie 1975) it is not surprising that buffel establishment in both communities has met with little success. Buffel grass has been observed readily to establish, without seedbed preparation, beneath the canopies of deep rooted mature *Eucalyptus* spp., and in particular *E. populnea* (poplar box), which is found in both communities. Little spread occurs in the adjacent inter-tree area. The value for available soil phosphorus in the surface soil beneath a mature box tree canopy, in mulga shrublands, of 65 p.p.m. is much higher compared with the concentration of 10 p.p.m. found in the inter-tree area. pH and potassium levels are also much higher in the tree microhabitat than the latter site (Ebersohn and Lucas 1965). Similarly, in the open eucalypt woodlands of central-western Queensland, available phosphorus concentrations of 27 and 10 p.p.m. for the canopy and inter-tree sites respectively, have been recorded (Silcock unpublished data). The critical available soil phosphorus concentration for buffel grass establishment grown on a sandy red earth from south-west Queensland is around 25 p.p.m. (Christie 1975).

This note examines the role of poplar box in the herbage production system of semi-arid woodlands and suggests the need for further appraisal of its role in infertile environments.

METHODS AND RESULTS

The yield of Gayndah buffel grass growing under mature poplar box trees in mulga shrublands in south-west Queensland and open eucalypt woodlands in central-western Queensland was compared with the yield of native pasture in the adjacent inter-tree area in April 1975. The sites sampled were near Charleville and at Yalleroi 45 km N.E. of Blackall. Rainfall (October-March) for the Charleville and Yalleroi sites was 328 mm and 346 mm respectively.

Box tree canopy

At each site the effective area colonized (initial establishment and volunteer spread) beneath the canopy of 15 mature trees was estimated from five random radii from the circumference of the tree trunk. Estimates of buffel yield were obtained by

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placing three closely grouped 1 m^2 quadrats along each radius, using the ranked-set sampling method (Halls and Dell 1966). All plant material cut was oven dried at 80° C for 24 h then weighed. The product of mean yield and effective area colonized gave an estimate of buffel grass yield per tree (Figure 1).

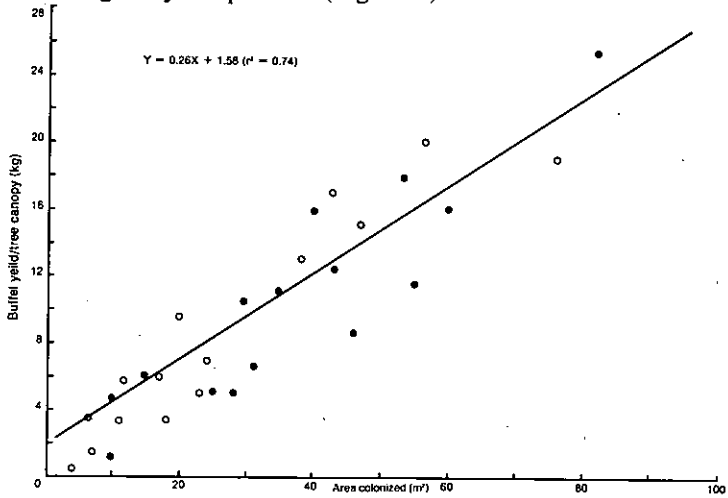

FIGURE 1

Relationship between effective area colonised beneath a mature box tree canopy and yield per tree of buffel grass in a mulga shrubland (•) and a eucalypt woodland (o).

The yield of buffel grass per tree canopy followed a similar pattern in each community. Therefore, the slope of the regression line could be taken as an index of the production potential of a mature box tree microhabitat. Yield per tree canopy varied from 0.5 kg to 25.6 kg with a mean of 8 kg; mean area colonized was 35 m^2 and varied from 4 m^2 to 82 m^2.

Inter-tree area

Using a random stratified pattern, a 0.5 ha area of well-grassed native pasture was sampled at 50 positions with the above ranked-set sampling technique. Basal cover was estimated with the wheel point quadrat. No buffel grass was present in the inter-tree area.

Dry matter yield (mean ± S.E.) of native pasture in the mulga shrubland was 890± 74 kg ha^{-1} and the bulk of the herbage was comprised of the perennial grasses *Thyridolepis mitchelliana, Monachather paradoxa, Aristida* spp. and *Eragrostis eriopoda.* Basal cover was 4.2% .

The yield of native pasture in the eucalypt woodland was 1,070± 113 kg ha^{-1} and the main perennial grasses were various *Aristida* spp., *Enneapogon pallidus, Eragrostis* spp. and *Eriachne mucronata;* basal cover was 4.6% .

DISCUSSION

As animal production per hectare in semi-arid Queensland is low any contemplated pasture improvement method must have a small cost per hectare. Sowing buffel grass directly beneath mature box trees is a simple low cost method for establishment in this environment. Purcell (1963) suggests that in open eucalypt woodlands rough cultivation to eliminate competition during establishment may also be desirable.

Some estimate of the differences in potential for herbage production of the microhabitat beneath the tree with that of the inter-tree area can be made by comparing the mean buffel yield beneath box trees in both communities, on an equal area basis, with yield in the inter-tree area. The mean value for the former was about 300 g/m^2 (Figure 1) which is much greater than the values of 89 g/m^2 and 107 g/m^2 recorded for native pasture yield in mulga shrublands and open eucalypt woodlands respectively. In effect, then, the microhabitat beneath a mature poplar box tree would be almost three times more productive than the intercanopy area. Poplar box densities in mulga shrublands are generally low (Burrows and Beale 1969). At the Charleville site, density of mature box trees varied from 16 to 40 trees per hectare (Pressland personal communication). Assuming this tree density, and an average area available for colonization of 34 m^2, then almost 7% of each hectare would be comprised of tree microhabitats. However, because of their higher production these sites have the potential to produce around 20% of the total availab3le herbage per hectare. Furthermore, in areas where grassland ground cover in the inter-tree areas has deteriorated so that production declines, the contribution made by these microhabitats may be even more significant. Poplar box densities in the woodlands of central-western Queensland are higher so that strategic thinning may be desirable; poplar box densities of around 100-150 per hectare have been recorded (Turner unpublished data). Although such information is lacking at present for semi-arid environments, Walker *et al.* (1972) have shown for sub coastal Queensland, that for maximum herbage production no more than six mature *E. populnea* trees should be left per hectare.

Woodland communities are essentially dynamic communities characterized by a large and remarkably efficient circulation of nutrients between plant cover and soil and this efficiency helps partly to explain the ability of trees to produce large quantities of organic matter from relatively infertile soils (Ovington 1965). Nutrient circulation by mature poplar box trees may therefore primarily be responsbile for, as well as maintaining, the high fertility status of the microhabitat beneath the tree canopy and hence buffel production. Nutrient returns by animals, through camping beneath large box trees, may also be an important factor in maintaining the fertility of the tree microhabitat. If areas of mulga shrubland are thinned in strips to promote grass growth (Burrows 1974; Pressland 1974) provision should be made to maintain some mature poplar box trees in the cleared areas. Ebersohn (1970) concluded that because of the poor establishment and growth of buffel in a eucalypt woodland in central-western Queensland, and the high cost in pulling and seeding such a community, together with a possible regrowth problem, development is a questionable proposition. Further work to determine an optimal tree density commensurate with near maximal herbage production within this community is warranted.

Although this note indicates that tree microhabitats represent an important complementary herbage production source in infertile environments, they should, in addition, be regarded as buffel seed loci, from where seed can be disseminated throughout the community where it may establish with time.

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