DEVELOPMENT OF PASTURE LANDS IN THE NORTHERN WALLUM FIELD MEETING OF THE BURNETT SECTION, APRIL, 1967.

AN OUTLINE OF WALLUM DEVELOPMENT

by

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INTRODUCTION

In his book "The History of Bundaberg" published in 1890, J. Y. Walker states, "South of the Elliott River, extends for many dreary miles, the miserable wallum country, where animal and vegetable life seems equally absent. The trees seem to shrivel to shrubs, grass is invisible and the bird and beast alike are conspicuous by their absence".

"Wallum", apparently meaning banksia, is a name attributed to the aborigines, and it is interesting to note that the early settlers used the term in reference to specific sections of the coastal lowlands. In more recent years it has become loosely applied to include all of the infertile and particularly the non-developed south-east coastal lowlands (see Whitehouse 1967 for a definition of Wallum types). Soil types are diverse and their scope for agriculture varies considerably. This should be kept in mind when interpreting reports on production, carrying capacity and other results from wallum country.

THE SOUTH-EAST COASTAL LOWLANDS

The Queensland Wallum is a narrow strip of coastal lowland country extending intermittently from the New South Wales border to well north of Bundaberg. The topography is mainly flat to gently undulating and the total area has been assessed at 2 million acres (Coaldrake, 1961). Contrary to popular belief, a considerable section of this land is held privately under various forms of land tenure.

The south-east coastal lowlands can be conveniently divided into the southern "wet" wallum where the annual average rainfall exceeds 65 inches in the vicinity of Coolum and Beerwah, and the northern "dry" wallum in the Bundaberg-Maryborough region where the average annual rainfall is less than 45 inches. The difference of 20 inches, accentuated by the fact that the southern area enjoys a better overall annual distribution, is of major importance when one is endeavouring to apply results of research from the south to the north.

All of the south-east wallum is extremely infertile. The flats, depressions and drainage lines are frequently excessively wet, and in certain soils of the southern areas in particular, the water table may be close to the surface for weeks at a time (Coaldrake, 1961). Although drainage in some areas is necessary in initial development, this should be done with some caution. Excessive drainage can rob the wallum of one of its greatest assets. In many instances excessive moisture is no longer a problem after clearing of timber and its replacement with suitable sown pasture species. A productive pasture acts as an effective sponge.

On the credit side, the south-east coastal lowlands are favourably located for markets, railways, roads, electricity, and general amenities for living conditions.

Fertilizer Requirements

At the Beerwah Research Station the C.S.I.R.O. (Andrew and Bryan, 1955) have established that the soils are grossly deficient in nitrogen, phosphorus, potassium, calcium, copper and sulphur and are also deficient in zinc and molybdenum. The fertilizer requirements for pasture establishment are met by applying 6 cwt of ammoniated super potash 10 with copper, zinc and molybdenum plus 5 cwt of agricultural lime per acre. Work at the Coolum Research

Station of the Department of Primary Industries confirms these requirements for the wet heath country. An additional 5 cwt. of lime is required to counteract the more acid soils.

These recommendations are accepted in the drier northern wallum, particularly for the heath and more heavily leached areas. However, there is evidence to suggest that the nutrient status of soils on eucalypt ridges is somewhat higher than those expressed for both Coolum and Beerwah. Here, Mo super-phosphate meets the requirements for the initial development of pasture legumes.

In fodder sorghum trials located on grassy forest wallum country, north of Bundaberg, there have been spectacular yield responses to phosphorus with nitrogen. There was little response to potash, and no measurable responses to lime at one ton per acre, or to a range of trace elements. It is to be expected that the position may alter after a few years of cropping.

It would seem that the southern wallum is less fertile than the north, and this may well be associated with greater leaching of soil nutrients under considerably higher rainfall.

Land Utilization

The Forestry Department has been active in the area for over thirty years in the establishment of exotic pine forests.

Pineapples, sugar cane, and more recently tobacco, have found a place on the deeper sandy loams, offering fair moisture holding capacity and good drainage. Citrus has mainly been restricted to the alluvial soils, but it is worthy of note that one grower has established a productive orchard near Howard on white wallum sands previously carrying heath vegetation. Aiding the establishment of these industries is the fact that their economics justify expenditure on liberal fertilizer application which is a prerequisite for intensive production.

Wallum development to sown pastures has only been introduced on a worthwhile scale in the last four years. This has followed the leads and recommendations based on research work at Beerwah and Coolum Research Stations. In 1964, the first block of crown land was opened for pasture development in the northern wallum near Bundaberg. Since then, fourteen blocks, each of approximately 4,000 acres, have been opened in the Maryborough-Bundaberg region. In addition, one block of 1700 acres was opened near Lake Wyeba, in the Noosa district, and four smaller blocks approximating 1000 acres were offered at Tin Can Bay.

Earlier, applicants were required to submit a programme of development and to make an offer both with regard to rental as a special lease and also a purchase price for subsequent freeholding. More recently, the terms and conditions have stipulated an annual rental of 6 cents per acre for a 20-year special lease, and upon satisfactory completion of development, a purchase price of two dollars per acre.

Land Classification

There is a close association between vegetation and soil type. To some extent this reflects fertility, but more particularly, drainage and moisture holding capacity is indicated. A knowledge of wallum vegetation provides prospective developers with a reliable guide to property problems and potential.

For pasture development, the blocks opened in the Maryborough-Bundaberg region may be classified into three types of country.

Grassy Forests

Eucalypts predominate in the forest vegetation with bloodwood *(Eucalyptus intermedia)* and stringy bark *(Eucalyptus acmenioides)* most common.

The soils are variable in texture and depth, but there are large areas of grey fine sandy loams merging into yellow sandy clay with some mottling, overlying red brown clay at a depth of four to five feet. The deeper soils on the ridges offer fair drainage and moisture holding capacity. In some areas, notably around Bundaberg, these soils extend into the slightly more elevated red brown sandy loams of the Elliott River and North Isis districts.

The grassy forest country is expensive to clear, but where there is a good depth of sandy loam, it offers good prospects for pastures and other agricultural enterprises.

Tea Tree Forests

The tea tree *(Melaleuca quinquenervia)* tolerates extremely wet conditions and is a fairly reliable indicator of poor drainage. It forms dense stands on the lower slopes, flats and along drainage lines.

The soils are leached, and of a very fine sandy loam texture in the surface few inches. Ironstone nodules appear freely in the profile and frequently occur as massive bands within a foot of the surface. Surface compaction is another undesirable feature of these soils.

On the Boonaroo coastal plain where two blocks were recently opened for selection, stunted tea trees and sedges covered much of the area. A feature of these podzolic gleys is the tight compaction of the fine sandy and silty surface, which overlies at shallow depths, heavy clays and ironstone nodules.

The tea tree country, because of frequent water logging and in many instances severe leaching, is of extremely low fertility, and goes through periods of excessive wetness and dryness.

Banksia-Heath Association

In this type of country, leptospermums, boronias and similar low growing shrubs, collectively described as heath, grow in dense stands under a taller story of bottle brush *(Banksia aemula)*. Ground surface herbage is very sparse and often non-existent. The northern heath is found in strips along depression lines, and a major area is located east of the railway line between the Gregory and Elliott Rivers.

White sands overlie compacted and cemented brown sand (coffee rock) at varying depths averaging about four feet. In the northern wallum a water table may appear close to the surface for a period following exceptionally heavy rains.

Clearing cost is low, but these soils may well present difficulties for pasture establishment. The clearing of large unit areas could expose the land to wind erosion before a ground cover is obtained. The provision of wind breaks may well form part of the developmental programme for all wallum lands, particularly the white sands of the heath.

Costs of Pasture Establishment

In pasture establishment, the following costs have been based on clearing, land preparation, fertilizer, seed and planting. In all items there is likely to be a wide variation in actual costs, depending on the density and size of timber stands, actual fertilizer requirements, and the price of seed.

The following represent a fair average of costs per acre experienced by those who have commenced wallum development.

Clearing	$22.00	(Including pulling, pushing into windrows, burning, restacking and reburning).
Land Preparation	$8.00	(Including an initial break up, two discings and one harrowing).
Fertilizer	$17.00	(Including 5 cwt. Amm. Super-potash 10 with Cu Zn and Mo).
Seed	$12.00	(Based on one pasture combination. Nandi setaria 1 lb., Siratro 2 lb., Lotononis $\frac{1}{4}$ lb.).
Planting	$1.50	(Labour, fuel, oil and depreciation).
Total	$60.50	per acre.

Where calcium is required, an additional $4 may be added to cover the cost of agricultural limestone applied at 5 cwt. per acre.

In areas allotted to seed production as part of the developmental plan, clearing will involve stick-picking to allow the safer movement of harvesting machines. In such cases, costs will be higher.

Sucker Control

Without good management, suckers and seedling regrowth can be a major and costly problem in wallum development. Firstly, the owner requires the services of an experienced and conscientious clearing contractor, and secondly, the clearing job should be done when there is ample soil moisture for effective pulling.

The practice of annual cropping for one or two years before planting permanent pastures is a very effective means of eliminating regrowth. This becomes more attractive if the fodder or cash crop can make a contribution towards establishment costs. Seed production may be part of this programme.

Where pastures are sown without precropping, steps must be taken to control regrowth as part of the pasture management programme. Methods being used include—

(a) Early and adequate stocking.
(b) Spot spraying with 2, 4, 5-T.
(c) Hand removal by the use of a mattock.
(d) The periodical use of a slasher.
(e) Renovation at appropriate times to suit the pasture species.

CONCLUSION

To date the commercial development of northern wallum land under pastures is largely based on seed production. There will always be scope for owners to grow their own seed production for the open market. The economics of pastures on the wallum must be based on beef production. The position will not be fully clear until a point is reached where beef cattle are run commercially.

A promising start has been made with pasture development, and we can rest assured that the Bundaberg early historian, Mr. J. Y. Walker, would be pleased to know that the present generation is attempting to make effective use of "the miserable Wallum Country".

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C.S.I.R.O. PASTURE RESEARCH IN THE NORTHERN WALLUM

by

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Pasture work in the northern wallum began in 1962/63 with plant nutrition studies and initial species evaluation. The fertilizer requirement for the establishment of grass-legume pastures is 5 cwt superphosphate, 1 cwt potassium chloride, 5 cwt lime, 7 lb copper sulphate, 7 lb zinc sulphate and 2 oz elemental molybdenum per acre. This requirement is met by applying 6 cwt/acre of ammoniated-superpotash 10 fertilizer with trace elements and 5 cwt/acre ground limestone. Any reduction in the amount of superphosphate applied, or omission of potassium or trace elements will reduce dry matter yield and content of the element in the above ground parts of the plant. This was demonstrated with Siratro where 2 cwt/acre superphosphate reduced the dry matter yield to 40% of that obtained from a 5 cwt/acre application. Omission of potassium reduced the yield to 30% compared with 1 cwt/acre potassium chloride, and omission of trace elements slightly reduced the yield but resulted in very low levels of element in the plant.

The initial species evaluation was carried out using 52 grasses and 45 legumes (see Evans, T. R. 1967). Primary evaluation of grasses and legumes for the northern wallum of S.E. Queensland. *Tropical Grasslands* **1** (2): 143-152. Several of the most promising grasses and legumes were selected for further evaluation under grazing. These experiments are being carried out on the major soil types of the northern wallum on the properties of Mr. J. T. Summers, "Kinyerrie", Isis Junction and Mr. W. J. Dorrian, North Isis. The species used include some that were highly productive and others that showed cold tolerance. Grasses and legumes that produce winter growth or remain unaffected by light frosts are particularly important in an environment where early summer growth is restricted because of low rainfall. The occurrence of frost at "Kinyerrie" over the period 1964-66 is shown in table 1.

TABLE 1

Frost occurrence at Kinyerrie over the period 1964-66.

Month	Number of frosts recorded when grass minimum < 32°F		
	1964	1965	1966
May	Nil	Nil	1
June	3	4	Nil
July	13	15	13
August	8	9	2
Total	24	28	16

The frost incidence in July is greater than the mean recorded for this month at the C.S.I.R.O. Beerwah Research Station, and this suggests that frost may be a more important factor in the northern wallum. In this month for each of the three years seven consecutive frosts were recorded. Over the three year period the minimum grass temperature recorded was 22°F, and the mean for all frost days was 28°F.

Pasture evaluation at "Kinyerrie"

An experiment to determine the productivity and persistence of twelve pastures under grazing with beef cattle, was sown in December, 1965. Each treatment was replicated twice in paddocks half an acre in area. The species used, pasture mixture and seeding rates are shown in table 2.

TABLE 2

Pastures used in the grazing experiment

No.	Grass	Legume*	seed rate lb/acre	
			grass	legume
1.	*Paspalum plicatulum* C.P.I. 21378	*Lotononis bainesii* cv. Miles *Teramnus uncinatus* CPI 25937	3	1 3
2.	„	*Phaseolus atropurpureus* cv. Siratro *Lotononis angolensis* CPI 26293	3	3 1
3.	*Paspalum commersonii* cv. Scrobic	*L. bainesii* cv. Miles *Desmodium intortum* cv. Greenleaf	3	1 3
4.	„	*P. atropurpureus* cv. Siratro *L. angolensis* CPI 26293	3	3 1
5.	*Panicum coloratum* CPI 16796	*T. uncinatus* CPI 25937 *L. bainesii* cv. Miles	3	3 1
6.	„	*P. atropurpureus* cv. Siratro *Trifolium repens* cv. Ladino	3	3 3
7.	*Panicum coloratum* CPI 14375	*T. uncinatus* CPI 25937 *L. angolensis* CPI 26293	3	3 1
8.	*Setaria sphacelata* CPI 33452	*D. intortum* cv. Greenleaf *T. repens* cv. Ladino	2	3 3
9.	*Setaria sphacelata* cv. Nandi	*D. intortum* cv. Greenleaf *T. repens* cv. Ladino	2	3 3
10.	„	*P. atropurpureus* cv. Siratro *L. angolensis* CPI 26293	2	3 1
11.	*Digitaria decumbens* Pangola	*L. angolensis* CPI 26293 *T. uncinatus* CPI 25937	vegetative 12' x 12' centres	1 3
12.	„	*D. intortum* cv. Greenleaf *L. bainesii* cv. Miles	vegetative	3 1

**Phaseolus lathyroides* (phasey bean) sown in all mixtures at 2 lb/acre

Pastures 3 and 12 were included as 'control' comparisons of animal production from these pasture mixtures in the southern wallum where production has been assessed over a number of years. *Setaria sphacelata* C.P.I. 33452 *Teramnus uncinatus,* and *Lotononis angolensis* were included in the trial because of their known frost resistance and in order to obtain information on their reaction to grazing.

Land preparation consisted of an initial ploughing and disc-harrowing, followed by a broadcast application of fertilizer and a further discing to a depth of

approximately 4 inches. Seed was broadcast and rolled in with a culti-pack roller. All legumes were inoculated with the appropriate strain of *Rhizobium.*

There was an excellent establishment of all species. However, *Phaseolus lathyroides* was severely attacked by nematode. Grazing began in April 1966 at a stocking rate of 1 beast: 2½ acres. However, due to an abnormally well distributed rainfall through the year the stocking rate had to be increased and the overall mean stocking rate for the first year was slightly above 1 beast per acre. This carrying capacity is being maintained under a rotational grazing system of 4 days on and 28 days off the pasture.

The botanical composition of some of the pastures in February 1967 is shown in table 3.

TABLE 3

Botanical composition of pastures in February 1967
(on dry weight basis)

grass	*P. plicatulum*		Scrobic		Panicum 16796	Panicum 14375	Setaria 33452	Nandi Setaria	
Pasture No.*	1	2	3	4	6	7	8	9	10
Sown grass (%)	72	48	44	34	49	49	26	39	36
Total legume (%)	26	50	54	63	40	49	63	60	61
Miles lotononis	24	—	26	—	—	—	—	—	—
Greenleaf desmodium	—	—	18	—	—	—	58	57	—
Siratro	—	44	—	54	28	—	—	—	55
Teramnus ucinatus	—	—	—		—	44	—	—	—
Phaseolus lathyroides	2	2	10	7	—	—	2	1	4
Lotononis angolensis	—	—	—	2	—	5	—	—	2
Ladino w.c.	—	4	—	—	12	—	3	2	—
Weed	2	2	2	3	11	2	11	1	3

This table illustrates the high legume percentage component of the pastures, in most cases more than 50%. It further demonstrates that the weed component in a vigorously growing pasture is reduced to very low levels. A maintenance fertilizer dressing of 2 cwt superphosphate and 1 cwt potassium chloride per acre was applied in October 1966. Chemical analyses of plant material has shown adequate levels of nitrogen, phosphorus, and potassium for healthy growth of all species.

CONCLUSIONS

The results to date have shown that highly productive pastures can be established, and with adequate rainfall a high carrying capacity may be obtained even in the establishment year. However, pasture production was enhanced by a well distributed rainfall, unusual in this environment. Under a more normal rainfall

distribution a stocking rate of 1 beast to 3 acres might be adequate in the establishment year. The grasses used in the experiment have shown large differences in dry matter production and rates of growth. It is probable that a different management system might be required for the rapidly maturing *Panicum coloratum* cultivars. This aspect will be examined in the 1967-68 season. *Setaria sphacelata* C.P.I. 33452 has shown good recovery from grazing and produces a greater number of tillers than Nandi Setaria. It is obviously too soon to draw conclusions on the productivity of individual pastures and the evaluation will continue for at least three years.

DISCUSSION

Have sown grasses got any value as a stand-over crop?

Mr. Evans: In comparison with native pastures, yes. Species such as Setaria or *Lotononis bainesii* that are winter green have a quite high feeding value. Other species when frosted rapidly lose feeding value particularly when rain follows a frost. Pangola grass appears to decrease least in feeding value after frosting.

What is the reason for the low proportion of Ladino clover plants and their unhealthy appearance?

Mr. Evans: There are two reasons for this — firstly, there has been severe competition and shading because of very dense growth from the other species, and secondly, there has been some degree of nematode attack. However, nodulation is effective and I would expect the clover to improve through winter. *Trifolium semipilosum* may be an excellent alternative as it appears more vigorous and has better summer growth.

Is pasture management in spring and early summer important?

Mr. Evans: Yes, particularly with respect to the legumes because of hot dry periods and the consequent risk of overgrazing.

Is it advisable to use Super King phosphate?

Mr. Evans: On wallum soils this fertilizer should be used with caution as it contains only 3% sulphur. Thus, in a phosphate application equivalent to 5 cwt/acre of normal superphosphate, sulphur addition would be about 7½ lb compared with 60 lb. Work on sulphur requirements is currently being carried out at Beerwah.

Would you consider using fire to control regrowth?

Mr. Evans: No, because of damage to the legumes. Other methods such as slashing, could be used. Regrowth is not likely to be a problem where adequate fertilizer is applied and provided conditions are favourable for pasture growth. There has been no regrowth in the pastures in the grazing experiment.

Would you use Dolichos lab lab in your pasture establishment phase?

Mr. Evans: No. It is unable to withstand periods of excessive soil moisture.

Are the levels of trace elements sufficient for animal health?

Mr. Evans: All the evidence from pasture analyses, and from blood and liver samples from cattle at Beerwah have shown adequate levels. No mineral supplements have ever been given and the animal requirements are met solely by the pasture.

What methods did you adopt to get the lotononis into the pasture?

Mr. Evans: Legume and grass seed was mixed and sown by hand because of the small areas involved. Larger areas have been established quite successfully by sowing either with a conventional seed drill or broadcast with a "Vicon" spreader.

Do you have to inoculate lotononis separately?

Mr. Evans: Yes. Lotononis is very specific in its *Rhizobium* requirement and nodulation is only effective when this specific strain is used.

PROPERTY DEVELOPMENT

MR. J. SUMMERS, ISIS JUNCTION

The first pasture plantings were made here in 1963. Initially there was an early heavy mortality but, as can now be seen, the ground is completely covered. Germination and establishment is better and quicker on the sandy soils than on the grey soils. However, in the long run, the pastures on both soils are comparable.

This area has been heavily fertilized with N.P.K. to promote seed production.

Land preparation. In preparing land for planting it is most important to plough early so that storm rains can be trapped prior to planting in January.

When clearing, it is not necessary to remove ground level stumps as they are too expensive to remove. To overcome this stump-jump equipment should be purchased. In this respect a disc drill is preferable to the tyned type since it rides over sticks and stumps and will not clog up. Such a drill is easier to adjust to seedbed conditions when sowing.

DISCUSSION

What is the incidence of frost in the area?

Mr. Summers: Fairly bad. There were 13 frosts in July 1966 and an absolute minimum grass reading of 22°F.

Would this pasture make good silage?

Mr. St. Ledger: I have made very good vacuum pack silage from similar material.

Have you used lime?

Mr. Summers: Yes, but with no apparent beneficial results in tropical legumes. The pH ranges from 4.5 to 5.5 on these soils.

What seed yields can you expect?

Mr. Summers: With lotononis I have had up to 30 lb per acre. The yield of Nandi setaria is closely tied to the nitrogen status of the soil. Three crops can be obtained in one year but I prefer to harvest only a spring and autumn crop which should yield 50 lb. per harvest. Siratro is a temperamental plant. I have had a maximum yield of 90 lb. per acre, but I would say an average yield of 40 lb. could be relied upon.

MR. W. DRAPER, GOODWOOD.

An inspection was made of a newly cleared area on Mr. Draper's property. This is located on a solodic soil that has a high silt content and moderate levels of soluble salts. On this difficult soil type pastures sown in January-February 1967 were not as well established as those sown at the same time on the properties inspected at Isis Junction. At the time of inspection the legumes showed some signs of salt damage but the grasses Nandi setaria and *Paspalum plicatulum* did not appear to be affected.

MR. D. TAYLOR

An area of 200 acres had been pulled in 10 hours and subsequently windrowed in 70-80hrs. It was burnt 4-5 weeks after windrowing. Costs involved were $12 an acre for pulling and windrowing combined and heaping after the first burn $1 an acre. Subsequent stick picking was estimated to cost a further $12 an acre. The area was ploughed in November with first planting commencing in December. Fertilizer was applied at the rate of 5 cwt of ammoniated super potash 10 with copper, zinc and molybdenum. The pasture seed mixture sown was Siratro 2 lb, Nandi setaria 1 lb, and a sprinkling of Lotononis. Planting was best done after harrowing to obtain the best establishment.

Results of the operation have been very satisfying and encouraging.