THE TROPICAL GRASSLAND SOCIETY OF AUSTRALIA FIELD VISIT, 6 AND 7 APRIL, 1972

THE WALLUM AFTER 20 YEARS

INTRODUCTION

Research commenced in the Wallum in 1950 and in 1964, the first development lease was granted by the Government. While research demonstrated an outstanding potential for animal production within the area, there has been a large proportion of commercial developers whose efforts have met with disappointment. A complete review of research on the Wallum, by Dr. W. W. Bryan, is published in Vol. 7, No. 2 of *Tropical Grasslands*.

This two-day field visit was aimed at assessing the future for the area after considering the findings of researchers and developers. Dr. E. F. Henzell introduced the topic, 'Research and development of the Wallum region', at the C.S.I.R.O., Beerwah Research Station. Dr. W. W. Bryan reviewed progress in the Wallum and Mr. T. R. Evans defined research aims in the light of past experience. Large scale development of the Wallum by L. Tutt and Co. Pty. Ltd. was seen at Caloundra Downs. On the second day members visited the Department of Primary Industries Research Station at Coolum where the results of current investigations were discussed by Messrs. C. B. Wright and T. J. Tierney. The results of a survey of ill-thrift in beef cattle in the southern coastal lowlands were presented by Dr. J. Ebersohn. Mr. J. Kingston reviewed costs of development, problems associated with the region and animal performance from cattle grazing pastures in the Wallum.

DEVELOPMENT OF MIXED PASTURES ON THE WALLUM

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In terms of climate and soils the Wallum may be divided into a southern and a northern section, the dividing line being Big Tuan Creek, just south of Maryborough. The northern part is drier than the southern and the main effect is on choice of species, with Siratro and *Panicum* spp. coming into prominence in the north as against white clover, *Desmodium* spp. and *Paspalum* spp. in the south. Lotononis and pangola grass do well in both areas.

There is a universality of soil deficiencies in N, P, K, Ca, S, Cu, Zn and Mo and the same basal dressing of fertilizers is advocated for all soils except peats, where more Ca and Cu are needed, or where emphasis is on growing white clover, when at least an extra 600 kg/ha of lime is required.

For the pastoral development of a new region we need:

(1) Adapted and productive plants.
(2) Normal growth of these plants, which involves proper mineral nutrition and effective strains of Rhizobium.
(3) Good animal production.

The following plants have been shown to be valuable in the region:

(a) Legumes: Phasey bean (as a pioneer annual), white clover, lotononis, Greenleaf and Silverleaf desmodium, Siratro and Kenya white clover.
(b) Grasses: *Paspalum dilatatum*, pangola, scrobic, plicatulum, rhodes, setaria and *Panicum coloratum*.

There is still a need for more and better species and major research is going on into *Lotononis* spp., *Desmodium* spp., *Setaria* spp., and *Digitaria* spp.

MAJOR FINDINGS

A large grazing trial at Beerwah, now in its 10th year, was used to illustrate the major research findings relating to mixed pastures. The experiment was put down in February 1964 with a uniform standard dressing of fertilizer. The species were white clover, phasey bean, Greenleaf and Silverleaf demodium and lotononis; rhodes grass, scrobic, paspalum and pangola. On this mixture 12 treatments were imposed—stocking rates of 1.23, 1.65 and 2.47 beasts/hectare, and annual fertilizer rates of 125 kg/ha superphosphate and 125 kg/ha KCl (1P1K), 2P½K, 2P1K and 2P1½K. The formal experiment began in December 1965 and ended in December 1971. Grazing was continuous with three Hereford steers per plot, introduced at a mean liveweight of 275 kg at 12–15 months of age and slaughtered at 420–450 kg liveweight.

Effect of soil type

On the basis of species frequencies, the seven major soil types on the area fell into two groups, the better drained podzolic soils in one and the humic gleys into another. Rhodes grass, *Desmodium* spp. and lotononis did better on the former group, paspalum and white clover on the wetter group. Thus these soil groups provide a logical basis for fencing and for appropriate and simpler seeds mixtures. There is also the implication that even when both soil groups are improved, the better drained soils remain more productive than the poorly drained ones.

Effect of fertilizers

Potash. There was no effect of K treatments on species distribution or animal production. The K concentration increased in soils and plants with increasing K application, but plant composition was good at all K levels. Therefore 63 kg/ha KCl annually is considered adequate for these plants (representing a good cross-section except for setaria) on these soils (being a range of podzolic and humic gley soils). This dressing is only half that previously recommended and forms an important saving in costs.

Phosphorus. The higher annual dressing of superphosphate favoured all sown grasses and legumes except paspalum and lotononis and depressed all major weeds. The concentration of P increased in all sown species, as did the N content of legumes and the Ca content of grasses. There was a significant increase in animal liveweight gain (LWG) of 64 kg/ha, which means that beef at 10c/kg (cf. current prices of beef at 67c to 74c/kg) would meet the cost of the extra superphosphate. Time to turn off of finished animals was reduced by 34 days on average. The effect of the higher P rate showed up most in periods of stress, i.e. especially in winter.

The conclusion is that at least 250 kg/ha superphosphate must be applied annually, and there is indirect evidence, from another experiment in which 500 kg/ha superphosphate annually gave 500 kg/ha LWG, that still more might be advantageous.

Effect of stocking rates

The low stocking rate favoured *Desmodium* spp. and pangola grass, the high stocking rate favoured lotononis, white clover, paspalum and weeds. Stocking rate had no effect on soil fertility or on chemical composition of the plants but striking effects on animal production as shown in the table (all at the 2P level).

	LWG (kg/ha)	Days to turn off
High SR	348	399
Medium SR	303	311
Low SR	282	266

At all stocking rates, legume content decreased with time, as did animal production, and there was a significant positive correlation between legume content and LWG. Conversely, weed content was negatively correlated with LWG.

Over a period of 15 years grass-legume pastures at Beerwah have averaged about 340 kg/ha LWG and about 170 kg/head.

ANIMAL PRODUCTION FROM NITROGEN FERTILIZED PASTURES

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Nitrogen fertilizer on pure grass swards is more likely to be a viable economic system for beef production in a region where rainfall rarely limits pasture growth. Such a system should enable maximum intensification of production from the environment.

Early work showed that pangola grass fertilized with 476 kg N/ha/yr and continuously grazed at 7.5 steers/ha produced mean liveweight gains of about 1500 kg/ha/yr over a six year period. A subsequent experiment compared production from pangola and Nandi setaria pastures receiving 280, 476 or 673 kg N/ha/yr and continuously grazed at stocking rates of 2.5, 4.3, 6.2, 8.0 and 9.4 steers/ha.

The abnormally wet summers of 1970/71 and 1971/72 severely affected pasture growth and pastures grazed at 6.2, 8.0 and 9.4 steers/ha had to be destocked for varying periods. There was some evidence of an adverse effect on pasture growth in pastures receiving the highest N level and severe infestations of leaf rust (*Puccinia oahuensis*) affected growth of pangola. The experiment has now been modified to exclude the highest N level and stocking rate and an intermediate N level of 378 kg N/ha has been introduced. Both grazing and cutting experiments with rates of nitrogen have indicated that above 476 kg N/ha/yr serious problems arise in pasture growth. The growth response to high N levels requires further detailed investigation. A further important aspect is that of disease susceptibility. This can be particularly devastating in clonally propagated material where no genetic variability exists.

An economic assessment of production from pangola/legume and pangola pastures fertilized with different nitrogen rates was published in *Tropical Grasslands* Vol. 6, No. 3 (1972). This paper stressed the sensitivity of budgets to changes in beef price and costs. These data have been updated on current costs (as at March, 1973) and at beef prices of 88c/kg deadweight (40c/lb) the internal rate of returns for the legume based pasture was ca. 9.6%, for pangola receiving 168 kg N/ha/yr about 11.3% and pangola receiving 448 kg N/ha/yr ca. 12.9%.* It is clear that nitrogen fertilized pastures offer a viable economic system for beef production in the southern wallum.

RESEARCH AIMS IN THE LIGHT OF PAST EXPERIENCE

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Research projects at Beerwah cover a wide field and include plant introduction, plant breeding, legume bacteriology, plant physiology, plant nutrition, animal nutrition, pasture ecology and animal production. Much of the basic work is not

* The economic analysis was presented by Mr. J. Firth, Bureau of Agricultural Economics.

specifically generated by regional problems although the results will be directly applicable to the region as well as elsewhere.

The results of major grazing experiments on grass-legume pastures indicate that two aspects of major importance in maintaining a high level of animal production are (a) the legume content of the pasture and (b) the level of maintenance superphosphate application. Stocking rate is obviously important but mainly in the effect on botanical composition and stability of the sown species.

It has been shown that over a six year period, under continuous grazing, the legume content decreased at all stocking rates; at the lowest (1.23 steers/ha) it fell from 39% to 14%, at 1.65 steers/ha from 38% to 13% and at 2.47 steers/ha from 34% to 10%.

Individual legume species reacted in different ways to the imposed stocking rate but the legume content was highly correlated with liveweight gains, and clearly may limit animal production and rate of turnoff. If any progress is to be made in improving production from legume based pastures we need to have a better understanding of factors affecting legume persistence under grazing. Some of the questions to be answered are—did some legumes decline because of inability to set seed? what effect does seasonal variation in grazing pressures have upon them? is the decline due to too frequent defoliation? would there be greater persistence under some other management system than continuous grazing? would higher levels of superphosphate application affect persistence and production? It was shown that a higher legume content was maintained at the higher level of superphosphate, and that the phosphorus content of plant material was increased, as was the *in vitro* digestibility of pastures receiving more than 250 kg superphosphate/ha/yr.

Investigations have commenced on management systems involving different grazing strategies and higher superphosphate maintenance applications.

Preliminary results indicate that inclusion of a rest period (May–August) on pastures grazed at 2.5 steers/ha will allow an increase in legume content, and that pastures stocked at 1.25 steers/ha in summer and 2.5/ha in winter were not adversely affected. If these results are proven then manipulation of grazing management through use of pastures with different legume components and grazed at different pressures on a seasonal basis may increase total animal production while maintaining legume content.

The current research programme with pure grass pastures has two main objectives. Firstly, a comparison of nutritive value as expressed through animal production of some species in commercial use and secondly, evaluation of new species that may replace pangola grass (*Digitaria decumbens*) for use in intensive management systems. The assessment of nutritive value under grazing compares *Setaria anceps* cv. Nandi, cv. Narok, cv. Kazungula, *S. splendida*, *Digitaria decumbens* and *Pennisetum clandestinum* cv. Wittet (kikuyu grass). Three of these grasses (Narok, splendida and kikuyu) have shown greater winter production than the others and possess greater frost tolerance. This may ultimately enable daily liveweight gains to be maintained at reasonable levels through winter and eliminate the "winter trough" in animal production.

The major limits to production from pangola grass have been (a) relatively poor winter growth and (b) susceptibility to leaf rust (*Puccinia oahuensis*). A number of new *Digitaria* cultivars are now available that have shown better rust resistance and higher winter production than pangola under cutting experiments and warrant further evaluation under grazing. The species selected for this work are *Digitaria pentzii* CQ911, CQ709, CPI8385, 17661B, *D. milarjiana* CP141192, *D. macraglossa* CPI16267, *D. setivalva* CPI8383, a *D. smutsii* × *D. setivalva* hybrid. Other species being examined are *Eragrostis curvula* CPI43218 and *Chloris gayana* cv. Samford.

LARGE SCALE DEVELOPMENT AT CALOUNDRA DOWNS

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Early in 1964 a special development lease for 4370 has was granted to Tropical Cattle Pty. Ltd. By the end of 1972, 3240 ha had been cleared and 2670 ha sown to pasture. The area covers a wide range of vegetation and soil type. Ridges carried large scribbly gum (*Eucalyptus racemosa*) and red stringy bark (*E. resinifera*); *Melaleuca quinquinvervia* (tea tree) occurred in depressions and there were small areas of heath.

Machinery used in the initial development had a high flotation requirement. On wetter areas drainage was undertaken and this enabled clearing to be done 12 months later with a marked reduction in bogging of machinery. Timber was cleared by chaining with two 190 h.p. crawler tractors and a 110 m chain of 6 cm cross section, in traverses of 40-50 m. The fallen timber was then windrowed at intervals of about 100 m.

After initial ploughing to 25 cm the land was fallowed for 5-6 months and a second cultivation done to 12 cm. Fertilizer was then applied, ground limestone first and then the mixture of other nutrients. An annual dressing of 250 kg/ha superphosphate and 125 kg/ha KCl was applied in August/September.

The most successful pasture sowings have been from summer planting and mixtures are based on:

Lotononis bainesii at 0.3 kg/ha
Desmodium intortum at 0.3 kg/ha
Trifolium repens cv. Ladino at 0.3 kg/ha
Trifolium repens cv. Grasslands Huia at 0.9 kg/ha
Setaria sphacelata cv. Nandi at 0.6 kg/ha
Setaria sphacelata cv. Kazungula at 0.3 kg/ha
Paspalum dilatatum at 1.1 kg/ha
Chloris gayana cv. Pioneer at 0.6 kg/ha
Digitaria decumbens—vegetative planting by discing in cut material

During the 1972–1973 summer, 120 hectares was sown to Narok setaria which will be fertilized with bagged Nitrogen in an effort to boost winter production.

During the last three years excess summer growth has been harvested and conserved as pit silage to be fed to weaners and breeders during September, October and November, usually a period of very reduced production.

Paddocks are 65–75 ha in size and stock water is provided in small dams at a cost of approximately $160–$200 per paddock. It has been necessary to equip the dams with troughs (gravity fed where possible) and/or pump and tank, to avoid bogging of stock where direct access to dams was allowed. The annual rainfall of 1650 mm with reasonable monthly distribution maintains a good supply in the dams.

A system of roads has been built to enable all areas to be serviced by bulk fertilizer and lime trucks. To cut handling costs a mobile bin was designed with a capacity of 20 metric tons. The bin is constructed of bolted hardwood on sled runners and with a galvanised corrugated iron roof that can be rolled back to allow entry of bulk tippers or a front-end loader. The bins are towed empty to a new roadside site, from where spreaders will travel a minimum distance between loading and beginning to spread the fertilizer.

In the first and second seasons aircraft were used to broadcast the initial fertilizer mixture but this was discontinued because of uneven distribution, which resulted in unsatisfactory pasture establishment and meant waste of quantities of expensive seed.

The original aim in beef production was to buy store cattle and fatten them, but the acute shortage of stores has led to the introduction of a breeding programme.

The females are of mixed breeds, bred to Brahman type bulls. Branding is about 90 per cent of females mated. Ticks are a problem especially in summer when monthly spraying is required. Other diseases (tuberculosis, brucellosis, blackleg, internal parasites) are controlled by standard techniques.

Cattle numbers are presently down from 4000 plus to 3400 due mainly to the disposal of all saleable store cattle prior to the 1972 winter, when seasonal conditions on the coast were at their worst for quite some time and carrying capacity was drastically reduced.

Pastures are first stocked at 12–14 weeks after planting. The stocking rate in year 1 is a beast to 1.6 ha; in year 2, 1 : 1.2 ha; in year 3, 1 : 0.8 ha, and thereafter a beast to 0.6 ha. Average liveweight gains per head are 170–180 kg/year and average dressed weights of 235–240 kg at two years old have been obtained. The dressing percentages range from 52–56 percent on starved weights.

Overall costs have tended to vary within the range of $160–$225/ha. One of the factors affecting costs is variability in seasonabl conditions. The costs quoted do not include those involved in burning windrows or clearing the area of sticks, etc., prior to cultivation.

BREEDER PERFORMANCE ON WALLUM PASTURE

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The work in progress at the Coolum Research Station which is situated in the narrow belt of coastal lowlands of south-east Queensland was described. The average annual rainfall is 1700 mm of which 70% is received in summer. The incidence of radiation frosts averages approximately 16 per year. The land utilized is known as "wet heath" and consists of a structureless sandy soil which is initially deficient in all macro- and a number of micro-elements. The area used for this work is 2.1–2.7 metres above mean sea level.

Most of the cattle research in this area has been restricted to fattening castrated male cattle. However, in recent years purchase of these cattle has become increasingly difficult forcing cattle producers to turn to breeding enterprises. Because of the lack of commercial and experimental guidelines in relation to grazing breeding animals on nitrogen fertilized pangola grass, the initial studies have been of an exploratory nature. This is an interim report on two of the initial phases of this work.

The fertilizer rates for the first phase of this trial were 627 kg/ha/yr of superphosphate and 314 kg/ha/yr of muriate of potash in split applications. The scheduled nitrogen application was 448 kg N/ha/yr in equal split applications at approximately six-week intervals during the spring-summer-autumn period. However, only 308 kg N/ha could be applied during this first phase because of the extremely wet summer experienced. The maintenance fertilizer applications during the second phase were altered to 376 kg/ha/yr of superphosphate and 188 kg/ha/yr of muriate of potash. The nitrogen was applied as in phase I.

The wet season rainfall figures are shown below:

TABLE 1

Wet season rainfall in mm at Coolum Research Station

	70/71	71/72	72/73	17 yr. mean
December	390	331	44	160
January	327	146	172	193
February	698	660	281	193
March	152	280	178	232
	1,567	1,417	675	778

In both phases of the trial rotational grazing was compared with continuous stocking. In phase I the stocking rate for both sections was 7.4 breeders/ha while in phase II it was 6.2 breeders/ha using 30 breeders on each system. The cattle used in phase I were all commercial Hereford maiden heifers. Half the cattle used in phase II were those used in phase I. The other half were again commercial Hereford maiden heifers.

Mating of the phase I heifers was carried out using artificial insemination over the January–March 1970 period. A 75% pregnancy rate was achieved using once daily inspection and insemination. Paddock mating was used in phase II from October–December 1971 and 100% pregnancy rate was achieved in both rotational and continuous grazing systems. All cows were non-lactating. The pregnancy rates from the 1972 mating (October–December) were 83.3% and 93.3% for the rotation and set-stocking groups respectively. Weaning percentages in phases I and II were 64 and 86.6% respectively. No undue problems with calving on pangola grass were experienced in either phase.

The December–March inclusive period in 1970/71 and 1971/72 was very wet compared to that of 1972/73 and to the long-term average.

Weaning weight in phase I was 80 kg (177 lb) at 163 days of age compared to 195 kg (431 lb) at 231 days of age in phase II.

The large difference in performance between the two phases was contributed to by several factors including the extremely wet summer season and the late calving (November–January) in phase I. The calves were born at a time when pastures were beginning to mature and decline in nutritive value. The heavy wet season caused a further decline in pasture feed value and this reduced the milk production of the dams. Internal parasites (mainly Cooperia spp.) also played a part. These factors contributed to the poor performance of the calves. The lactation effect plus the deterioration of pastures also brought about problems in the breeders. Of those that calved only 13% exhibited regular oestrus, 27% were anoestrus and the remaining 60% were in sub-oestrus or silent heat, i.e., they were actually cycling but not showing external signs of heat. At this stage most of the breeders were still in good store condition. Within three to four weeks of weaning the majority exhibited normal oestrus.

Because of the phase I experiences, phase II calving was brought forward to late July–early October 1972, i.e., just before the anticipated break in the season. Grazing oats drilled into the pangola sward was made available soon after calving began at 0.09 ha/breeder (0.2 ac/br) on a restricted grazing basis. This ensured that the breeders were on a rising plane of nutrition and so ensured early cycling for a short calving-conception period. The oats also ensured a better milk supply for the calves. The 1972/73 summer rainfall was a little below normal and much drier than the two preceding summers with the result that pasture growth just stayed ahead of the animals needs, thus maintaining pastures of a high nutritive value which was ideal for the calves. The higher level of nutrition possibly lessened the effect of internal parasites.

From these two phases it can be seen that in this area, particularly, if calves are late and there is a severe wet season, then problems may be encountered in getting breeders back in calf because of deterioration of pastures and resulting lactation anoestrus. Also late calves reared in a severe wet season are retarded because of the deterioration of pastures, internal parasites and poor maternal milk production. This applied particularly to first calf heifers which do not stand up to stress as well as mature breeders because they themselves are still growing as well as trying to feed a growing calf.

By calving just before or at the break in the season, both breeders and calves have the advantage of a rising plane of nutrition when it is needed most. If a severe wet season were to occur, the calves would be well enough grown to be weaned if necessary and the breeders in calf again before they start to lose condition. By calving earlier, calves can be weaned earlier, giving the breeder a few months on reasonable feed and a good chance of wintering in good body condition.

THREE METHODS OF UTILIZATION OF COASTAL LOWLANDS FOR BEEF PRODUCTION

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INTRODUCTION

Grazing trials conducted on one pasture type only and stocked yearlong with a constant number of cattle have decided limitations in applicability to commercial beef raising. Firstly, cattle numbers are not increased to use pasture growth peaks, and are not decreased when pastures are growing slowly or are dormant. Glut and famine recur monotonously. Secondly, such trials cannot take advantage of the different growth rhythm and therefore complementary role of other pasture types and of forage crops. The trial is unreplicated in order to achieve practical applicability.

THREE LAND USE SYSTEMS

18.6 ha of heath land and 3.2 ha of low Eucalypt ridge is used for three utilization alternatives, units being about 7.2 ha each. Pangola grass-white clover pasture is common on 4 ha of each unit and is used essentially as warm season grazing. The remaining 3.2 ha in each unit is used strategically but primarily as cool season grazing. These alternate forages are as follows:

(A) Saia oats drilled in during early June at 40 kg/ha with 63 kg nitrogen fertilizer and 3.4 kg white clover after rotavation of strips about 1.5 m wide and about 5 cm deep. Strips of pangola 15–25 cm wide are left for recolonising cultivated strips. Additional nitrogen may be used if feed is in short supply.

(B) Cold tolerant Setaria is fertilized with 100 kg nitrogen broadcast in both March and August for bulking up feed in autumn and for stimulating growth in spring respectively. During summer 40 kg nitrogen is applied at 6 week intervals, weather permitting. The highest total application of nitrogen so far amounted to 360 kg/ha/year. Grazing is usually confined to the pangola area during autumn to allow the setaria to bulk up.

(C) A pasture consisting essentially of Greenleaf desmodium, siratro, Petrie panic and Nandi and Kazangula setarias on a low ridge. No grazing is allowed when the pasture is being bulked-up in autumn.

All pastures are annually topdressed with 380 kg superphosphate and 190 kg KCl per hectare, except for the tropical species in (C) which receive 254 kg super and 127 kg KCl in the spring. Pangola pastures receive two-thirds of the annual maintenance fertilizer drilled in during autumn coinciding with clover resowing at 3.4 kg/ha.

Fresh weaner or yearling steers weighing 180 kg are introduced each spring and kept for 12–18 months. The overlap of steer groups during spring–summer gives a programmed stocking rate of one steer to 0.54 ha in autumn–winter and one to 0.27 ha in spring–summer. Additional steers are grazed when a surfeit of forage occurs. When the opportunity permits hay is made for feedback.

Fifty percent of bodyweight gain is presumed to be beef (income) and costs are made up of seed, fertilizer, mechanical operations, and animal health and husbandry measures. The gross margin analyses take no account of interest on capital nor of depreciation.

RESULTS

TABLE 1
Alternative land use systems for fattening steers (per ha).

	iii.68/* ii.69	iii.69/* ii.70	iii.70/* ii.71	iii.71/† ii.72	iii.72/‡ ii.73	5 yr. mean
Rainfall (mm)	713	1,743	2,092	1,911	2,511	1,794
A. Pangola + Oats						
Dressed wt. gain (Kg)	151	367	288	360	292	291
Gross returns ($)	83	202	158	221	206	174
Costs ($)	91	88	76	98	100	91
Net return ($)	—8	114	82	123	106	83
B. Pangola + Setaria						
Dressed wt. gain (Kg)	226	344	257	319	261	281
Gross returns ($)	125	189	141	196	184	167
Costs ($)	80	93	87	111	94	91
Net return ($)	45	96	54	85	90	76
C. Pangola + Tropicals						
Dressed wt. gain (Kg)	179	276	189	234	265	228
Gross returns ($)	99	152	104	144	186	137
Costs ($)	51	56	45	74	45	54
Net return ($)	48	96	59	70	141	83

* Cost of hourly rates for mechanical operations were constant—materials were costed at ruling prices. Beef was valued at $55/100 kg.
† Hourly rates were increased from $2.80 to $3.20. Beef was valued at $61.60 per 100 kg.
‡ Beef was valued at $70.40 per 100 kg and mechanical operations costed at $3.70 per hour.

Pangola/Oats and Pangola/Setaria are consistently higher yielding in dressed weight and gross return systems but they are also very costly. Nitrogen fertilizer applied on oats and setaria; one and a half times as much maintenance superphosphate and KCl as Pangola/Tropicals; oats seed; and the mechanical operations accompanying these practices are the principal items responsible for the increased expenditure.

The much lower dressed weight gain and lower costs of Pangola/Tropicals give a nett return on a par with that from Pangola/Oats with its rather high returns and costs. The nett return from Pangola/Setaria is appreciably lower due to lower dressed weight gains and thus gross returns. Excluding the settling in period during the first year, year to year variability was least in Pangola/Oats and most pronounced in Pangola/Tropicals.

Pangola/Oats has the highest failure risk since cultivation and planting are weather dependent. Sod seeding of oats was tried but because of the rather light cultivation and warm weather the strike was poor; pangola responded to the nitrogen application and crowded out the oats.

Although nett returns on the average are similar among the three systems, steers on Pangola/Tropicals always have a higher proportion of unfinished animals than on the other two systems.

It has been demonstrated that by having in addition to pangola another source of feed such as oats, cold tolerant setaria or a tropical pasture, and by overlap of steers in summer, mean daily dressed weight gains of between 0.30 and 0.36 kg/ha/day can be consistently obtained. Such steers have highly acceptable carcases of around 400 kg with a good finish at 2–2½ years.

Grazing additional steers over and above the programmed groups during times of surplus pasture accounted for about 10% of the dressed weight gain.

A SURVEY OF ILL-THRIFT IN BEEF CATTLE IN THE SOUTHERN COASTAL LOWLANDS OF SOUTH-EAST QUEENSLAND

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INTRODUCTION

Ill-thrift among cattle (and sheep) in Queensland is an annually recurring phenomenon. Normally it coincides with the dormant season of pastures, usually from late autumn through winter and up to the spring "break of season" rains.

However, this condition recently has also been observed during the active growth period of pastures, i.e. during two consecutive summers on the southern coastal lowlands of south-east Queensland.

During the extremely wet summer of 1970/71 many cattlemen in this developing area reported that both young and adult cattle failed to thrive, they lost condition and some died. Some 1500 mm of rain were recorded during December 1970 and January–February 1971. Heavily overcast conditions prevailed for lengthy periods.

Preliminary clinical investigations of cattle and their treatment with copper, cobalt and selenium were commenced by Departmental veterinarians during March 1971 on three affected properties. No measurable effect on condition or liveweight response could be demonstrated. By November the Department resolved that the condition had wide implications and set up a multi-disciplinary field group to examine those properties in the affected area with more than 50 beef cattle.

The group, consisting of the authors of this paper, was to determine:

(i) The nature of the syndrome and whether it was a single or diverse entity:
(ii) How widespread was the occurrence of the condition;
(iii) What common elements existed among affected properties; and
(iv) What the causes were.

HISTORICAL

The cattle

An ill-thrift syndrome was described by Sutherland (1952) in a herd in the Mooloolah District. The symptoms were scouring, marked emaciation, weakness, harsh staring coat and loss of coat colour. All classes of animals were involved, with calves most severely affected. The condition was prevalent during years of excessively high summer rain. Similar cases were encountered on other coastal properties. Copper deficiency was diagnosed and oral dosage was effective in preventing further manifestations of the syndrome.

Sutherland (1952) recognised also that other factors such as endoparasites, heavy tick infestations, aphosphorosis, and general malnutrition can independently or in combination produce symptoms similar to copper deficiency.

A number of authors (Alexander *et al.* 1953; Sutherland 1956; Alexander and Harvey 1957; Chester *et al.* 1957; Harvey *et al.* 1961 and Gartner *et al.* 1968) have reported on copper deficiency. There was an increase in copper reserves in the animals after copper therapy. Scouring ceased and no further deaths occurred. There was no growth response.

Contrarily, Donaldson (1960), Harvey *et al.* (1961), Donaldson *et al.* (1964) and Alexander *et al.* (1967) demonstrated growth responses in cattle following copper therapy on coastal marine plains.

The pastures

Research and experience in the coastal lowlands with pine trees (Young, 1948), pineapples (Mitchell and Cannon, 1953) and citrus, together with information from soil analyses (Vallance, 1938) had shown that the soils were deficient in nitrogen, phosphorus, potassium, copper and zinc. Soil fertility work by Andrew and Bryan (1955, 1958) at Beerwah found nitrogen, phosphorus, potassium, calcium (for clovers), copper and sulphur definitely deficient while zinc, molybdenum and boron required further assessment. Their recommended fertilizer mixture per acre (ha) for pasture establishment is: 5–6 cwt (560–672 kg) superphosphate; 5 cwt (575 kg) calcium carbonate; 1 cwt (125 kg) muriate of potash; 7 lb (8 kg) copper sulphate; 7 lb (8 kg) zinc sulphate; 7 lb (8 kg) borax; 4 oz (0.28 kg) sodium molybdate.

Methods of development, drainage and land preparation are given by Wright (1966). Barnard (1969, 1972) has indexed suitable species for this environment such as the grasses pangola, setaria and paspalum for all areas, and Green and Gatton panic and guinea grass for better drained sites only; and the legumes greenleaf, lotononis and siratro for better drained sites and white clover for poorly drained sites.

Grazing experiments on rolling coastal lowland at Beerwah (Evans, 1970) have shown that increasing annual maintenance dressings of superphosphate from 1 cwt to 2 cwt per acre (125 kg to 250 kg per ha), increased both legume content of the pasture and animal liveweight gain at each of three stocking rates studied. These were 0.5, 0.67 and 1 beast an acre (1.23, 1.65 and 2.47 beasts a hectare). On those soils there was no benefit from increasing potassium above ½ cwt muriate of potash per acre (63 kg/ha), the lowest rate used in the experiment.

Grazing trials at Coolum (Young and Chippendale, 1970) on wet heath have repeatedly been adversely affected by flooding and poor persistence of legumes so that maintenance fertilizer requirements under grazing have not been determined.

The survey

Between January and May 1972 altogether 47 properties were inspected. One or more properties could have been overlooked due to the group not being aware of their existence or not being able to locate the owner/manager. The owners/managers were questioned on details of the property and ownership; on its development such as clearing, pasture establishment and fertilizer use, pasture management, paddocks, watering points, cattle handling facilities; and numbers, production, breeding, turn-off, diseases, losses and supplementary feeding of cattle.

The properties surveyed were bounded by Caboolture–Elimbah Creek in the south and Tin Can Bay in the north and with few exceptions lay east of the Bruce Highway.

The properties surveyed comprises a total of 28,525 ha (70,486 acres) of which 41,395 acres had been sown to pasture. Twenty-seven had more than 400 acres developed and 20 less than 400 acres. These properties at the time supported some 23,000 head of cattle. Four of the properties were partially or wholly developed prior to 1920; on seven development commenced between 1964 and 1967; and on the remainder development began since 1968. Pasture development of one kind or another was still current on all properties during 1972.

Eleven per cent of the total area surveyed was almost flat land, i.e., alluvials and heath, while the remainder was undulating, rolling and ridge country and supported tea-tree, eucalypt and rainforest.

The findings

1. The *nature* of the malady is aptly described by the term ill-thrift. In simple terms it consists of lower levels of reproduction, growth and fattening of cattle with more deaths than can reasonably be expected from the type and class of cattle when viewed against the apparent amount and quality of the pastures they are grazing. It is of very little consequence in drier years (1967/68 = 1472 mm; 1968/69 = 1036 mm; 1969/70 = 1310 mm; 1972/73 = 1135 mm in the period September to March) and severe in wet years (1970/71 = 2326 mm; 1971/72 = 2333 mm). More rain does not alleviate the condition but rather aggravates it.

The syndrome is *diverse* in character and constitutes a continuum from a mildly seasonal one in which cattle are in backward condition, many cows fail to cycle (a calving percentage of only 66% was found), they don't have much milk and wean light calves and steers and bulls lose condition rapidly. Their condition then deteriorates gradually to the critical form described earlier by Sutherland (1952) as scouring (often very smelly), marked emaciation, weakness, harsh staring coat, and loss of coat colour. Weaners, steers, heifers, cows and bulls (but not horses) are equally susceptible to ill-thrift.

Blood and liver copper levels are often depressed, external and internal parasite burdens are variable, some animals die, while others linger on. More and higher quality feed together with administration of anthelmintics and dipping will not cure acute cases but animals suffering from the mild form will regain some condition so that they can be disposed of.

2. The condition is *widespread* throughout the area surveyed and only few properties were entirely free from either the incipient or the acute form. On six of the largest properties great numbers of cattle were in the early stages of ill-thrift. Still others were in worse condition. Some 1–2 per cent had deteriorated to the terminal or acute form.

The 'acute' form accounted for 61 per cent of deaths on all properties, or put differently, of 84 deaths per 1000 head in 1971, 50 were due to acute ill-thrift. The principal remaining causes of death were perinatal, tick fever/anaemia, ephemeral fever, wild dogs, lantana poisoning, clostridial diseases and unknown causes.

The magnitude of impaired production/reproduction as a consequence of incipient ill-thrift could only be guessed at. An example is available from the Coolum Research Station which gives some idea of the intensity of the losses sustained in the surveyed area. During 1970/71 cows and calves suffered severely from incipient ill-thrift while during 1972/73 they thrived. Production levels in the former year were less than one-third of that in the latter peak year. Similar depressions were evident on many properties in both 1971 and 1972.

3. The factors *common* to badly affected properties were: More than half their area was low-lying, poorly drained land; pastures being inundated for lengthy periods, and very wet soils. Such soils were either hard setting clays when dry and puggy when wet (Gn 3.91 and 3.94) or structureless sands (Uc 2.2 and Uc 2.3). Improved pastures established slowly and poorly on these sites and soils. As a consequence such new pastures suffered too severe initial grazing pressures, i.e., too many cattle per unit of pasture.

These properties are essentially located on land with the lowest elevation on the alluvials around river and creek deltas and around the lakes and on areas of heath. Properties with most of their land undulating, rolling or ridges had very little ill-thrift, either incipient or acute.

4. The *causes* of ill-thrift are clear. Such cattle are just not obtaining enough nutriment to meet the requirements of lactating cows and fast growing weaners, heifers, steers and young bulls. The result: production poorer than should be expected!

Such deficiencies in amount and/or quality of feed supply and the consequent ill-thrift have a few prime causes; in the case of the surveyed properties experiencing ill-thrift, many of the pastures were in their first or second year and therefore well below full productive capacity. The tuft grasses had not yet stooled out nor had the rhizomatous grasses fully covered the ground. The legumes present had only short runners. In addition there were the reduced pasture growth rates and the accelerated breakdown of standing summer pasture encountered during these prolonged and very wet periods with overcast skies. There was also inability of the legumes to nodulate effectively and to survive submersion. Large areas of pasture were inundated and the stock were reluctant to forage there. Superimposed on all this was the difficulty of mustering cattle for dipping and drenching and a consequent build up of ticks and internal parasites, the latter associated with short grazed pasture. The scene is thus set for catastrophe!

A further exacerbating factor is that many of the cattle purchased to stock these properties were often the culls (i.e. poor converters of pasture into energy, milk, muscle, bone and fat) in their home herds and usually not adapted to the local environment. Such animals were the first to succumb when the feed supply became limiting.

When such deterioration in condition proceeds for a lengthy period and is intense enough the critical form of ill-thrift is reached, i.e., shaggy coats, listlessness, scouring and death.

Copper, cobalt and selenium deficiency in animals must be ruled out as an initiating cause. In the three therapy trials located at the southern end, in the middle of the area and on the northern end, liveweight responses have yet to be demonstrated.

Possible control measures

Although the survey group was not specifically asked for proposals to combat the malady, such measures nevertheless emerge from the causes. Among the more important are the following:

1. Prevent inundation as much as possible by ensuring that low lying land sown to pasture is adequately drained and the drains are properly maintained.
2. Stock newly established pastures very leniently (beast to 4 acres = 1.5 ha) in their first year, lightly (beast to 2–3 acres = 1 ha) in their second year and to capacity (beast to 1–2 acres = 0.4–0.8 ha) only by the third year.
3. When intense and prolonged wet conditions are experienced, either drastically reduce the grazing pressure on pastures by selling, feeding or agistment, or boost growth in better drained paddocks by applying nitrogen fertilizer.
4. Although arduous, ensure that cattle are dipped at the prescribed 18 day intervals in spring and early summer and drench cattle against internal parasites when such are suspected or diagnosed.
5. Do not buy the next man's culls, nor should poor doers be retained once they are identified as such. Such animals will still survive under the less demanding subcoastal and western areas. Under the exacting and unforgiving conditions of the southern coastal lowlands they are the first to deteriorate and rapidly decline into critical ill-thrift.

Advice to advisers and consultants

1. An unambiguous statement to developers is needed on the land, pasture and cattle husbandry practices essential for viability of intensive beef production on the lowlands.

2. In collaboration with researchers and developers, recheck the application and implications of research findings in land, pasture and animal husbandry to specific habitats and particular commercial management regimes in order to locate problem niches.

Advice to researchers

1. The wetter parts of the alluvials and heaths have their most favourable conditions for plant growth in autumn, winter and spring. These habitats may yet have their biggest role in animal nutrition during these seasons. This approach would require consideration of pasture and forage species suited to and meeting animal requirements during these months rather than for summer.

2. The suite of legumes presently available for the alluvials and heaths is grossly inadequate both as regards their seasonality of production and contribution of nitrogen to the system. They also lack persistence in reasonable densities when grazed. White clover produces negligible feed in summer and autumn when incipient

ill-thrift is at its worst. Lotononis and Greenleaf do not survive in adequate densities when grazed under very wet conditions. Siratro, axillaris and glycine are restricted to drier locations. Phasey bean does not regenerate adequately from its own seed drop.

Legumes are needed to supply protein rich feed and nitrogen so essential for maintenance of the stands, adequate nutritive value and high productivity of pangola, paspalum and setaria grasses. These tolerate the wet conditions provided they are not very closely grazed.

3. The feasability of using short term (1–2 year) pastures and forage crops as fillers during the establishment and the initial vulnerable periods of long term pastures should be determined.

4. Probability and intensity estimates of risks (meteorological, pests, diseases) inherent in intensive beef production on coastal lowlands are required, and means of meeting such risks.

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COMMERCIAL DEVELOPMENT OF THE WALLUM

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Commercial development of the Wallum, particularly the northern Wallum, is considered in this paper. Cost of development, problems associated with the region and the performance of animals are discussed in relation to personal findings.

THE COSTS OF DEVELOPMENT

The role of the researcher is to define the ideal development methods, then commercial people have to adapt these ideals to suit economic constraints and yet remain successful.

It may be worthwhile mentioning a few such adaptions under the following headings:

(a) Clearing and raking; (b) Fertilizer costs; (c) Seed costs; (d) Planting; (e) Fencing; (f) Trading losses in initial years.

(a) *Clearing and raking*

The responsibility for clean stick raking has shifted from bulldozers to pederick rakes, i.e. we allow the bulldozers to do a reasonably rough job, and then remove the residue with a pederick. In general a saving of from $2 to $4 per acre results.

(b) *Fertilizer costs*

When development commenced 753 kg/ha (6 cwt/ac) of wallum mix, as it was then, was recommended. This cost $44 per ha ($18 per acre). For some years now separate components have been used as follows:

(1) A boom spray is used to apply trace elements.

(2) The relatively inactive oxides of the trace elements, including molybdenum, are included in the seed pelleting mixture.
(3) $1\frac{1}{2}$ cwt/ac (188 kg/ha) of super with copper, zinc and molybdenum are applied as the trace element source.

To date this appears to have been successful and establishment fertilizer cost per acre is $11 to $12 ($27–29 per ha).

(c) *Seed costs*

Whilst a developer will eventually fail if he stints on seed bed preparation and fertilizer and seeding rates, it is felt that the cost of the seed and the species to be used should be examined in relation to intensity of grazing it is intended to follow after development. It is well to remember that the investment in stock on a developed property can often equal the investment in land and development, and that cattle reproduce only once a year, and so the rate of build up in numbers is initially slow if finance is limited. If the decision is made that a low intensity course will be taken, e.g. (a) for low maintenance fertilizer rates, then soil nutrient levels will be low, dry matter production per acre will be low and (b) that drainage will be less than ideal, then there is a strong case for the use of cheap seed such as plicatulum which is vigorous, resists invasion and tolerates the low fertility and poor drainage situation, but has not the potential to produce as highly as grasses such as pangola and kikuyu which are relatively expensive to plant. In practice it is desirable to plant different pastures with different seeding times so that they can be spelled and allowed to seed.

(d) *Planting costs*

The same philosophy applies to planting large areas to pangola, where planting is slow and expensive. If the potential of pangola cannot be utilised for the first few years, the procedure on sandy soils has been to plant a cheap grass seed and use the combine to plough in a small amount of pangola runners. This increases planting costs by about $2.20 per ha ($1 per acre) and has resulted in a good growth of pangola after 1–2 years.

One deveoper near Maryborough has spun his seed out with his fertilizer for some years now and has good results at a low cost, but he does use 3 discings.

(e) *Fencing*

A large area of the wallum is devoid of timber suitable for fencing, and good split posts now cost about $50 per 100. Suspension fencing, and round posts which are driven are generally used. The wires are stapled on to the post thus avoiding the costs of post hole digging and post boring. Small round stringy barks, bloodwoods and ti trees have been treated satisfactorily and together with purchased treated round pine posts have produced stock-proof fences.

(f) *Trading losses in initial years*

As stated before, the investment in livestock on a developed peroprty can often equal the investment in land and development. Because of the uncertainty of the performance of cattle on the wallum and the trading difficulties involved in steer fattening, most people went into breeding, and this limited immediate cash flows. Some encouraging results are now becoming available from commercial young steer fattening, and the present premiums being paid for fat animals may overcome the difficulty usually associated with the high cost of stores.

However, a cash crop is still needed in the initial year to improve early cash flows. Seed production is an obvious one, but it is a specialist job if done on a large scale, and the market is subject to large fluctuations. The ideal situation would be the sowing of a pasture under a cash crop of a relatively stable commodity such as sunflowers or sorghum. More research is required in this field.

MAINTENANCE COSTS

When you have finished congratulating yourself on reducing your development costs to $5 per acre, then do a quick sum and see how much it affects your percentage returns on investment. Then reduce maintenance costs $1 per acre and repeat the sum and you find a marked increase in returns. For this reason it is necessary to make several comments on maintenance costs related to maintenance fertilizer, labour and animal health.

(a) *Maintenance fertilizer*

This must be considered under two headings:

(1) Direct costs
(2) Costs which allow a manipulation of the all year stocking rates and thus lower the fertilizer cost per breeder unit, which is the important figure.

(1) *Direct Costs*

Research findings which show that the use of an additional 125 kg/ha (1 cwt/ac) of super, i.e. a total of 377 kg/ha (3 cwt/ac) per year, is repaid with a profit margin by the resulting increase in animal production. Observations of the legume responses by the use of 377 kg/ha (3 cwt/ac) of super on our property agree with this finding and the use of 377 kg/ha (3 cwt/ac) of super and 63 kg/ha (½ cwt/ac) of potash is now practised. This results in a per acre cost of approximately $1 ($2.20 per ha) less than the traditional 250 kg/ha (2 cwt/ac) of super and 125 kg/ha (1 cwt/ac) of potash. Obviously the K situation will have to be reviewed constantly.

(2) *Costs which allow manipulation of stocking rates*

The use of nitrogen in early autumn to cause bulking up for winter has been advocated. This has been practised on a limited scale with success and is preferable to conservation, such as silage. It is not possible to generalise on stocking rates but the following stocking figures were achieved in winter on paddocks which were allowed to bulk up in autumn for a seed crop, and were grazed after harvest. All cattle had access to urea and molasses, and in all instances the crop was frosted. The paddock was 113 ha (250 ac) of siratro and plicatulum. In 1970 we grazed 160 cows and 6 month old calves for 60 days commencing in July. On my figures this is equivalent to 19,200 steer grazing days, i.e. 169 steer days/ha or 76.8 steer grazing days/acre, or 1 dry cow equivalent per acre for 70 days. In 1972—on the same paddock we grazed 251 cows and calves on 57 hectares (125 acres) for 70 days. i.e. 280 steer days/acre, i.e. just over 6 livestock units (l.s.u's)/acre in winter on residues. (NOTE—once legumes are frosted it doesn't hurt to graze them very hard.)

(b) *Labour*

For some time attempts have been made to cost labour against different enterprises. One point is slowly emerging—over a certain level the increased use of labour for cattle care is not warranted economically. Higher mortality rates or lower calving percentages are not experienced on properties where cattle are treated as second class citizens because of seed production.

(c) *Animal health*

You cannot expect to survive in the wallum using the same level of husbandry which would be acceptable in western Queensland.

However, in the northern wallum our animal health costs are lower than expected. We used to budget $5 per breeder, but this has been reduced to $3 to $4 per annum.

Two areas are significant:

(1) *Ticks*

Routine 17-day dipping commenced on the 1st of September saves us chemicals and labour. Of course some knowledge is necessary of when your local spring tick rise occurs and the date after which eggs do not hatch until the following spring. However, you have to be in a position to assess what control you would achieve by 4-weekly dippings. Dipping once a month from September to April would involve 8 dippings, i.e. equivalent to 17-day dippings to 30th December. At present 17-day cycles are more economic overall, but constant reviews are necessary.

(2) *Internal parasites*

From constant egg counts, it is possible to show that young cattle can sustain high worm burdens and do well as long as feed is good. However, such cattle are at risk. Hookworms of course have to be treated with a great deal more respect. In general we seem to be surviving without clinical symptoms with a single drench at weaning.

Some years ago Mr. Randy Winks of C.S.I.R.O. measured the effects of routine monthly drenching of calves in central Queensland and found that the increase in growth rate was not high enough to warrant the expense.

Presently Mr. Rick Bryan, also of C.S.I.R.O., is repeating this trial on 3 of our properties. It is too early to draw conclusions but to date the treated groups are gaining weight more rapidly than the untreated. One paddock in which trials are being conducted has 274 animals 9–18 months old on 113 ha (250 acres)—so the worms have every chance.

PROBLEMS ASSOCIATED WITH THE REGION

Those properties in the high rainfall area which have caused so much adverse comment lately are not discussed here. The main problems come under the following headings:

(a) Economic—Man made;
(b) Economic—Physical;
(c) Biological.

(a) *Economic—Man made*

Wallum country has suffered, often unjustly, because it is a new development area, it has received a lot of publicity both favourable and adverse, and it is political.

Firstly there have been some irresponsible and misleading statements made in the forestry versus beef land use argument by people in a position to influence Government decisions. Probably the worst example is that forestry employment figures have been extrapolated to include all ancillary industries such as saw mills, with no regard to timing, yet the employment figures for the beef industry have not, hence it has been frequently quoted that forestry will employ 25 people per 453 hectares (1000 ac) developed to beef's one. If you are interested in reading a well presented argument that Australia does not need further forestry plantings, it is recommended that you read the article by Richard Routley in the December, 1972 edition of the Australian Quarterly.

The second comment concerns the difficulty of definition of economic acceptability. It has often been said that the economic return resulting from Wallum development is low. Until standard methods of comparison are used and comparisons are actually made with other rural enterprises, we will not really know.

Investments are usually compared in terms of return to capital invested, but what does this mean? If such investment is considered by a public company a discounted cash flow method would probably be used, but the cattle value used would probably be book value: If a mining company did the same exercise they would probably use equity accounting. Private individuals would probably use the flat percentage return on total capital. However, percentage return can be varied significantly by:

(1) Changing the time of the year when you calculate capital tied up in the herd, i.e. considering them before or after sales, as cows and calves, or as breeders at a flat rate, or in a fattening exercise as steers in which you have 50% equity.
(2) Including the trading losses in the first few years as a development cost.
(3) Not including increase in cattle inventory value at market value as a profit.
(4) Consideration of profits before and after tax.

Basically, the fact is that you cannot accept a figure for the percentage return until you have the inputs used, the production indices, and the methods used, and compared the results with those of other enterprises budgeted on the same basis.

To return momentarily to the forestry versus beef land use argument, most considerations of the use of public monies, such as flood mitigation, are now considered using a discounted cash flow method. A recalculation of the benefits of investment in forestry and beef done with present day inputs, using a discounted cash flow would most probably bring the beef enterprise out on top because of the long wait for significant returns from forestry.

To return to our consideration of the economics of the Wallum. The DPI Farm Management Accounting Service Report No. 12 examined groups of properties in different enterprises and areas using a standard method, i.e. their ability to pay a return to investment, and a return to management after they have been charged 7% against capital.

It is significant that:

(i) The Moura beef group showed a return of 6.13% on assets and no return to management.
(ii) The Warwick beef group did not achieve a $ return to assets.
(iii) Neither did the Karara sheep and beef group.
(iv) The Central Highlands grain and beef group showed a 7.18% return to assets.
(v) The South Burnett beef and crops group showed a negative return to assets.

It is, of course, debatable that such co-operative groups are truly representative.

The most important man-made difficulty has been caused by a great deal of development being undertaken on the basis of poorly executed budgets, and these budgets not being achieved. Input data and production indices are only now being recognised. This difficulty is inherent in every new venture be it agricultural or otherwise, and the fault lies with the budget, not necessarily with the enterprise.

What do we know of production figures on the wallum? We have some encouraging facts such as:

(i) We now feel confident that a legume based grass pasture will support 6 l.s.u. per acre on a year long basis (with molasses and urea). We are currently running the equivalent of 3 steers/.41 ha (1 acre) on pangola and 448 kg/N/ha (400 lb/N/ac).
(ii) We have seen trials in which calves gain one and three-quarter lb a day or more.
(iii) Figures from North Isis are most encouraging in terms of a growing and fattening exercise. A five year average liveweight gain of 320 kg/ha (288 lb/ac) with a range from 228 kg/ha to 538 kg/ha on legume based pasture.
(iv) On one of our properties we can turn 2 year steers off at 227–272 kg (500–600 lb) fat and win carcass competitions.
(v) We have Charolais cross calves gaining 1.4 kg/day (3 lb/day).

(vi) One developer in the Maryborough area is claiming 8% return to capital.

To sum up it is suggested that enough success has been reported for us to be encouraged.

(b) *Economic—Physical*

The economic difficulties imposed on us by the very nature of the wallum are considered. This includes such things as:

(i) The need for annual top dressing.
(ii) The apparent non-accumulation of nutrients at times.
(iii) The poor performance of pastures and animals during very wet spells.
(iv) The difficulty of growing winter and early spring fodder economically because of rainfall unreliability.

Firstly an investor must list his priorities correctly. If he rates high and relatively reliable rainfall and proximity to markets and amenities high on his list, then inherent soil fertility must be given less consideration. There are very few places in the world that can fulfil all the ideal requirements for beef production. Some of these physical difficulties are briefly considered in the light of our experience.

(i) Maintenance fertilizing obviously will require constant monitoring. It is unfortunate that more accurate knowledge over a longer period is not available so that soil tests can be interpreted more accurately, but slowly information is emerging—for instance there is an indication at Maryborough that the missing P and K may be found at a depth of 25 cm (10 in).

(ii) Dr. Ebersohn explained the non-accumulation of nutrients when used at high levels in terms of dry matter on the paddock, i.e. a heavy fertilizer user must always have a reasonable level of dry matter on his paddock.

(iii) The growing of dryland winter fodder crops in the wallum is uneconomic, yet winter limits our all year stocking rates. For this reason the use of a small area of high intensity irrigation on these properties can show a high return to marginal capital because of the increased number of cattle which can be carried, and because cows can be calved in stronger condition and thus will go into calf promptly. There is a need to rotationally graze these heavily fertilized irrigated paddocks.

(c) *Biological*

This can be discussed in conjunction with the next major heading.

COMMENTS ON POOR ANIMAL PERFORMANCE

This must be considered under two headings:

(a) The severe problems of some high rainfall properties.
(b) The lesser problems of not achieving as high animal performance per acre as we would like.

To deal with the lesser problems first under the following headings: (i) Definition of budgeting objectives; (ii) Legume survival and drainage; (iii) Nutrition; (iv) Phosphate; (v) Breed; (vi) Parasites.

(i) *Definition of budgeting objectives*

Once again there is a difficulty of definition. Is the country at fault or are there initial optimistic budgets? Are economic production levels being attained? We are trying to achieve high stocking rates and the ability to fatten simultaneously in one paddock. Perhaps this is asking too much of any one system? Wollongbar Research Station recently released the results of trials which achieved a stocking rate of 3 steers per acre on kikuyu, and a high weight gain per acre, but they did not attempt to fatten.

What do we know about animal performance in the Wallum?

(1) We can run a breeder on two and three-quarter acres and turn off an $80 vealer at 14c/kg (30c/lb) if the vealer is dropped in early spring. (Why everyone wants to raise vealers I don't understand.)
(2) We know calving percentages are good if husbandry is good.
(3) At Isis a gross return of $24 a hectare ($53 an acre) i.e. equivalent to 2 tons of sorghum at normal prices can be achieved.

The real question should be—we know we can achieve the above—can we translate the above into reasonable economics. This is possible but there are some factors which are limiting production. We should consider them briefly.

(ii) *Legume survival and drainage*

It has become quite obvious that legumes will not survive in areas of poor drainage both internal and external. This eventually leads to the ingress of sedges and native grasses and deterioration of improved grass species. Attempts have been made to overcome this by using a rotary drain digger and I think the indications are we are having moderate success.

(iii) *Nutrition*

We have all known for some time that tropicals are low in energy and that energy is limiting production. However, it is not difficult to provide energy to animals. The question is can you do it economically? We are presently trying to compare the weight gains of two groups of steers—both on good pasture—one with molasses—one without. Molasses, of course, also supplies sulphur.

Evans and Bryan postulated that phosphate may be limiting liveweight gains on pangola with heavy nitrogen. The South Africans have done some excellent work showing increases in weaner growth rate from P supplementation. It is somewhat disconcerting to find that a team of steers from the wallum which had won prizes in a fat cattle competition were marginally phosphate and copper deficient. A copper cobalt supplementation trial was implemented to test many more animals and a very confused picture emerged. A high percentage of our animals are marginally deficient, but the marginal deficiency is being masked by the energy lack. It is probably reasonable to assume that if lack of energy is overcome then evidence of copper, cobalt, phosphate and sulphur deficiency will become more apparent.

Urea and molasses is a must in winter and we have used it through into spring at a higher rate than recommended in an attempt to achieve early cycling of cows.

Dry matter intake becomes a problem during wet periods. Weight gains stop in a wet month and recommence in the succeeding dry month. Perhaps hay feeding, or shifting to a bulked up higher and drier roughage paddock would solve this—I also believe that low dry matter intake exacerbates the worm problem and animals start to scour.

Evidence suggests that the wallum demands the use of Brahman Cross Animals. British breed cows lose condition more easily and don't milk as well. Weighing trials on Royce Sommerfeld's property revealed that British calves on British cows gained 0.57 kg/day ($1\frac{1}{4}$ lb/day) whilst Brahman X calves on British cows gained 0.68 kg/day ($1\frac{1}{2}$ lb) and Brahman X calves on Brahman X cows gained 0.80 kg/day ($1\frac{3}{4}$ lb).

To sum up my thoughts on the reasons for relatively poor animal performance, firstly I would need some convincing that given an acceptable level of husbandry in the northern wallum poor performance is the rule rather than the exception. Secondly I think that a great many of us are operating in a more intensified situation than we are accustomed to and increased intensity means increased risk and demands increased husbandry. Animal production could obviously be higher, but I haven't seen anywhere that it couldn't.

THE PROBLEMS OF THE HIGH RAINFALL AREAS

I think the problems which have arisen with one or two notable exceptions are the result of a combination of factors such as:

(1) Relying on undeveloped country to carry stock, (2) Overstocking young pasture, (3) Inadequate drainage and legume loss, (4) Lack of nutrient accumulation, (5) Lack of recognition of the need for a high level of husbandry, (6) Lack of dry matter intake and an excess of parasites both internal and external in the wet season, (7) Marginal and clinical levels of phosphate and copper deficiency, (8) Use of British breeds.

Combine all of these and you have a severe problem. We have discussed all of these to some degree.

As long as beef prices stay at a reasonable level we'll keep our head above water, but won't make a fortune. Present research is being directed to the correct areas and the outlook is encouraging; the research teams should be congratulated.

BOOK REVIEW

The Grasses of Southeast Queensland by J. C. Tothill and J. B. Hacker and published by University of Queensland Press, St. Lucia, 1973.

Though presented by the authors as primarily a compilation, the Grasses of Southeast Queensland constitutes a major contribution to the botanical knowledge of a complex region. In presentation and interpretation, the work can be regarded as a scholarly production with appeal to a wide range of professional disciplines and popular skills related to plant taxonomy.

The bulk of the descriptive matter (Part III) is devoted to detailed descriptions of 104 representative species of the 103 genera recorded for the region. For comparative purposes, the descriptions are helpfully consistent in format and for the benefit of the enlightened layman, taxonomic terminology is restricted to a practical level. A concise glossary is provided for more difficult terms. Following the description of each species is a paragraph containing useful information on ecological distribution, economic value and taxonomic affinities. Conveniently placed on the opposite page is an illustration of the plant, the spikelet and its components. Better usage of the full page by increased magnification of the floral organs would have improved the value of many of the drawings. For those requiring additional information, relevant references to local and recent publications are available. Dichotomous keys are provided for those genera with more than one species in the region and supplemented in large genera with illustrations of the spikelet.

Supporting information is not lacking. Part I of the book classifies the region into six ecological zones containing 13 geographic-vegetation units. These are informatively described and characterized, particularly in relation to the grass flora, and illustrated by photographic plates. Furthermore, a table plots the distribution and frequency of the 343 grasses in the region, so that component native, weed or cultivated species of any unit can be readily ascertained.

Part II comprises a description of the grass plant, a pictorialized key and a detailed dichotomous key to generic level. The descriptive account, supported by stylized illustrations, emphasizes the variation and taxonomic significance of the floral and vegetative organs, and is an invaluable aid to those not familiar with the peculiar characteristics of the grass family. The pictorialized key, based only on features of inflorescence and spikelet, provides a rapid guide to groups of genera, but requires coping with several alternatives. The taxonomic key, like the species' keys in Part III, depends largely on fairly obvious characters and should not be difficult for most readers.