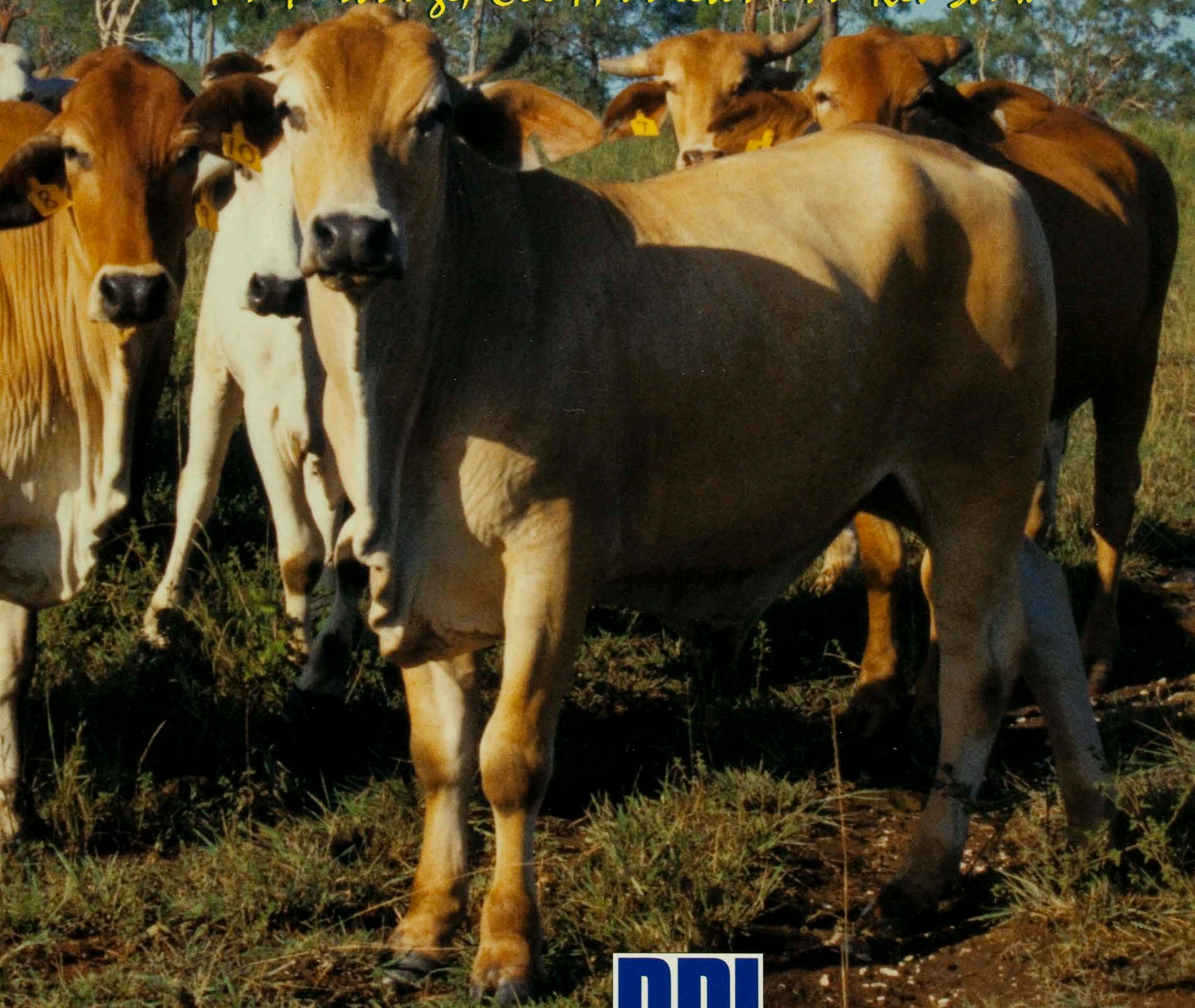


Stylos for better beef

Ian Partridge, Col Middleton and Kev Shaw



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Why?

Why plant legumes?

It costs money to improve pastures with legumes so there has to be a good reason for doing it. The main reason is to meet the market and get those premiums being paid for better quality stock.

There used to be little financial incentive to change the existing low-input, low-risk system; the markets would accept and pay reasonably for steers as old as 5 years.

Now the specifications have changed; heavy steers for Japan (the old Jap Ox) must reach 550–700 kg liveweight in under 3½ years while the live export trade, the feed-lotters and grass-fatteners all want younger well-grown stores.

The specifications for grass-fed animals fluctuate with contracts, but are typically:

Market	liveweight kg	dressed wt. kg	fat score	age months	teeth
Japan Ox	550–750	280–400	5	<42	<7
EEC	<620	<327	2–4	<30	0–4
Korean	550–650	280–330	2–3	<42	<7
Domestic	300–400	160–220	2–3	<16	0

Steers have to gain at least 160 kg every year to grade as Jap Ox, and they cannot do it off native pastures.

What sort of benefit can I expect from planting stylos?

Steers on native pastures need legumes—adding stylos can put on an extra 40–50 kg each year. You can expect a 3-fold increase in production per hectare—from a doubling of your sustainable stocking rate and an extra 40–60% weight gain on each animal.

On very large properties in northern Australia, the relative improvement could be much greater because production from extensively managed native pasture is so low. Improving even a small proportion of the property can have a very large effect on turn-off.

What's wrong with our native pastures?

Our native grasses provide most of the grazing for the beef herds in northern Australia. Traditionally they feed nearly all of the breeders, most of the stores and many of the slaughter animals.

But most native pastures provide good feed for only a short period during the year.

SPECIFICATION FEEDBACK SHEET
 TEYS BROS (BENLEIGH) PTY. LTD.
 R.C.N. 009 676 455
 LOSBY RIVER ROAD
 BENLEIGH QLD 4127

Lot Number: 452 Species: Cattle Kill Date: 06 DEC 95 Our Ref: 1821 Page: 3

Carcass Details		Left Side		Right Side		Total Body	
Works	Sex	Fat	Butt	Ultra	Hot	Ultra	Hot
Body	#	#	#	Stat	Wt	Stat	Wt
				Wt	kg	Wt	kg
294	M	2	14.0	C			
295	M	4	15.0	B	177.8	300.0	300.0
296	M	6					318.34
297	M	4					261.40
298	M	6					11.13
299	M	4					74.46
300	M	4	19				17.35
301	M	2	12				6.98
302	M	4	14				7.68
303	M	4	14				3.04
304	M	6	18				4.06
305	M	4	17				1.50
306	M	6	15				1.30
307	M	2	8.0				1.8
308	M	4	11.0				25
309	M	6	9.0				32
310	M	4	8.0				96
311	M	6	15.0				14
312	M	4	21.0				6
313	M	6	15.0				5
371	M	6	9.0				11
372	M	4	13.0				11
373	M	4	25.0				11
374	M	2	11.0				11
375	M	4	25.0				11
376	M	6	18.0				11
377	M	8	15.0				11
378	M	4	16.0				11
379	M	6	20.0				11
380	M	4	12.0				11
381	M	4	12.0				11
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385	M	4	20.0				11
386	M	6	12.0				11
387	M	6	14.0				11
388	M	4	11.0				11
389	M	6	24.0				11
390	M	6	20.0				11

Recognised Measurers: PB, 159, PB, 235, PB, 159, PB, 68, PB, 158, PB, 90, PB, 217, PB, 237, PB, 91

FROM YOUR AUS-MEAT ACCREDITED ABATTOIR

Steers have to gain at least 160 kg every year to grade well.

Steers can gain an extra 40–50 kg a year when native pasture is improved with stylos.



Stylos for better beef 1



The quality of native pasture drops quickly in late summer.

When does grass quality drop?

Most native pastures in the higher rainfall areas (above 600–800 mm) provide reasonable quality feed for the first 1–2 months of each wet season. After this, even green grass may be too low in protein for cattle to grow well.

Grass quality drops further when flowering starts and continues to decline as the stem matures to a woody indigestible stalk. Then a frost can finish it off.

What's wrong with sown grasses?

Our improved grasses can tolerate heavy grazing, maintain their quality over a longer period and respond to good conditions.

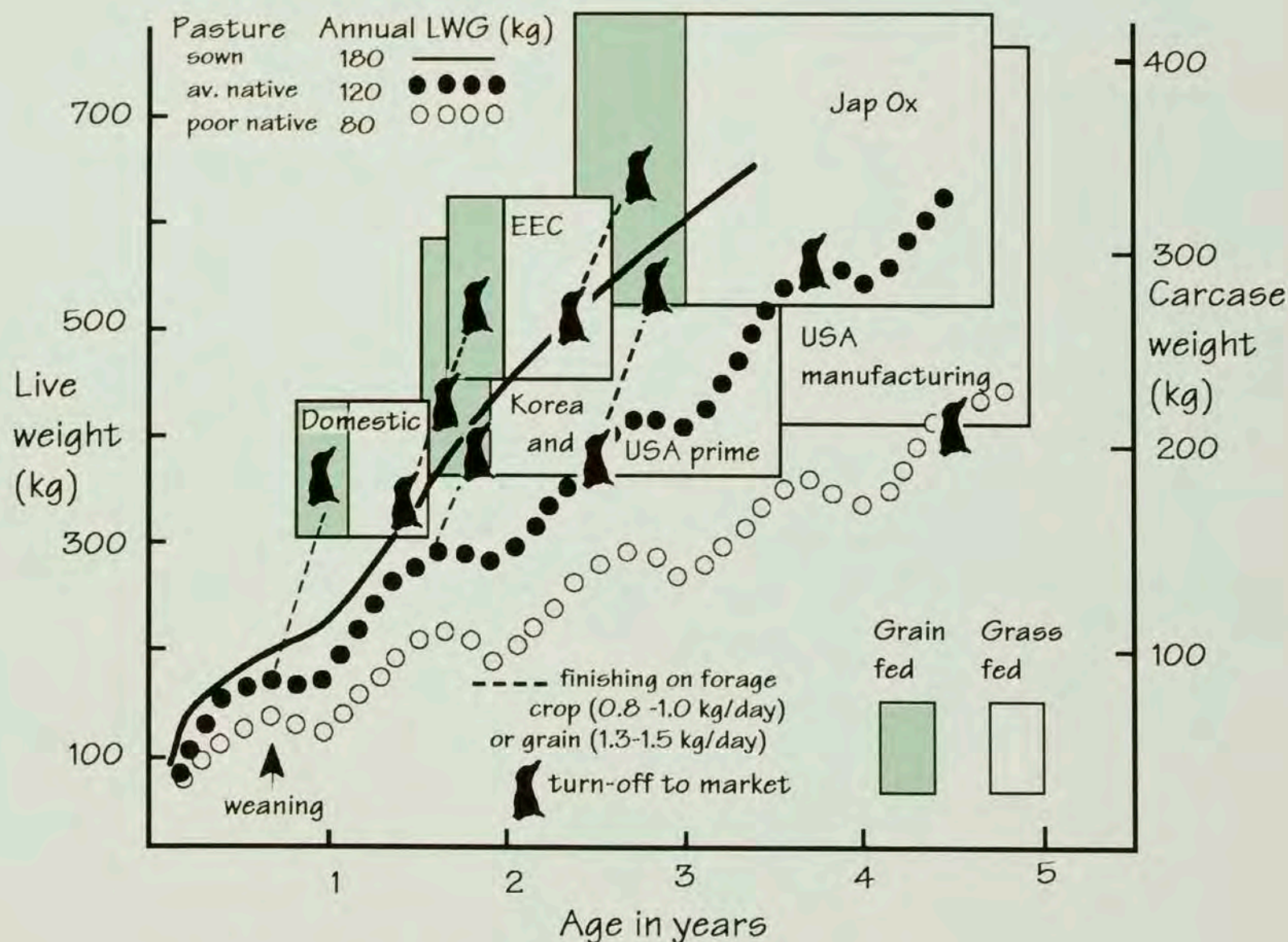
But even in fertile brigalow soils, the productivity of grasses like buffel and green panic declines as nitrogen becomes locked up in soil organic matter. Productivity can be restored temporarily with renovation; it can be kept high by including a legume to recycle nitrogen and to provide a more digestible diet.

What is the effect on cattle growth?

Cattle put on a spurt of growth at the start of the wet season with leafy green grass, but then slow down as protein becomes limiting and grass becomes more fibrous. They maintain weight in autumn, but lose it in winter and the dry season.

This gives the typical saw-tooth pattern of growth from native pastures. To reach 160 kg of weight gain each year, we have to use legumes or expensive supplements to maintain growth during autumn and to stop weight loss during winter and the dry season.

Cattle on native pastures need legumes to overcome the typical saw-tooth pattern of growth.



Growth patterns of steers on different pastures and the finishing options for various markets

How do legumes improve animal performance?

Legumes are high protein plants and so improve the quality of the diet, especially in autumn. This allows stock to make better use of the aging grass. Stock continue to grow into autumn and maintain their weight over winter.

Their effectiveness depends on how vigorously they grow, and this will depend on the species and the fertility of the soil.

There are many species of legumes for cattle feed, ranging from small trees like leucaena to low creeping types, such as lotononis or pinto peanut. All can have their place under different types of pastures, soil, or management.

This booklet describes legumes of the Stylosanthes group, commonly known as the 'stylos'.

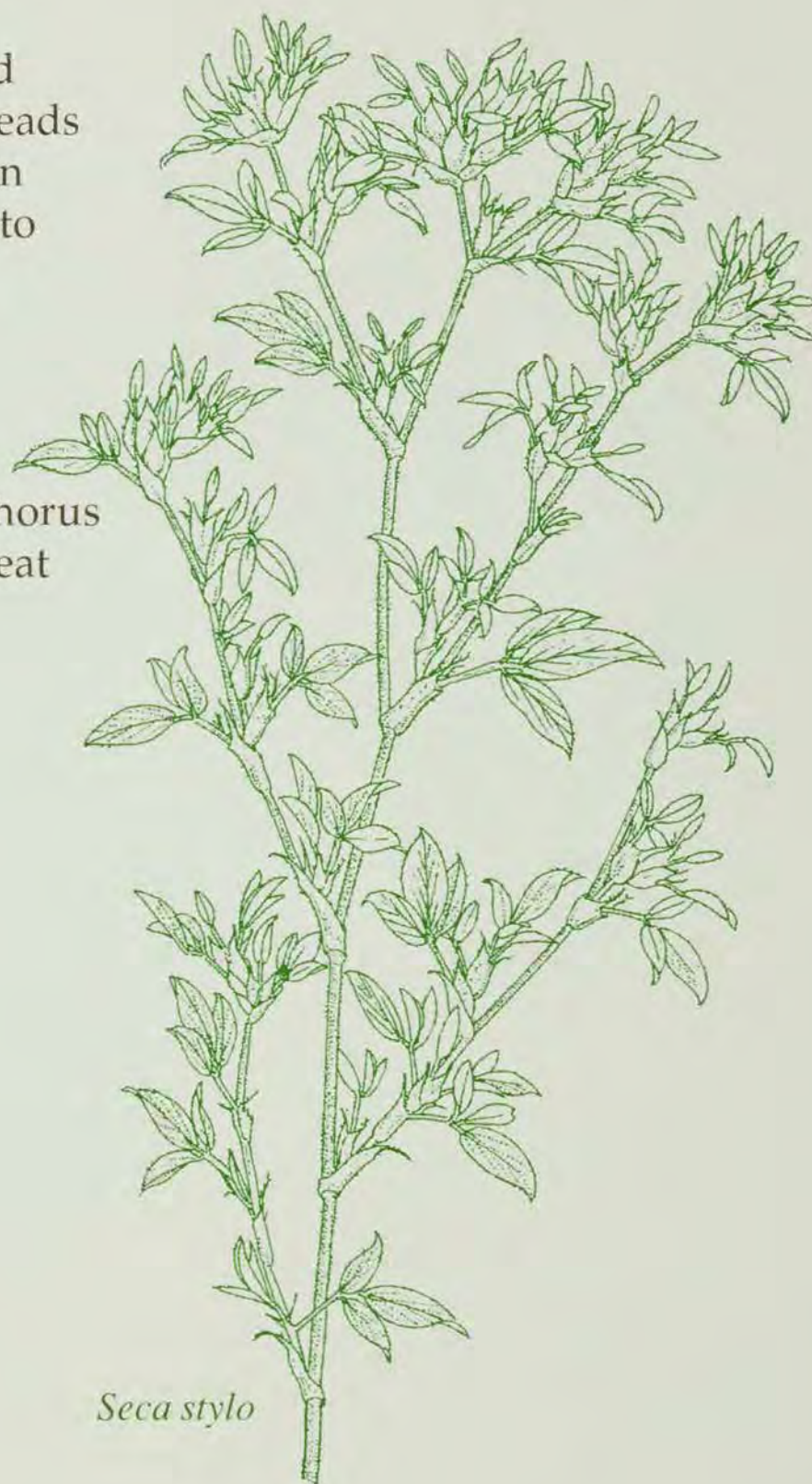
Stylos

There are many different species and types of stylo, each selected to grow under different conditions of soil and rainfall.

As a group, they are herbs (forbs) or small shrubs with branched stems and with pointed or elliptical trifoliate leaflets. The flower-heads are usually clusters of yellow or orange flowers on the ends of main stems or on stems arising from axillary buds. Each floret gives rise to a single seed, which is usually loosely held within the seed-head.

The stylos are not soft, lush, vigorous plants; they tend to be stemmy, hard-leaved, slow-growing—but tough.

Stylos will establish, grow and persist on our infertile soils without additional fertiliser—but they can respond to both phosphorus and sulphur. They are not highly palatable and, as cattle prefer to eat green grass early in the season, this helps them to persist well under grazing.



**Stylos —
tough plants
for tough country**

Who?

Who relies on stylos?



Bill Tincknell checks *Seca* stylo growth on Dagworth Station.

Stylos in the gulf

'We needed to improve our cattle and we knew native pastures couldn't do it. We thought stylo pastures could.'

So said Bill Tincknell of Dagworth Station before embarking on his pasture development program. Bill has oversown nearly 3000 hectares of native pasture with stylo, with plans for a further 1500 hectares over the next few years. He has identified a total of 8000 hectares as suitable for sowing with stylo.

Bill, together with his wife Frances and their three sons, runs Dagworth Station, a 976 square km (377 square mile) property situated about 60 km north-east of Georgetown in north Queensland's gulf country. Dagworth, with rainfall averaging 700 mm per year, straddles the Einasleigh River, but has little good river frontage. With its better granite soils carrying black speargrass, and its poorer soils carrying wire grasses, Dagworth has traditionally turned off 4½-year-old bullocks with a carcass weight of 220 kg for the US trade.

'We aim to use stylo pastures and a production feeding system to turn off steers with a carcass weight of 280 kg at 3½ years old,' said Bill. 'This will give us a lot more flexibility with our turn-off because we can target any market—live export, Japanese or Korean.'

No improvement from fencing alone

There were not many fences when Bill and his family moved to Dagworth in 1983. It is marginal country for beef production and Bill saw that, without improvement, the property could turn off only low-quality beasts. Bill found that the native grasses were depleted by the middle of the year and even subdivision of his better country could not improve his turn-off quality.

'It was hard to justify the cost of fencing only in terms of management gains with little or no improvement in quality or carrying capacity. Using stylo in our native pastures, we could grow more and better quality feed which makes the overall investment much sounder,' he said.

Weaners lost too much weight

'We also had a problem with our weaners. We supplemented them around the yards until they reached about 160 kg. Then when we bushed them, they lost so much weight through the dry season that they would never grow or breed well. We had to change the system to allow weaners to go ahead right throughout the year. Stylo pastures are important here because they grow later into the dry season and produce significantly more feed than normal native pastures,' Bill said.

The development program began in 1989 with a 200 ha weaner paddock being sown by tractor and with another 200 ha sown in a steer paddock in 1990. A total of 800 ha was sown in 1991—600 ha for the steers, 100 ha for the weaners and 100 ha as a multi-purpose holding paddock. Bill sowed another 1600 ha from the air over 1992 and 1993; these are for fattening steers in conjunction with a production feeding system.

2 of Seca, 1 of Verano

Bill sows his mixture of 2 kg of Seca stylo and 1 kg of Verano per hectare in October so that hard seed is softened by high soil temperatures. Despite the recent drought years, no plantings have failed although establishment has been slowed by the very short wet seasons. Seca has proven better adapted than Verano, and greatly out-yields it.

The best soils first

Apart from the initial planting, no fertiliser has been used; instead Bill has targeted his stylo plantings to his loose-textured red soils under open box woodland. These soils support vigorous stylo growth even though they are marginally phosphorus-deficient at 5 ppm P.

With production supplement

The most recent plantings will be grazed in conjunction with a production feeding system using molasses, protein meal and other supplements to allow stock to reach a desired target weight-for-age and quality. Some smaller stylo paddocks have been used to hold cattle as they are accumulated to reach the required number for sale, and have to hold large numbers of stock for a short time.

New plantings are fenced to allow the stands to thicken and for management. This fencing is a major part of the capital investment for stylo pastures; it may take 4–6 years before there is a return on the investment, depending on the wet seasons, particularly the first one.

More and better breeders

Bill reckons that, with extra development and subdivision, Dagworth can carry 2000 breeders and their progeny. By feeding them phosphorus in the wet season, vaccinating for botulism and weaning down to 3 months of age, he expects branding rates of close to 80%. He currently runs about 1500 breeders and brands around 70%.

‘But that’s a lot better than the 50% branding we were getting when we started here,’ he said with a grin.

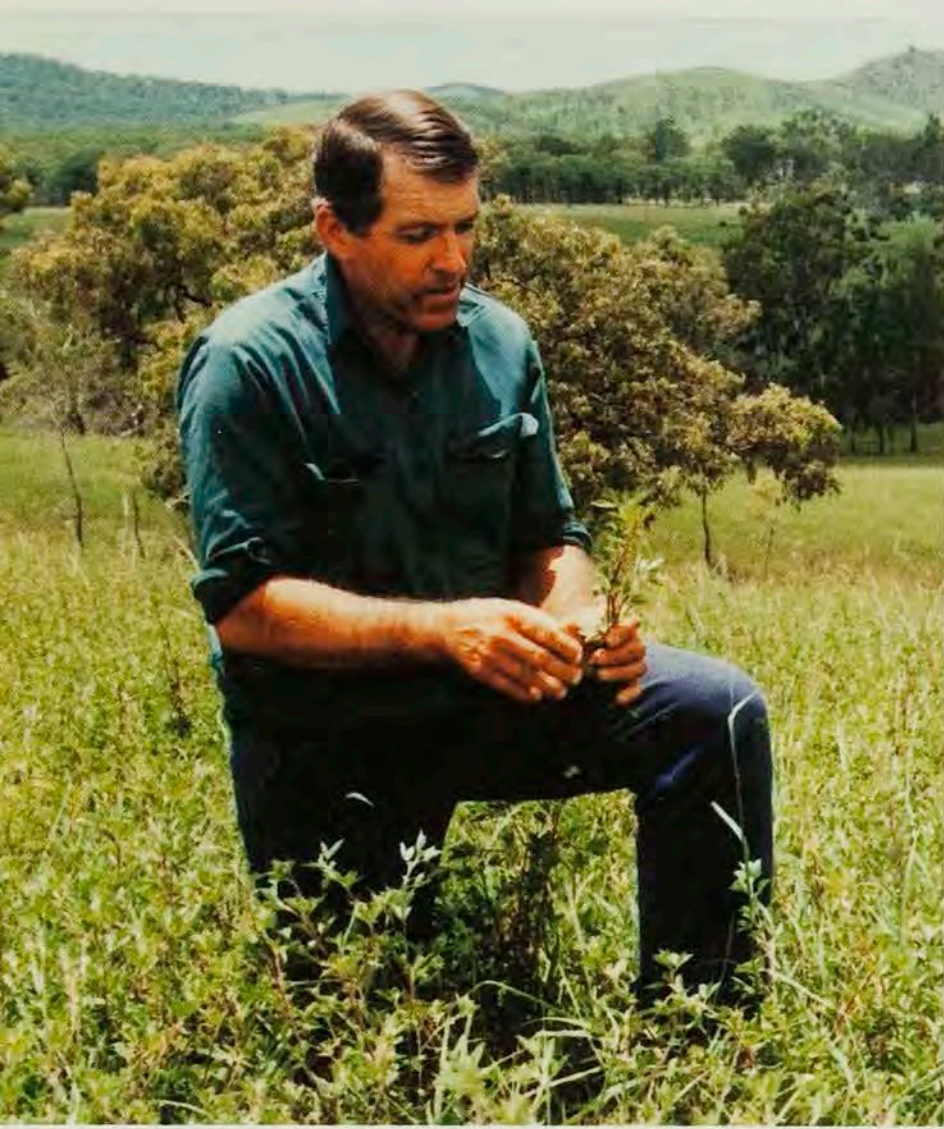
*A stylo pasture on Dagworth—
spelled over the wet season and ready
for the first muster weaners*



‘Stylo pastures are important here because they grow later into the dry season and produce significantly more feed than normal native pastures.’

Seca in central Queensland

'Seca keeps stock fattening for longer in autumn and holds their condition through winter.'



Tom Chapman inspects the Seca stylo in his native pasture.

Tom and Lynne Chapman run a herd of about 1000 Brahman cross breeders on 8000 hectares of typical central Queensland rolling speargrass country.

The Chapman family have owned 'Wycheproof', on the Calliope River just south of Mt Larcom, for over 30 years, but most of the ironbark and bloodwood timber was cleared much earlier this century.

Breeding and fattening are dependent almost entirely on black speargrass growing on shallow infertile duplex soils, but the low quality of feed had made it increasingly difficult to meet the market specifications for younger animals for Jap Ox and live export.

'Cattle gain good weight for four months, with marginal gains for the next four months. Then they lose condition over winter and spring,' says Tom. 'My options for pasture improvement here were limited by the poor soils. I tried many crops and pasture grasses and legumes over the years, but without much success. Seca seems to have more potential than most. It keeps stock fattening for longer in autumn and holds their condition through winter, stopping them going backwards.'

The Chapmans decided to give Seca a go in 1989 after they saw what a 40 ha MRC/DPI trial was doing for their animals after three years. 'We were turning off cattle 12 months earlier from the paddock oversown with Seca stylo.'

Since then, Tom has planted Seca every year except for 1991 and 1995. He has spread 3.5 tonnes of seed over some 1000 ha of country, but because of the dry seasons, much of it is just coming good after the rains of the 95/96 wet season. Tom puts the seed out through a fertiliser spinner over short speargrass in summer.



Steers off stylo pastures at Wycheproof

'I prefer to plant after a burn to reduce competition from the grass, with some seed going into every paddock for cattle to spread. I now plant the Seca only on the slopes and ridges as I very soon found out that it does not like the colder flats with heavy soil.'

'My biggest disappointment with Seca has been its slow establishment in the first year, although the dry years have not helped. This could put off some graziers who want quick returns. You have to be prepared to invest your money and wait for up to three years to see a return. But if you can afford to wait, you will get your reward.'

However, like most people who have tried Seca, Tom was surprised how well the small seedlings survive dry conditions. After good rain, they grow and eventually set seed.

'When you get up to 6–8 plants per square metre, you really start to get somewhere. It is surprising how quickly it will then spread through the dung. Once you get a good population, it really takes off.'

Seca should not be burned in the first three years or so after planting, and this initially interfered with Tom's burn-off of his speargrass each spring. 'However, this inconvenience is well worthwhile if you get a good stand of legume.'

Tom sees that the big advantage of Seca is that it puts 30–50 kg more weight on his animals each year, cutting 12 months off their age at sale. 'Seca will also hold cattle better during droughts, and we have had plenty of those recently. It has a deep tap-root, and it stays green during the dry.'

The drought has now broken and the Seca has come away beautifully. 'Paddocks which I thought were failures have Seca everywhere now. The seed I planted two years ago is still coming up.'

The Chapmans intend to continue planting shrubby stylo, maybe with aerial seeding in the future. They want all their cattle to be able to get a belly full of stylo.



Even small Seca seedlings can survive long dry periods.

'We were turning off cattle 12 months earlier from the paddock oversown with Seca stylo.'



Steers on speargrass and stylo at Wycheproof

Fine stem stylo in the Burnett

'Fine stem stylo has turned my forest country almost into the equivalent of scrub country.'



Wayne Moxham-Price inspects his Brahman- and Wagyu-cross heifers on Katambora rhodes and fine stem stylo.

Monto grazier, Wayne Moxham-Price, is aiming at the highest premiums for the top Japanese market for marbled beef, but he knows that his speargrass pastures on silver-leaf and narrow-leaf ironbark country can normally produce only store cattle.

'Fine stem stylo has turned my forest country almost into the equivalent of scrub country,' says Wayne.

Wayne and Judy Moxham-Price run 650 high-grade Brahman-cross and Wagyu-cross breeders on their 6000 hectare (15,000 acre) property 'Oakey Creek'.

'This sort of country can produce only store steers at a stocking rate of about 1 animal on 12 acres. With improved grasses and legumes, we can almost double the stocking rate and easily get Jap steer specifications. We also raise young well-grown steers which will produce well-marbled beef after 200 to 300 days in the feed-lot,' says Wayne. 'Under a particular set of conditions last year, we had the odd steer making Marble 3 straight off pasture.'

Wayne has improved pastures over about 15% of the property, and uses them :

- to produce 4–6 tooth Japanese bullocks of around 315–335 kg dressed weight
- to keep weaners growing without a check to 440 kg liveweight for the feed-lot
- to get his heifers in good condition for mating.

The best legume for our conditions

'Only fine stem stylo has survived over the last 20 years, and it has prospered under our hard conditions; it's hot in summer, cold in winter and the granite sands don't store any water. Siratro disappeared under heavy grazing many years ago; more recently, Wynn cassia died out during the drought.'

'Only fine stem stylo has survived over the last 20 years.'



Wayne checking fine stem stylo in his paddock

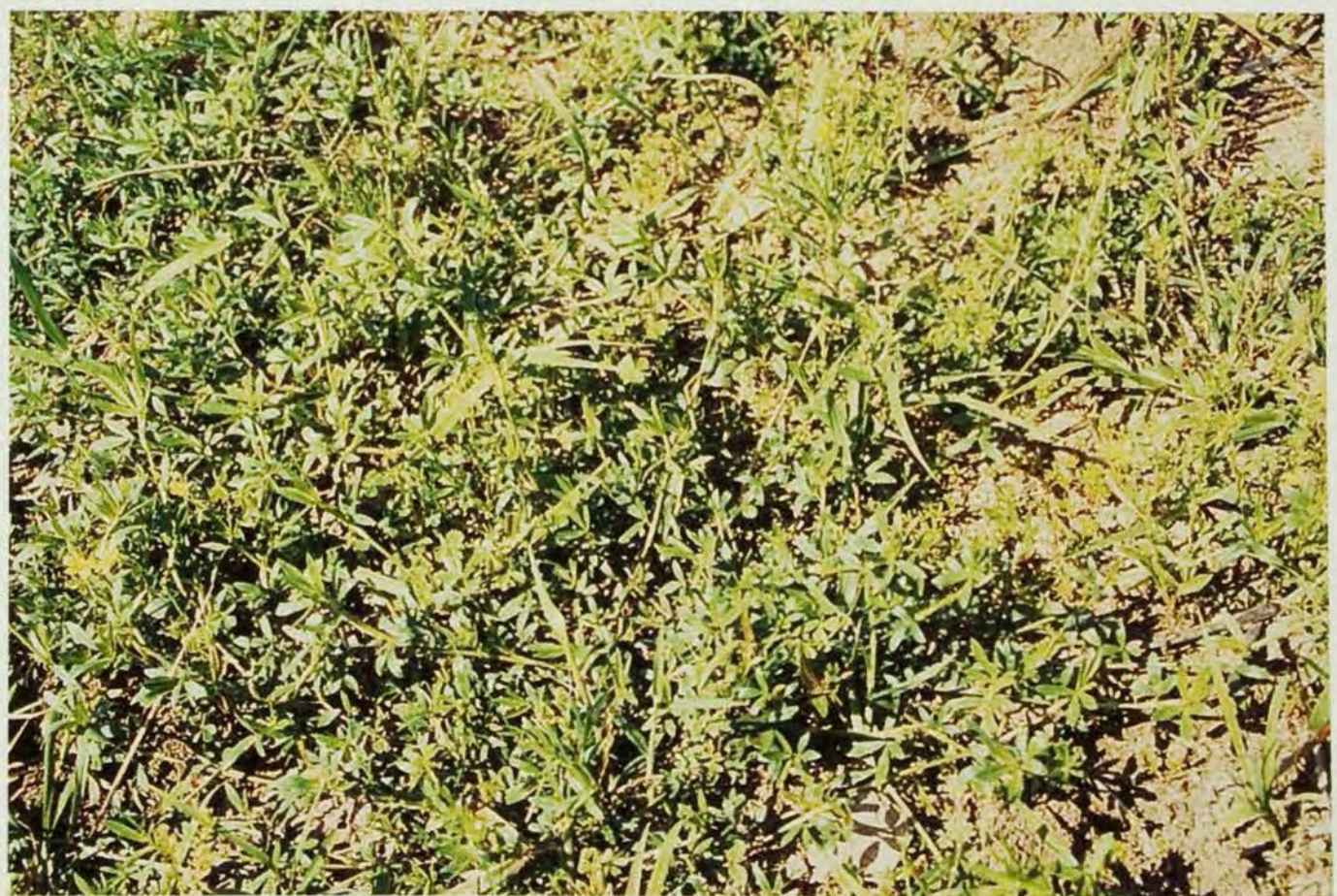
'Over twenty-five years ago, we had four short rows of experimental fine stem which spread down a gully. We hand-harvested an ice-cream container of seed with scissors for our first paddock planting.'

'Our soils have moderate levels of phosphorus, and we sow fine stem with Katambora rhodes and American buffel into fully cultivated seed-beds.'

A kilo a day over summer

'We weigh our steers on these pastures and have found they put on 0.9–1.0 kg a day over summer and, with plenty of cotton seed, meat meal and molasses supplement, gain about 0.6 kg a day over winter. We sell the tops in summer and the rest in the next spring.'

'I'm working out how to get fine stem into the large native pasture paddocks, but am a bit worried about the loss of speargrass after 4–5 years of drought. Without fire during the drought, woody regrowth has become a major problem; when I stick-rake the paddocks, I'll sow fine stem into the disturbed ground.'



Fine stem stylo plants and seedlings

Which?
Which stylo to plant?

The stylos you select to plant on your property must be adapted to your region and soil type. The best soils for stylos are generally light-textured with a sandy surface.

Seca, Siran



semi-arid tropics
and subtropics

Verano, Amiga



semi-arid tropics
(Verano dark, Amiga light)

Fine stem



sub-humid subtropics



Seca planted into speargrass in central Queensland.



Seca planted with buffel grass on lighter brigalow soils.

Shrubby stylo

(*Stylosanthes scabra*)

Cultivars **Seca** and **Siran**

- for the tropics and subtropics with a short rainy season
- wide range of moderate to well-drained soils
- very hardy against drought and grazing
- spreads quickly via stock
- regenerates from seed or basal branching.

The shrubby stylos are exceptionally hardy plants, ideal for extensive grazing where the growing season is short and unreliable—in the tropics south to about latitude 27°S, in districts with 600–1700 mm of rainfall. They will grow on a wider range of soils than the other stylos; although usually sown on infertile sandy-surfaced soils, they can grow on soils ranging from gravels to lighter duplex and even light brigalow clays.

The shrubby stylos establish easily. Although the young plants grow fairly slowly, even small seedlings can stand long periods of moisture stress.

As the name suggests, these stylos can grow into small well-branched, erect shrubs up to 2 metres high, but they are usually 30–80 cm high when grazed. Under heavy grazing, they develop a closely eaten crown on a single woody stem—bonzai stylo—but never seem to be eaten out.

Their deep roots can tap soil moisture well below the roots of grasses, allowing the plants to remain green well into the dry season and to persist through droughts. Light frosts will cut leaves and small shoots while heavier frosts and fire can kill the

whole plant or just the top-growth. Plants can reshoot from buds at the base, and regenerate from seed on the ground.

The shrubby stylos are eaten throughout the year. Cattle prefer green grass early in the growing season, but may eat up to 80% stylo in late summer.

In the subtropics, tall Seca plants seem to be more susceptible to frost and fire, more open to a leaf and seed-head fungus (*Botrytis*) if the autumn is especially wet, and may be less vigorous in the following year.

Varieties

Seca was originally very late flowering, but it has changed over the years; commercial Seca is now more leafy and will flower whenever there is moisture and warmth.

Seca has field resistance to the common types of anthracnose, but this comes from only a single gene. It could be devastated if a new race of anthracnose develops.

Siran is a leafier plant than Seca, and is a composite of bred and selected lines incorporating four sources of resistance to anthracnose. Siran should be included in stylo plantings to provide some insurance against devastation from a possible anthracnose attack.

Sowing recommendations for sandy soils

Tropical districts: 2–3 kg/ha of legume mix of 50% shrubby stylo (mainly Seca with 10–50% Siran) and 50% of a mixture of Caribbean stylo (Verano and Amiga) and Wynn cassia.

Subtropical districts: 2–3 kg/ha of a mixture of shrubby stylo, fine stem stylo and Wynn cassia.



Shrubby stylo – ungrazed ...

... and heavily grazed



Massive regeneration from seedlings



Seca reshooting after a fire

Caribbean stylo

(*Stylosanthes hamata*)

Cultivars **Verano** and **Amiga**

- for the tropics and warmer subtropics
- biennial or short-lived perennial
- for free-draining soils
- usually sown with shrubby stylos
- less stemmy and faster establishing than the shrubby stylos.

Verano thrives on sandy-surfaced soils in the hot tropics and warmer subtropics with 600–1700 mm rainfall; its limits are set by frosts or waterlogging.

It is a semi-erect well-branched small bush with narrow and pointed leaves; its fine stems have a very fine white down on one side (compare this with fine stem stylo which has long but sparse hairs). The flowering spike produces two seeds, one with a hook about 3–5 mm long, the other hookless.

Verano establishes more quickly than shrubby stylo, and can flower within 10 weeks. Under good conditions, most plants survive into a second year, and can flower within 6 weeks of the start of the season. Seed ripens 2 weeks after flowering, with a higher proportion of hard seed forming during hot weather. The main seeding is in autumn.

Verano often behaves as an annual after seeding heavily, and dead plants are replaced by new seedlings in the next wet season.

Verano is more productive than Seca in the first couple of years on soils with some fertility. It combines well with native grasses such as speargrass, with open naturalised grasses like urochloa, and with some improved species under moderate to heavy grazing. It does not like being shaded by tall ungrazed herbage, and may not re-establish from seed in a dense mat of Indian couch.

Verano and Amiga have moderate field resistance to anthracnose, but can be attacked if the weather is wet and humid at flowering time in March–April.

Varieties

Verano is the original and most common Caribbean stylo as described above.

Amiga is a newer cultivar selected to extend the area of adaptation into harsher (drier) and cooler (higher altitude) districts. Since it was released, drought conditions over much of Queensland have prevented any confirmation of the new regions of adaptation under commercial grazing.

Planting recommendations

In drier districts, Caribbean stylo is usually mixed with shrubby stylos; in wetter districts, it can be mixed with **Glenn** or **Lee** jointvetch and **Cook** common stylo.



Verano usually survives into a second year, but also regenerates from seed.

Urochloa can provide stability to Verano pastures.



Fine stem stylo

(*Stylosanthes guianensis* var. *intermedia*)

- for the subtropics
- for free-draining soils
- resistant to heavy grazing, fire and frost
- long-lived plants
- early and continuous flowering.

Fine stem stylo is the most subtropical of our stylos, and can be sown in frosty districts with an annual rainfall of 700–1100 mm. It grows only in well-drained soils, and has been the most successful legume on free-draining infertile granitic soils in the Wide Bay – Burnett district of south-east Queensland.

You can easily identify fine stem by its small pointed leaves and fine stems covered with sparse hairs about 3 mm long (these can be seen by holding the stem up to the light). The plant has a deep tap-root and a buried crown which protects it from fire, frost and heavy grazing.

Fine stem can be oversown into open grassland on sandy-surfaced soils, but establishment will usually benefit from some soil disturbance. In new ground, fine stem should be inoculated with 'S' group *Rhizobium* to improve growth in the first couple of years.

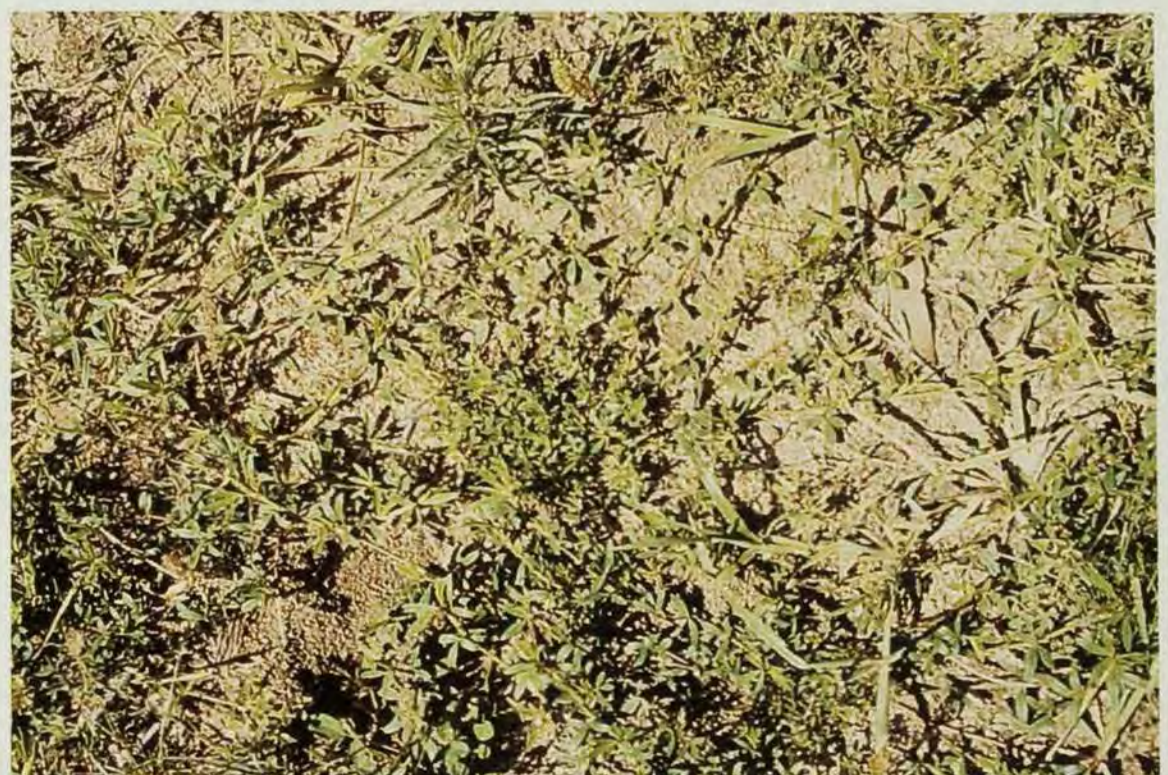
Fine stem is palatable and tends to be grazed heavily; this puts too much pressure on the associated grass plants, leading to patches of pure legume. Fine stem thrives under this moderately heavy grazing as it does not like being shaded. It can combine well with well-grazed sown grasses such as Katambora rhodes.

Fine stem flowers from September to May, with peaks of production in December–January and April–May. Even heavily grazed plants continue to set seed which is spread through the stock.

'Oxley' or 'Common'?

Commercial fine stem seed should be called 'common' and not 'Oxley'; there is now no certified Oxley seed. Fine stem seed was naturalised in the Gin Gin and Gayndah districts before cv. Oxley was selected, and commercial seed is derived from that source.

Fine stem stylo under grazing



Silver-leaf ironbark indicates the best soils for fine stem.



Fine stem has naturalised on granite country in the southern and inland Burnett.

Common stylo

(*Stylosanthes guianensis*)

Cultivar **Cook**

- mainly for the wet tropics
- tolerates low P and low pH soil
- sown as a pioneer legume with improved grasses.

The common stylos are true tropicals, growing poorly in cool weather, being easily frosted, and often flowering too late for the subtropics. Although recommended for the wet tropical coastal districts, they are fairly drought-tolerant, and can survive a long dry spell in areas with as little as 900 mm rainfall. They are very tolerant of low fertility and acidic soils.



Cook stylo is the best variety for the wet tropical coast.

Common stylo does not tolerate shading well, and prefers moderate grazing pressure in unimproved or fully sown pastures. It is not very palatable, and is not grazed much until late in the growing season. Grazed plants are likely to be 20–40 cm high and well branched, whereas ungrazed plants can grow 1.5 metres tall without much basal branching. Tall stands can be thinned severely if burnt, although they can recover from seed in open native pastures.

Common stylo combines well with erect or clump grasses such as guinea or setaria, but not with signal or humidicola. Common stylo soon disappears under heavy grazing; grazing pressure should be adjusted to keep the grass vigorous to prevent weed invasion.

Common stylo does not fix large amount of nitrogen, and it may take four years before any effect is seen in the companion grass.

Varieties

Seed of **Cook**, the most anthracnose-resistant variety, is available sometimes. The stems and leaves of Cook are densely hairy and sticky, and it can be identified by its bright red stipules (which wrap round the stem at the base of side branches). Cook is fairly tolerant to water-logging, and has been the main species for forest and tea-tree country of the wet tropical coast. Little of this land is now being developed for pastures.

Graham is a more productive variety adapted to a wider area, and has persisted under grazing as far south as Miriam Vale. However, seed is seldom available because anthracnose is rife in dense seed crops in the high rainfall seed-producing districts.



Most varieties have succumbed to anthracnose. There is little new development of wet tropical coastal land for pastures.

Aff. scabra

(*Stylosanthes* sp. aff. *S. scabra*)

Aff. (affinity) means that the plants are of a stylo species close to, but not quite the same as, the usual *scabra* types. They may eventually be given a separate classification, but presently do not even have a common name. Two cultivars will soon be released, and are likely to be called **Unica** (CPI 110361) and **Primar** (CPI 92838B).

- intermediate in morphology between shrubby and Caribbean stylo
- suitable for clay soils
- more cold-tolerant than shrubby or Caribbean stylos
- early flowering, and prolific seeding
- highly specific *Rhizobium*.

The 'aff. scabras' are a new type of stylo intermediate in shape and growth between the shrubby stylos and the Caribbean stylos. They are more strongly perennial than Caribbean stylo, but finer stemmed than the shrubby stylos. They will complement the shrubby stylos on medium fertility soils in the subtropical regions too cold for Caribbean stylo.

The selected accessions of 'aff. scabra' are showing better frost resistance, survival, seedling regeneration and yields than the existing stylos, while their resistance to anthracnose is similar to that of *Seca*. They can withstand early winters and tolerate drought because they seed early and prolifically.

The 'aff. scabras' will grow in 500–1000 mm rainfall country, and on heavier soils than the other stylos. They are thus suitable for the lighter brigalow clay soils, the rolling downs of the Central Highlands, and also for other soils of moderate fertility such as box–belah and box woodlands. Experimental plantings as far south and west as the Maranoa have survived winters and are showing some promise as summer legumes for that district.

The 'aff. scabras' selected for clay soils have a highly specific *Rhizobium* requirement, and must be inoculated. Failure to nodulate can result in thin pale growth, poor branching and low seed-set, but this may be masked in early years when planted in clay soils with moderate levels of available nitrogen. The release of 'aff. scabras' was delayed until a suitably persistent strain of *Rhizobium* was identified, and better survival could be ensured for inoculant on seed sown into hot, dry soil.

Unica is more suited to the northern end of the aff. scabra region, for example around Springsure or Nebo; **Primar** is likely to be better in the subtropics.

'Aff. scabras' must be inoculated. Check these plants in sand culture – from left to right: nitrogen fertilised, inoculated, not inoculated.



Clay soils in the subtropics



'Aff. scabra' is mid-way between the shrubby and Caribbean stylos.



Townsville stylo

(*Stylosanthes humilis*)

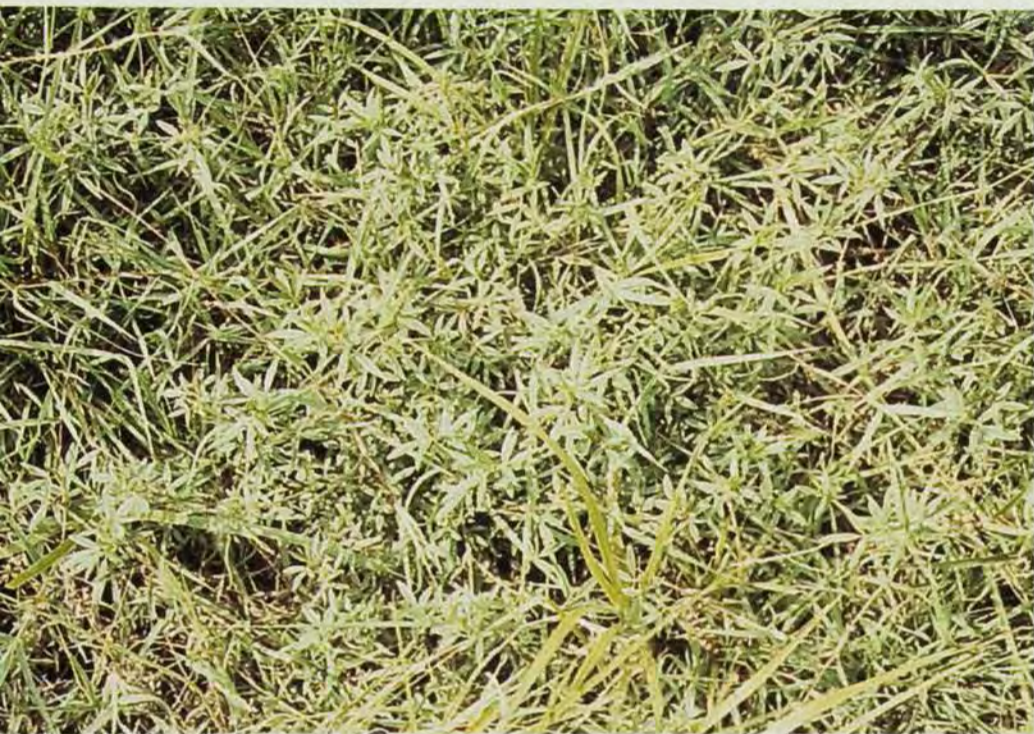
- our first grazing stylo
- naturalised in northern Australia
- commonly seen on roadsides
- highly susceptible to anthracnose
- no longer sown but still valuable.

Townsville stylo spread rapidly after being accidentally introduced into Queensland early in the century; it was recognised as valuable cattle feed in the seasonally dry tropics as early as the 1920s.

Townsville stylo is a low-growing annual with narrow stems, narrow pointed leaves, and yellow flowers which develop into hooked seeds. Seeds in the soil germinate at the start of the wet season and the plants flower again from March to May. It prefers freely draining light-textured soils, but will grow on some heavier soil types.

Townsville stylo cannot tolerate shade and so grew well in heavily grazed native pastures. Under heavy grazing perennial native grasses were replaced by annual grasses, leading to bare ground over every dry season.

Although it is no longer used as a commercial legume, Townsville stylo is naturalised in many districts and is commonly found on roadsides. It can provide useful feed but, in those wetter years when it grows vigorously, it usually gets wiped out in mid-summer by anthracnose.



Townsville stylo is still common in the north but succumbs to anthracnose in wet summers.



Townsville stylo pastures in the 1970s. Now as then, stylos can encourage overgrazing of native pastures unless stocking rates are managed.



Where? Where did they come from?

Our stylo varieties in Australia did not just appear out of the blue, nor are they derived from imported commercial varieties.

The release of a new stylo is the result from a long period of plant introduction, accession evaluation, seed multiplication and finally commercial production. It may take 10–12 years from start to release, and many more years before graziers have planted areas large enough to have an impact on overall animal production.

Plant introduction and evaluation

Our new pasture plants start with the collection of germ-plasm from regions where likely species are native—South and Central America for stylos.

Accessions. Seeds of selected plants are forwarded to quarantine in Australia, and given a CPI (Commonwealth Plant Introduction) accession number—Seca started as CPI 40292 while Unica aff. scabra was developed from a single seed. Some seed is kept in cold storage, some is planted out.

Evaluation. Seedlings are raised in pots in the quarantine glass house, then planted out in the field as spaced individual plants. Details of their morphology, date of flowering, disease resistance and general vigour are recorded.

Seed increase. The few grams of introduced seed must be increased. When there is enough seed from these promising lines, it is used for regional field testing over a wider range of environments. The top selection of a new species may be tested under grazing to check its acceptance, persistence and the benefits to animal production.

Release

When proven, the new species or type is released as a cultivar (cv.) with the breeder seeking Plant Breeders Rights (PBR). Seed production and marketing rights are licensed to private industry. The licensee increases the seed to commercial quantities, and the new cultivar of stylo is on its way to the market.

Extension

Now begins an extension programme to show graziers the expected benefits of the new species, and to demonstrate what may be new technology and systems of management.

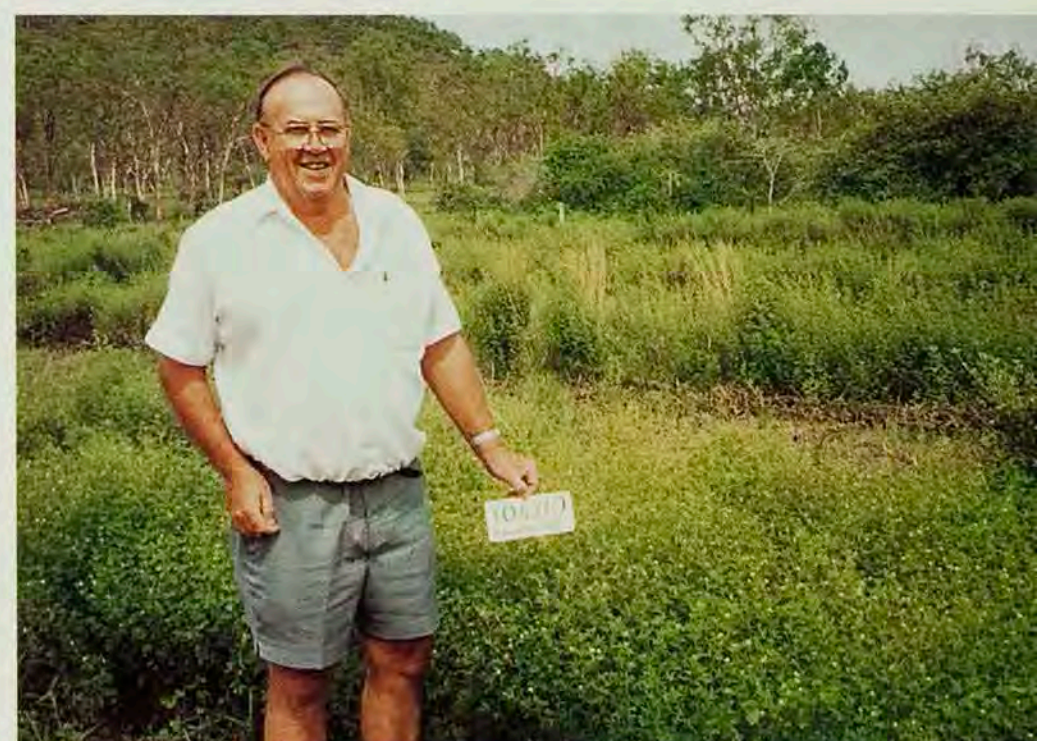
Extension work includes demonstration sites, field days, and leaflets and written material, and is carried out by the DPI, CSIRO and seed companies, sometimes with the help of funding from the Meat Research Corporation.



Our varieties started as selections from wild plants in South and Central America



Hundreds of individual plants are evaluated



Les Edye, who has championed stylos since the early days, checks an 'aff. scabra' in a regional trial

Anthracnose



Anthracnose lesions on stylo



Anthracnose wiped out Fitzroy shrubby stylo as a commercial variety.

Stylos have been planted over 1 million hectares of northern Australia and, with seed production at 100–150 tonnes a year, a further 100,000 hectares are being planted each year. The future for pasture development looks good as long as new virulent strains of anthracnose do not evolve.

Anthracnose could wipe out many of our stylos, and so poses the major threat to those extensive plantings.

Take the example of Townsville stylo, once planted or naturalised over nearly 2 million hectares of tropical Australia. Anthracnose was first recorded on stylo here in 1973, and within a few years had wiped out Townsville stylo as a reliable productive legume. Townsville stylo can still be found, becoming quite vigorous early in a good wet season—before it collapses from anthracnose.

Anthracnose on Fitzroy shrubby stylo virtually wiped out stands of this leafy plant just a few years after its release, and when anthracnose lesions appeared on Seca in 1980, the future for stylos started to look bleak.

A breeding program to develop broad-based resistance was started; this would reduce the chances of a virulent specialised line of anthracnose evolving.

Fortunately anthracnose on Seca has not evolved in virulence since then, possibly because commercial Seca is itself quite diverse genetically. Natural outcrossing within the Seca population may keep re-patterning its resistance and so slow down the evolution of virulent lines of anthracnose.

Anthracnose types and races

The two types of the anthracnose fungus (*Colletotrichum gloeosporioides*) that attack stylos here are different from those that damage many other plants such as mangoes and avocados.

Anthracnose **Type A** is our most serious threat. The four races found here can attack many of the stylos, including Seca and Verano. Type A produces lesions with a well-defined dark margin, but a light centre, on leaves, stems and seed heads.

Anthracnose **Type B** affects common stylo and a small number of other stylos. Again four races are found in northern Australia. Type B causes irregular dark lesions on any part of the plant; if a lesion girdles and 'ring-barks' the stem, the tips of the branch wilt and die, giving a blighted appearance.

Limiting future damage

Research to ensure develop new sustainable varieties of the different stylos is running along a number of different tracks. These include:

- continued selecting from plant collections
- breeding for anthracnose resistance
- genetic engineering.

Selection

Selection from plant collections has given us our existing varieties, including Seca, Amiga and the new 'aff. scabras'. But Seca's resistance to anthracnose comes from only a single source of resistance, and subsequent testing of another 300 accessions of *S. scabra* has shown nothing better adapted or more disease-resistant than Seca.

Higher yielding accessions of *S. hamata* with good field resistance to anthracnose could provide replacements for Verano and Amiga if these succumb to the disease. Evaluation of *S. hamata* accessions from the high-altitude tropics has not turned up any good lines for the subtropics, so collecting from subtropical South America may yield more useful material.

Introduction of selected *S. guianensis* lines from Brazil may provide resistant common stylos for the higher rainfall areas.

Breeding

Siran is a **composite** or mixture of one selected and two bred lines of shrubby stylo, and incorporates four of the original sources of resistance. Although Seca and Siran have similar low levels of field disease at present, the three extra sources of resistance act as insurance in case the Seca race becomes more virulent.

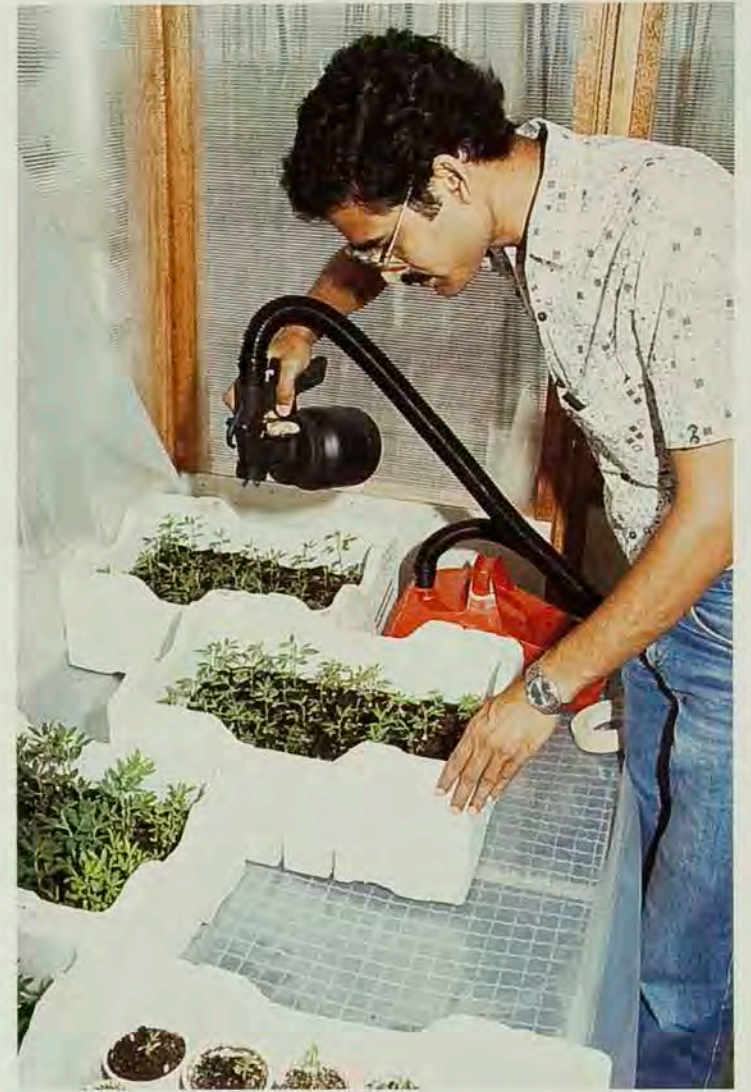
A second strategy involves **intercrossing and selecting** lines with partial resistance to develop a broader-based resistance. After three cycles of crossing and selecting, lines are now being tested in regional trials in Australia, and are being exposed to anthracnose populations in Brazil, the centre of origin for our shrubby stylos and the fungus.

A third approach is to **pyramid** genes which have major effects on resistance into a single cultivar; this is now possible through the use of linked DNA markers.

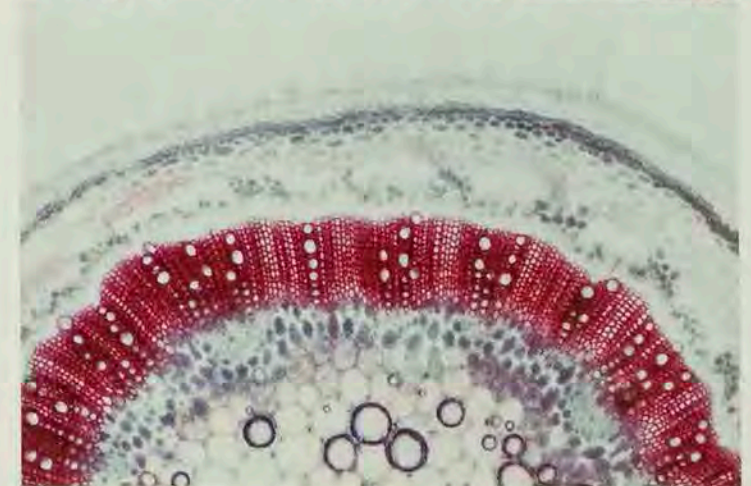
Genetic engineering

Rapid advances in the understanding of the structure and functions of genes allow molecular biologists to transfer genes from one species to another quite different species. Native Australian plants are being screened for proteins with strong anti-fungal properties. Once the protein peptides have been characterised, their genes can be cloned and inserted into the stylo plant. The transformed plants must then be tested for resistance to fungal attacks.

Some plants rapidly induce peroxidase enzymes at the leaf surface to defend themselves against fungal infection. Research is focusing on cloning these peroxidase genes, and finding out how they will act in transformed stylo plants.



Dr Sukumar Chakraborty inoculates stylo seedlings to test for resistance to anthracnose.



Genetic engineering—stained sections of stylo stem showing lignin composition altered by reversing a gene responsible for lignin synthesis. Transformed stylo may be more digestible.

How?

How to establish stylos

How do I establish stylos?

Stylos are not difficult to establish, but you should be aware of the following points:

- much of the seed will not germinate immediately—'hard' seed
- seed planted too deep will not emerge
- legume seedlings have to compete with existing grasses.

'Hard' seed

'Hard' seed has an impermeable seed-coat which prevents water reaching the embryo and starting seedling development. This natural survival mechanism prevents all seeds germinating with the first shower—and possibly dying if there is no follow-up rain.

Freshly harvested stylo seed may be 90% 'hard', and will usually need to be treated.

What proportion of hard seed should I sow?

The desirable proportions of 'hard' and 'soft' seed will depend on the conditions expected after planting.

Seed oversown in a paddock in the tropics a month or more before the start of the wet season should have a high proportion of hard seed; seed sown into a fully cultivated seed-bed with good soil moisture should have more 'soft' seed.

There are several ways to break hard seed, but all involve damaging that hard impermeable seedcoat.

Seed treatment

Treatments include:

- mechanical scarification by abrasion or hammer-milling
- heat treatment with hot water or dry heat.

Mechanical scarification. Seed merchants can mechanically scarify your seed to your order.

You can scarify your own Seca seed by putting it through a hammer-mill. The mill should have a hammer speed of 1500 rpm, and should use a small-holed screen (3 mm round hole) brazed onto the normal 12.5 mm sieve.

Heat treatment. Heat causes the seed coat to swell and crack.

Hot water. Shrubby stylo seed can be heat-treated by being dipped in hot water (80°C) for 4–5 minutes. A front-end loader can be used to lower seed in a hessian bag into a drum of hot water (with 10 litres of water for each kg of seed to prevent cooling). After 4–5 minutes, the bag is raised to drain, then the hot wet seed is spread out over a concrete floor to cool and dry.

Hot surface. Seed (especially of fine stem) is poured slowly down an inclined, revolving, heated steel cylinder. The angle of inclination of the cylinder determines how long the seed stays in the hot cylinder, and hence the degree of heating.



Dr John Hopkinson developed this modified hammer-mill to speed up treatment of hard stylo seed.



Col Paton found this revolving heated cylinder gives the best results with fine stem stylo.

Heat it or beat it?

Heat treatment ruptures that part of the seed coat where water would naturally enter—the strophiole. Water enters the rupture only slowly, and seed germination may be staggered over a period of weeks. On the other hand, water enters very quickly through a seed-coat fractured by mechanical scarification; germination is almost immediate after wetting.

Thus heat-treated seed may be safer for southern districts where the start of the wet season is prolonged, whereas mechanically scarified seed is better for the north where the start to the monsoon is more reliable.

How long can I store treated seed?

Treated seed can be stored almost as long as untreated seed provided it is dry.

Do I need to inoculate?

Shrubby and common stylos are rarely inoculated; they use the common strain of *Rhizobium* usually present in the soil. Fine stem is more specific and inoculation with 'S' strain inoculum (CB82) will improve early nitrogen fixation.

Caribbean stylo performs best with a slightly different *Rhizobium* (CB1650) used in the 'Verano' group, and this should be used when Verano is first sown into a new area.

The new 'aff. scabras' are highly specific and show pale spindly growth without the correct *Rhizobium*. The problems of keeping alive the inoculant on a seed sown into dry soil have delayed the commercial release of the 'aff. scabras'.

A sticker (methyl cellulose) should be used to hold the bacteria onto inoculated seed. You can order packets of sticker from your seed merchant when you order the inoculant. Dissolve the sticker in water as instructed on the packet, add the peat-based inoculant, pour the paste over the seed and mix thoroughly. Spread the seed to dry under cover, and sow as soon as possible. Sprinkling dry inoculant powder over the seed in the seed-box is much less effective.

Do I need to pellet seed?

Some form of pelleting may be developed to protect the inoculant on aff. scabras seed, but the other stylos rarely need it.

What sort of seed-bed is needed?

All pasture seeds will establish better in a fine firm seed-bed, but most stylos are sown into native pasture with little or no cultivation.

Stylo seed is usually broadcast into undisturbed and timbered country in the monsoonal parts of northern Australia because the wet season there is reliable. The vegetation and soil are usually disturbed first in more southern regions where the rain is less reliable.



Effective nodules are about 2 mm in diameter and have a pink centre.



Oversowing is more reliable if the soil has a coarse sandy surface.

Planting in monsoonal regions. Shrubby and Caribbean stylos are often oversown about a month before the break of the wet season.

Oversowing is more successful if:

- the soil has a fairly coarse sandy surface that does not set hard
- the native pasture has been burnt or heavily grazed
- rainfall persists once the wet season breaks
- there is enough soil moisture for both established grasses and the legume seedling.

Planting in the south. Oversowing in the south is less successful because early rains in November are often followed by heat waves.

The existing grasses take the soil moisture needed by the establishing seedling unless they have been checked with one or two passes with discs or a chisel plough.

What sort of planter is needed?

Stylo seeds flow reasonably freely, and can be sown through any seeder or spreader. Fertiliser spinners, aircraft spreaders, old combines with seed tubes hanging loose or removed, rolling drum seeders, C-seeders, Crocodile seeders and Band-seeders have all been effective.

Stylo seed does not spread well if just tipped down a tube out of an aircraft at low altitude; seed should be put through a spreader or applied from a higher altitude for better coverage.



Seed can be spread over undisturbed or disturbed seed-beds.

Clockwise: fertiliser spinner; aerial seeding; rolling drum seeder with brigalow blade plough; Crocodile seeder.

How should seed be planted?

Do not plant stylo seed *into* the soil; the seedlings cannot emerge if the seed is planted deeper than 10 mm. Seed left on the surface will be washed in by heavy rain, or it can be pressed into loose fluffy soils with a rubber-tyred roller.

Covering with harrows, chains or tree branches may bury seed too deep, and is unnecessary.

The Band-seeder uses tynes to bury fertiliser in a furrow before seed dropped onto the furrow surface is pressed into the loose soil by a concave rubber press-wheel. A band of herbicide is then sprayed to kill the existing grass without disturbing the soil.

Stylo seed can be mixed with sawdust, sand or fertiliser for ease of calibration of low seed rates. Check how far a spinner will throw the stylo seed.

Do I need to apply fertiliser at planting?

If you improve your best soils first, you may not need extra phosphorus. On poorer soils, fertiliser may help the stylos to establish faster and set seed earlier and more heavily.

Apply some phosphorus (for example 60–100 kg/ha super or 30–50 kg DAP) if:

- soil P levels are below 4 ppm
- seed of improved grasses is also sown.

Check the section on supplements and fertiliser.

When can I start grazing?

Graze as normal, or even heavier than normal, after planting to reduce competition from the grass. Destocking later in summer will allow the stylos to set and drop more seed.

Stock should be kept out for a couple of months if stylos are sown into heavily disturbed seed-beds, and when grass seed is sown.



Allow new plantings to drop plenty of seed before you burn.



Most seed is spread through the paddock in dung.



Strip plantings of fine stem stylo through killed timber

Other ways to establish stylos

How effective are strip plantings?

Planting stylo into cultivated strips through native pasture is cheaper than cultivating the whole area. The legumes establish well and spread into the undisturbed areas.

However, stock may concentrate on the 'sweeter' grass in the disturbed strips, and trample the legume seedlings.

What about feeding stylo seed to cattle?

Most stylo is spread through the paddock through animal dung. Cattle eat the legume seed-heads as they graze, give it some acid treatment on the way through the intestine, and pass it out in dung. The seedling then has a little nutrient-rich oasis in the dung-pat.

Feeding stylo seed directly through the animals' supplement in late winter or spring results in far fewer seeds in the dung, and only about 30% of these remain viable. Much of the viable seed ends up in cattle camps or around troughs where seedlings cannot survive.

Feeding stylo seed to cattle is cheap, but it's a slow way to get effective amounts of legume into the pasture.

What about mother or pilot plots?

Mother plots. Mother plots are small fenced blocks into which stylos are planted into a prepared and fertilised seed-bed. The gate is opened in autumn, stock graze the seed-heads and spread the seed throughout the paddock in their dung. The speed of this spread depends on the size of the plots.

Pilot plots. Larger 'pilot' plots have been more successful in northern Australia. John Rains of Southedge, Mareeba, recommends planting a block covering 10% of the paddock, and siting it well away from water points.

Good establishment and growth within the block is encouraged by:

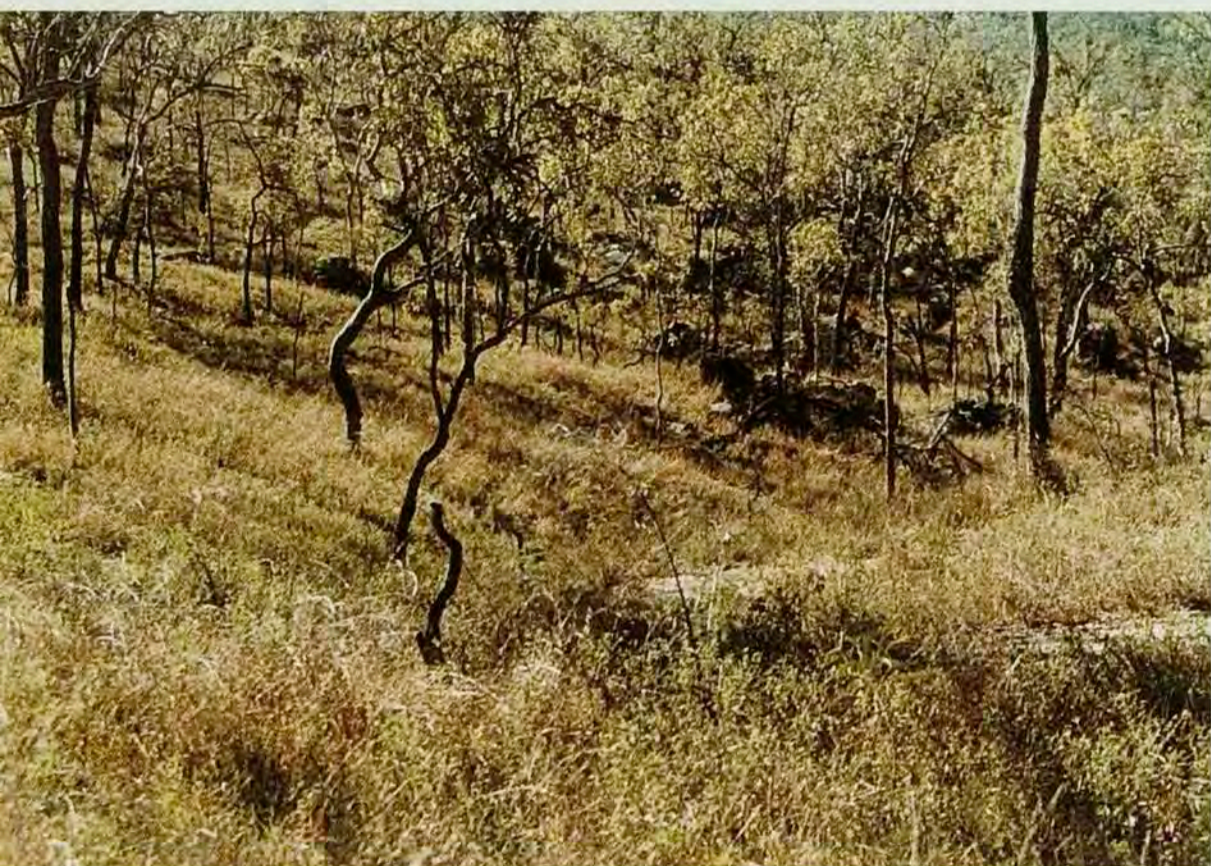
- soil disturbance with discs or Crocodile seeder
- higher seed rates (4–5 kg/ha)
- mixture of species (Seca, Verano, Wynn cassia) plus some urochloa grass (1% by weight)
- fertiliser if needed
- fencing and grazing control.

The pilot plot is locked up until autumn when cattle graze the seed heads; they spread seed over the rest of the paddock as they walk to water.

The slow build-up of stylo after oversowing low rates of seed over large paddocks often failed to convince graziers of the legume's value. Planting the same amount of seed into a small area and allowing the plants to grow and seed fully acts as a powerful demonstration of the benefits of stylos.



Sow 10% of the paddock for an effective pilot plot.



Cattle spread this stylo into unsown rough grazing.

How?

How to graze stylos

Stylos are tough plants and can survive most grazing management without special treatment. They are not over-palatable, they can withstand heavy grazing, and they set plenty of seed.

However, moderate grazing and no burning in the first years can speed up the increase in the legume population, and so shorten the time before cattle start to benefit.

Other management practices may help to maintain a better balance between legume and grass.

Legume survival may be less of a problem than legume dominance—it's the grass that may disappear.

What management practices are important?

Grazing management practices that can affect your pastures include:

- stocking rates
- burning
- spelling
- fertilising
- sowing grazing-tolerant grasses.

Animal management practices affecting pastures include:

- providing phosphorus supplements
- providing nitrogen supplements.

Why is stocking rate so important?

Stocking rate has the overriding influence on the condition of your pasture and on the performance of your animals. Only with moderately low stocking rates can each animal select a good diet out of the rough pasture and gain good weight—without losing the native grasses.

Stock at a rate that will allow your steers to gain that extra 40–50 kg each year and so meet your target weight for age.

Fertilising will grow more feed and allow more stock to be carried, but you may need to plant a grass able to stand the heavier grazing.

Use stylo pastures to put more weight on each animal rather than carry many more stock.

How much legume is needed to improve animal performance?

Extensive plantings that start with only 2 plants in 10 square metres may not noticeably increase animal production. Animal production will improve after the legume content of the pasture reaches about 10%, and keep improving with more legume.

Animal growth rates from pastures with 60% stylo have often been better than from those with 20% stylo.

With a good reservoir of seed in the soil, stylo is almost indestructible—it's the grass that may disappear.



Moderate stocking rates allow animals to gain target weights and maintain grass/legume balance.



Grazing must be managed to prevent legume dominance.



50% grass – 50% legume will keep good ground cover.

What is a good balance of grass and legume?

A 50–50 balance of grass and legume will keep a good ground cover. The balance will be affected by seasonal conditions and soil fertility, but moderate grazing pressure will help maintain the native grasses.

What happens to a heavily grazed stylo pasture?

Most graziers increase their stocking rates in stylo pastures. But beware—overstocking, especially in spring, can soon result in the loss of the best grasses. Under heavy grazing, the palatable perennial grasses can set little seed and will be replaced by unpalatable wire grasses, small annual grasses and forbs, or by bare ground.

The well-adapted stylos keep seeding. Within five or six years, the population may increase from 1–2 plants per square metre to more than 15—with hundreds of seeds per square metre in the soil ready to germinate.

Stylos can dominate your pasture under heavy grazing.

What's wrong with too much legume?

When the legume gets to be more than 50% of the pasture, the good grasses are put under too much pressure and decline. Stemmy shrubby stylo offers little protection from heavy rain, and once ground cover on these sandy-surfaced soils drops below 40%, run-off and loss of topsoil increase dramatically. Less water infiltrates the soil and pasture growth declines further—the pasture system has become unstable.

Similar problems arose in the past when grasses were completely grazed out in Townsville stylo paddocks.

How do I keep the grass–legume balance?

From the start, you must not overgraze your pasture during summer. Once you have lost your good grasses, it may be difficult to recover the balance.



Sandy-surfaced soils will wash quickly without a grass cover.

*Burning before the pasture has gone too far will check *Seca* and encourage grasses.*



What can I do to get grass back?

Burning will encourage grasses and thin out excess stylo, but you may need to spell the paddock in summer to accumulate enough fuel to burn. The lack of fire in many well-grazed pastures has also allowed woody species to increase. After a hot fire that kills most stylo plants, the pasture will have to re-establish from seed—with an appropriately reduced stocking rate.

Spelling and resting the paddock in summer will allow the grasses to seed, and permit burning. Spelling and burning every 5–7 years will control woody species and reduce shrubby stylos, but the grasses must also be allowed to recover after a fire.

Fertilising with phosphorus may encourage grasses like Indian couch and urochloa on soils with moderate (5–6 ppm) phosphorus deficiency. As stylos are more efficient at extracting phosphorus than grasses, total legume dominance under moderate grazing may indicate phosphorus deficiency.

Once you have lost your grass, it may be difficult to get it back.



The paddock on the right received one application of 10 kg /ha P four years previously.

The other solution to stylo dominance is to introduce grasses more tolerant of heavy grazing.

Which grazing-tolerant grasses could be useful?

There are several grasses that could be seeded into stylo pastures to provide better stability, but the best choice is not yet clear—much depends on the basic fertility of the soil. Seca will grow in soil that has too little phosphorus for some improved grasses.

It may not be possible to get an instant pasture by oversowing grass seed into an undisturbed seed-bed, some grass plants will establish and, with extra phosphorus, they will gradually spread.

In the Charters Towers district, oversown American buffel grass and urochloa established and grew so well on high-phosphorus basalt soils that they started to suppress the



Indian couch combines with Seca but may suppress Verano seedlings.



Compare this Seca/urochloa stand with the Seca/bare ground stand on the right ...

... where the native grasses could not stand the heavy grazing possible with stylo.



stylos. These grasses also increased on the poorer red sandy duplex soils when super was applied. Callide rhodes and Hatch creeping bluegrass were not successful.

Urochloa is naturalised along roadsides and in paddocks in many districts; adding 10% urochloa grass seed to a legume mix may allow a few grass plants to get started in the paddock.

Indian couch will probably colonise many stylo pastures. It is less productive and less drought-tolerant than urochloa or buffel, but it will probably spread faster under poor conditions. The common Bowen strain goes to seed very quickly after rain; Keppel, Dawson and Medway may be better.

Indian couch combines well with Seca, but may suppress Verano. In wet years, the dense couch stops new Verano seedlings establishing. Stylo seedlings may re-establish after drought conditions when the mat of Indian couch retreats to open-spaced crowns.

If you are carrying a beast to 2 or 2½ ha, you should plant a grazing-tolerant grass, and can justify some inputs to establish it.

Researchers are checking grazing-tolerant grasses; some of the creeping *Digitaria*, *Urochloa* and *Bothriochloa* grass species may be found suitable for sowing with stylos.

Add 10% grass seed to your stylo seed mix when you plant. You can also justify sowing a grass later if your stock are growing well at high stocking rates.

New species under test—this creeping urochloa could be suitable for stylo pastures and for rehabilitating mine lands.



What P?

When phosphorus is deficient

Stylos are the best legumes for infertile country because they can grow in soils with very low levels of phosphorus. But once stylos increase the amount of nitrogen in the diet, stock on native pastures will respond to extra phosphorus.

Although stylos will grow on very poor soils, you are still better off to target soils with more than 4 ppm available phosphorus for your pasture improvement.

When do I need to supply phosphorus?

Seca may grow in soils with less than 4 ppm phosphorus, but if the phosphorus level is:

- below 4–5 ppm, both plants and animals need extra phosphorus. Stylo may be difficult to establish and even when it does grow, stock will perform poorly—but respond dramatically to P.
- between 4 and 8 ppm, stylo will be more vigorous, providing extra protein—the animals can use extra P.
- above 8–10 ppm P, there is enough phosphorus for both stylo and animals.

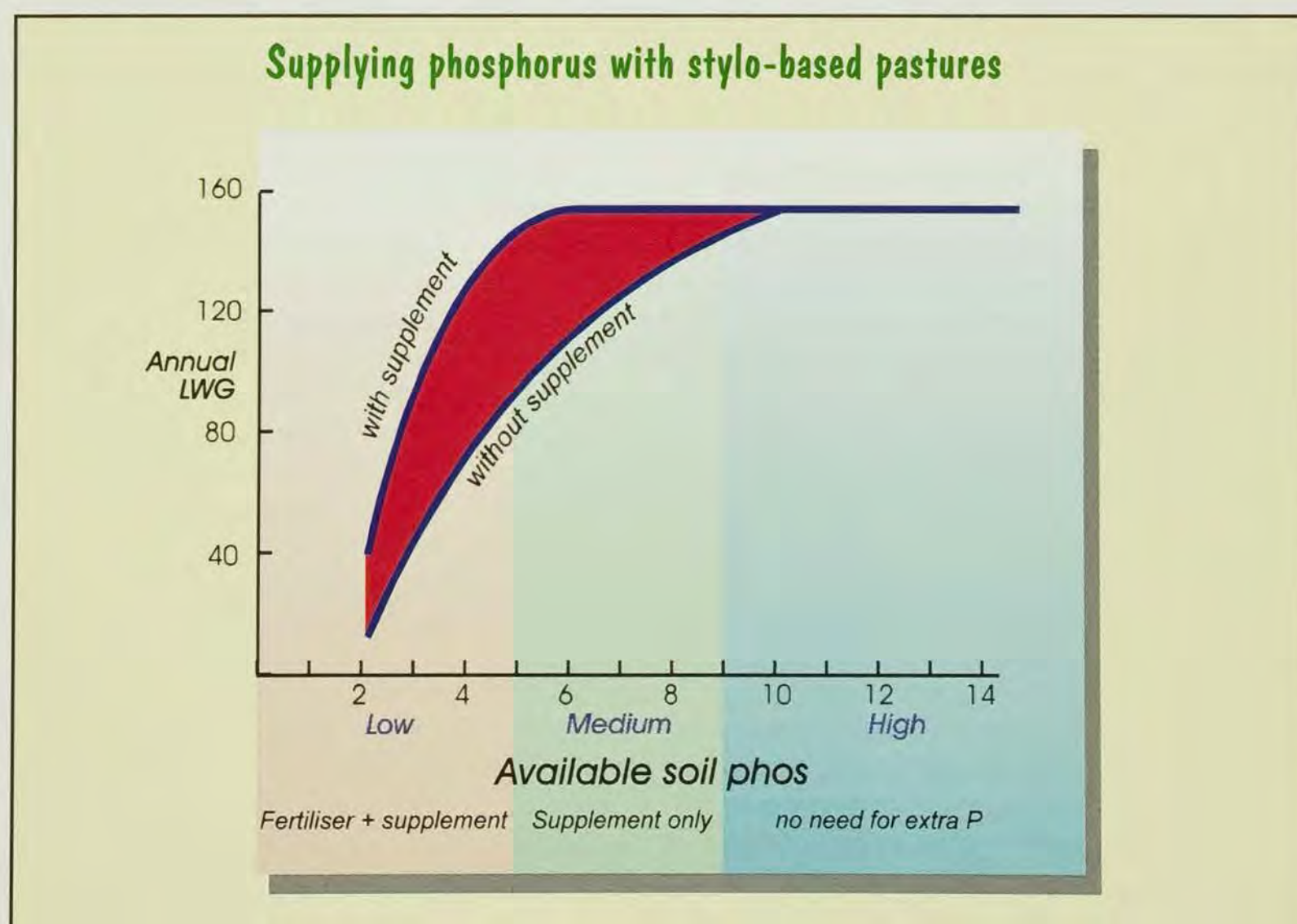
Supplement or fertiliser?

Extra phosphorus can be supplied as supplement direct to the animals or as fertiliser applied to the pasture. Supplement will benefit only the stock, fertiliser will benefit both pasture and stock.

In more arid and extensive grazing areas, stocking rates are generally too low to recover the costs of even minimal fertiliser application, and phosphorus supplements are fed directly to the cattle.

Animals on low-P soils will respond well to extra phosphorus when eating stylo.

Economics drive the decision of how to supply P.





Feeding a P supplement is highly profitable with stylo pastures on low P soils.

What form of P should I provide?

Cattle are fed phosphorus in the cheapest non-toxic form. MAP is no longer fed because it may have a high cadmium level.

Di-calcium phosphate (DCP) is now used for home-made mixes, but there are numerous proprietary brands on the market.

Phosphorus feeding is described in detail in the DPI book *Phosphorus nutrition of beef cattle in northern Australia*.

Where should I feed P supplement?

All cattle should be fed phosphorus supplement on grossly P-deficient soils where botulism is endemic.

On marginal-P soils, feeding a P supplement will maximise the benefits from grazing stylo pastures.

When should P supplement be provided?

Cattle need P supplement during the grass-growing season when protein in the diet is adequate; they need nitrogen supplement in the dry season when protein in the diet is deficient.



Above. Cows and calves off a stylo pasture on low-P soil—without feeding P.



Left. Cows and calves off the same country, but receiving P supplement.

Should I apply fertiliser?

Stylos may not need phosphatic fertiliser to establish and survive, but fertiliser will make them establish faster, grow better, set more seed.

Improved and grazing-tolerant grasses may need extra phosphorus to establish and spread.

Does phosphorus affect the grass?

Native grasses may take up more phosphorus but do not respond; naturalised Indian couch responds well and some improved grasses, such as urochloa and buffel, need reasonable soil phosphorus to thrive.

A fertilised legume will fix more nitrogen which will eventually reach the grass.

How much nitrogen do the stylos fix?

The amount of nitrogen fixed depends on the total yield of legume, and so on the phosphorus level of the soil. It takes about 3000 kg of stylo dry matter to provide 100 kg of nitrogen.

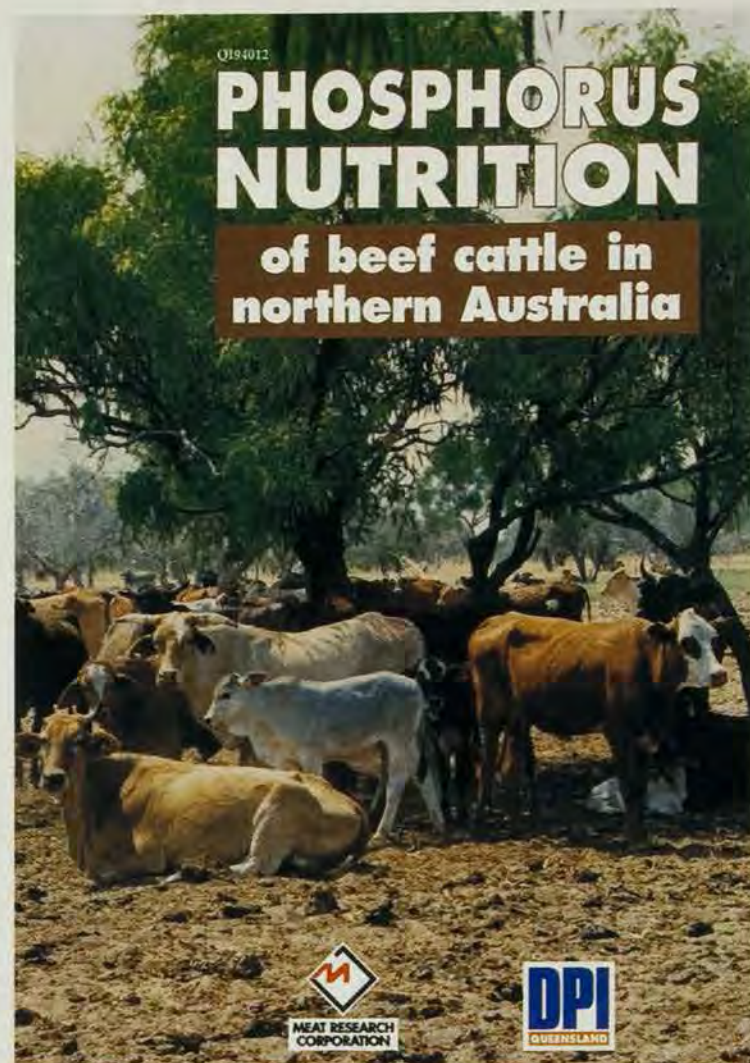
Stylos are generally regarded as a protein source for cattle rather than as a nitrogen supply to the grass, but the grass may respond to the nitrogen cycled through dung and urine after a few years.

When does fertiliser pay?

In higher rainfall areas where a sown grass is included and where stocking rates can exceed 1 steer to 2 hectares, animal responses per hectare may be large enough to justify regular maintenance dressings, albeit at reasonably low levels.

The economic optimum is usually around 5 kg P/ha/year or 100 kg super every second year (the old bag of super an acre every second year).

On soils where sulphur is more important than phosphorus, costs can be reduced by applying lower rates of super reinforced with elemental sulphur or by applying gypsum or elemental sulphur.



The steers (above) on stylo pasture on low-P soil were fed supplement at 5 g P each per day.



In 11 months, they gained 90 kg more than unsupplemented steers (left).

Seed

Seed production is a skilled operation, and the best quality seed is produced by specialist growers and seed processors. Some graziers with harvesters and seed cleaners may harvest their own seed which will be cheaper but of less certain quality.

Harvested seed of a variety with Plant Breeders Rights (PBR) can be sold only through the holder of the PBR, but it can be sown on the harvester's own property.

Points to check when purchasing stylo seed include:

- purity
- percentage germination
- percentage of hard seed
- the presence of weed seeds.

Purity. Most legume seed is over 90% pure seed; the dense seed is much easier to clean than grass seeds which can contain a lot of trash.

Seed harvested by suction starts off with a high proportion (by weight) of sand which has to be taken out with a gravity table.

Germination. Most legume seed has good germination unless it is old. Legume seed stores much more reliably than grass seed, and will keep for several years. However, it can be spoilt on the farm if kept in a hot tin shed, or if moths or mice get into the bags.

Hard seed. A high proportion of legume seed is 'hard' and will not germinate immediately. 'Hard' seed should be treated to speed germination, but the proportion and method depends on the seed-bed conditions. This is described earlier under 'Seed treatment'.

Weed seeds. Unwanted weed seeds in your legume seed may infest your paddocks for ever.

Seed contaminated with *Prohibited* weed seed must not be sold; seed of *Declared* weeds must be listed and it is up to you whether you think they are important.

Broad-leafed weeds can be removed from stylo seed crops with 2,4-D as stylos are resistant, while grass weeds can be removed with (expensive) selective herbicides. Both grass and broad-leafed weeds build up under fertilised stylo seed production crops because soil nitrogen increases and the paddocks are bare at the start of the growing season.

The adverse effects of poor quality seed last long after the thrill of a 'good deal'.



Harvesting thick *Stylo* crops needs plenty of power.



Verano crops are suction-harvested to collect fallen seed.

Stylos for better beef describes the use of these well-adapted legumes to help meet beef market specifications. Written in an easy-to-read style with plenty of colour illustrations, the booklet aims to encourage graziers to plant more legumes into their pastures. It tells of graziers who rely on stylos to meet the market for quality beef, and it provides detailed background information on the different stylos and their management.

Sections of *Stylos* describe:

- why stylos are needed
- who has planted them
- which varieties to grow where
- how to establish them
- how to manage the grazing
- how to supply phosphorus.

Stylos for better beef makes interesting and informative reading for graziers, produce agents, advisers and also for students.