holding. Basic development projects for the first four years include houses for married staff and quarters for single men, implement sheds and workshops, storage sheds, and a laboratory and office building; a road to give access to the building site and minor roads and tracks to proved for movement within the property; some 18 miles of new boundary fencing plus much internal subdivision fencing; a water supply for the housing area and more stock water points; telephone and electricity connections. We have to build up a herd of cattle to graze on the property, whilst there are two existing sets of stockyards these will need extensive modifications to fit our needs. And finally there will be land clearing, fencing, water reticulation, and cultivation to set up experiments.

All this will take much time and effort. As a consequence only small scale experiments to study fertilizer requirements and species behaviour will be possible in this first year. These will be done on both the brigalow and spear grass lands and will provide necessary preliminary information to help plan further work. The first large scale grazing trials are expected to start in the 1967-68 summer.

Fortunately there are no development problems concerned with staffing the Research Station. Managerial staff have already been recruited, and the research program will be undertaken by existing staff of the Division of Tropical Pastures at the Cunningham and Cooper Laboratories. Thus we have a fine property with types of country to suit our needs, we have funds to set the place up, and we have the research staff. The future will show how well we can succeed.

PASTURE IMPROVEMENT IN THE SOUTHERN SPEAR GRASS REGION MAY MEETING, 1966

C.S.I.R.O. PASTURE RESEARCH, ESKDALE DISTRICT—L.'T MANNETJE

See 't Mannetje, L. (1967)—Pasture development in the Eskdale district of South eastern Queensland. Tropical Grasslands **1**(1): 9-19.

DISCUSSION

What do you consider is the contribution of legumes to the nitrogen status of this Rhodes grass/Siratro/lucerne pasture?

Dr. 't Mannetje: It is difficult to measure. Siratro contains about 3% N, Hunter River lucerne 5% N. The grasses and weeds have shown a good response to the presence of legumes and contain up to 1.2% N. Overall the nitrogen status is fair in the legume pastures. I think it is reasonable to say that the legume contributes about 100 lb. N per ac. per year.

Is it possible to establish legumes in native pasture?

Dr. 't Mannetje: I don't know yet. The drought has prevented us investigating this. Perhaps Mr. Filet of the Department of Primary Industries has some information.

Mr. G. Filet: Our work on direct introduction of legumes into native pasture is not promising at Eskdale. The results are better at Toogoolawah, especially with Siratro. In this case, the seed is introduced with a tyne cultivator with 2 cwt superphosphate broadcast on the surface.

What cultivation procedure do you recommend for establishing a pasture of Rhodes grass, Siratro and lucerne?

Dr. 't Mannetje: We have found at Eskdale-West that a short period between first cultivation and planting is to be preferred over a long fallow or a pre-cropping phase. The reason for this is that if the land is left bare for any length of time or if it is cropped a tremendous weed infestation follows which is almost impossible to beat, and which outweighs the advantage of pre-cropping. It is not wise to plant at any other time but summer. The land can be prepared in November and planted from December to March depending on the earliness of the wet season. In drought years it is perhaps better to plant in a dry seed bed rather than wait too late for rain because valuable days can be lost following storms in waiting for the ground to dry sufficiently for the use of implements. The danger of losing the effectiveness of the inoculum is greatly reduced by pelleting the seed.

What do you estimate the longevity of the legume to be?

Dr. 't Mannetje: The pasture planted in January 1963 has been fairly heavily grazed and this has not prevented the Siratro from setting seed, because seedlings have come up regularly, and the stand has thickened up considerably. The plant density of lucerne has deteriorated somewhat over the years but the total yield has not fallen off. It is not possible to say how long the lucerne will last. If it lasts 5 years, as it appears it might, it is as good as any grazed lucerne stand in most areas of Queensland.

How does Siratro stand heavy grazing?

Dr. 't Mannetje: The evidence from wetter areas, such as Samford suggests it does not stand up to heavy grazing, but in the speargrass country grazing at the level of a beast to three acres has not done Siratro any harm. In fact one paddock of Siratro at Rodd's Bay (near Gladstone) has been grazed as heavily as a beast to 1½ acres right up to the middle of the drought. Siratro and in fact all other vegetation was eaten out completely, as nothing would grow because of dry conditions. Because of this the stocking rate was decreased to a beast to three acres in the middle of 1965 and when good rains fell in December Siratro seedlings appeared everywhere. Now there is again a reasonable density of Siratro.

Mr. Jones: At Samford, Siratro goes out under both intensive cutting and grazing. The maximum stocking rate commensurate with maintaining Siratro in a pasture is 1 beast to 2 acres. One beast to 1 acre is too severe.

Dr. Humphreys: Referring to Dr. 't Mannetje's estimate of live weight production from this pasture I would like to add here that at Brian Pastures Research Station we have been able to achieve 200 lb. live weight gain per acre for animals on fodder crops, 160 lb. on lucerne and 100 lb. on sown pasture based on lucerne.

It is true that Rhodes grass is "sour" in this country?

Dr. 't Mannetje: No not exactly. It gets its bad name because it has not been treated

correctly, without adequate fertilization and association with legumes it becomes stemmy and poor. Fertilizer should be applied before or at sowing and subsequently each year in November-December.

You stated that pasture establishment costs about $16 *per acre here; what is the schedule of operations?*

Dr. 't Mannetje: There are at least two cultivations, one a disc ploughing followed by a tyning. However, the weather will dictate the necessity for more cultivation. For sowing a "C seeder" was used and this is recommended as a cheap effective unit. The seed bed is rolled with a Cambridge roller after seeding.

Is it necessary to pellet Siratro seed?

Dr. 't Mannetje: No, it is not necessary. However, it is recommended to use inoculum to ensure rapid nodulation with a known and highly effective strain of *Rhizobium.*

How long can seed be kept after pelleting without the inoculum deteriorating?

Dr. 't Mannetje: 3-4 weeks in a cool shady place.

On lucerne stands established from pelleted seed, what sort of regeneration of plants from seed can be expected?

Dr. 't Mannetje: No regeneration seems to occur. Only the original plants comprise the stand and their longevity appears to be about 4-5 years. Even in regions more favourable to the growth of lucerne there seems to be little regeneration, however.

Dr. Ebersohn: in closing the discussion commented that in establishing pasture we really don't know what the animals are eating, as weeds form an important component of the diet. He extended the thanks of the meeting to Dr. 't Mannetje for his address and to Mr. Bell for his hospitality on his property.

THE BURNETT DISTRICTS

by

N. F. Fox, Department of Primary Industries, Brisbane

It is very fitting that the Tropical Grassland Society should visit Gayndah. For almost 100 years Gayndah was the centre of a grassland society, a community which depended for its very existence on grass.

A study of the history of this valley is helpful to those who wish to really understand this land, its people and their problems, and the biotic, social and economic interactions that influence land use.

HISTORICAL ASPECTS OF SETTLEMENT

Henry Stuart Russel first visited the Burnett in 1842 and 1843. He "came upon a river flowing from the east in full stream". It was the Stuart. This district which was untouched and untrampled by the white man and his flocks before 1842, became a veritable hive of human activity between 1845 and 1849. "Ban Ban", "Ideraway" and "Wetheron" stations were occupied in 1845 and 1846. Humphreys, Herbert and particularly Reid of Ideraway were in high spirits and pleased with their good future when Thomas Archer visited the district in 1847-48.

The forties were bountiful years. Archer returned to settle at Eidsvold. He camped at Ban Ban springs with 4,300 sheep, 2 drays, 20 oxen and a party of 16 on the 31st May, 1848. He camped on Barambah Creek opposite Brian Pastures the next day and on 4th June drove his flock through the present town site. After starting his sheep the next day he went ahead to burn grass between the river and the mountains. A white man for the first time imposed his stock and his management on the native vegetation—grazing and burning.

On 14th July he made good progress—8 miles in the day. He tells us "this was partly due to the broken nature of the country, but more to the thick matted grass we had occasionally to force them through. At last by perserverance, flogging and dogging we once more reached the banks of the Burnett, a broad sandy river bed with a narrow stream rippling through it, which in the moonlight looked like a gigantic silver thread". He mapped and carefully avoided the softwood-brigalow scrubs on his trip to Eidsvold.

So rapid and so confident was this pastoral invasion that in 1849 a township was declared at Nortons Camp. They named it Gayndah. Four hotels, a court house, numerous bark shanties and three medical practitioners were in evidence in the early fifties. The were prosperous years. These early squatters were men of substance. The township grew. Gayndah was seriously considered as a possible capital for the proposed new State.

The first note of discord was felt and heard as early as 1854, when there was a serious out-break of footrot and scab. There is also some evidence that internal parasites were becoming increasingly serious. Another fatal out-break of disease

occurred in 1874, which coincided with an economic depression. Footrot, scab, internal parasites and economic depression were affecting production but the seasons remained fairly good. Dogs were a problem.

The year 1883 spelt disaster for the Sheep Industry. Gayndah registered only 1,380 points of rain for the year. At the break of the drought black spear grass is reported to have assumed dominance in the pastures. I query the statement but its intrusion was certainly serious enough to accelerate the change to cattle, or rather to cattle and horses. Good horses brought high prices.

Thus footrot, scab, depression, parasites and predators, drought and a change in the botanical composition all combined to influence a change in land use in the first 35 years of settlement.

Social pressures were imposed. The State's population had increased and there was some political demand for closer settlement. The Land Act was passed in 1884. In 1887 about 87 square miles was resumed from the Eidsvold Consolidated Run. In the same year there was a gold rush to Eidsvold. An area on the Burnett River, known as "Grosvenor Flats", was surveyed and declared open for selection in 160 acre blocks @ 2/6 an acre or 6d. per acre a year. This was forest land. Farmers with no precedent to guide them supplied Eidsvold with milk, vegetables and eggs. They survived the disastrous floods of 1890 and 1893. The sons and grandsons of these first settlers are in the district today.

The 1893 economic depression put hundreds of unemployed on the city streets. The Government of the day opened 3 group settlements—Resolute (Gooroolba), Bonacord and Byrnestown. Again, 160 acre blocks were opened for selection at 2/6 an acre but payable over 20 years. The settlers had very little money. They had to walk from the rail head at Degilbo. There were no Eidsvold miners to buy their produce. They lived in unbelievable poverty for years.

Between 1898-1902 this settlement pattern was repeated at Gayndah, Ban Ban, and Reids Creek. Mundubbera was opened for closer settlement in 1906 and Binjour Plateau in 1908. Dairy factories were not built at Gayndah till 1911 and Mundubbera until 1916, in each case nine to ten years after settlement. The planning was not efficient. The railway seemed to follow and not precede the settlement. The Upper Burnett and Callide Valley Land Settlement Act was passed in 1923. The settlement in Monto is as young as 1926—just 40 years old. Here on better country in the age of the machine, conditions were easier.

In this period between 1887 and 1926 much of the better land was excised from the grazing holdings. The old pattern, disease—drought—economic depression—weeds, plagued the Cattle Industry again between 1901 and 1934. Cattle tick and red water decimated herds in 1901 and 1902. The great 1902 drought added to the severity of the problem. Graziers were faced with the problem of finding the capital to restock, build yards and dips, sub-divide and provide water.

Then prickly pear, almost forgotten by this generation of graziers, farmers and scientists, overran the grass lands. In places it formed a complete ground cover. It covered fences and yards and hindered movement on the stock routes. Costs of prickly pear control were enormous and holdings and farms were surrendered or abandoned. It was the cause of bitterness and wrangling between the land owner tenant and the crown. Special legislation was enacted to deal with pear infested lands.

It was not controlled until *Cactoblastis* was introduced. The eggs were distributed first in this district in 1927 and by 1935 the prickly pear was no longer a pest in Southern Queensland.

In 1924 while the cattle tick and pear raged, the price of fat cattle fell from about £8 to £3 a head. It wasn't till 1954 with a rising market that the beef industry really returned to solvency and graziers were able to find capital for development—60 years of struggle. There was a period in the 1930's when cotton became an important industry. It was a pioneer crop on the newly cleared scrub farms. In 1931 the value of the crop from this district exceeded £100,000.

The central Burnett was the cradle for the Grass Seed industry. Rhodes grass was introduced in 1907 and 1908 by the Department of Agriculture. In 1909 it was sold by farmers, Loch, Hughes and Seeney, at about 4/6 a pound. Aerial seeding of Rhodes was pioneered here in 1947. Rhodes grass made possible the economic development of the Scrub lands. Prior to 1936 the Burnett was the only source of supply. The first 5 ton consignment of Rhodes to the U.S.A. came from this district.

Petrie of Madoora observed and multiplied Green Panic. Gayndah buffel was distributed from a school plot by Rasmussen. After 1902 another force, not always discernible, influenced the agricultural-pastoral complex. Animal husbandry men and veterinarians showed a way to cope with disease. The early agrostologist introduced new plants and the entomologist found controls for the prickly pear (*Cactoblastis*) and for the insect attacking cotton and citrus.

The character of the people who live in this district has been moulded by its history and environment. The state of development of their properites and the policy of the shires have been influenced by the past. Extension officers in particular should be aware of the implications.

The research officer and the agricultural administrator should be aware of the complexity of the interactions that affect land use. A review of the history of a region illustrates these interactions—animal disease, drought, predators, changes in the flora, economic depression, social pressures and the influence of scientific and technological advances.

Changes are occurring in the district at the present time. New breeds of cattle have made their appearance. Ticks are becoming resistant to known insecticides. Prices are rising. Water conservation programmes on the river have been started. The dairy industry is declining in importance. Developments occurring in the Brigalow areas to the west and on the coastal lowlands to the east could affect the pattern of land use in the Burnett.

THE ENVIRONMENT

Now let us examine the environment which has been subjected for just 120 years to the gentling hand of man.

The climate in the Central Burnett is typical of much of sub-coastal Queensland. The mean annual rainfall is 28 inches but the reliability of the effective rainfall is much lower in comparison with the 50 inch rainfall country on the coast. The area is subject to frosts between the months of May and September.

The following grouping of soil, vegetation and land use associations is convenient for the Burnett District as a whole:

1. The coastal lowlands
2. The coastal foot hills
3. The coastal ranges
4. The Yarrol Basin—brown soil belt
5. The granitic sandy soils.

The divisions which interest us here are those which we may term sub-coastal. We will discuss only the last 3 of these 5 divisions or groups.

The Coastal Ranges

In the north the division is extensive but south of the Burnett River it narrows to a simple range formation. Topography is broken and steep. Rainfall is between 35 inches and 40 inches. Frosts are common in the valleys between May and September.

Shales and sandstones in the Kalpowar district produce brown gravelly loams. The upper slopes of the range and some of its spurs are covered with dense vine scrub. Hoop Pine plantations have been established.

To the north of Mt. Perry and east of Yarrol granites out-crop. The intrusions extend south to the Burnett River. The forest is on open iron bark (*Eucalyptus crebra*) with spear grass (*Heteropogon contortus*) dominant ground flora. The gullies are well grassed with paspalum (*Paspalum dilatatum*) and forest blue grass (*Bothriochloa intermedia*).

The Yarrol Basin—Gayndah Brown Soils

A complex of soils of medium to heavy texture has been formed on Yarrol basin sediments in the north and on volcanics in the Gayndah district. The soils are pH neutral and adequately supplied with essential nutrients. The division lies between the 30 inch and 35 inch isohyets. Frosts are common and occur between early May and September.

Open silverleaf iron bark (*E. melanophloia*) forests grown in association with the brigalow softwood scrub. Softwood scrubs with some brigalow occur on elevated plateaux at Yarrol, Mulgildie, Binjour, Gurgeena and on the valley floor at Coalstoun Lakes. The basalt derived grey brown loams and clay loams of the Gayndah district carry bloodwood (*E. dichromophloia*) and iron bark on the ridges, and poplar box (*E. populnea*) on the lower slopes with blue gum (*E. tereticornis*) common on the flats.

Native pastures have become spear grass (*H. contortus*) dominant following ringbarking. Pastures do contain a high proportion of forest blue grass and Queensland blue grass (*Dicanthium* spp.) which become dominant on the flats (Downs type soils).

The scrubs have been cleared and planted to exotic grasses—Rhodes (*Chloris gayana*), green panic (*Panicum maximum* var. *trichoglume*) and buffel grass (*Cenchrus ciliaris*). Where the topography is suitable the scrub soils produce grain, field and fodder crops. Dairying is an important form of land use on the scrub soils. The dark grey brown loams and clay loams produce grain and field crops in association with dairying or grazing.

A narrow strip of sandy loam on the Burnett River terraces is used for citrus and melon cropping under irrigation. Heavy alluvial soils in the Monto district produce irrigated lucerne and fodder crops. This division is the dairying—mixed farming—horticultural area of the Burnett. Beef cattle are grown and fattened on soils which for reasons of topography, depth or drainage are unsuited to cultivation.

The Auburn Granitic Sandy Soils

The division lies to the west and south of the Burnett River. The topography is generally undulating and the soils are either directly derived from or influenced by the Auburn Granitic Massif. Soils vary in texture from deep sands to gravelly loams and seem to be directly related to the basic constituents in the parent material. The soils are acid, pH 6.2 and 6.6. Legume responses to P, Mo and K have been recorded.

Mean annual rainfall is 27 inches to 30 inches. Frosts are common between May and September. The vegetation is dominated by narrow leafed ironbark on the light textured soils and by silver leafed ironbark as the clay content increases. Spear grass is dominant on ring-barked country.

Within the division there are relatively small areas of soils carrying brigalow soft-wood scrub. These occur in the Coonambula and Hawkwood areas and have been pulled and seeded to Rhodes grass. There are relatively small areas of solodic soils particularly on the eastern fall of the Auburn range, and on flats between granite slopes.

Grazing is the principal land use. The division supplies the store cattle for the Eidsvold markets and fattening areas to the east and south.

AN INTRODUCTION TO "BRIAN PASTURES" RESEARCH STATION

by

K. B. Addison, Department of Primary Industries, Gayndah

Following an agreement between the Australian Meat Board, the Queensland Government and the Commonwealth Scientific and Industrial Research Organisation to investigate methods of improving beef cattle production in Queensland, two research stations were established. "Belmont" near Rockhampton was placed under the control of C.S.I.R.O. to concentrate primarily on cattle breeding and selection studies in relation to climate. The other "Brian Pastures" was placed under the control of the Department of Primary Industries for pasture research. The general policy is determined by the Australian Beef Cattle Research Committee and the research programme at "Brian Pastures" is supervised by a technical committee comprising representatives of the Department of Primary Industries, C.S.I.R.O. and the United Graziers Association.

The Station occupies approximately 5,300 acres at an average altitude of 428 feet. The mean annual rainfall is 28 inches. Frosts can be severe during winter, (13.4°F absolute grass minimum July 1965), and high temperatures are frequently recorded in summer (109.5°F absolute maximum November 1965).

Geology and topography vary considerably. Basalt occupies most of the western half of the property and occurs as isolated knobs and stony ridges which give way to slopes of varying steepness, generally gentle enough for clearing and good grazing and, in some parts, for cultivation. Granite outcrops appear as rough spurs along the Barambah Creek on the eastern section of the property while acid igneous rocks occur intermixed with basalt as single outcrops on some of the stony ridges.

Soil associations are closely related to the parent material but differences are to topographical location are evident. Generally the basalt areas have given rise to brown and red brown soils of heavy texture. Sandy soil have been derived from the granitic and rhyslitic rocks and a grey clay soil occurs on the creek flat alluvial.

Open eucalypt forest originally occupied most of the area with the exception of the rocky ridges and along the banks of the Barambah Creek. While blue gum (*Eucalypt tereticornis*) occupied most of the alluvial flats, the forest on the higher, gentler flats was dominated by poplar box (*E. populnea*). Forest in the remaining area was dominated by red-barked bloodwood (*E. dichromophloia*) silver (*E. melanophloia*) and narrow-leaved (*E. crebra*) ironbarks with occasional trees of Moreton Bay ash (*E. tesselaris*).

The ground cover consists mainly of grasses and is dominated by black spear grass (*Heteropogon contortus*). On the higher slopes *Heteropogon* is associated with *Digitaria* spp., *Aristida* spp. and *Enneapogon pallidus* while on the alluvial flats forest blue grass (*Bothriochloa intermedia*) is an important associate.

Research Objectives

The object of the Station is to explore various means of increasing beef production through improved nutrition and husbandry practices, principally through pasture improvement. To achieve this, plant nurseries are maintained for the introduction of grasses, legumes, browse plants and forage crops from other countries and small-scale sward trials are conducted to assess their suitability to the local environment. Seed production studies arise from the need to obtain sufficient seed of selected varieties for further testing in large-scale grazing trials and information gained from this work provides a useful guide to the future commercial seed-grower.

Fertilizer requirements for satisfactory plant growth on the region's main soil types are being explored in the glasshouse and under field conditions. Additionally, special cultural practices necessary for optimum growth of the selected plants under local conditions are being investigated. Physiology of pasture growth is receiving attention to determine the plant's reaction when several factors of the environment are varied and to define basic principles for its successful management.

Methods of controlling unwanted timber are being compared. These comparisons aim to establish more convenient ways of effecting control other than traditional ring-barking techniques and include a wide range of aboricides together with time, quantity and method of their application.

Studies in management of both sown and native pastures, together with forage crops, are receiving particular attention. In addition to studying their reaction to varying intensities of use at different times of the year, their feeding qualities are being evaluated to ascertain periods when they can be used to provide satisfactory animal feed.

The Station's herd of Hereford cattle embraces breeder, growing and fattening animals. Apart from supplying the animals for evaluating various pasture trials, valuable information is obtained from ancillary husbandry investigations conducted with the herd.

Routine observations of bodyweight behaviour is indicating a clear pattern of animal growth and feeding experiments are in progress to ascertain possible ways of improving their performance.

Reproduction is of particular importance and the influence of milk production and time of weaning and of calving on the breeding cow's performance is being studied. Aspects of animal health are under surveillance and strict measures are taken to ensure that this is maintained at a high standard. This work not only tests the efficacy of currently recommended practices but defines additional problems and suggests methods of control.

PASTURE DRY MATTER PRODUCTION AND UTILIZATION

by

W. J. SCATENI, DEPARTMENT OF PRIMARY INDUSTRIES, GAYNDAH

INTRODUCTION

The beef industry in the spear grass region (Shaw and Bisset, 1955) depends almost entirely on native pasture in which spear grass (*Heteropogon contortus*) is the dominant species over most of the area. During winter and early spring a common feature of all the main component species of the pasture is their low nutritive value (Milford, 1960). In order to minimise winter weight loss in animals, stocking rates are low which allows selective grazing. Because stock numbers cannot be varied from one season to another the low winter stocking rate sets the level for the whole year. Under present management annual pasture production usually exceeds its consumption by animals which necessitates the annual burning of excess roughage in spring in order to make the new season's growth accessible.

Any increase in dry matter production in spear grass pasture under the present form of management would only result in greater excess material for burning in spring. On the other hand if alternative sources of feed were available for the winter and spring period, the possibility would then arise for improved utilization of native pasture during summer. Thus, the effect of different stocking rates on animal production and on the pasture is under investigation on spear grass pasture reserved for summer grazing.

Young, Fox and Burns (1959) studied year round grazing on sown green panic (*Panicum maximum* var. *trichoglume*) and lucerne pasture and showed that cattle gained weight during winter and spring by utilizing mainly standover pasture which had grown during the previous summer. Because cattle make good weight gains on native pasture during summer it seems possible that sown pasture could be reserved for dry season grazing, which would allow more stock to be carried during this period. Thus, the effects of stocking rate and mid-summer hay conservation on animal production and pasture reaction are being studied here using a sown pasture of green panic and lucerne which is reserved for winter to early summer grazing.

Pasture production in this environment is severely limited by a shortage of available soil nitrogen. Both native pasture and pasture based on green panic have given linear responses to high levels of nitrogen fertilizer. Thus for native pasture under a six weekly summer defoliation regime a low yield of about 10 lb. dry matter per pound of applied nitrogen resulted while a greater response has been measured for green panic based pasture.

Lucerne provides a high quality protein supplement for animals in winter but appears to have done little to promote the production of associated grass. Tropical legumes, of which Siratro appears to be the most promising, have not yet grown sufficiently well in mixed swards on the heavy clay soils to bring about any substantial increase in the production of associated grasses.

The supply of nitrogen to improved pasture grasses either through an effective legume or by way of nitrogen fertilizer is essential in maintaining the pasture against invasion by native grass species adapted to a low nitrogen regime. Incorporation of an effective summer growing legume into the native pasture would allow a greater summer carrying capacity and would in consequence require a greater supply of alternative feed if the increased number of animals were to be maintained during the winter-spring period.

GRAZING EXPERIMENTS

Rate of Stocking of native pasture for summer and autumn grazing

Continuous summer grazing of spear grass pasture from December to May at three stocking rates; 1 yearling steer to 1 acre, 1 to 2 acres, and 1 to 3.3 acres has been carried out for five consecutive summer periods in an experiment containing four absolute replications. The animal production data is presented in Table 1.

TABLE 1.

Summer Liveweight Production (lb.).

Stocking Rate	GRAZING PERIOD									
	13.12.61 to 10.5.62		14.12.62 to 9.5.63		10.1.64 to 30.4.64		20.11.64 to 22.4.65		24.12.65 to 17.3.66†	
	Gain/ head	Gain/ ac.	Gain/ head	Gain/ ac.	Gain/ head	Gain/ ac.	Gain/ head	Gain/ ac.	Gain head	Gain/ ac.
1/1 ac.	51	51	81	81	—8	—8	—11*	—11	77	77
1/2 ac.	76	38	179	90	98	49	69	35	156	78
1/3.3 ac.	76	23	177	53	120	36	92	28	154	46

*Animals removed from treatment on 8.4.65.
†Grazing period incomplete.

There was no significant difference between animal production per head at stocking rates of 1 to 2 acres and 1 to 3.3 acres. A severe dry matter shortage occurred at 1 to 1 acre during most grazing periods and this markedly reduced animal production.

At all stocking rates there has been a decline in basal cover of the pasture. At stocking rates of 1 to 2 acres and 1 to 3.3 acres the decline has been the same but is possibly an effect of the dry summers rather than the experimental stocking rate. At the stocking rate of 1 to 1 acre the decline in basal cover has been greater. In terms of species composition forest blue grass (*Bothriochloa intermedia*) is showing a much greater ability than spear grass to persist at the high stocking rate of 1 beast to 1 acre.

Stocking rate and conservation of sown pasture reserved for winter and early summer utilization

The pasture of green panic and lucerne was sown into a fully cultivated seed bed on a shallow, heavy, brown clay soil of basaltic origin, at sowing rates of 5 and 2 lb per acre respectively, in February, 1962.

A maintenance dressing of 90 lb. nitrogen per acre in the form of ammonium sulphate was applied in December, 1965.

Rotational grazing (2 weeks on and 6 weeks off in a 4 paddock rotation) of the pasture by weaner steers at two stocking rates; 1 to 1 acre and 1 to 1.7 acres has been carried out from late autumn to early summer. Mid-summer hay conservation for winter to spring feeding was compared with no hay conservation at each stocking rate. The experiment contained two absolute replications of each of the four treatments. Liveweight production data is presented in Table 2.

TABLE 2.
Liveweight Production from Sown Pasture (lb.).

Treatment	Grazing Period					
	29.5.63 to 8.1.64		8.5.64 to 18.11.64		13.5.65 to 23.12.65	
	Gain/ head	Gain/ ac.	Gain/ head	Gain/ ac.	Gain/ head	Gain/ ac.
1/1 ac. No conservation	73	73	143	143	48	48
1/1 ac. Conservation	97	97	148	148	45	45
1/1.7 ac. No conservation	140	84	182	109	123	74
1/1.7 ac. Conservation	176	106	254	152	167	100

Inproved animal performance from mid-summer hay conservation occurred only at the light stocking rate (1/1.7 acres). Animal production per head increased at the light stocking rate, but stocking rate had little effect on production per acre in the first two grazing periods. The lucerne component of the pasture has declined markedly in all treatments.

By a complementary use of sown pasture for winter to early summer grazing, and native pasture for summer to autumn grazing, annual production of cattle can be greatly increased in terms of both production per head and production per acre. More complete utilization of native pasture is possible, and by increasing animal production per head, earlier marketing of cattle is possible.

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DISCUSSION

The openness of this green panic sward is very obvious. Do you think the lucerne could be reseeded by sod seeding?

Mr. Scateni: The successful re-introduction of lucerne into green panic requires a fairly drastic renovation of the sward.

Would you consider lucerne and green panic to be compatible?

Mr. Scateni: In this environment they seem to be as good a combination as any. We need a winter legume to provide a high quality protein supplement for swards and so far lucerne is the only suitable one. However, an effective tropical legume would help to keep the sward in a vigorous condition but so far we have nothing that is entirely satisfactory.

Have other lucerne varieties besides Hunter River been tried?

Mr. Scateni: Yes. Mr. Stonard has been testing many varieties and finds Hunter River is not the best producer. Certain American cultivars show promise of being better. At present Hunter River is the cheapest and most persistent. The commercially available "African" is not necessarily better than Hunter River at this stage, is more expensive and less persistent.

In a sward as open as this, how do you control weeds?

Mr. Scateni: Mostly the weeds are the native grass species re-invading the area and include *Panicum queenslandicum* and forest blue grass in particular. They are easily controlled by applying nitrogen to the pasture. This stimulates the green panic so markedly that the weed grasses are crowded out. Broad leaved weeds are no problem.

How does the pasture behave under dry conditions?

Mr. Scateni: Green Panic is very drought tolerant and displays rapid recovery from drought following rain. This has been particularly noticeable this year where regrowth on green panic has been very rapid after the late summer rain, while the adjacent native pasture has responded only slowly.

PASTURE PROTEIN PRODUCTION AND UTILIZATION

by

P. STONARD, DEPARTMENT OF PRIMARY INDUSTRIES, GAYNDAH

PASTURE SPECIES

Species assessment

(a) *Plant Introduction Nurseries*

To date, 250 grasses and 200 legumes from all over the world have received initial assessment of their suitability to the local environment in these nurseries. Drought, particularly in the early part of 1965, reduced the number of legumes worthy of further evaluation to forty, the majority of which are *Desmodium* and *Dolichos* species. Since then an additional 50 lucerne introductions have been established. The need for drought hardy legumes has placed emphasis on shrubby plants likely to withstand competition from grasses.

(b) *Sward plot trials*

Small sward plot trials are currently being conducted to extend the assessment of various legume species and strain introductions.

1. Prostrate perennial legume trial: Lucerne (*Medicago sativa*), Siratro (*Phaseolus atropurpureus*), *Centrosema pubescens* C.P.I. 23086, *Dolichos* sp. C.P.I. 28701 and seven strains of *Glycine javanica* are being compared when grown in association with Burnett Makarikari grass (*Panicum coloratum* var. *Makarikariense*). Establishment of the legumes has been satisfactory but so far repeated attempts to introduce the grass into the legume sward have been unsuccessful.
2. Annual legume trial: Eight annual legumes are being compared for productivity when sown at two spacing, 6 in. and 12 in. apart in 3 ft. rows, with clean inter-row cultivation. Commercially available cowpea and *Dolichos* strains are included.
3. Lucerne variety trial: Various introductions of lucerne had to be grown in isolation for seed increase before a variety trial could be established in June 1964. Eighteen varieties are being assessed for suitability for grazing under rain grown conditions on a self-mulching basaltic clay. Good growth was made from establishment until January 1965 during which period four harvests were taken. Subsequently until April, and again between July and December, growth was restricted and plant losses occurred due to drought conditions. Seven harvests were obtained up to early March 1966 with total varietal yields of dry matter ranging from 7,186 lb/ac. down to 4,083 lb/ac.

   The variety Saladina has been outstanding and eight varieties have outyielded the standard variety Hunter River.

Seed production

If new plant introductions prove to be of value, seed has to be increased before commercial release is practicable. Two such introductions have been proven on the Station in recent years and multiplication of seed undertaken. These are Burnett Makarikari grass and fine stem Stylo.

(a) *Burnett Makarikari grass*

In trials on the Station an introduction of *Panicum coloratum* var. *makarikariense* showed good frost tolerance and a capacity to outyield green panic (*Panicum maximum* var *trichoglume*). A seed production trial proved the superiority of growing this grass in 8′ rows with clean inter-row cultivation rather than in a sward.

The application of fertilizer nitrogen greatly increased seed production and sufficient was harvested to enable this strain to be commercially released as "Burnett Makarikari".

(b) *Fine-stem stylo seed multiplication and harvesting*

Rapid seed increase of fine-stem stylo (*Stylosanthes guyanensis* spp. *guyanensis*—C.P.I. 11493 type) is essential if the great promise shown by this species is to be fully exploited. Seed production during 1964-65, however, was severely restricted by prevailing drought conditions. Every effort was made to harvest the limited quantity available and some success was achieved on small areas with a motorised hand-propelled vacuum sweeper. Sufficient seed was obtained to provide the Seed Trade with a nucleus of this species which was recently released as "Oxley" fine-stem stylo.

INTRODUCED LEGUMES AS PASTURE COMPONENTS

The value of legumes in mixed swards

In two separate trials it has been shown that where lucerne was grown with various grasses, the crude protein content of those grasses was increased. The following example demonstrates this effect:

	% Crude Protein of Grass	
	Grass alone	Grass grown with Lucerne
Burnett Makarikari	7.2	10.2
Green panic	7.8	10.7

In a grazing trial continued for nine years three mixtures of grasses and lucerne showed that the critical factor in animal production was lucerne yield (Young, Fox, Burns, 1959).

Now that the value of the legume component has been demonstrated it is important to define the nutritive requirements of pasture legumes and methods for their establishment to form mixed grass/legume swards.

Nutritive requirements of introduced legumes

(a) *Basaltic soils*

In pot trials, lucerne and Siratro were grown in the basaltic, self-mulching clays of the Station. Lucerne gave a significant response to sulphur and to molybdenum and showed a positive sulphur x molybdenum interaction. Siratro showed a response to sulphur and to a lesser extent to potassium.

(b) *Granitic soils*

Fine-stem stylo was observed to give a positive response to molybdenised superphosphate on a number of granitic soil sites. Consequently pot experiments are in progress to study the effects of applying phosphorus, sulphur, molybdenum and trace elements to soils from the "Madoora" Sward Trial site and the "Whittys" Grazing Trial site.

Preliminary results indicate that the stylo did not respond to phosphorus applied to the "Madoora" grey-brown loamy gravel but that sulphur increased dry matter yields. This advantage was slightly improved in the presence of phosphorus. The combination of phosphorus, sulphur and potassium produced the greatest increase in yield.

On the "Whittys" reddish, light-brown coarse sandy loam fine-stem stylo showed little response to either phosphorus or sulphur applied alone. However, application of phosphorus and sulphur together doubled herbage yield. Thus, it is becoming increasingly clear that sulphur has an important role in the nutrition of *Stylosanthes* spp. on these soils.

Establishment of Sown Species

(a) *Replacing native pasture with sown pasture*

Norton and Cull (1966) have shown that limited cultivation does not destroy native species and that they will quickly re-invade and dominate any sown pasture. Thorough cultivation in association with a cycle of cropping such as winter and

summer fodder crops has proved the only satisfactory way to obtain destruction of the native pasture and provide suitable conditions for the establishment of small-seeded grass species.

(b) *Depth of sowing for Stylosanthes species*

The optimum planting depth for commercial stylo (*Stylosanthes guyanensis*) Townsville lucerne (*S. humilis*) and fine-stem stylo has been determined to be $\frac{1}{4}$ to $\frac{1}{2}$ in. for both granitic and basaltic soils. Little emergence has occurred from surface sowing or from depths greater than $\frac{1}{2}$ in. These facts may be the key to the failure of many sowings of these species.

(c) *Time of establishment of legumes trial*

Six legumes are being studied to ascertain the optimum month of sowing. Sowings are being made into a prepared seed bed in the second week of each month from September to February. Observations indicate that early sowing is preferable to late. November and December appear to be the optimum months this season.

(d) *Pasture establishment on self-mulching basalt clay*

Except under ideal conditions of soil and moisture, the establishment of small-seeded grasses and legumes has proved difficult during spring and summer on the self-mulching basalt clays. The provision of ideal conditions involves the risk of leaving a fine, compact seedbed open to serious soil erosion.

The larger-seeded, summer-growing legume Siratro will establish readily on a fairly rough seedbed and can provide good ground cover. It is suggested that this legume could be sown to provide immediate ground cover, act as a nurse crop for later introduced small-seeded species, and then become a component of the mixed sward. Thus, a trial has been established in which Siratro has provided an excellent entire ground cover and is acting as a good nurse crop for concurrently sown green panic. Green panic and lucerne will be introduced into the Siratro swards in due course to determine the best method of introduction.

Introduction of legumes into native pasture

(a) *Introducing lucerne into native pasture*

Various methods for the introduction of lucerne into native pasture have been examined by Cull and Norton (1966). In open forest country on basaltic soil the most satisfactory establishment has been obtained by the following method. Burn and chisel plough in January with a second chiselling in March; lucerne seed then drilled and covering with harrows.

(b) *Lucerne persistence in native pasture*

Measurements of lucerne persistence in grazed native pastures have provided encouraging results. Lucerne has not only persisted for nearly four years but has increased in density and now comprises 13.4 per cent of the plants in the sward. Results indicate that lucerne contributed between 15 and 135 lb. dry matter/ac. depending upon time of year and this was associated with 260 to 1,510 lb. native pasture dry matter.

(c) *Tropical legumes in native pasture on basalt*

Five tropical legumes have been sown into native pasture in the same manner as has proved successful for the introduction of lucerne. These legumes are being compared for establishment and persistence under intermittent grazing.

Commercial stylo, Oxley fine-stem stylo and Townsville lucerne establishment was unsatisfactory for the third successive year. It is suggested that apart from shortage and distribution of rainfall, movement of the self-mulching clay causes burial of the seed to a depth from which it cannot emerge. In addition to lucerne, Siratro and to a lesser extent, Clarence glycine (*Glycine javanica*), have established satisfactorily. The persistence of the two latter species, however requires further investigation.

(d) *Methods and times of sowing fine-stem stylo into native pasture*

A trial was established in 1963 and is being replicated in time to study methods and times of sowing fine-stem stylo into native pasture on light granitic sands. In the first trial the most rapid build-up in stylo density occurred in treatments involving chisel ploughing, mid-summer sowing and drilling of the seed. The position is summarised as follows:

	Mean density fine-stem stylo plants/ac.
Early summer sown	21,000
Mid summer sown	45,000
Late summer sown	30,000
Twice chiselled—seed drilled	44,000
No cultivation—seed broadcast and harrowed ..	18,000

(e) *Establishment of fine-stem stylo under continuous grazing*

Fine-stem stylo and Townsville lucerne have been established in native pasture on granitic sand both in an enclosed paddock subject to intermittent grazing and on sites in an open paddock subject to continuous stocking. The continuously grazed fine-stem stylo has maintained a superior plant density to that of the intermittently grazed stylo over the three years since sowing. The indications are that it will be possible to establish this promising legume over large areas without having to give protection from grazing stock.

UTILIZATION OF IMPROVED PASTURES

(a) *Deferred grazing grass sward trial on granite*

Six species of grass each sown with and without fertilizer nitrogen, *Dolichos axillaris*, *D. biflorus* and Siratro are being compared for foggage* grazing on sandy soils on granite. The grasses were selected for frost tolerance and capacity for rapid response to winter rainfall. Since the whole of the summer grass growth is conserved as standing material this could afford the legumes some protection against early frosts.

Molopo and Lawes strains of buffel grass (*Cenchrus ciliaris*) were the only grasses which established satisfactorily when sown in November 1964. They withstood severe frosts, continued growing during the winter when moisture was sufficient and made

*The practice of saving seasonal growth or crop aftermath in a green and leafy condition to provide winter grazing is termed "foggage".

early spring regrowth. The production of grass was highest in the presence of fertilizer nitrogen and in treatments harvested late in the winter. Yields up to 12,500 lb. per acre of dry matter were achieved by the end of August. However, legumes in association with grass depressed grass yield but the mixed pasture outyielded the pure legume sward. By mid-November, at a critical time when there was no new growth on the native grasses, Lawes buffel grass yielded over 1,000 lb./acre of dry matter from new season growth.

(b) *Stylo sward trial—"Madoora"*

Fine-stem stylo was introduced into native pasture on granitic soil as a frost tolerant perennial in an attempt to improve the nutritive value of that pasture particularly in the winter-spring period. As a comparison Townsville lucerne was similarly introduced and both were subjected to intermittent heavy grazing. The production of native species was depressed in the stylo and Townsville lucerne treatments; however, the highest percentage consumption of native species occurred in those treatments containing fine-stem stylo. These were the only treatments where the bulk of the season's production was used; in the others there was a progressive accumulation of dry matter. The whole of the fine-stem stylo production was used. Stylo was available at each grazing, whereas the small quantity of Townsville lucerne was only available in March.

(c) *Stylo grazing trial—"Whittys"*

A large scale grazing trial has been established on typical granite country used for breeding to study what improvement in animal nutrition can be provided by the introduction of fine-stem stylo and Townsville lucerne into native pasture. Various stocking rates and fertilizer treatments are also included. Assessment of the treatments will be through livestock performance i.e. breeder liveweight, conception rates, calving percentage and calf weaning weights.

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DISCUSSION

How were the green panic and Siratro sown?

Mr. Stonard: Green panic was broadcast on the surface and the Siratro drilled to 1½ inches depth, with a disc coulter drill. The disc drill seems to be advantageous in that it rides over stumps and stones. It also cuts instead of rips, which reduces the amount of ground disturbance. The plot was sown after 90 points of rain but the surface was dry at the time of seeding. Consequently no germination took place until after the next rain. The poor establishment of green panic is no cause for worry. The seed is very durable and establishment will improve with time as more seed germinates.

GRASS REACTION TO GRAZING AND CUTTING

by

L. R. HUMPHREYS, DEPARTMENT OF PRIMARY INDUSTRIES, BRISBANE

INTRODUCTION

Pastures are grown primarily for use by animals. Maximum animal production is secured through the efficient use of a sustained forage supply of optimum nutritive value. The attainment of this objective depends partly on understanding the animal's responses to changes in the feed supply, and partly on understanding the pasture's reaction, in terms of growth and composition, to variations in grazing and cutting practice. A series of defoliation experiments (Humphreys and Robinson 1966, Humphreys 1966*a*, 1966*b*) was carried out at the "Brian Pastures" Pasture Research Station, Gayndah, to see whether conditions could be laid down to provide better continuity of feed supply, improvement in feed quality, and increased dry matter production. This paper describes some of their salient features.

Carbohydrate Reserves

The ideas on which people base pasture management have been recently reviewed (Humphreys 1966*c*). In the past, management has often been advocated which was directed to maintaining a high level of energy "reserves" in the roots and crowns of the plants. Many believe that the amount of these substances determines the rate at which a pasture grows after some stress such as drought, frost, cutting or heavy grazing, and also determines whether plants persist.

In an experiment at "Brian Pastures", green panic (*Panicum maximum* var. *trichoglume*) and buffel grass (*Cenchrus ciliaris* cv. Gayndah) were grown for two seasons under two extreme management conditions. Maximum opportunity to accumulate reserves was provided in one series ("infrequent"), where the swards were cut only at the end of each winter. In the other series ("frequent") swards were cut at 2 in. height every eight weeks. This had very big effects on the root growth of the plant, as shown in Table 1. The level of carbohydrate reserves also varied between treatments by a factor of four. However, despite these differences, the total shoot growth in all treatments was very similar. Frequent defoliation gave more leaf, and this

TABLE 1.

Effect of cutting frequency and species on yield (g/plant).

Plant Part	Buffel grass		Green panic	
	Infrequent	Frequent	Infrequent	Frequent
Stem	47.4	36.5	57.0	39.5
Leaf	19.0	25.6	17.9	25.9
Inflorescence	1.2	0.6	2.2	0.7
Total shoots	62.3	59.9	67.2	60.5
Roots	66.6	40.6	27.7	21.6
Whole plant	116.0	95.6	90.3	74.4

was compensated by less stem and inflorescence production. It is believed from this and from other experiments, that with hardy plants like green panic and buffel, much of the reserve carbohydrate is simply respired away, and that substances other than the non-structural carbohydrates are also involved in determining how fast new shoots are made.

Optimum Leaf Area

A more recent idea has been that pastures should be maintained with the amount of leaf surface present which will make the most efficient use of the sunlight which falls on the pasture. The argument runs that too little leaf means too much wasted sunlight striking the soil surface, too much leaf means that the lower layers of the sward are in deep shade and therefore not functioning properly.

A green panic sward was used to test the applicability of this idea under the normal moisture and nutritional stresses of the Gayndah environment. For three years, this paddock was grazed lightly every six weeks during the growing season. On each occasion a third of the plants received no other treatment ("lenient" series), a third were slashed at about 6 in. height after grazing ("medium" series), whilst the remainder were slashed at about 4 in. height ("heavy" series). This varied the amount of leaf and stem remaining after each defoliation. The plots were changed about at each grazing, and the equivalent of 60 lb nitrogen per acre per annum applied.

TABLE 2.
Effect of cutting intensity on green panic growth (Lenient = 100).

Growth factor	Cutting treatment		
	Lenient	Medium	Heavy
Leaf weight	100	134	169
Leaf area increase	100	144	180
Shoot growth	100	101	95

The results in table 2 show average relative values summed for twelve growth periods, each of six weeks duration. Once again, differing treatments caused little difference in total shoot growth, but the more heavily used pastures produced much more leaf. Under the conditions of the experiment, the pasture canopy rarely intercepted more than 70 per cent of sunlight. In the first three weeks after each defoliation, the initial advantage in leaf area of the lenient series was maintained in ten of the twelve periods; from three to six weeks after defoliation this advantage was usually lost.

The fact that the more heavily used pasture grew as much as the other is attributed to the intermittent checks to growth imposed by moisture or nitrogen shortages; the greater flowering in the leniently treated pasture may also have set a ceiling on growth. It was clear that light was not the prime factor limiting growth, and scope for manipulating pasture leaf area will no doubt increase when the fertility level or moisture status of pastures is improved.

Animal Requirements

This series of experiments has shown that plants such as green panic and buffel grass are fairly resilient in their reactions to grazing and cutting. In these circumstances,

the main guide to pasture management can be the animal's reaction. Where animals are maintained on sown pasture, stocking rate can be set more in terms of the optimum response of cattle to particular grazing conditions rather than in terms of the needs of the plant. This generalisation can be taken too far, but it nevertheless contains some important truth.

In sub-coastal cattle country, pastures are constantly deficient in protein. It is of interest that in the second experiment mentioned above, the green leaf fraction of the green panic plant averaged three times the nitrogen content of the rest of the shoots; the nitrogen content of the separate plant parts was also higher in the more heavily used pastures. A further feature of importance in these experiments was the rapid decay of pasture leaf. This fact is often overlooked, but the measured losses are most substantial, even in young, vigorous pastures. It follows that reserving pastures from grazing inevitably reduces pasture quality, unless compensating effects occur which improve botanical composition or sward vigour. Stocking rate should be as high as is consistent with sustained output.

Perhaps the principal difficulty in obtaining more efficient pasture management is that of synchronising more nearly grazing pressure and pasture growth. The main problems are related to the flexibilty of animal numbers on a property basis (which is assisted by variation in herd composition), the seasonal nature of pasture growth, and the prediction of pasture growth rate. Some improvement in the use of excess summer pasture growth can be achieved by spring calving, sale of non-pregnant cows and other dry stock in autumn, purchase of cattle in early summer, supply of high protein feeds to improve intake of standover pasture, and the growing or conserving of special feed for periods of pasture scarcity.

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INVESTIGATIONS IN EXPERIMENTAL ECOSYSTEMS

by

K. B. ADDISON, DEPARTMENT OF PRIMARY INDUSTRIES, GAYNDAH

Investigations of native pasture together with the introduction and assessment of improved strains of grasses, legumes, browse plants and forage crops have provided an initial appreciation of potential forage production. Additional studies have made clearer the needs of animals and revealed important problems limiting efficient reproduction and growth.

Results from the investigations have suggested methods of approaching current beef production problems and application of the findings is being explored in model ecosystems designed for breeding, growing and fattening animals.

Problems of Breeding

The requirement of every breeding cow to produce a calf each year and to raise this calf to a satisfactory weaning weight is concomittant with efficient use of financial and natural resources. A review of the literature, however, indicates that the present calving percentage is not satisfactory and although studies have been undertaken on the roles of disease, breeding and cattle management practices affecting reproduction, specific nutritional aspects remain to be explored.

The majority of breeding cows are run on native pastures with no additional feed and a thorough understanding of the nature of this roughage and its place in the nutrition of breeding cows and calves is desirable.

Previous investigations have indicated the importance of protein and stressed the need to define clearly the extent and the periods when shortage of this nutrient may limit satisfactory reproduction. In addition, both production and utilization of roughage from native pastures require elucidation for those situations in which protein shortages are remedied.

A large scale project incorporating six ecosystems has been initiated to study the effects of providing adequate levels of protein at various times of the year to beef breeders which graze native pastures at different stocking rates.

Problems of growth

Winter feed

The low plane of nutrition during winter and the severe limitation which this imposes on beef cattle production in Queensland has been stressed repeatedly. Furthermore, the need to improve feeding of the animal so as to minimize any weight loss during this period has been emphasised.

Following weaning the immediate problem is to provide an adequate level of nutrition for growing animals during the ensuing winter. Use of sown pastures for this purpose has received considerable attention but it is apparent that the role of readily available roughage supplied by native pastures requires clarification.

It is clear that management of native pastures to provide winter roughage to sustain high stocking rates does not present any difficulty. In addition, provided the

level of intake and digestibility of the material are satisfactory, available energy appears to be adequate for moderate animal liveweight gains. However, data from previous work indicates that protein is the most important factor affecting animal production. Shortage of this nutrient precludes satisfactory intake and digestion, and subsequent use of the energy available in the roughage.

A project has been initiated to investigate the effects of supplying additional protein to weaner beef animals grazing native pastures managed in different ways for winter roughage.

Summer feed

Due to seasonal fluctuations in the feed supply efficient beef production depends upon maximum weight gains being obtained during summer when feed is most readily available and nutritious. Results from previous work indicate a wide range of bodyweight behaviours during the summer period. This can also result in an advanced slaughter age, reduction in turn-off and lowered efficiency. Thus various sown and natural pastures are being compared to establish summer levels of nutrition which will secure satisfactory bodyweight gains during this period.

The fattening period

In practice the type of animal produced for slaughter is greatly influenced by market demands and it is necessary that research establish principles of raising differing classes to meet the various requirements. Principles governing feed sequences for raising 2½ to 3 years old animals for slaughter should be reasonably well elucidated in studies embracing winter and summer feeding. Production of fat animals two years old is, however, dependant on the provision of a generally higher nutritional plane. While development of protein sources for growing stock can also be expected to satisfy protein needs of fattening animals, feed with a higher carbohydrate availability than that of the usual roughages is required.

Investigations have been compared in the use of crops rich in carbohydrate for fattening beef animals between the ages of 18 months and 2 years.

Definition of feed requirements

The various methods of feeding beef animals during winter, spring and the fattening period have been arranged in several feed sequences. In this way it will be possible to study their inter-relationships and determine the most efficient combination of feeds for animal production.

Results from this project will more clearly define the needs of the animal in all stages of its production and will guide the development of agrostological and agronomic practices to meet them.

FORAGE CROP RESEARCH

by

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Protein and energy-rich feeds are required for fattening beef animals and various summer and winter crops are being examined for this purpose. While production and management requirements of these crops are important aspects receiving attention, trials are also in progress to evaluate their use as supplements to the more readily available but lower quality roughages.

Cowpea Experiments

Cowpeas are widely used as a forage crop and several cultural practices have been studied.

The individual varieties did not differ greatly in their reaction to any particular sowing date. The results show that growth rate of the three varieties Santiago, Malabar and Havana was not greatly influenced by date of sowing. However very late sowing dates reduced the period to flowering and the yields at this time. All varieties emerged satisfactorily when sown at depths ranging from 1 inch to 3 inches.

Data presented in Table 1 clearly indicate that cutting or grazing should commence at flowering. Defoliation before this stage of growth results in low herbage yields and high plant mortality.

TABLE 1.

Yield of cowpeas when defoliated at different stage of maturity.

Maturity Stage at defoliation	Yield/Plant (gm. dry wt.)	
	1st Harvest	2nd Harvest
Floral initiation	20.4	75% Mortality
Flowering	49.6	16.1
Flowering + 2 weeks	54.8	9.3

Further work to establish the optimum intensity of defoliation indicated that regrowth from plants bearing four or six buds was superior to regrowth from plants bearing two or eight buds.

Trials to compare forage production from a number of cowpea varieties have shown that highest yields were obtained from Caloona and Havana. Despite poor seasonal conditions these varieties produced 1978 and 2288 lb. dry matter/acre respectively.

Forage Sorghum Experiments

Sorghum species are suited to local conditions and particular attention is being paid to forage varieties adapted for grazing. Examination of the commonly grown Sugardrip variety has shown that highest dry matter yields were obtained from populations of 261,300 plants/acre spaced 12 inches between rows and 2 inches in the

row. In two seasons with marked climatic differences yields were 7,993 and 2,202 lbs./acre respectively.

Results indicate that nitrogen is the most important plant nutrient affecting herbage production. Current work has been designed to clarify the need for this nutrient by crops of various densities.

Although herbage yields are greatest from crops grown at higher plant populations, grain production is substantially reduced. In the absence of any data defining the significance of plant components for beef fattening, the production of both herbage and grain is being measured under the various treatments.

Varietal tests have shown that among the fine stemmed plants, Sudax and Zulu are superior to *Sorghum almum* and sudan grass. The results are, however, subject to confirmation in grazing trials which will assess their value in animal production.

Winter Crop Studies

It has been demonstrated that winter oat crops for grazing can be successfully grown in the Central Burnett region. These crops compliment high quality summer pastures and provide satisfactory fattening rations for producing animals to meet special market demands.

Early to mid-season varieties Saia, Benton and Bentland have produced the highest yields of herbage. Although seasonal variations in yield are apparent, these three varieties have produced in excess of 4,000 lb. dry matter/acre. Lampton, Landhafer and Trispernia are superior late maturing varieties and have consistently outyielded the Algerian variety.

Stem rust has affected all varieties to some extent each year but it is of particular interest to note that *Puccinia graminis* pustules were first identified on the variety Saia during September 1964. Prior to this the variety had exhibited resistance to the disease.

In an area with predominantly summer rainfall good oat crops are ensured by thorough fallowing of land and early autumn sowing of early to mid-season varieties. The technique results in mature growth relatively early in spring and to improve the quality of feed at this time, Hunter River lucerne was included in this pasture.

Crude protein values for oat material varied with age and stage of use from 23% at commencement to 6% on completion of grazing.

In Table 2 the results show that inclusion of lucerne in the pasture lowered both total yield and the yield of oats, and did not provide any advantage in animal production.

TABLE 2.

Production from Saia oats in pure swards and Saia oats with Lucerne.

	Saia Oats Alone		Saia Oats with Lucerne		
	lb./ac.		lb./ac.		
	Oats D.M.	Animal Live wt.	Oats D.M.	Lucerne D.M.	Animal live wt.
1963	2511	237	1677	112	170
1964	3179	279	2854	15	273
1965	5318	329	5001	28	324

DISCUSSION

To what do you associate the decrease in yield when oats is sown with lucerne?
Mr. Hendricksen: It is probably due to competition between the two species.
How are the oats grazed?
Mr. Hendricksen: Set stocking is practiced. The length of time varies, usually starting in early June.

HEREFORD MILK PRODUCTION

by

W. P. Bewg, Department of Primary Industries, Gayndah

INTRODUCTION

Improvements in management techniques of beef breeders are usually made with the ultimate intention of improving the calf. It is assumed that treatments applied to the cow will have a beneficial effect on the foetus or on the suckling calf (Neville, 1962; Heyns, 1960). In the case of the live calf there is often a tacit acceptance that this benefit will be transmitted by an improvement in the milk yield of the dam.

It is well known that the yield of dairy cows is very largely controlled by the quality and quantity of their food (Broster 1958). With beef cattle at "Brian Pastures" a similar obvious relationship is not readily demonstrable.

Milk Production at "Brian Pastures"

The subject has been approached from two sides: recording actual milk yields of Herefords, and attempts to influence calf performance by treatments applied to their dams.

Measurement of milk yield began in 1960 using the calf suckling technique in which milk production in the twenty-four hours following stripping after hormone stimulation is measured. This involves weighing calves before and after suckling twice in the twenty-four hour period and hand stripping residual milk. The twenty-four hour yield is then used to calculate monthly yields. In 1964 a small milking machine was installed and groups of heifers were recorded for six month lactations. Their yields were lower than cow yields measured by the suckling technique but it was accepted that they were younger animals. To provide a direct comparison between the two methods, one group of cows was divided, half were measured by the suckling method and half by machine. Similar lactation data were obtained suggesting that both approaches were equally satisfactorily for measuring yields. Overall average yields were 170 gallons of milk for cows in 186 days and 123 gallons in 161 days for heifers. Details of the measured yields are summarised in Table 1.

Time of calving were July, October or January. Those calving in late winter and spring gave higher milk yields than those calving in summer. This suggests some response to better pasture conditions. The summer group finished their lactation in July, well after the normal end of native pasture production. Some response to summer rain and grass growth can be inferred from a lift in the lactation curve or the July

TABLE 1.

Measured yields of Hereford cows and heifers

Designation	Date Calving	No. days lactation	Lactation (gallons)	Average (lb./day)
a. Cows by Suckling Technique				
Early	August 1961	196	166.1	8.47
	July 1964	184	197.8	10.75
Normal	October 1960	202	163.5	8.09
	November 1961	196	197.3	10.07
	November 1964	150	171.8	11.45
Late	January 1962	194	154.0	7.94
	February 1964	178	136.6	7.67
b. Heifers Machine Milked				
Early	July 1964	188	161.4	8.58
Normal	October 1964	168	108.0	6.43
Late	January 1964	128	100.0	7.81
	January 1965	166	88.8	5.35

calving cows in October by about 2 lb. of milk per day corresponding with the first rain. Each group had a characteristic lactation curve but total yield was about the same in the first two groups with the late group nearly 20% lower (approx 35 gallons).

In a management trial groups of about 30 cows each were selected for similar pregnancy status and rotated between two paddocks at fortnightly intervals in an attempt to even out paddock differences. Supplementary feed in the form of lucerne hay was given in the winter and spring to provide the following treatments:

Group 1. Hay fed for 8 weeks before calving (August and September)
2. Hay fed for 8 weeks after calving (October and November)
3. Hay fed both periods
4. No hay fed at any time

Hay was fed twice weekly to provide a daily ration of 5 lb. per head per day except pre calving in the first year when the rate was 3 lb. This trial was carried out in two successive years. Feeding before calving, was an attempt to "steam up" the cows and after calving, to encourage milk production.

Results were interpreted through the liveweights of the cows and their calves. It was found in both years that there was no difference in liveweight between the four cow groups (at the end of the treatment). All four calf groups had similar birthweights and all grew at the same daily rate and had similar weight at weaning the following May. In so far as milk yield is reflected in calf performance there was apparently no response on the part of the cows to extra feeding. Cow liveweight appeared to follow the normal seasonal pattern and were slightly higher at the end than at the beginning of the treatments. Conception rate was the same in all cow groups and the average foetal age was also the same, so that no breeding advantage resulted from the feeding.

In a trial designed to investigate the use and suitability of sorghum silage made on the property, four groups of pregnant heifers were confined to yards to simulate

drought conditions. Silage with and without grain and urea was fed. All groups lost weight over the treatment period of 12 weeks to the extent of about 25% of initial bodyweight. Calf birthweights were low at approximately 50 lb. and subsequent daily rate of gain was very low at 0.4 lb. per day. This represents growth on a sole diet of milk with no grazing or green pick, and evidently a very low level of milk production. These two examples serve to show that there are nutritional limits affecting Hereford milk production, but that above a certain level there is no further response on the part of the cow.

The present milking trials are an attempt to define normal yields and to provide a base from which to measure any future treatment responses. One small group of cows milked by machine were offered free access to grain and lucerne hay in addition to the normal native pasture grazing. Their response was to increase liveweight to about 200 lb. above their unsupplemented contemporaries, but to produce no more milk. Beyond the fact of low total milk yield and an apparent inability to convert extra feed into milk, there is no obvious response in calf liveweight to the milk actually measured as produced.

All calf groups both in the milking trials and also in the hay supplementation trial gained weight in a linear fashion, not responding visibly to changes in milk supply as the lactation progressed. Rates of gain varied between calf groups born at different times of the year but each group gained at a regular rate. The liveweight changes of calves over the lactation period together with the lactation yields are summarised in Table 2.

TABLE 2.

Liveweight Changes of Hereford Calves from birth to end of dam's recorded lactation.

Group	Date of Birth	Birthweight (lb.)	Weight at last recording (lb.)	Av. days Recorded Lactation	Liveweight gain per day (lb.)
Early	8.8.61	58.4	291.0	200.8	1.16
	23.7.64	78.0	379.3	181.0	1.66
Normal	27.10.60	49.9	295.8	187.9	1.31
	1.11.61	64.3	322.7	199.7	1.29
	24.11.64	77.1	281.8	178.0	1.15
Late	26.1.62	69.7	237.5	195.5	0.86
	2.2.64	64.4	296.0	177.0	1.31
					Av. 1.24

Average daily milk yield of Hereford cows was measured at a little under 1 gallon per day; calves gained at an almost steady rate averaging for all groups 1.24 lb. per day. A comparison of liveweight gains of suckling calves with measured lactation of their dams shows that an average of 7.4 lb. of milk was consumed for each 1 lb. of liveweight increase with a range of 10.9 to 4.2 lb. from the beginning to the end of the lactation.

SUMMARY

Hereford cows give a lactation of about 170 gallons in a six month period and heifers 123 gallons. The cows appear to express their full genetic capability for milk

yield at a comparatively low level of nutrition. Additional feed does not result in additional milk above this level.

The growth rate of calves does not obviously depend on the level of milk yield under normal paddock conditions.

Measuring milk yield over several years produces comparable results for similar groups. Milk yield measured daily by machine milking or monthly calf suckling appear to be equally satisfactory methods of assessing production.

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DISCUSSION

What is the butterfat content of the milk towards the end of the lactation?

Mr. Bewg: It was 3.4—3.5 which was rather disappointing. The calf will usually take all the milk that is available.

In protein supplementing feed how many pounds of protein/day need be fed to achieve 150 lb. of animal weight gain?

Mr. Bewg: It requires about 3 lb./day for 5 months. This of course begins at a fairly low level of supplementation in May which increases to higher levels into the dry season. This sort of direct supplementation is being compared with that of feeding green panic and lucerne pastures.

TIMBER REGROWTH CONTROL

by

N. D. YOUNG, DEPARTMENT OF PRIMARY INDUSTRIES, TOOWOOMBA

Most of the experimental programme on *Eucalyptus* regrowth control on Brian Pastures has been conducted on *Eucalyptus dichromophloia* (bloodwood), with some work on *E. populnea* (poplar box).

Of the herbicides tested prior to 1964 the most promising was 2,4,5-T butyl ester. The best control with this herbicide was achieved using a 2% concentration in diesel distillate applied to a complete frill at or very near ground level. One percent concentration gave almost as satisfactory control but water as a carrier proved ineffective. The control achieved was independent of the season of application. The main disadvantage of this method was the necessity to completely frill at or very near ground level. When 2% 2,4,-5-T butyl ester was applied into a frill cut at normal waist height, suckering frequently occurred as close as 6 inches below the frill.

Since 1964 the use of Pichloram "Tordon 50D" has been studied. Good kills have been achieved when applied as a stem injection using 1% concentration in water. A wide range of *Eucalyptus* species appear susceptible though some exceptions have been recorded.

Species against which the use of Tordon has given poor "kills" include Cypress pine (*Callitris columellaris*), Brigalow (*Acacia harpophylla*), bush box (*Tristania conferta*), Sandlewood (*Eremophila mitchelli*), She oaks (*Casuarina* spp.), *Eremophila sturtii*, Wilga (*Geijera parviflora*), Bloodwood (*Eucalyptus gummifera*), several coastal wattle species (*Acacia* spp.).

Additional work in progress is designed to examine:—

1. The spacing of the stem injection
2. Methods of application
3. Application as a foliage spray to suckers and seedlings
4. Application as a basal bark spray

None of these trials was commenced prior to June 1965 and no results are yet available. However trends from recent counts indicate:—

(a) The spacing of the injection may be a very important factor influencing the degree of control. When spacings exceed 6 inches centre to centre, suckering has been frequently noted in species known to be quite susceptible to Tordon 50-D.

(b) Various "machines" developed to apply Tordon 50-D have been tested. Where small volumes of herbicide are used it is important that the "device" is capable of delivering the herbicide accurately onto the cut surface of the cambium tissue.

(c) Although treatments occurred only in late winter and spring 1965 it is of interest to note that Tordon 50-D mixed with dimethyl sulphoxide, D.M.S.O., caused tree defoliation when applied as a basal bark spray at 100 ml per tree.

No information is available yet regarding the affect of season of application on subsequent timber control. However from observations based on the commercial use of Tordon 50D in south east Queensland it would appear that the reaction to this herbicide is much slower if applied in mid-winter. Also, less satisfactory kills have resulted from treatments applied during drought stress.

C.S.I.R.O. PASTURE RESEARCH—BRIAN PASTURES

by

N. H. SHAW, C.S.I.R.O., DIVISION OF TROPICAL PASTURES

Research conducted by the C.S.I.R.O., Division of Tropical Pastures on the granitic area of "Brian Pastures" has been concerned with determining fertilizer requirements and selecting legumes and grasses suitable for pasture. It is now quite clear that productive grass-legume mixtures can be grown, and these should provide the basis for greatly increased beef production.

Fertilizer

In pot experiments conducted in the glasshouse at Brisbane, *Phaseolus lathyroides* growing in the granitic soil has responded well to additions of phosphorus and sulphur. For example, mean yields from the second harvest of one experiment were:—

Untreated	2.0 g/pot
P added	2.2 ,,
S added	3.1 ,,
P and S added	4.2 ,,

Added sulphur increased both the nitrogen and sulphur contents of the plant tops and markedly improved nodulation. There have been no indications of a shortage of other elements, except, of course, nitrogen.

The separate effects of phosphorus and sulphur have not been measured in the field, but it has been shown that Siratro responds well to applications of superphosphate. For example, in one experiment the yield of Siratro grown without fertilizer was 860 lb./acre, whereas plots which had received superphosphate at 1 cwt/acre in the previous year plus ½ cwt/acre in the current year produced 1,690 lb./acre. Following about 2 cwt/acre superphosphate at sowing, it is suggested that an annual maintenance application of 1 cwt/ac. superphosphate be applied.

Legumes

Many tropical legumes have been tested and two that have been outstanding are "Oxley" fine-stem stylo (*Stylosanthes guyanensis* var. *guyanensis*) and Siratro. Both of these have produced yields of up to 1,600 lb. dry matter per acre in mixed pastures, and they have persisted without any reduction in stand through the last few years of drought. Their efficiency in providing nitrogen for an associated grass is being compared in a current experiment.

It is interesting to note that whilst *Glycine javanica* grows well on the basaltic soils of Brian Pastures, it has performed very poorly on the granitic soil.

Grasses

It has proved to be quite easy to establish sown grasses on the granitic soil and many species have grown well. Among the most promising to date are the Molopo and Tarewinnabar varieties of buffel grass (*Cenchrus ciliaris*), the Samford and commercial varieties of Rhodes grass (*Chloris gayana*), and molasses grass (*Melinis minutiflora*). Several introductions of *Digitaria* spp., *Panicum maximum* and *P. coloratum* are also promising. The combining ability of the best grasses with fine-stem stylo and Siratro is being studied in a current experiment.

DISCUSSION

What is the best method of establishing fine-stem stylo on these granitic soils?

Mr. Shaw: The seed is best drilled using a disc rather than a coulter drill. Where the soil is soft it may be necessary to use depth skids to control the depth of sowing to ¼ to ½ inch. Two pounds of seed sown in the hull is a satisfactory rate though better results are achieved with hulled and scarified seed. However where the weather is unpredictable the hard seed of unscarified seed may be advantageous.

How does this species grow on the soils of basaltic origin?

Mr. Shaw: There seems to be an establishment problem as there is with most legumes.

What advantage does fine-stem stylo have over other stylos here?

Mr. Shaw: It has the added advantage that it is perennial and thus it is there in spring when it is wanted. It is difficult to harvest seed from it however.

DISCUSSION SESSION—Chairman, D. Cribb

This district was one of the early centres for the establishment of Rhodes grass, yet we have seen very little of it here.

Mr. Young: Screening work over the first ten years at Brian Pastures has shown Gayndah buffel and green panic to be equally superior over Rhodes grass, since Rhodes grass will not persist over drought periods. However, lucerne is more compatible with green panic than with buffel grass.

Set stocking appears to be an advantage on rotational grazing. Is this always the case?

Dr. Humphreys: There are few data available on this matter to give a clear answer, but there is evidence at Brian Pastures to show that rotational grazing of native pasture reduces yield per head by about 50 lb. live weight per annum. However, where lucerne is used in the pasture rotational grazing will be necessary. Stocking rate is a most important consideration also.

What is the effect of grazing on grass-legume pastures?

Dr. Humphreys: Not much work has been done at Brian Pastures varying the grazing on mixed associations. Mr. Young has found that pure swards of legumes can be used intensively.

Mr. Scateni: The lack of persistence of lucerne does not appear to be associated with any of the treatment effects of the green panic-lucerne experiment. It is perhaps a result of grazing at a critical period of soil moisture. It does not appear to be inversely proportional to the density of green panic.

Mr. Young: In one experiment studying the effects of defoliation cutting intervals were 4, 16, 32 and 96 days. After eight cuts on the four day routine the carbohydrate level of the roots was reduced by 60%. However, there was no reduction in the nitrogen content of the tops.

Is there much seedling regeneration in the green panic pastures?

Mr. Scateni: Initially the stands thicken up from seed which is dormant, provided there is not too much competition from re-invading native species. Green panic will persist well when the nitrogen status of the soil is maintained at a fairly high level. Depending on the season there is a yearly fluctuation in the amount of ground cover.

Why should we be apologetic about the use of artificial nitrogen?

Mr. Addison: We are not really worried about the use of nitrogen as there is a definite place for its use in pasture production. Generally speaking we have not yet reached that degree of refinement for most spear grass properties are not short of dry matter and the application of nitrogen only accentuates the production of dry matter at a time when it is usually not required. Legumes on the other hand, provide a protein supplement for the usual surplus of dry matter. It makes more efficient use of this material than would otherwise be the case.

Mr. Young: In applying nitrogen up to 210 lb. N/ac together with sulphur, over a period of 14 months, 21,000 lb. dry matter/ac was cumulatively produced over four harvests. Crude protein levels reached 24%.

Mr. Scateni: In the experiment quoted by Mr. Young nitrogen fertilizer was applied in March, 1959. During the period November-February 1960 inclusive the rainfall was 21.22 inches compared with the Brian Pastures average of 14.89 inches for

this period. A more realistic figure for expected pasture production during this period at the level of nitrogen fertilizer applied would be 8,000-10,000 lb. dry matter per acre.

What is the possibility of increasing breeder production? The normal for the district seems to have been a very stable level in the past.

Mr. Bewg: It is not possible to look at all facets of this problem at once. Under existing conditions not much can be done about birth weights of calves, however, calf growth can be affected by increasing the milk yields of the mothers.

The flushing effect is also important in increasing conception rates, particularly of heifers. For example, poor heifers being fed on oat stubble and increasing in condition conceived 97% while comparable animals in better condition which were left on spear grass conceived only 87%. It is better if animals are increasing in weight at mating than if they are heavy and decreasing in weight.

Pregnancy diagnosis can be used effectively in the herd as an aid to culling. By this means the conception rate can be maintained fairly high, other things being equal.

What is the average live weight of steers at one and two years of age reared on native pastures?

Mr. Bewg: The calves are weaned at 350 lb. at the beginning of winter. By Christmas they are about the same. At the end of the following summer they have gained 200-250 lbs. Yearlings weigh about the same as their weaning weight.

Mr. Scateni: Yearlings carried on sown pastures from May to December and on native pasture from December to May will reach 1,100 lbs. at $3\frac{1}{2}$ years of age while similar animals carried on native pasture reach 1,040 lbs. at $4\frac{1}{2}$ years.

Mr. Fox: Some of the figures given for animal weights at $2\frac{1}{2}$ to $3\frac{1}{2}$ years for grazing on native pasture are below the district average because most properties have paspalum flats in their low lying parts which carry the cattle through the winter.

Professor Dowling: Mr. Bewg's data are important since the animals are not doing as well as they should be. I wonder about the possibility of internal parasites?

Mr. Bewg: All calves are drenched at weaning and worm counts do not indicate severe infestation. Ticks are not a problem as the animals are dipped once a month andall animals are given blood inoculations three times a year as a protection against red water.

This morning we were shown how animal production can be materially increased by the combined use of 54 ac of green panic and lucerne pasture with 46 ac of native pasture. Why not use 100% improved pastures? Mr. Shaw's work shows there is little possibility of improving native pasture by management alone.

Mr. Scateni: This is perhaps true but it will be a long time before we reach 100% replacement of native pastures.

Dr. 't Mannetje stated at Eskdale that virgin ground should not be pre-cropped, but here the opposite appears to be the case?

Dr. 't Mannetje: At Eskdale and Rodds Bay on granitic soils the best stands of sown species are obtained when no previous cropping is undertaken. The ground should be ploughed 6 weeks before sowing allowing the shortest fallow possible. When pre-cropping is practiced this usually results in a serious weed problem.

Dr. Humphreys: At Brian Pastures it is desirable to pre-crop for 3 or 4 successive occasions before sowing down a pasture of introduced grasses.

Mr. Fox: This is a problem because whatever course is taken depends to a large extent on the particular situation and on how good this initial establishment is. For example, on granitic soils with some clay in the surface it is cheaper to put in cowpeas and sudan grass as a crop for feeding off. This then goes into oats and lucerne and after feeding this off in November-December, buffel grass and Siratro may be chisel ploughed into the ground.

How quickly will the spear grass re-invade the sown pasture at Eskdale?

Dr. 't Mannetje: This depends on the nitrogen supply to the grasses. In an experiment at Rodds Bay, where 0, 50, 100, 150 and 300 lb. nitrogen per acre were compared on a Rhodes grass pasture, only at the higher levels of nitrogen application did Rhodes grass persist.

Do you consider native spear grass provides adequate nutrition for young stock or for adequate milk production when stocking rates are 1 beast/5 ac?

Mr. Bewg: Native pasture is adequate for breeding stock. This is evidenced in the cattle industry's swing in recent years to breeding rather than fattening.

Mr. Fox: This has happened largely over the last 10 to 15 years. Previously these areas fattened old bullocks. Due to a price structure change there has been a change to breeding.

Though we have seen some attractive pastures on the Station we find that with green panic the lucerne disappears and Siratro is severely knocked back by winter frosts. Could annual crops play a more important role?

Mr. Hendricksen: From an economic standpoint annual cropping fits more into the fattening part of the enterprise. However, there is a definite place for this in a breeding enterprise since animals increasing in body weight will fall pregnant better. Also, as intensification of production proceeds the need for conserved feed becomes greater, and crops are perhaps the best way of meeting this.

Mr. Young: Mr. G. Robertson of Wandoan has found annual cropping for fodder conservation to be profitable in the Brigalow. Annual summer leguminous crops such as cowpea and dolichos have been quite successfully bailed but a hay conditioner is necessary.

Mr. McCallum: I have conserved crops for a number of years. However I have found it most satisfactory to wean calves onto green oats, with pasture hay fed at the same time. These animals are carried on green panic pastures for the summer and then back to oats for winter. At 2 years of age they weigh an average of 460 lb.

If it is considered one needs $10,000 *for hay making equipment and storage facilities would not more benefit be gained from spending this amount on irrigation equipment provided the water is available?*

Mr. Hendricksen: We have not had much success with irrigated lucerne. With maize we cannot supply enough water for maximum yield. Irrigated oats sown with lucerne has been successful. However most of these crops involve conservation and hence hay making machinery. Finally there is the labour requirement for regular irrigation.

PASTURE IMPROVEMENT ON "MADOORA", GAYNDAH

by

J. McCALLUM, GAYNDAH

During the early 1930's this property was owned by Mr. A. A. Petrie who experimented with a number of introduced grasses, hoping to find one suitable for pasture improvement. He had been fairly impressed with the potential of blue panic (*Panicum antidotale*) but out of a line of this grass there appeared an impurity which is now known to be the very successful grass green panic (*Panicum maximum* var. *trichoglume*). Although it is difficult to date the exact appearance of the grass on the property it is considered to be before 1936*. By 1938, when Mr. Petrie sold the property, green panic was firmly established on several hundred acres. However, Mr. Petrie repurchased the property in 1940 after which further areas were sown to green panic, blue panic and Rhodes grass.

I purchased the property in 1950 and the areas sown to green panic remained very productive until about 1960. During the last three years there has been a marked decline in the productivity and persistence of the sown grasses, particularly in the open areas. However, the green panic has persisted in the scrubs and open timber. This decline of the grasses has no doubt been largely due to the very low summer rainfall of the last three seasons.

This is a serious problem for the farmer and grazier. While it is desirable that some of our resources should always be devoted to the search for new and better pasture species, we should not lose sight of those we already have and continue to work on them for their betterment and more efficient use.

Let us now examine some of the factors which may have contributed to this decline.

Management

The stock management on the property does not differ greatly from the general practice of the district i.e. the number of head carried is that which can be safely carried in an average year. This number fluctuates during the year in accordance with the feed supply and the natural herd increases. Sale cattle are turned off in autumn and winter which reduces numbers at the critical feed season.

The areas containing green panic have been grazed over the years at an average of one beast to five acres. In normal years this allows the scrub areas to be spelled for a short period. However, due to the great shortage of feed over the last three summers this has not been possible. The advantages of spelling are to be seen in the cultivation paddocks where the green panic has persisted on the headlands.

However, severe grazing alone is not the sole reason for the decline, since on the newly felled and seeded scrubland, which has been managed similarly to the old areas, the green panic and Rhodes grass have improved during the last three years.

Soil Fertility

The big scrubs of the northern rivers of New South Wales, which were felled out

*See article in this issue "The origin of green panic", p. 37.

and converted to pasture at the beginning of this century were, in my early upbringing, four to five feet tall with paspalum (*Paspalum dilatatum*) in summer. By 1930 the paspalum was declining and by the mid and late 1930's had reverted to mat grass (*Axonopus affinis*).

This same pattern is evident all along the Queensland coast wherever softwood scrubs have been converted to pasture. For Maleny, Gympie, Atherton and here in the central Burnett twenty five years seems to be the limit of satisfactory productivity of these pastures. From this it seems that soil fertility is a major factor governing pasture decline.

Palatability

During a good season stock prefer the grass which grows in the open clean areas, leaving that of the shaded and scrub areas for later when feed is becoming short. It is unlikely that this contributes to the decline as it is a regular seasonal phenomenon.

Regeneration of depleted pastures

Regeneration of these depleted pastures means clearing, cultivating and resowing. This operation costs at least ten dollars per acre, with seed an added expense. From our experience with areas so treated we might expect five years of good pasture before they again become depleted. However, the growing of winter oats for fattening feed appears to be a proposition and we now have 150 acres sown to this crop.

We badly need information on types and amounts of fertilizer to be used in pasture regeneration. Also we need suitable legumes for these pastures. So far, the most promising is Siratro.

In contrast to this, new scrub on this property can be bulldozed down for $5.50 per acre and sown from the air for a further 50c per acre plus the cost of seed. From such a pasture we are sure of getting 20 to 25 years of good pasture. It is quite evident, therefore, that developing new areas is a better economic proposition than in re-generating old ones.

Fodder conservation and cropping

In my 31 years of experience in this district major droughts have occurred in 1936, 1940, 1946, 1951 and to a lesser degree in 1957 and 1960. From these years it is evident that not even good sown pastures will carry a property through a major drought. Establishment of improved pastures must go hand in hand with fodder conservation. The lesson to be learnt where this is not practiced is graphically illustrated by many cases of severe stock losses in the current drought in New South Wales where stock numbers have been increased following the use of superphosphate, clovers etc. but without the added precaution of fodder reserves.

Over the past eight years it has been the practice on this property to conserve sufficient hay to feed all the breeding stock for at least five months if necessary. One bale of reasonably good quality hay will give a cow a survival ration for one week. Under these circumstances the cows are fed every third day, which allows all the animals to get a good feed whether they are strong or weak. When non-legume hay is fed, urea and molasses is added to it.

Hay is also conserved for feeding the weaners. To start with they are kept in yards for fourteen days and fed hay. This quietens them and teaches them to eat hay. They

are then put onto green oats for four hours per day with an additional ration of hay, the amount depending on the amount of available roughage in the paddock.

During the wet season in summer the steers are grazed on green panic through to the following winter when they are placed on green oats for topping off and sale at two years of age when they kill out at an average of 460 lb. dressed weight.

Any surplus growth is made into hay but cow-peas provide the basis of the good quality hay. These are planted in late December and when ready mown, conditioned and baled. In a good year two cuts may be obtained. The average yields of hay from cow-peas run at 50 to 60 bales (65-70 lb. per bale) per acre on the soils derived from granite and 80 to 85 bales per acre on the scrub soils. In addition to this wheat, oats, barley, sudan grass, *Sorghum almum* and more recently Sudax, have all been successfully used for hay.

Cropping is limited mainly to growing oats for winter grazing of which 150 to 200 acres is usually grown. It is mainly used for feeding weaners and fattening steers. The main variety used is Bentland.

CONCLUSION

In conclusion it seems that, in this environment, property improvement requires an integrated approach. While it is obviously cheaper to develop new scrub land rather than regenerate old pasture land there is a limit to the amount of new land that is available. Sooner or later we must come to grips with the problems of the old depleted lands. It is probably better that we start thinking of this now because the problems of regeneration will increase through weed invasion and soil erosion if these lands are neglected.

Any intensification of the farm program necessitates more adequate provision for drought and off-season feeding in the form of hay and special forage crops. This provision can be part of the programme of regeneration of depleted pastures.

Mr. C. Pinwill—Gayndah

Mr. Pinwill discussed the relative merits of buffel grass and green panic on his property which is a dairy/pig farm also producing grass seed. He stated that buffel grass was generally more hardy in dry seasons than green panic. However green panic comes away more rapidly after rain in the spring. Buffel grass produces heavy growth in mid-summer.

Green panic is nutritous and palatible up till seeding but it rapidly loses feeding value after seed maturity. The Gayndah variety of buffel grass is not stalky, appears to be palatible even after flowering and is a heavy seeder.

Forty-five to fifty pigs are fattened regularly in 1½ acre runs, using the grass as green fodder, grain is also fed and self waterers used. It still persists under this intense grazing. The farm consisting of 360 acres produced four thousand pounds of buffel seed during 1965-66 as well as carrying 120 head of cattle. Experimental plots fertilised with urea and sulphate of ammonia produced a good crop of flag, but as no rain fell at the critical stage no seed was produced. However the paddock was mown and baled for hay which cattle eat readily. Apart from these experimental plots, no fertiliser has been used on the farm for grass seed production.