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Tropical pasture establisment. 15. Experiences with the band-seeder in commercial pastures

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Abstract

The Connor Shea Napier band-seeder was tested by graziers and QDPI staff over a wide range of country in the inland and coastal Burnett, the Maranoa and the eastern uplands of southern Queensland from 1989-1991. Survival of the planted legume species was variable because of almost continuous drought conditions over the 2 years.

Although the band-seeder had some minor design problems, all operators were impressed by its ability to operate effectively in rough country and by its low power requirement. Most graziers with average-sized properties considered the purchase cost too high for the specialised use; they would continue to use the cheaper and more versatile plough/rolling-drum seeders on flat or rolling terrain.

The band-seeder had no peer on land too steep, too stony or too heavily timbered for conventional machinery but, under such conditions, a 2-row, mounted seeder might be a more appropriate configuration than the standard 3-row, trailed model.

Introduction

Introducing legumes into native pastures will increase productivity in northern and coastal districts of Queensland; however, this practice has not been widely adopted in the inland Burnett.

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A major reason for this poor adoption has been the unreliable establishment of legumes sown into native pastures in an intermediate climate zone — too far south for the monsoons, too far north for winter rainfall, too far west for coastal showers and too far east for reliable storms.

Dr S. Cook of CSIRO found poor establishment of species sown into existing grassland was due to competition for moisture in the root zone, inadequate plant nutrients (Cook and Ratcliff 1985) and unreliable depth of sowing. Cook and P. Walsh, an agricultural engineer with the QDPI, designed a planter, the band-seeder, to overcome these problems (Walsh and Cook 1988).

Two prototype band-seeders were constructed before commercial manufacturing rights were sold to Connor Shea Napier (CSN) of Dalby. The early band-seeders had been used successfully on CSIRO's Narayen Research Station near Mundubbera but the system had not been tested under fully commercial conditions.

A commercial band-seeder was purchased from Connor Shea Napier in December 1989, only the second unit they had made. The primary objective was to test the technology and the machine on commercial properties and also to demonstrate band-seeding in the inland Burnett. Later objectives included planting winter legumes in southern Queensland and planting a creeping grass where native pastures had been degraded through overgrazing.

Method

Summer legume plantings 1989/90

The seeder was used to plant summer legumes — shrubby stylo (*Stylosanthes scabra* cv. Seca), Wynn cassia (*Cassia rotundifolia* cv. Wynn) and fine stem stylo (*Stylosanthes guianensis* var. *intermedia*) into native pastures of speargrass (*Heteropogon contortus*) in the inland Burnett.

The following areas were planted at 5 sites:

- small plots (0.5 ha) to compare methods of establishment — oversowing on to undisturbed soil, disturbance with conventional chisel ploughs or disc harrows, and band-sowing
- semi-commercial blocks (10 ha) of adjacent native pasture
- commercial paddocks (50–100 ha) under as many conditions of soil type and land development as possible.

The sites were on sloping to steep hill country, mostly on duplex soils with a granite sand surface but 2 sites were solodic soils with a pebbly surface. Co-operators were asked to comment on the band-seeder, and seedling emergence was monitored by measuring seedling survival along the planted row.

Winter legume plantings 1990

The band-seeder was used to plant winter legumes — lucerne (*Medicago sativa*), barrel medics (*Medicago truncatula* cvv. Cyprus and Paraggio) and snail medic (*Medicago scutellata*), with and without fertiliser or herbicide on 6 sites in the Maranoa. Soils ranged from solodics to structured earths and cracking clays.

Summer plantings 1990/91

The band-seeder was used to plant tropical legumes, mainly the species used in the first year but sometimes including lotononis (*Lotononis bainesii*), at demonstration sites (1–5 ha) at 13 locations. Sites ranged from the Arcadia Valley in the west, to Miriam Vale in the north and Kilkivan in the south. Most sites were under speargrass and on sandy-surfaced duplex or hard-setting solodic soils. It was also used in the inland Burnett to plant legumes with pelleted Bisset creeping bluegrass (*Bothriochloa insculpta* cv. Bisset) into a degraded pasture on a better-quality scrub soil on steep hill land near Biggenden.

Autumn plantings 1991

The seeder was used for many small demonstration plantings of rhodes grass (*Chloris gayana* cv. Katambora), lucerne, white clover (*Trifolium repens*), ryegrass (*Lolium* spp.) and medics on a range of soils by Landcare Groups in the Warwick district and the Maranoa.

Findings

Plant responses

Plant establishment and survival have been generally poor because of virtual drought conditions since November 1989. Rainfall after sowing in the summer (January–March) of 1989/90 in the Burnett was well below average, being in the driest 10% of years at Mundubbera for example. Conditions were so dry that proposed plantings at Eidsvold and Monto had to be postponed for a year. At the other sites, little seed germinated until the heavy rain in autumn. The number of seedlings per metre of planted line ranged from 0–4 in May 1990. Most of these seedlings survived the winter until rain in September, but there was no follow-up rain until December and many small plants died. Sites with 2.2 plants per metre in May 1990 were down to 1.2 by January 1991.

There was negligible establishment of oversown seed. Growth of legume seedlings was generally better with a full cultivation (2 workings with tyne or disc) than with the band-seeder. In most of the hill country sites, full cultivation would not be feasible because of the steep slopes, fallen timber and stones. The better growth with full cultivation could be due to better moisture availability following almost complete removal of the speargrass, or from better mineralisation of plant nutrients (nitrogen and sulphur) following severe disturbance of the soil.

With the winter legume plantings in the Maranoa, autumn conditions were too wet for planting until June. Medic and lucerne establishment in the moist soil was good but plants grew little in the subsequent dry conditions.

Summer (1990/91) plantings of stylos, cassia and lotononis in the Miriam Vale area received excessive rain (> 200 mm) in January but then grew well. Establishment and growth in the inland Burnett plantings were disappointing due to the almost complete absence of rain (20–40 mm) over the period January–March.

The fluffy seeds of Bisset creeping bluegrass were pelleted to allow flow through the band-seeder. Although adequate numbers of coated seeds were planted in the furrow, germination was poor; seed germination appeared to be reduced severely in some way during the pelleting operation.

Autumn (1991) plantings in the Warwick district of winter species (white clover, medics, lucerne, ryegrass) and coated rhodes grass failed

to establish in the most severe drought in the district's history. Autumn plantings (medics, lucerne) in the Maranoa were more successful but subsequent growth has been disappointing because of the dry conditions and overgrazing by kangaroos.

Although the results, in terms of legume establishment, have been disappointing because of the low rainfall, we were able to demonstrate the band-seeder in many situations, to evaluate its potential performance in the field and to decide on its application.

Performance of the band-seeder

The concept of the band-seeder is excellent; it can overcome the major causes (plant competition, low nutrients and poor seedbed preparation) of poor establishment on light sandy soils — provided there is adequate rainall.

The design of the machine is good and robust; it can be trailed using a remote hydraulic ram to raise and lower the tynes, or mounted directly on the 3-point linkage. In the trailed mode, the CSN band-seeder is easy to attach, easy to tow and handled well in the field, but when fully mounted, the seeder was too heavy for most tractors under 100 KW and the unit was unstable on rough country.

The overall width of the seeder (3.6 m) makes it awkward to transport; it has to be loaded lengthways on long-body trucks and is too wide to pass through the normal gates on some properties.

Our band-seeder has planted more than 500 ha, often deliberately on some of the roughest of country, with steep slopes covered with granite boulders and dead tree trunks. It has been operated by more than 40 different users, mostly graziers with different sympathy towards machinery and tended by QDPI officers with varying mechanical aptitudes. With routine maintenance and some replacement of parts, it still operates effectively and is expected to do so for some years.

There were a number of small faults in the design, most of which have been rectified by the manufacturers in later models. The most important construction fault was in the quality of the steel in the disc coulters. These bent and cracked even on soft cultivation country so the machine often operated without coulters. In one instance with a grass turf of blue couch (*Digitaria didactyla*), not using coulters may have resulted in furrows being too deep and ragged, and in the seed being buried too deeply when soil filled the furrow after heavy rainfall. Also the original depth control adjustment on the hydraulic ram was prone to seize and could not be adjusted quickly to compensate for point wear. The low seed tube in front of the press wheel became dented and blocked with moist soil.

A major cause of concern to graziers has been the rate of wear of the spear points, which might last only about 3 hours on dry granitic sands. They need constant attention and have to be built up in the farm workshop before becoming too worn as replacements cost more than $12 each. However, all tyned or disc cultivators suffer exaggerated wear on these soils and the band-seeder has only 3 tynes. A better-quality, or better-priced point could alleviate this wear problem.

The seed and fertiliser metering systems are only moderately accurate. Fertiliser flow is difficult to calibrate once fertiliser has been applied because of build-up. Since the seeding rates are so low, the seed delivery system will block easily with seeds of some species. In spite of this, we established a setting for our standard sowing rates and the delivery over a whole paddock was usually satisfactory.

It was difficult to load the high fertiliser boxes because the press wheels and spray nozzles prevented a flat-top truck coming close. On steeply sloping country, the tall seed/fertiliser boxes lean over so far that the tops knock standing timber that the tractor and seeder frame miss, and breakages occur. The points of attachment of the boxes have now been strengthened.

Grazier interest and publicity

The band-seeder has received excellent publicity. Individual producers and Landcare Groups throughout the Burnett, Darling Downs and Maranoa showed interest, and many wanted a demonstration on their property. Even those who said that they would not buy a band-seeder, because of the price, thought that the machine was good. Many potential users had dismissed the seeder at its original price of $17 000 but sales have increased to around 20 following a price reduction and manufacturer's discount. Some graziers have built their own seeders despite the

QDPI being unable to provide plans because of manufacturing agreements.

One result of the publicity surrounding the band-seeder and legumes has been an increase in sowings of winter legumes using conventional machinery.

Discussion

The band-seeder has no rival for planting areas of native pasture that cannot or should not be planted with conventional equipment — too steep, too stony or too much timber. On other types of country — better soils, more gentle slopes, previously cleared — conventional cultivation with a chisel plough or disc harrows will usually give equal or better establishment and growth of seedlings, and also a better initial plant population because higher seed rates are used.

Recent surveys show that farmers in cropping areas prefer multi-purpose machinery and dislike using chemicals — the band-seeder fails on both counts. The band-seeder has to compete with the ubiquitous chisel plough and offset discs, which have many other uses, and with other seeders, such as the rolling-drum seeder, which can be used for all types of seed — from small pasture legumes to forage legumes and fluffy grasses. (To illustrate the comparison, a set of heavy discs fitted with a rolling-drum seeder from Forsythe Seeders of Monto cost $4500 when the CSN band-seeder was listed at $17 000.)

The band-seeder uses 1 L/ha of glyphosate. Some graziers consider the direct cost of herbicide to be greater than the cost of operating an existing piece of machinery despite the much lower power consumption associated with spraying. The cost of herbicide is offset by savings in seed costs because of low seeding rates. This saving is considerable when tropical legume seed costs are high ($16/kg for Seca stylo), but there are no worthwhile savings with cheap winter legumes (medics at $3–4/kg). The low seeding rate with the band-seeder can mean a wait of a few years until the legumes spread sufficiently to make a significant contribution to the pasture, and seeding rates are too low for fodder crops.

Band-seeding is useful only with species that spread naturally, not with those that decline after the initial planting. The band-seeder could be used to plant improved creeping grasses into degraded pastures on steep country, but it needs a better seed-metering system to sow the fluffy seeds of these species.

Poor reliability of establishment has been a problem with the unreliable commencement to the wet season in the inland Burnett. It is rarely a problem with the more reliable rain in the coastal Wide Bay-Burnett, or in northern monsoonal areas where seed can establish satisfactorily even after aerial oversowing without cultivation. There is usually no problem with winter legumes being sown in autumn in southern Queensland where good establishment can be achieved when high seeding rates of medic seed are broadcast over grazed pasture and trampled in.

In the inland Burnett, with 'normal' weather patterns, poor establishment may be a problem in 40% of years, and in 20% of years the total lack of rain (drought) may prevent even band-seeded seedlings from establishing successfully. Thus a band-seeder may offer an advantage over normal light preparation (single cultivation) of the seedbed in only 2–4 out of 10 years.

Graziers in the inland Burnett have often not adopted the technology of planting legumes into speargrass pastures on their granitic sands because they can fatten their stock on other better classes of land. So far the market specifications for Japanese Ox have been met from the existing production system without the risk from trying to plant legumes. However, increased premiums for younger cattle could provide the financial incentive for graziers to improve the quality of their grazing.

Conclusions

The band-seeder performed well in difficult conditions although subsequent survival of sown plants was reduced by a long, exceptionally dry period. Considering the widespread interest from graziers, sales have been disappointing. It was partly due to the high price of the band-seeder but also to the graziers' lack of confidence in beef prices, and the continuing drought.

If the band-seeder's *forte* is to sow country which is too steep, too stony or too covered in fallen timber, the current 3-tyne band-seeder may have the wrong configuration. A 2-tyne unit mounted on the tractor would be more

manoeuvrable and give a better balance between spray, fertiliser and seed capacities. Coulters would not be needed and depth control could be achieved without the cost of remote hydraulics.

In some ways, the band-seeder was over-specified; its excellent design is moderately 'hi-tech' with a corresponding cost, but many operators feel that comparable results could be achieved with lower specifications.

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References

COOK, S.J. and RATCLIFF, D. (1985) Effect of fertilizer, root, and shoot competition on the growth of Siratro (*Macroptilium atropurpureum*) and green panic (*Panicum maximum* var. *trichoglume*) seedlings in a native spear grass (*Heteropogon contortus*) sward. *Australian Journal of Agricultural Research*, **36**, 233–245.

WALSH, P.A. and COOK, S.J. (1988) Development of a three-row planter for band-seeding of pasture legumes. *Proceedings of Conference on Agricultural Engineering, Hawkesbury Agricultural College*, pp. 109–111.