THE TROPICAL GRASSLAND SOCIETY OF AUSTRALIA FIELD DAY TO THE BRISBANE VALLEY, 14 APRIL 1972
INTRODUCTION TO PASTURE DEVELOPMENT

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The main objective of the field day is to see if tropical pasture development is a practical and economic proposition in the Brisbane Valley. The advantages of development can be categorised in three ways:—

1. Improving the herd performance or 'gross margin' whilst maintaining stock numbers i.e. more productive cows, more and better calves, earlier joining and heavier steers.
2. Maintaining production per head at a constant level and increasing cattle numbers.
3. Improving production per head as well as achieving a higher carrying capacity.

Areas of land available for improvement will be defined and the potential development discussed in relation to the improvement of native pasture, with and without supplements, the possibility of oversowing with tropical legumes and the desirability of establishing areas of improved tropical pastures.

LAND SYSTEMS, LAND CAPABILITY AND LAND USE IN THE BRISBANE VALLEY

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To achieve optimum production it is important to use each unit of land in accordance with its capability. It is therefore desirable to have a resource inventory of land systems with the capability classes for the area. A preliminary classification for the Brisbane Valley area is shown in Table 1.

TABLE 1
Land systems and land capability classes in the Brisbane Valley

Land system	Area (acres)	Capability class				
		I-III	IV	VI	VII	VIII
Monsildale	430,000			98,900	331,000	
Jimna (part)*	3,500			1,500	2,000	
Allan (part)*	5,000				5,000	
Bellthorpe	57,000			14,000	43,000	
Stanley	140,000	5,960	62,580	80,4€0		
Esk	390,000	7,800	163,800	214,500		3,900
Eskdale	40,000			26,000	14,000	
D'Aguilar	78,000			11,700	66,300	
Byron	68,000			57,800	10,200	
Totals	1,220,000	13,760	226,380	504,860	471,600	3,900
Percent	100%	1%	19%+	40.5%+	40%+	Minimal

* Balance of these land systems is in the Mary River Catchment

TABLE 2
Land capability classification

Land Capability Division	Land Capability Classes
A. Suitable for cultivation (and for other purposes)	I Without special practices II With special but simple practices III With complex or intensive practices IV Occasionally or limited
B. Not suitable for cultivation but productive	V Not susceptible to erosion VI Moderately susceptible to deterioration, therefore requiring some restriction in use VII Highly susceptible to deterioration and therefore requiring severe restrictions
C. Not suitable for cultivation or productive vegetation	VIII Suitable only for wild life reserves and watershed protection

Nine land systems, which are areas with recurring patterns of land forms, soils and vegetation, have been categorised for the area. These are further sub-divided into eight land capability classes shown in Table 2.

The object of land capability classification is to classify land to indicate the limits of intensity of safe land use, the required management techniques, and the permanent hazards attached to the use of the land.

Fourteen additional limitations to these land capabilities such as topography, stoniness, salinity etc. were discussed.

It is of note that eighty percent of the area in the Brisbane Valley is class VI-VII which is best suited to pastoral and/or forestry use and nineteen percent is class IV which may be termed transitional cultivation/pastoral land. Such land requires complex conservation measures for long life but lends itself to pasture improvement.

THE CASE FOR MORE EFFICIENT USE OF NATIVE PASTURES IN AN EXTENSIVE BEEF ENTERPRISE. I. BY AGRONOMIC METHODS

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It seems fairly obvious that, unless one can afford to waste, on average, at least half of the season's herbage production by burning it each year before the next season's growth commences, the case for more efficient use of native pastures is very strong.

The first hundred years of occupation of these grasslands saw some measure of increased efficiency in their use through close sub-division, more watering points for stock, leading to better distribution of grazing, and ring-barking trees to increase grass growth. Do we still have only these tools at our disposal?

Where native pasture is the main grazing resource there are two systems which may be adopted.

1. *Management alone systems*

More efficient use of native pasture has resulted from studies in recent years. Ring barking or hormone treatment continues to be used to improve grass growth. This generally has the effect of increasing carrying capacity but not turn-off rate.

Burning. Spear grass native pastures have traditionally been burnt off in the spring and generally this is uncontrolled. Unless some form of intensified management is adopted the necessity to burn will remain. The use of urea/molasses roller lickers allows poor quality roughage to be used as a stand-by drought reserve. Therefore, it seems sensible particularly in a breeding operation, to burn only part of the property in spring, keeping the remainder as a reserve, either burning it later in the season or deferring it to a subsequent year. Such out of season burning is unlikely to have a serious effect on the vegetation if a different area each year is so treated. A planned burning policy requires the co-operation of neighbours but since this has been achieved in other parts of the world it can be done here.

Supplementation. The use of urea/molasses roller lickers is being increasingly used by graziers, particularly in the north. Although there is little experimental evidence to demonstrate their value, they lead to more efficient use of the pasture. This reduces the need to burn, leads to changes in botanical composition, and probably aids establishment of species like Townsville stylo.

2. *Cultural Systems*

Sod-seeding. The introduction of legumes and fertilizer into native pasture by direct drilling, minimal cultivation or chemical treatment of the vegetation is now being examined. Improved native pastures are very complex and, unlike the fairly predictable response of well known sown pasture species, there is a great diversity of plants and plant types. As yet little is known of the consequences of these practices, what sort of changes take place and the level of stability which may be achieved.

The success and speed of establishment of legumes is generally directly proportional to the amount of seed-bed preparation and precision of seed placement. However, since the aim is for minimal cultivation to preserve the existing grasses and save expense, slower and more fitful establishment must be accepted.

Improving the quality of native pastures in this way leads not only to increased carrying capacity through more effective use of the herbage but also to more rapid turn-off, because the period with herbage of below-maintenance quality is reduced.

Improved sown pastures. Sown pastures are on a different scale of operations, usually requiring tree clearing, several cultivations and seed for a grass-legume pasture mixture. Improved pastures lead to a considerable increase in carrying capacity and turn-off rate.

Intensification of production on a property is likely to include several of these systems. This is a very individual matter depending on the inclinations of the manager, finance available, nature of country and climate, and type of enterprise. It is important to realize that we know very little about the consequences of some of these practices. For instance, the intensification of grazing on unimproved native pasture that the use of supplements allows, may lead to quite a different type of pasture composition from that on native pasture oversown with legumes and fertilizer. Not much information is available on the performance of the native grasses in these intensified systems, whether it is detrimental to lose them and what sort of grasses replace them. Perhaps there is a critical time for oversowing introduced grasses. Some of these problems are evident in north Queensland already where Townsville stylo is being used.

THE CASE FOR MORE EFFICIENT USE OF NATIVE PASTURES IN AN EXTENSIVE BEEF ENTERPRISE. II. BY SUPPLEMENTS

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The effect of mineral supplements, non-protein nitrogen supplements and energy supplements will be discussed in relation to increasing carrying capacity and rate of turn-off.

1. *Mineral supplements*

There is no need to elaborate on the geographical distribution of mineral deficiencies. Emphasis in this talk is given to phosphorus. Rowan (1966) showed wide fluctuations in the phosphorus content of native pasture in Queensland throughout the year (Table 1).

TABLE 1

Variation in the phosphorus content of native pasture

Month	*% P*
Nov.	0.30
Dec.	0.25
Jan.	0.22
Feb.	0.16
Mar.	0.13
Apr.	0.10

Ritson et al. (1971) found that the phosphorus contents of spear grass and associated annual grasses rarely reached 0.2 percent and were commonly below 0.1 percent.

The N.R.C. standards for beef cattle revised in 1971 give the percentage of phosphorus required in the dry matter of the ration for different classes of cattle (Table 2).

TABLE 2

Phosphorus requirements of various classes of stock

Growing steers	*Daily gain of*	
L.W. (kg)	0.50 kg/day	0.75 kg/day
150	0 31	0.41
200	0.20	0.28
300	0.18	0.18
Finishing steer calves		
200	0.34	
300	0.27	
400	0.23	
Finishing yearling steers		
250	0.28	
300	0.25	
400	0.22	

The recommendation for a cow nursing a calf for the first 3-4 months post-partum is 0.22-0.23 percent phosphorus in the dry matter of the ration. While allowing for selective grazing, it is likely that the grazing animal is ingesting material deficient in phosphorus for optimum performance and growth. On a whole property basis, the following points should be considered:

(i) It is sometimes difficult to achieve uptake of the supplement during the wet season.
(ii) Dry matter reserves are relatively unchanged and total cattle numbers unaffected.
(iii) Rate of turn-off can be greatly improved with phosphorus supplementation resulting in improved conception rates, branding percentages, improved growth rates of young cattle, earlier joinings and earlier sale of steers.
(iv) Phosphorus supplementation is a relatively low cost input and should not cost more than 1c per head per day.

2. *Non-protein nitrogen supplements*

Winks et al. (1970) recorded a weight gain by weaners grazing native pasture supplemented with urea and molasses. The normal response has been a reduction in weight loss over the dry season. While some of the weight advantage may be lost in the following growing season there generally remains some benefit from non-protein nitrogen supplementation in improved rate of turn-off and increased carrying capacity. Alexander (1966) lists several cases of responses to such supplements. Swans Lagoon results indicate that breeding performance can be improved with non-protein nitrogen supplementation.

The efficiency of utilisation of native pasture can be improved with supplements but care should be taken because:

(i) The long term effects on native pasture communities by encouraging hard grazing are not well understood.
(ii) There is a limit on the amount of dry matter which may be utilized from native pasture and further improvement would require the introduction of new species capable of greater production.
(iii) The ideal would be to remove all standing roughage by the onset of the following wet season but this could be dangerous if an extended drought should follow.

Non-protein nitrogen supplementation should not cost more than 3-4c per animal per day and may be as low as 2c per animal per day.

3. *Energy supplements*

This form of supplementation has been largely disregarded as a means of improving utilization of native pasture, particularly in terms of rate of turn-off. The standing native pasture may be regarded as a roughage source to be supplemented by materials with a higher total digestible nutrient (TDN) content. Two aspects are worthy of consideration:

(i) *Creep feeding of calves*

Such a system simply allows calves access to a high energy grain supplement while they are still sucking their mothers, and results in a good quality vealer by ensuring the calf a high energy feed when the mother's milk supply is declining. All male calves can be removed from the property and while not affecting the number of cattle carried such a procedure will increase the rate of turn-off.

Costs should be 7-10c for each pound (.45 kg) of liveweight gained over a milk-fed calf.

(ii) *Finishing cattle grazing native pasture*

The energy supplementation of grazing cattle to take advantage of market price rises can improve efficiency of utilization. This may be particularly so in the feeding of steers to take advantage of the higher prices paid for beef between August and December. An example of this in Western Australia is quoted by Barker (1971) who supplemented weaners grazing wheat stubble. Between January and February these animals were losing weight on stubble prior to being supplemented but gained 95 kg (210 lb) in 156 days, consuming 3.5 kg (7.8 lb) per day of grain plus non-protein nitrogen supplement. The practice was profitable.

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THE ROLE OF NATIVE PASTURES OVERSOWN WITH AN INTRODUCED LEGUME FOR BEEF PRODUCTION IN THE BRISBANE VALLEY

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With only unimproved native pasture for breeding, raising and fattening cattle the usual pattern of production is that animals only do really well in the summer when there is sufficient rain. In autumn these animals may still improve slightly in condition but during winter and spring growth of animals stops and they lose weight. In the case of breeders this may lead to low branding percentages and for fattening cattle it means a slow turn-off and steers too old to attract premium prices at slaughter. In addition carrying capacity is low because it is necessary to understock during periods of good pasture growth in order to carry your stock during winter. The major reason for this mediocre production on native pastures is that quality of the pasture is lacking most of the time even in summer but more particularly in autumn, winter and spring. This low quality is due to a lack of protein and digestible energy in native pasture species. Legumes are generally better feed than grasses, but native pastures contain only a small proportion of legumes.

Therefore, an obvious improvement is to include a productive legume into native pasture. The best known case of this in northern Australia is Townsville stylo which combines well with speargrass pastures in central and northern coastal areas and to some extent also in some more inland areas. However, in the Brisbane Valley Townsville stylo has not been generally successful, the reason being that it does not persist. Fortunately, though, there are two other legumes which can be used. One is white clover (*Trifolium repens*) on creek and river flats and the other is Siratro (*Phaseolus atropurpurus*) for the poorer soils. The need for molybdenised superphosphate on most soils when establishing these legumes is stressed.

What is the role of native pastures oversown with a productive legume?

Because of the lack of data for the Brisbane Valley I can best illustrate this with data on Townsville stylo from pastures at Rodd's Bay, near Gladstone. An article by N. H. Shaw and myself published in Tropical Grasslands of March, 1970 describes this experiment.

The results refer to the period 1959 to 1966 and for five years the rainfall was below average. The pastures were stocked with steers, 2½ years old during the first five years and 1½ years old for the last two. They remained on the pastures for one year. The carrying capacity of unimproved speargrass pasture was a steer to 3.6 ha (9 acres) and mean annual liveweight gain was 83 kg (183 lb) per head, and 25 kg per ha (22 lb/ac). By introducing Townsville stylo with 125 kg/ha (1 cwt/acre) of molybdenised superphosphate annually and 63 kg/ha (0.5 cwt/acre) of KCl in three of the years, stocking rate was a steer to 1.2 ha (3 acres) in four of the years and a steer to .81 ha (2 acres) in three. The mean liveweight gain on this pasture was 149 kg/head (328 lb/head) and 148 kg/ha (132 lb/acre). Apart from the six fold increase in production per hectare, steers on the unimproved pasture never reached marketable condition in one year, whereas nearly all of those on the fertilized Townsville stylo pasture reached slaughter condition. This meant a saving of one year in age of marketing. A recent analysis by the Bureau of Agricultural Economics has shown this to be a profitable practice.

Results on speargrass with Siratro in the Brooweena district, near Maryborough with a rainfall of about 1016 mm (40 inches) were obtained by Mr. W. J. Bisset of the Queensland Department of Primary Industries. At stocking rates of a beast to 0.8, 1.2 and 1.6 ha (2, 3 and 4 acres) mean annual liveweight gain over a five year period was 93, 129 and 182 kg/head (205, 285 and 400 lb/head) respectively.

How to use these pastures

This is a difficult question because there are no experimental results on hand. However, possible ways of integrating such pastures in a whole property situation can be indicated.

The main factor influencing the use of such pastures is the area available. If the whole property is improved there is obviously no problem, but this will usually not be the case. It also depends on the type of enterprise—whether this is breeding only, fattening only or a combination of the two. It is possible to use these pastures in the following ways:

(i) For *breeding* the objective obviously is to increase carrying capacity and to get more and better calves. For this cows must be in good condition at mating time. If the mating period is from November till sometime in March, calves will be dropped between August and December. Unimproved native pasture is at its best after the rains start until about February but during winter and spring native pasture is at its worst. Improved pasture is also of poor quality in winter and spring but is a lot better than native pasture. It would seem logical to have the breeders on oversown pasture at calving time, that is August, until the start of the rains when they should go on native pasture for mating. This allows for the oversown legume to grow well and maintain a good grass-legume balance. Cows and calves can then be moved to oversown pasture when the mating period is over to obtain good weaning weights of the calves in May. From May till August all pastures, unimproved as well as improved, can be grazed.

(ii) For *fattening* the aim is to have the animals on good pasture all the time. However, if only a small proportion of the property is improved it might be most profitable to use oversown pasture for finishing animals that have grown on unimproved pasture. Forward store cattle should be selected to graze the improved pasture. In fact, oversowing pastures with a legume can change pastures on which cattle cannot be fattened into those on which fat cattle can be produced.

Finally, in the case of a property with three kinds of pastures, unimproved, oversown and fully sown, the fully sown pasture should be used for the periods when the best feed is required such as at calving or for finishing steers. The oversown pasture can then be used for the period after mating up to weaning.

To sum up, oversowing native pasture with a productive legume and proper management will lead to both an increased carrying capacity of the whole property and also better animal performance.

METHODS OF ESTABLISHMENT OF LEGUMES INTO NATIVE PASTURES

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There have been a number of notable successes in introducing legumes into native pasture. Probably the most noteworthy would be the sub-clover story in Southern Australia. White clover has also been sown into native pastures in northern New South Wales with a good deal of success. In tropical areas, the success of Townsville stylo in northern Queensland has given rise to large increases in animal turn-off from native pastures.

Unfortunately in this part of the world none of these species is sufficiently well adapted to persist. The area we are considering usually receives between 711-889 mm (28 inches to 35 inches) of rain annually. In general, research and commercial plantings in this environment are difficult even in well prepared seed beds.

Available species

What legume species are available? At Brian Pastures Research Station only the large seeded legumes such as Siratro, Glycine and lucerne have effectively been established into native pastures. Stylo species have not established well, but it has been suggested that this was caused by the seed falling into deep cracks in the heavy clay soil. In plantings of this type in West Moreton, Siratro has established well on a number of soil types. Although Glycine has not shown the same vigorous growth as Siratro on the poor forest soil and low rainfall environment, both it and Siratro have the advantage of being fairly nonspecific in their requirement for nodule bacteria. Fine-stem stylo, the most promising stylo to date, has the disadvantage of being very specific. This must contribute to poor establishment in rough conditions. Research into the most suitable legumes for oversowing in the region is needed urgently. Possible species apart from Siratro are *Dolichos axillaris,* lotononis, and Cook and Endeavour stylos.

Seed treatment

Mannetje (1967) found that lucerne could only be established in this forest country if the seed was lime pelleted. Siratro was less demanding, but pelleting ensured the correct strain of bacteria invading roots to form nodules. Dowling, Clements and McWilliam (1970) found that seeds sown on the soil surface were able to absorb water better if they were lime pelleted and germination was improved. The cost of lime pelleting is probably justified, especially if the seed is to be sown mixed with fertilizer.

Fertilizer requirements

Obviously, the most important consideration in such an enterprise is to achieve a satisfactory pasture as soon as possible. However, costs must be kept to a minimum as low-cost pasture development is essential. Minimum requirements are not known for certain, but successful sowings on very poor forest country have been achieved with 251 kg/ha (2 cwt/acre) Mo superphosphate. Molybdenum has been shown to be deficient on a number of forest soils and for the small increase in cost is essential

for these sowings. Potassium deficiency is not widely found in Brisbane Valley soils. The high cost of potash fertilizer must make its application a doubtful undertaking even where the element is deficient.

Methods involved

There has not been any comprehensive experimental work covering a comparison of all techniques. Successes can be quoted however from all of them in commercial plantings. Most successful plantings using broadcast techniques without cultivation have been conducted in areas receiving more than 1016 mm (40 inches) of rainfall. Those in areas of less than 1016 mm (40 inches) without cultivation have tended to be on more friable soils, which has allowed natural seed burial.

Establishment of legumes without cultivation

The essential factor affecting the establishment of legumes with this technique is the vigour of the existing vegetation. Young seedlings have to compete for water and light with already established plants. If the vigour of these native pastures can be reduced before sowing, then the young legumes have a better chance of survival. Burning the area prior to sowing not only reduces the foliage which is likely to shade seedlings but also provides a reasonably satisfactory seed bed. Heavy grazing can also be used. If grazing is continued after sowing, it can help to bury seeds from the trampling and scuffing of the soil by animal hooves.

Good weather conditions allowing rapid establishment of the young seedlings are necessary when legumes are established without cultivation. Non-scarified seed is a safeguard in this situation in providing a 'back up' germination if the initial population fails to establish.

Topography will often dictate when this technique must be used. In steep or broken country where soil cultivation in its simplest form cannot be considered this technique is the only possible approach. In most cases in the district where successful establishment has been achieved these steep areas also receive higher than 889 mm (35 inches) of rainfall.

Legume establishment with minimal cultivation

It is now a recognised fact that Siratro will establish in properly prepared seed beds with reasonable certainty on almost all soils in the district. Minimal cultivation techniques make a compromise, in that some of the seed applied must fall in disturbed soil. How well should the seed bed be prepared? Results at a number of sites in the district, and in various experimental plantings, have shown that one rough ripping has been sufficient for Siratro establishment even in years with low rainfall.

The length of time to achieve a productive stand of Siratro appears to be governed by the degree of cultivation and rainfall. The number of cultivations also determines how much of the native vegetation will be destroyed. Discing or ripping appear to give best results on the light forest soils. As for the technique with no cultivation, best results seem to be obtained if the area is grazed heavily or burnt before seeding.

Legume establishment with rotoseeding

A variant of the previous technique is the use of a rotoseeder, which has been used fairly successfully in northern New South Wales. The principle is that a small rotary hoe creates a seed bed about 28 mm (1½ inches) wide, into which the seed and fertilizer are placed. The seed bed in this small area is better prepared than for the previous technique, but there is very little disturbance of the native vegetation. It has the advantage of placing seed and fertilizer close together.

Sod seeding

Both sod seeding and rotoseeding are limited in their usage by the type of country. Very rough, steep, rocky or poorly cleared country would be too hard on the machinery. A shallow setting of the tynes or discs of the sod seeder is essential so as not to bury the seed deeply. Unfortunately this does not create much of a seed bed, and disturbs very little of the native sward. Under these circumstances there is little difference between this technique and no cultivation.

Chemical treatment

Murtagh (1963) showed that Glycine could be established in a native pasture by spraying the pasture with a mixture of pre-emergent and contact weedicides. Both legume and total herbage yields were lower than comparative figures of a pasture planted in a fully prepared seed bed. Siratro tends to be more susceptible to many weedicides than most other tropical legumes. Costs of these chemicals are high by comparison with costs of other techniques. Such a technique would therefore have little application in the Brisbane Valley today.

Sowing techniques

At present, aerial seeding and fertilizing appears to be the most suitable if large areas and rough topography are involved. Distribution of seed is quite satisfactory provided care is taken to allow for wind and other variables. For smaller areas, seed and fertilizer can be applied together either with a spinner-broadcaster or combine drill of some kind. Of all the methods, planting with a combine drill is the most effective, especially if some cultivation has been done. Harrows can be drawn behind to give light coverage. With other methods of establishment any attempt at coverage would add to the cost of the overall operation. Another alternative is a truck mounted fertilizer spreader which is operating in the district. This method allows the spreading of seed and fertilizer for virtually the same cost as bag fertilizer landed on the property.

Seeding rates

A seed rate of 2.2 kg/ha (2 lb/acre) of Siratro is desirable but at present the cost of seed precludes anything more than 1.12 kg/ha (1 lb/acre) of seed in commercial plantings. If seed costs can be reduced, the use of more seed will probably be a good safety measure. Glycine seed is cheaper but this species is only suitable for planting on better forest and scrub soils.

Management

Management will be determined by prevailing weather conditions and by the necessity of the pasture to set seed. Grazing during establishment does not greatly affect development. At Brian Pastures, research indicated that continuous grazing gave better establishment and yield of Fine-stem stylo than did intermittent grazing. There does not appear to be any justification for completely removing animals from this type of pasture. However a slightly lower grazing pressure than it could be expected to carry should be used during the seeding stages of Siratro in the initial year. This allows adequate seeding for thickening of the stand, and also a build up of seed in case of drought.

Indications are that the carrying capacity of this type of pasture on the type of country which the field meeting inspected will be between 1 beast to 1.6 ha (4 acres) to 1 beast to 2.0 ha (5 acres). Normal carrying capacity on partially cleared land is 1 beast to 4.0 ha (10 acres).

Costs

The major costs of developing pastures of this type are for seed and fertilizer. Approximate figures for the various techniques are shown in Table 1. These costs are based on Department of Primary Industries, Dairy Pasture Subsidy Scheme costs.

TABLE 1
Costs of establishing legumes into native pastures

	Ripping	Weedicide	Sod Seeding	Aerial Sowing	Ground Sowing
	$ c	$ c	$ c	$ c	$ c
Precultivation	2.50				
Pre-emergent spraying		0.40			
Sowing and fertilizing	0.50	0.50			
Sod seeding			2.50	1.00	1.50
Fertilizer (251 kg/ha (2 cwt/ac) Mo Super)	2.40	2.40	2.40	2.10	2.40
Seed (0.9 kg (2 lb) Siratro at $7.4/kg ($3.00/lb))	6.00	6.00	6.00	6.00	6.00
Weedicide (2,2DPA—22.4 kg/ha (20 lb/ac)) (Amitrol—9 kg/ha (8 lb/ac))		29.00			
Total cost	$12.40	$39.30	$10.90	$9.10	$9.90
With only 0.45 kg (1 lb) Siratro	$ 9.40	$36.30	$ 7.90	$6.10	$6.90

Aerial sowing costs less overall because of a lower application cost and because bulk fertilizer is used. However in the 760 mm (30 inch) rainfall country, more reliable pasture establishment could be expected from the minimal cultivation technique and the extra cost would probably be worth it.

The cost of seed is at present inflated because of a series of poor seasons. However, in future years costs should be lower and will make the cost per acre much more attractive to large scale development.

A sod seeding grazing experiment

Two 20 ha (50 ac) blocks of land, one a control and the other oversown with Siratro at 2.2 kg/ha, after ripping on the contour and the application of 251 kg/ha (2 cwt/ac) of Mo Superphosphate, were inspected.

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THE CASE FOR DEVELOPMENT OF LIMITED AREAS OF IMPROVED PASTURES AND ITS INTEGRATION WITH NATIVE PASTURE IN AN EXTENSIVE BEEF SITUATION
I. METHODS OF ESTABLISHING IMPROVED PASTURES

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There are many ways to establish a pasture. The best method is the one which under any particular circumstances will give the best results. It is difficult to define "the best method", because many variables are involved in the process.

The three main operations involved in pasture establishment are seed bed preparation, fertilizing and sowing. Conditions such as soil type, area, topography, seed size, climate and economics, are of importance in deciding the degree of preparation required for the successful establishment of a sown pasture.

Seed Bed Preparation

The main objective of this phase is to obtain a fine, firm and weed-free seedbed. The initial working is usually made with a plough, either disc or a mouldboard. This operation may need to be repeated.

Subsequent cultivations are usually necessary to produce a fine tilth. The main implements used in this process are disc cultivators, tynes and harrows. The main requirements are:—

(i) Seed of most pasture species is small and consequently a fine seed bed is most important for uniform germination and rapid seedling growth. Large seeded legumes will tolerate rougher seed-bed conditions.

(ii) A firm seed bed is necessary to prevent the deep placement of pasture seed and to assist in the retention of soil moisture. Firmness of the seed bed is achieved by cultivating at progressively shallower levels. A light rolling before planting can give good results when other cultivations have not given the desired results.

(iii) A weed-free seed bed is required to minimize early competition. Weeds may prove a problem, particularly in old cultivations and can only be controlled by frequent shallow workings.

Fertilizing

Most pasture plantings in the Brisbane Valley require fertilizer for successful establishment, superphosphate being required at rates of 126-502 kg/ha (1-4 cwt/ac). Fertilizer can be broadcast on the seedbed, placed in bands in close proximity to the seed with a combine drill or spread by aircraft. Over large areas costs and time spent applying fertilizer by aerial spreading are usually less than by other methods. If high rates of superphosphate are required it is often desirable to apply part of the fertilizer during seed bed preparation and the remainder at planting.

Sowing

Shallow sowing at a depth of less than 13 mm (0.5 inches) is important with small pasture seeds. Several implements are available for sowing pastures. Combine drilling is most satisfactory on a good seed bed. Spinning type broadcasters have been used successfully for the sowing of single pasture species but when sowing mixtures the different weights of seed can cause uneven establishment. This drawback can be overcome by closer runs with the spreader. Aerial sowing has proved successful for large scale operations. Inoculated legume seed needs to be lime-pelleted when planted with fertilizer. A light harrowing is usually sufficient to obtain a covering of seed. On light textured soils rolling can assist in establishment but this practice may prove dangerous on hard setting soils.

The establishment period is a most critical one and it is essential that the best possible conditions are created to safeguard the future of the investment.

2. THE ROLE OF SUCH PASTURES

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1. *Location*

The spear grass country in the south-east corner will be considered in this

paper but findings would be applicable to this class of country in the south-east quarter of Queensland generally.

2. *Uses*

The purpose for which improved pastures is used will vary with individual properties and depend on:

(a) Availability of suitable land and capital—which would govern the area of pasture laid down.

(b) Type of enterprise conducted on the property, e.g. the use to which improved pasture is put may be different for a breeding enterprise than for a breeding and fattening unit. Possible uses are:—

  (i) Improved pastures could replace native pastures and provide the total grazing all year round for a particular class of cattle, e.g. fattening steers.

  (ii) They could be used to supplement native pastures at strategic times, e.g. during the dry winter-spring months.

  (iii) They could be used to complement native pastures, e.g. native pastures provide the total grazing during the summer-autumn months and improved pasture could provide the total grazing during the winter-spring period.

3. *Likely development*

Because of capital requirements and possibly the uncertainty of establishing a successful pasture it is unlikely that large scale pasture improvement will be undertaken in any one year. The more likely approach would be to develop relatively small areas of the order of 100 acres or so at a time. On this assumption, the area of available improved pasture will be insufficient in the early years to meet the total feed requirements of large groups of cattle within a herd. Rather than rationing grazing to large numbers a more practical approach would be to use the pasture for longer term grazing by selected animals.

4. *What are the capabilities of improved pasture*

Our tropical and sub-tropical improved pastures are essentially summer growing species. In this respect they are similar to our native pasture species. It can be claimed, however, that improved pastures will produce a greater quantity of dry matter per hectare than native pasture and will, therefore, support a heavier stocking intensity. If they have a worthwhile legume component and have a later maturing habit they would provide a higher plane of nutrition over a longer period. Collectively,this should mean greater weight gain per beast and per hectare.

Native pastures provide a cheap source of feed and are capable of satisfactory production during the peak of the growing season. However, they fail badly on reaching maturity and are virtually non-productive during the winter-spring months. The logical approach in a feed management programme would therefore be to make optimal use of native pastures while they are capable of supporting animal weight gain and then rely on some other form of grazing to at least maintain the animal during the winter-spring period.

5. *Utilization of improved pasture*

The tendency to date has been to develop an area of improved pasture and then try to decide what to do with it. The first logical step should be to analyse the animal production chain on the property with a view to determining the weak links and then ask, what can be done to improve the situation? The growth rate pattern of cattle on native pasture in a normal year shows that the cattle gain weight from the commencement of pasture growth in the spring through until the end of autumn. At this time the nutritive value of the pasture has fallen below the maintenance

requirement of cattle and they lose weight through the winter and until pasture regrowth in the spring. Depending on the soil moisture level coming out of the winter, pasture growth may start by late August but may also be delayed until the first effective storm rains. This biphasic growth pattern of cattle is largely responsible for the older age of turn-off of cattle for slaughter. This then is one weakness in the animal production chain.

6. *Reproduction*

(i) *Heifers*
A study of a typical breeding herd in this area shows that lactating first calf heifers have a comparatively low conception rate. This is due largely to a nutrition-lactation interaction causing lactation anoestrus. This problem can be overcome by calving heifers in strong condition, preventing major weight loss in early lactation and by mating them on a rising plane of nutrition.

(ii) *Breeders*
The effect of body condition of the breeder on conception pattern is of interest. Again there is a lactation-body condition relationship which affects not only the rate at which cows conceive but also total conceptions. There is considerable field evidence that lactating cows below store condition have a low conception rate. Once lactation is removed, cows go back into calf even at a lower level of body condition.

Lowered reproduction rates caused by inadequate nutritional levels constitute the second weakness in the production chain.

(iii) *Weaners*
The growth pattern of calves shows that they derive little benefit from being left on the cow once pastures have deteriorated. However, the condition of the cow is markedly affected even when milk production is at a low level. Therefore, weaning before winter is indicated if the welfare of the cow is kept in mind.

The growth rate of young cattle grazing native pastures in the year following weaning is quite low and is of the order of not much more than 45 kg (100 lb) net liveweight gain.

Therefore to summarise our production weaknesses we could place them in the following order:—

1. Low conception level in lactating first calf heifers
2. Low growth rate of young cattle
3. Low conception level in lactating breeders in backward condition.

It is suggested that these categories of cattle should be given preferential treatment in an improved feeding programme.

(i) *Pregnant heifers* should be given preferential treatment during the winter-spring period so that they calve in strong condition and are prevented from losing too much weight in the early stages of lactation and are remated on a rising plane of nutrition. This would involve improved conditions from the end of autumn (May) until the completion of the second mating in the following March. Thus heifers could be mated on native pastures at the first mating (November to March) and maintained on this pasture until the start of the next winter. They would then be placed on improved grazing from June until the end of the second mating in February-March.
(ii) *Weaners* should be taken off the cow before the start of the winter. If improved grazing is available weaning earlier than May would give the cow a chance to improve in condition before the winter. Weaners could be weaned on to improved grazing and carried on these until the end of the following summer.
(iii) *Backward conditioned breeders* could be selected for preferential treatment at

weaning time or even later. The aim would be to improve their condition or at least to prevent winter weight loss so that the cow would have a better chance of going back into calf in the next mating season. The period from June to October is a suggested period of preferential treatment for this class of animal. Assuming improved pastures are used to supply the better standard of grazing, a spell period from February-March to June is envisaged. The aim would be to allow the pasture to build up dry matter for use during the proposed grazing period.

7. How much pasture is required?

Assuming improved pasture is capable of carrying an adult beast to 0.8 ha (2 ac) or 1 weaner per 0.4 ha (1 ac) during the winter-spring grazing period, and assuming a branding of 85 percent once the improved system becomes functional and a breeder replacement level of 20 percent, the improved pasture requirement per 100 breeders would be as follows:

20 heifer replacements @ 0.88 ha (2 ac)	= 16.2 ha	(40 ac)
85 weaner „ @ 0.41 ha (1 ac)	= 34.4 ha	(85 ac)
	50.6 ha	(125 ac)
say 10 percent of backward conditioned breeders @ 0.8 ha (2 ac)	= 8.1 ha	(20 ac)
TOTAL	58.7 ha	(145 ac)

The programme outlined presupposes that improved pastures are capable of providing a positive plane of nutrition during the winter-spring period. If not, then one would have to ask whether there is a place for a limited area of improved pastures in the extensive cattle situation.