with both fertilizers ($P > 0.05$) but only the highest rate of super, and no rate of biosuper, resulted in a concentration that exceeded ($P < 0.05$) that of the control.

It appears that comparatively little of the P or S from biosuper had been taken up by plants 20 months after treatment. After three years however, P and S levels in herbage were generally equivalent from both fertilizers, suggesting an increase in P and S availability from biosuper over time, similar to results of Jones and Field (1976) and Partridge (1980). It is not known whether similar results would have been obtained had rock phosphate been used in place of biosuper. However, it seems most likely that the biosuper was simply acting as a mixture of rock phosphate and sulphur, rather than as "biological superphosphate". Such a possibility has also been reported elsewhere. Rajan (1982) found that bacterial inoculation of biosuper did not alter the effectiveness of the fertilizer because of the large resident population of thiobacilli in the soil. Further, von Stieglitz (1951) found similar responses in pasture to both superphosphate and rock phosphate four years after application, while Bryan and Andrew (1971) measured a high residual value of rock phosphate with lotononis, albeit never as high as that of superphosphate.

ACKNOWLEDGEMENTS

We thank Dr. R. J. Swaby for his interest in this experiment, and also for supplying the biosuper and inoculum; Mr. G. B. Faulkner for technical assistance; and Agricultural Chemistry Branch, Department of Primary Industries, for performing the chemical analyses.

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PROCEEDINGS

BEEF PRODUCTION IN THE BURNETT REGION BASED ON IMPROVED NATIVE PASTURES
FIELD MEETING, GAYNDAH, SEPTEMBER 30, OCTOBER 1, 1983

A joint field meeting with the Gayndah Branch of the Australian Society of Animal Production was held on September 30 and October 1 on a number of properties in the Murgon-Gayndah area. The programme covered the role and potential of the browse shrub leucaena (*Leucaena leucocephala*) on the first day and the improvement of native pasture with fine stem stylo (*Stylosanthes guianensis* var *intermedia*) on the second day.

LEUCAENA USE IN PRACTICE

H. SHELTON
"Merlwood"—Murgon

The meeting was invited to inspect the two-year-old 3 hectare stand of leucaena (*Leucaena leucocephala*) cultivar Peru which was established in the drought year of 1981 on light, softwood scrub soil previously used for cropping. The seed was disc drilled at about 1 kg ha^{-1} in rows 3 m apart. Initial establishment was slow because of the drought but a vigorous stand of plants 2–3 m high is now present. Last year, green panic seed was broadcast by hand over the area and has established well. The paddock gives a large amount of feed and has been grazed by cattle over the past 18 months, at times very heavily, without any evidence of any health problems arising in the animals because of its mimosine content. Frosts occur in the lower slopes but have not caused extensive loss of leaf. Further sowings are planned for better soils on the slopes where cropping is not practicable, with the cultivar Cunningham preferred to Peru.

C. J. PAUL
Department of Primary Industries, Kingaroy

Investigation of the potential of leucaena in the Murgon district started about 10 years ago when ten small areas were planted. Establishment failed on three areas in which the soil was unsuitable, namely shallow forest soils with an impervious yellow clay subsoil. In contrast, leucaena did well on sites where the soils were deeper, more fertile and well drained. These soils however, are usually suitable for and reserved for cropping, and also being frequently in the lower lying areas are often subject to severe frosts which can cause substantial damage to leucaena and loss of its leaves in winter. No assessment of its benefit to animal production has been made in the South Burnett. Wider use of leucaena has possibly been limited by its requirement for the better soils, worry over toxic problems of mimosine, seed supply and cost, and its different growth habit and management from traditional pasture legumes.

LEUCAENA—ITS ADVANTAGES AND DISADVANTAGES

M. H. SHELTON
University of Queensland, St. Lucia

Advantages

Persistence—one of the best of the tropical legumes in this regard.
Productivity—high yielding and recovers well after grazing.
High quality—shrub is highly acceptable to cattle, high digestibility and protein content. At Samford near Brisbane, animal liveweight gains have averaged 420 kg ha^{-1} over 5 years and 160 kg $head^{-1}$ yr^{-1}.
Flexible—can be grazed rotationally throughout the year or saved for periods when other feed is short or of poor quality.

Disadvantages

Establishment—slow, especially in competition with heavy weed growth and when grazed by hares and wallabies.
Unusual growth habit—being a shrub it is different from more usual pasture legumes with possibly different management strategies.
Potential toxicity—contains the alkaloid mimosine but problems arising from this seem relatively rare under most grazing situations. Where leucaena is less than 30% of total diet, and grazing on it is confined to less than three months at a time, there seems to be a low risk of animal health problems. No problems arise in Hawaii and the Philippines where it has been used extensively.

Soil specificity—does not seem to be suited to the more infertile, shallow, poorly drained soils.

Frost—suffers frost damage in low lying areas but possibly less susceptible than many other tropical legumes. Can reduce its advantage as a high quality standover feed for winter.

Questions and discussion indicated that leucaena should be inoculated at establishment and lime pelleted seed is preferable because the young seedlings are sensitive to low pH. Established plants cope satisfactorily with acid soils. Weed competition is a problem during establishment, possibly requiring some post emergence cultivation. Planting directly into native pasture in strips sprayed with Round-up has been successful, and weeds are less of a problem on previously uncropped land than on old cultivation areas.

RESEARCH ON LEUCAENA—"BRIAN PASTURES"

K. G. RICKERT

Department of Primary Industries, Brian Pastures

Leucaena was first sown on Brian Pastures in 1954 in the plant introduction gardens, and experiments to determine its potential for animal production when used with native pasture commenced in 1968. Leucaena has persisted well and been highly productive on the brown to black clay soils present on the Research Station. Many hectares (in excess of 100 ha) of leucaena are now present on Brian Pastures, and are undersown with green panic (*Panicum maximum* var *trichoglume*) to form a stable and productive grass/legume combination.

GROWING CATTLE ON LEUCAENA/NATIVE PASTURE

D. G. COOKSLEY

Department of Primary Industries, Brian Pastures

A combination of leucaena and native pasture in the ratio of 1 hectare:6 hectares can produce steers and heifers in forward store condition at $2\frac{1}{2}$ years old. Weaners have gone from 185 kg to 462 kg in 30 months. The integration of leucaena with native pasture can double the stocking rate of the area. Native pasture is grazed all the year round, but the leucena is shut-up over the summer to accumulate dry matter for 6 months' grazing in winter and spring. No mimosine problems arose with respect to animal health. No fertilizer is used, the soils having adequate phosphorus.

BREEDING CATTLE ON LEUCAENA/NATIVE PASTURE

A. R. LAING

Department of Primary Industries, Brian Pastures

Comparisons are being made between breeder performance on native pasture supplemented with leucaena pasture, native pasture with sod-seeded fine stem stylo (*Stylosanthes guianensis* var *intermedia*) and native pasture supplemented with urea/molasses. Liveweight gain of breeders and pregnancy rates have been better on leucaena and fine stem stylo pastures than on the urea/molasses supplemented native pasture, especially in the drier years. No obvious animal health problems have arisen on leucaena which is grazed during the winter and spring at 2.5 cows ha^{-1}.

INTENSIVE PRODUCTION SYSTEM USING NATIVE PASTURE/IMPROVED PASTURE/LEUCAENA AND CROPS

G. B. ROBBINS

Department of Primary Industries, Brian Pastures

The above feed combination aims to produce finished cattle of 450 kg at 22 months old.

The area of 110 ha comprises 25 ha of sown pasture (green panic + 50 kg N yr^{-1}), 25 ha crops (lablab and sorghum), 54 ha native pasture, 6 ha leucaena. The feed year is green panic (late winter and spring), native pasture (summer), native pasture + leucaena (autumn), crop stubble (late autumn) and lablab (*Lablab purpureus*) chaff + sorghum grain (early winter). The experiment has been in progress for six years and each year 60 weaners (commencing at 8 months and 180 kg) have been turned off in finished condition averaging 426 kg per head.

Several problem areas have arisen which need further attention:

1. The animal gains on green panic in winter/spring have been highly variable from year to year (18–90 kg per head) and there has been a clear run down in green panic productivity with age of the pasture.
2. The gain on native pasture over the summer of 0.6 kg $head^{-1}$ day^{-1} is low and could be improved with a greater legume input.
3. Crop yields have been very variable from year to year, e.g. lablab hay 1.5 to 7 t ha^{-1} and sorghum grain 1.3 to 5 t ha^{-1}. The average yield over 6 years of lablab has been sufficient for the system but not so for the grain sorghum.

RUN DOWN OF GRASS PASTURES

G. B. ROBBINS

Department of Primary Industries, Brian Pastures

This is a widely significant problem becoming evident in many of the pure grass pastures on the heavier "more fertile" soils in Queensland. The problem has been highlighted by the intensive production system on Brian Pastures where green panic pastures varying from 1 to 5 years of age are grazed at various times in the overall system. Compared to 1-year-old pastures the five-year-old green panic pastures have produced less herbage, with a much lower nitrogen content and leafiness, and an animal liveweight gain 50% lower.

Fertilizing with 100 kg N ha^{-1} is needed to restore a 3-year-old green panic pasture to the same productivity it had in its first year. On a 5 year old pasture, 250 kg N ha^{-1} is needed to give the same nitrogen percentage in the herbage as in the first year.

Obviously the tie-up of nitrogen in long established grass pastures is a major problem for future research.

Indications are that if the run-down of sown green panic pastures continues then their productivity will decline to that of native grasses. This raises the interesting question of whether sown grasses are significantly better than native grasses or is their production advantage due to the cultivation and subsequent release of nitrogen during establishment? Experiments in progress are aimed to test the productive capacity of native grasses (speargrass (*Heteropogon contortus*) and forest blue grass (*Bothriochloa bladhii*)), green panic, purple pigeon grass (*Setaria porphyrantha*), creeping blue grass (*Bothriochloa insculpta*), Angleton grass (*Dichanthium aristatum*) and silk sorghum.

An interesting preliminary result is that animals grazing an area cultivated and recently sown with native grasses gained 8 kg over the winter compared to a loss of 20 kg on an old undisturbed area of the same native grasses. Pasture rundown is not a peculiarity of the introduced "improved" pasture grasses.

FINE STEM STYLO ON THE PROPERTY

L. BAKER
Old Mundubbera Road, Gayndah

The 50 ha paddock of excellent fine stem stylo (now 10 years old) was planted in 2.5 m strips about 9 m apart with a seeding rate over the whole area of about 2 kg ha^{-1}. The area was worked twice with a light chisel plough and disced, seed was broadcast with a spinner on the front of the tractor with a roller mounted behind. The area has been grazed at 0.8 beast ha^{-1} and within three years of sowing the fine stem stylo had spread quite evenly over the whole area. Buffel grass (*Cenchrus ciliaris*) was included in the initial sowing but the heavy grazing needed for good use of fine stem stylo has greatly reduced both buffel and native grass productivity. Superphosphate was applied at sowing but has not been used since.

The benefit of fine stem stylo to animal production has been so impressive that a newly acquired 500 ha block has just been sown (summer 1982/83) to this legume. After one chisel ploughing and a disc harrowing, seed was sown with a Yeoman's sod-seeder. On the rolling country in the block the ridges were planted but not the wetter lower slopes, which are unsuited to the plant. The establishment has been good and rapid spread is anticipated over the coming summer.

ESTABLISHMENT OF FINE STEM STYLO

J. C. KERR
Department of Primary Industries, Gayndah

Land preparation can be varied, usually the more cultivation used then the better the establishment. Full land preparation is only warranted for a seed production area. Otherwise, establishment can be by broadcasting after a fire, strip cultivation as in the present block although perhaps this could be achieved in future plantings as a one step operation (medium H.P. tractor with front blade/discs between the wheels, seeder behind and then harrows), or possibly sowing into herbicide sprayed strips. A seed rate of 2–3 kg ha^{-1} is recommended and spread from the sown strips is sufficient to give a benefit to animal production within 2 years. Hardseededness may be a problem and can be reduced by mechanical scarification or hot water treatment. The Department recommends 80 °C for 10 minutes, cooling and then air drying. Inoculation generally not used but if required use Verano (*Stylosanthes hamata*) inoculum. Establishment is aided by heavy grazing in the early stages to minimize plant competition. Seed cost is high, however lower seeding rates can be used with a consequently longer time for a complete spread over the area. No fertilizer is needed in this Gayndah area.

ANIMAL PRODUCTION

A. H. MILLES
Department of Primary Industries, Gayndah

Improved animal production in the area is being achieved using cross-bred cattle (*Bos indicus* × *taurus*) and better pastures such as fine stem stylo to lower costs. The capacity of the natural pastures on the granite country of the Burnett is a live weight gain of 90–125 kg $bullock^{-1}$ $year^{-1}$ off speargrass pastures, and the best we can achieve is usually a 3.5-year-old unfinished, forward store animal of 400–450 kg. The current aim for export is now a 600 kg (6 tooth) finished bullock at about 3.5 years of age. To do this liveweight gain per animal must be boosted to 170 kg $year^{-1}$ and we think fine stem stylo sown into native pasture may be the answer in this granite country. This gives, in my terms, a "fortified speargrass" pasture. The fine stem stylo being a legume

considerably boosts the protein content of the native pasture at critical periods and prevents the loss of animal liveweight in winter. The addition of fine stem stylo to native pasture has been so successful that the animals on this block and at Brian Pastures Research Station have achieved over the past 7 years (4 declared droughts) an average annual liveweight gain of about 165 kg head^{-1} which is the level needed for a 600 kg 6 tooth bullock at 42 months age. The consistency of animal production from year to year is a significant feature of this species.

AGRONOMIC FEATURES OF FINE STEM STYLO

K. G. RICKERT

Department of Primary Industries, Brian Pastures

The plant has a deep taproot with stems arising from a crown just under the soil which enables it to withstand heavy grazing, frost and fire. The species seeds throughout the summer to maintain good seed reserves in the soil. Individual plants only survive 2–3 years so it is essential to relax grazing at strategic times in the early years to build up a soil reserve of seed. Persistent overgrazing usually does not harm established fine stem stylo but leads to a loss of grass and incursion of weeds. Fine stem stylo is best suited to the deep, well-watered sands and will not thrive on shallow soils or areas which become waterlogged. Usually shows little response to phosphate fertilizer on the granite soils. Anthracnose disease occurs in fine stem stylo but is not a serious problem as yet.

SEED PRODUCTION OF FINE STEM STYLO

J. ROBERTSON

Mundubbera

Fine stem stylo is grown for seed on sandy, river flat soil under irrigation with 2,4D used for weed control. A major problem with fine stem stylo is the large amount of green material harvested with the seed. We have found that a rotary header is ideal for this job and modified with an extra auger it can harvest on a 6 m front with good speed.

A vacuum header is used afterwards to recover dropped seed. Two crops are taken each year in December and May/June. The germination percentage is about 70%. Seed available this year is still less than the demand for pastures.

ECONOMICS OF FINE STEM STYLO PASTURES

A. M. JAMIESON

Department of Primary Industries, Monto

What do fine stem stylo pastures have to offer?

1. Rates of return of 20% plus can be confidently expected.
2. Grown successfully in the Burnett since 1954 and has an excellent record for persistence.
   Tolerant of—frost, fire and heavy continuous grazing.
3. Initial development costs are dependent on seed price, but even at current seed prices a total of \$31 ha^{-1} should cover development costs on clear or open country.
4. No maintenance costs (except for normal timber control).
5. A simple system which fits readily into normal property management.

Developing 1 ha of fine stem stylo pasture from cleared native pasture

Assumptions:

1. Project life is 10 years
2. Cyclical market prices (4 year cycle)
   —fat cattle 60–90 cents kg^{-1}
   —store cattle 50–95 cents kg^{-1}
3. Stocking rate
   —unimproved 0.25 hd ha^{-1} (1:10 ac)
   —improved 0.75 hd ha^{-1} (1:3.3 ac)
4. Annual liveweight gain
   —unimproved 110 kg hd^{-1}
   —improved 150 kg hd^{-1}
5. A three year build up period for liveweight gain and stocking rate after the introduction of stylo.
6. Animal costs (health, losses, marketing)
   —unimproved \$21 hd^{-1} yr^{-1}
   —improved \$29 hd^{-1} yr^{-1}
7. Property costs
   An extra \$2 ha^{-1} yr^{-1} was allowed for timber control on the improved pasture.
8. Development costs

Seed 1 kg ha^{-1} @ \$24 kg^{-1}	25
Cultivation and seeding 20% of area @ \$30 ha^{-1}	6
	31

Cash Flow Stream

Year	L'stock capital	Net cash flow	
0		–31	
1		– 4	
2	89	–67	stocking rate increased
3	89	–14	,, ,, ,,
4		32	,, ,, ,,
5		32	
6		32	
7		32	
8		58	
9		58	
10		236	

Rate of return on invested capital = 24.5%
Pay Back Period = 9 years
(Assuming capital borrowed at 13%)

LONG-TERM FINE STEM STYLO PASTURE

The meeting visited an old planting of fine stem stylo in a 150 ha tordon-treated paddock sown in 1967. The original establishment covered a total of 8 ha in eight different blocks around the ridges of the paddock and the legume has not only persisted very well but has spread throughout the 150 ha carried by animals and water-wash. Initially stocked at 1 beast to 1.2–1.6 ha the standard stocking has now decreased to 1 beast to 2.4 ha which is at least double that of native pasture without the legume. Animal production figures are not available but in recent droughts whilst stock have

been lost on native pasture there have been no stock losses on this fine stem stylo paddock.

The field day meeting finished at about 3.30 pm with a vote of thanks from Dr. Date.

PROCEEDINGS

DAIRY PASTURES, LUCERNE EVALUATION AND SEED PRODUCTION FIELD MEETING, LOCKYER VALLEY, NOVEMBER 18, 1983

The Annual Meeting for 1983 was held on 18th November in conjunction with a field meeting to view dairy pastures near Mulgowie in the Lockyer Valley, lucerne breeding on Gatton Research Station, Qld Department of Primary Industries and grass seed production activities at Gatton Agricultural College.

IRRIGATED DAIRY PASTURES

C. EMMERSON* AND A. BIRD**

*Thornton via, Mulgowie, **Department of Primary Industries, Ipswich

The dairy herd of 70 head is supported on about 50 ha of arable land with irrigation, together with 150 ha of hill country on which improvement has begun using Callide Rhodes grass. The farm uses a combination of ryegrass pastures, ryegrass plus temperate clovers, lucerne, forage millet and Lablab bean. Emphasis at this meeting is on the ryegrass and ryegrass/clover pastures and comparison of their productivity.

The ryegrass pasture (cv. Tama) sown at 40 kg ha^{-1} receives 240 kg superphosphate and 125 kg potassium sulphate per ha at planting and 125 kg urea ha^{-1} after each of the four grazings commonly obtained over the winter/spring period. It is believed that a mixture of ryegrass with clover may be a more productive pasture system. This mixture comprises a seed sowing per hectare of Tama ryegrass 5 kg, Clare sub clover 20 kg, Haifa white clover 5 kg and NZ Red Clover 5 kg; planted in April with the same fertilizer as the ryegrass and one dressing of 125 kg urea in mid-winter. The sub clover and ryegrass provide early grazing in the winter and the white and red clovers contribute mainly in early summer. The present pasture, which is strip grazed on a 4–5 week rotation, has lasted 2 years and possibly will go for three years. Comparative production figures for 1982/83:

	Milk production/cow	D.M. production
Ryegrass alone	12.7 litres/day	17 t ha^{-1}
Ryegrass/clover	13.4 litres/day	16 t ha^{-1}

The cows are supplemented with 2–2.5 kg of grain per day in April to June. The better quality of the clovers improves milk production from a lower dry matter yield and costwise the ryegrass/clover mixture has a great advantage because of the lower amount of nitrogen fertilizer used (about 600 kg ha^{-1} less).

Johnson grass is a serious weed in some pastures and no doubt affects the quality of the pastures for milk production but possibly helps reduce bloat incidence.

The 15 ha of lucerne on the property is grazed in summer but in spring when the other pastures provide ample feed the lucerne is cut for hay which is used as a reserve for wet periods when grazing is not feasible.