METHODS OF OVERSOWING LUCERNE AND MEDIC INTO NATIVE PASTURE ON NON ARABLE SOILS IN THE EASTERN DARLING DOWNS OF QUEENSLAND

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ABSTRACT

Lucerne (Medicago sativa) *and barrel medic* (Medicago truncatula) *were oversown into native pasture on a stony soil in the eastern Darling Downs of Queensland. The eight treatments imposed were a factorial combination of rough cultivation compared with no cultivation, broadcast seeding with sod-seeding, and herbicide (2-2 DPA and amitrole) with no herbicide. Following good rainfall satisfactory establishment occurred in all treatments. Broadcasting seed on cultivation gave the best establishment. Sod seeding was very difficult in this stony soil and depressed establishment. Herbicide did not affect establishment, but increased sown species and weed yield and decreased perennial grass yield. Barrel medic persistence was not related to treatment. Lucerne density declined markedly but there was still a significant effect of establishment treatment on lucerne density four years after sowing. It is suggested that broadcasting into undisturbed grassland warrants examination as a low cost technique for oversowing of medics, but that replacement of native grassland by a lucerne/grass pasture may involve rough cultivation.*

INTRODUCTION

The eastern Darling Downs supports an important dairying industry with a feed year based on fodder cropping. However approximately one-third of the soils of the eastern Downs are unsuited to cropping because of shallow soil depth, slope or high stone content. Such soils support grass pastures of low nutritive value. This paper reports a preliminary experiment evaluating techniques for introducing improved species into these pastures.

METHODS

The experimental site, midway between Pittsworth and Cambooya, was a stony Southbrook neutral krasnozem (Thompson and Beckmann, 1959) dominated by blue grass (*Dichanthium* spp.) and spear grass (*Stipa* spp.). The average annual rainfall is 27 in., two-thirds of which falls in summer (October to March) and one-third in winter (April to September).

The following treatments were applied in May 1966 as a 2^3 factorial design with four replicates:

(rough cultivation)	(seed broadcast)	(herbicide)
×	×	
(no cultivation)	(sod-seeded)	(no herbicide)

Cultivation consisted of three runs with a chisel plough, fitted with small duck feet, on the day before sowing. Each of the four cultivation/sowing treatments was on a main plot of 66 × 12 sq ft, one half of which had been sprayed five weeks previously with a commercial mixture of 8.5 lb/ac 2-2 DPA (dalapon) and 1.5 lb/ac amitrole.

The experiment was sown with a mixture of lime pelleted lucerne (*Medicago sativa* cv. Hunter River) and barrel medic (*Medicago truncatula* cv. Jemalong), using high rates of 10 lb viable seed/acre of each species.

The experiment was initially fertilized with 80 lb/ac sulphur as gypsum and 12 oz. sodium molybdate/ac, and was topdressed annually with 20 lb sulphur/ac as sulphur fortified superphosphate. The site was grazed approximately six times a year.

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The density of all sown species was determined five weeks after emergence in July, 1966. Lucerne plant density was also measured in 1969, 1970 and 1971. In September, 1970 surface medic burrs which would have been set in the previous spring were counted. Growth during the establishment phase was measured in September, 1966, four months after sowing. Subsequent harvests were made 11 months and 54 months after sowing.

RESULTS

The chisel plough prepared a satisfactory shallow seedbed, although it markedly increased surface roughness (Fig. 1). The sod-seeder was not at all suited to the rough conditions. Consequently seed distribution and furrow depth were irregular and the seeder was severely stressed.

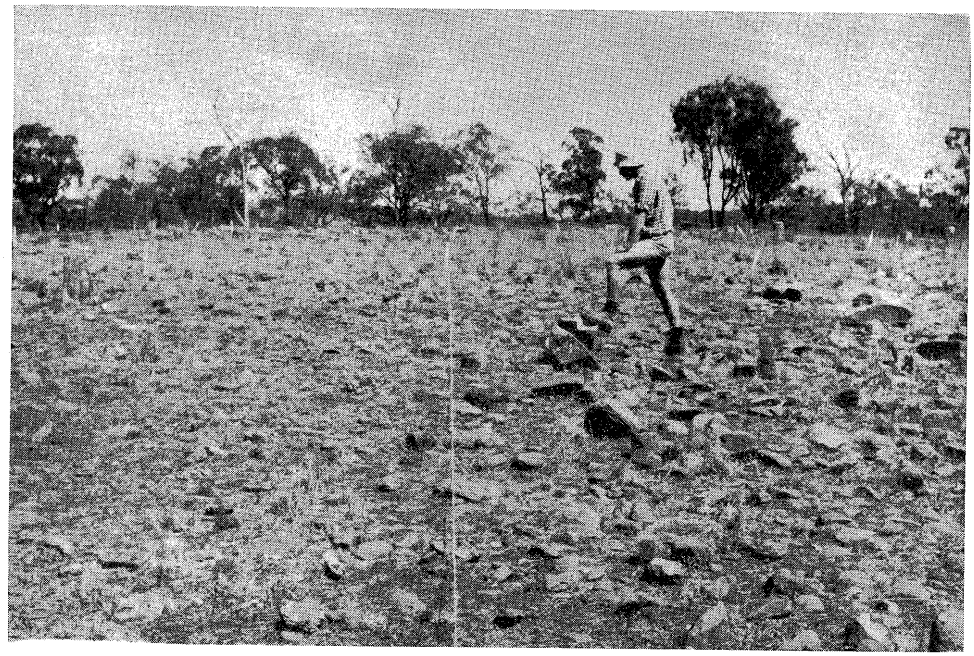

Figure 1. The plot on the right was cultivated and sod-seeded, that on the left was undisturbed; the photograph was taken during a drought four-and-a-half years after sowing.

Emergence commenced four weeks after sowing following good rains totalling 2.4 in. The results of the seedling count, expressed as percent establishment of viable seed, are given in Table 1. The values in Table 1 are the mean of the two herbicide treatments as herbicide did not significantly affect establishment (Table 2).

TABLE 1
Per cent establishment of viable seed as measured five weeks after emergence

Treatment	Medic		Lucerne	
	% establish.	Arcsine (radians)	% establish.	Arcsine (radians)
Cultivation broadcast	58	(.867)	31	(.590)
Cultivation sod-seeded	36	(.630)	19	(.423)
No cultivation broadcast	41	(.688)	19	(.438)
No cultivation sod-seeded	42	(.699)	17	(.412)
L.S.D. ($P < 0.05$)		(.160)		(.096)

TABLE 2

Significance levels of treatment effects on establishment of sown species and pasture yields

	% Establishment (arcsin transformation)		Yield 3.ix.66				Yield 4.v.67				Yield 17.x.70			
	lucerne	medic	medic	perenial grass	other weed	Total	lucerne	perenial grass	other weed	Total	lucerne	perenial grass	other weed	Total
Cultivation	††	—	††	***	—	—	†††	***	—	**	—	*	—	—
Sod-seeding	**	*	—	—	—	—	—	—	—	—	—	†	—	—
Cult. × sod-seeding	**	**	*	—	—	—	—	—	—	—	—	—	—	—
Herbicide	—	—	†††	***	†††	—	†††	***	†††	**	—	—	—	—
Cult. × Herbicide	—	—	*	*	—	—	**	—	—	—	—	—	—	—
Sod-seed × Herbicide	—	—	*	—	—	—	—	—	—	—	—	—	—	—
Cult. × Seed × Herbicide	—	—	**	—	—	—	—	—	—	—	—	—	—	—

† indicates that main treatments—cultivation, sod-seeding and spraying—significantly increased establishment or yield;
* indicates a significant depression of main treatments; *** = $P < 0.001$, ** = $P < 0.01$, * = $P < 0.05$;
— indicates non-significance.

Establishment of sown species by broadcasting seed on to cultivation was significantly better than on all other treatments (Table 1). Sod-seeding after cultivation depressed establishment of both species presumably due to the increased roughness of cultivated ground reducing the already limited effectiveness of the sod-seeder.

In the first harvest medic comprised 87% of the sown species, averaging over all treatments. Herbicide significantly decreased the yield of native perennial grass and increased the yields of sown species and invading weeds (Table 2, Fig. 2). Despite the heavy early competition from medics, lucerne yielded well in the following autumn, again with the highest sown species production on broadcast cultivated plots (Fig. 2). The presence of barrel medic burrs four years after sowing was not related to establishment technique. The effect of treatment on yields at the third sampling 54 months after sowing was only just significant at $P < 0.05$ (Table 2).

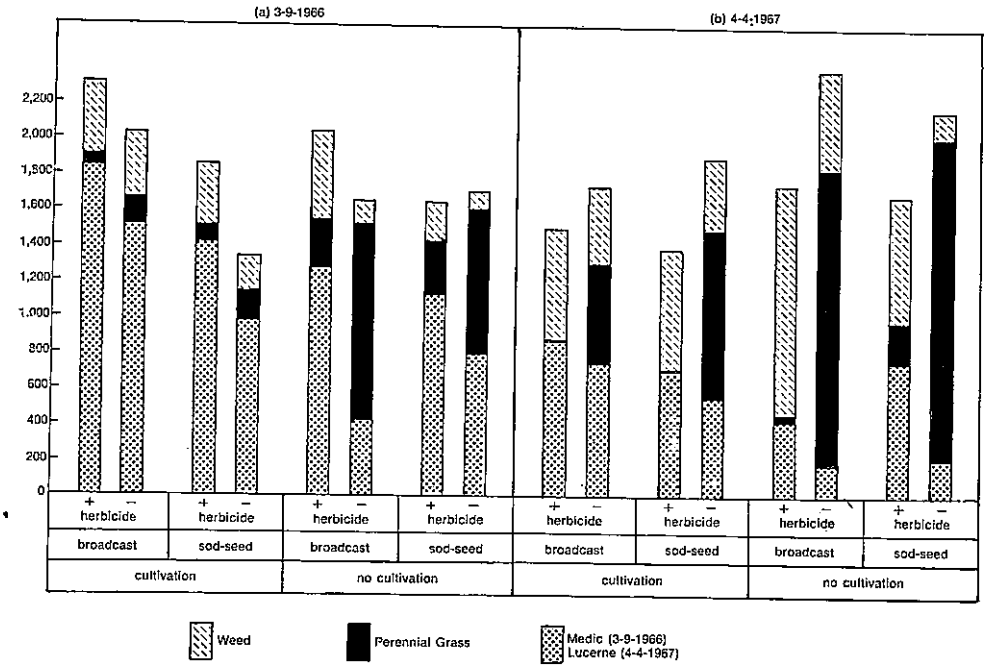

FIGURE 2
Yields, as lbs dry matter/acre, of sown species, perennial grass and weeds at two sampling dates.

Cultivation left some grass tussocks intact, as noted after similar minimal cultivation treatments in black spear grass (Cull and Norton, 1966). Consequently in both harvests the yield of perennial grass was less affected by cultivation than by the herbicide rate applied.

Mean lucerne density declined from 10.6 plants/sq ft at establishment to 1.6 and 0.3 plants/sq ft three and five years later, but was 68% higher on broadcast cultivated plots than on broadcast undisturbed plots in each year ($P < 0.05$ - 0.01). However the lucerne density of 0.3 plants/sq ft remaining five years after sowing was still similar to the density at which Christian and Shaw (1952) measured an appreciable effect of lucerne on animal production.

Five years after sowing the trial was dominated by grass species, mainly *Chloris ventricosa, Dichanthium* sp. *Stipa* sp., and *Urochloa panicoides*. The annual *Urochloa* yielded more in plots sprayed with herbicide five years previously.

DISCUSSION

Some caution is required in interpreting results of a one year study on establishment in this area. However from this experiment it was clear that rough cultivation can produce a surprisingly good though stony seed-bed and that the sod-seeder was unsuitable.

The failure of herbicide to affect seedling establishment and the highly significant effect of herbicide in increasing yields of sown species and weed parallels experience in southern Australia (Dowling, Clements and McWilliam, 1971). It is likely that this trend would be repeated whenever the existing grass tussocks were killed and there was adequate rain for plant growth.

Broadcast sowing on rough cultivation has given satisfactory establishment on this and three adjacent experiments and consequently promises to be reasonably reliable. The successful establishment obtained from broadcasting on undisturbed grassland suggests that the reliability of this technique warrants examination. Such broadcasting can be readily and cheaply incorporated with sulphur fertilisation of native grassland, a practice now being used in the eastern Darling Downs (Loader, personal communication). The lower cost of broadcasting seed on undisturbed grassland may offset the likely lower reliability of establishment.

The choice between these two establishment techniques could well depend on the species used. As medic regenerates and spreads from seed it follows that poorer establishment likely from broadcasting on undisturbed ground may have little effect on the long term productivity of medic. However, even with the good establishment obtained in this experiment, the long term density changes of lucerne still reflected initial establishment. Consequently rough cultivation may be more suited for establishment of a completely improved pasture such as lucerne/medic/green panic (*Panicum maximum* var. *trichoglume*), which is well suited to this site (Jones and Rees, 1972).

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