DEVELOPMENT OF PASTURE LANDS IN THE CENTRAL BRIGALOW, FIELD MEETING OF THE BURNETT SECTION, OCTOBER 6 & 7, 1967

BRIGALOW RESEARCH STATION AND ITS RESEARCH PROGRAMME

by

R. W. JOHNSON, DEPARTMENT OF PRIMARY INDUSTRIES,
BRIGALOW RESEARCH STATION, THEODORE.

INTRODUCTION

The Brigalow Research Station was officially opened on 8th May, 1965. The Department of Primary Industries has been studying the problems involved in the development of brigalow lands for many years and when the Brigalow Land Development (Fitzroy Basin) Scheme was initiated by the State Government it was decided to establish a Research Station in the area. The actual site was selected because it provided variations both in soil type and vegetation and was reasonably representative of properties in the Fitzroy River basin.

The Station is situated approximately 20 miles north-west of Theodore and comprises an aggregation of land excised from the original leases of "Highworth", "Thomby" and "The Rhyddings". It occupies 8888 acres divided by the north flowing Roundstone Creek into a larger eastern portion of approximately 6000 acres and a smaller western portion of approximately 3000 acres.

CLIMATE

No climatic data are available for the Brigalow Research Station. Based on data from the nearest official weather recording stations, the average annual rainfall is expected to be about 28 inches. Two-thirds of this rain is expected during the months November to March, the wettest months being January and February. A small peak in rainfall occurs in June when about 1½ inches is expected. The driest months are August and September. Mean maximum temperatures of more than 80°F should occur from September to April while frosts could be expected during the months June to August.

VEGETATION AND SOILS

Prior to clearing the main vegetation occurring on the eastern portion of the Station was virgin brigalow scrub. A number of distinct communities could be recognized, the major ones being

(1) Brigalow (*Acacia harpophylla*)-Wilga (*Geijera parviflora*) Communities — These occurred on uniform heavy cracking clay soils on level to undulating topography.

(2) Brigalow-Belah (*Casuarina cristata*)-Wilga Communities — These occurred on uniform heavy cracking clay soils deeper than the previous type and with well developed melonholes.

(3) Brigalow-Dawson gum or Blackbutt (*Eucalyptus cambageana*) Communities — These occurred on texture contrast soils, the surface often being a sandy clay loam. They were usually found on the crests of ridges or on their upper slopes.

(4) Softwood Communities — These were mostly dominated by bonewood (*Macropteranthes leichhardtii*) with some emergent trees of brigalow, belah and Dawson gum. The soils are deep loams to clay loams or texture contrast soils with a clay sub-soil. They were usually found on crests or slightly elevated situations.

In addition to these communities there were smaller areas of (1) Silver-leafed ironbark (*Eucalyptus melanophloia*) Forests — These were found on crests of ridges on shallow soils and occasionally on higher ground on poplar box alluvial flats.

(2) Poplar box (*Eucalyptus populnea*) Forests — These occurred principally on creek flats and lower slopes on a sandy surfaced, texture contrast soil.

Similar vegetation existed on the western portion of the Station but this area has been ravaged by fires in the past leaving large areas of dense regrowth of brigalow, Dawson gum and sandalwood (*Eremophila mitchellii*).

DEVELOPMENT

Very little clearing had been undertaken prior to the establishment of the Station. Approximately 200 acres was pulled and sown to Rhodes grass about 1957 while most of the silver-leafed ironbark and poplar box forest and adjoining brigalow scrub was ringbarked about the same time.

Since 1963 approximately 3500 acres of brigalow scrub has been pulled and most of this has been sown to improved pastures. Of this area, 500 acres is now being cultivated and further cultivation is planned.

RESEARCH OBJECTIVES

The Brigalow Research Station is administered by the Research Stations Board on which are representatives of the major Divisions of the Department of Primary Industries. A local committee, responsible to the Board, has been formed and this committee's function is to formulate an annual programme of research work and prepare the annual Station budget for submission to the Board. Representatives on the Station Committee include some members of the Station staff as well as field officers and a graziers' representative.

The objectives of this Research Station are

(a) To study problems relative to the development and utilization of brigalow lands of the Fitzroy River Basin.

(b) To classify land on the property in terms of vegetation, soil types and topography and to relate this to potential productivity.

(c) To study and devise systems of land development and use appropriate to the different land classes.

(d) To study long-term changes in factors affecting productivity under different systems of land use.

On these objectives a programme of research has been built.

RESEARCH PROGRAMME

The objectives of the Station as stated above are very broad and the problems associated with the development and utilization of the brigalow lands of

the Fitzroy River basin are numerous. So it has been necessary to consider these problems in perspective and to arrange our research programme with priorities clearly in mind. Though the research programme is an integrated one it can be summarized under the following headings:

Brigalow Control Research

One of the major factors limiting production on cleared brigalow country is the presence of brigalow suckers and the problem of brigalow regrowth occupies a high place on our list of priorities. Minimizing regrowth density or controlling regrowth in the initial phase of developemnt is an important consideration. Much is known of this aspect of brigalow development and the present research programme is concentrating more on the maintenance of improved pastures by controlling regrowth with chemicals and on the reclamation of areas which have reverted to brigalow dominant communities. In this later phase trials involving ploughing and spraying are being undertaken.

Pasture Research

The grasses, buffel, green panic, Rhodes and *Sorghum almum,* now being used in the initial development phase, are quite satisfactory. No legume has yet been found which will persist with these species in the first few years after clearing.

The major pasture problem at present is to halt or slow down the inevitable nutritional decline in pasture growth following the initial burn and to reduce or eliminate the weight loss in cattle sustained in the winter and spring. The greatest pasture need to-day is to find suitable legumes adapted to this environment. This entails, first, screening the numerous legumes which offer possibilities, finding a way to establish and maintain them either alone or in a grass-legume pasture and then testing their persistence and productivity.

Another important problem is the improvement of old stands of improved pastures. Where brigalow regrowth is common the use of cultivation as a method of control offers the opportunity of replacing degenerate pastures with better quality legume-grass pastures. The finding of suitable pastures of this type is an important aspect of the pasture research programme.

Crop research

Properties close to railheads are in a position to grow cash crops and an expansion of this type of enterprise will occur in the brigalow belt. The screening of possible winter and summer cash crops and their varieties is a basic and continuing study. These screening trials also provide plant breeders with an opportunity to test many of their new varieties in an environment for which they are bred. Fertilizer trials are also being undertaken as a routine part of the research programme.

Most brigalow properties are in a position to grow forage crops and the presence of brigalow and other regrowth will accelerate the move into this field. A forage cropping programme has been initiated and a basic part of this research is the screening programme. Field testing of proven and promising winter and summer crops under experimental conditions is planned. During the summer of 1967–68 a grazing trial comparing three *Sorghum* types, Sudan grass, *Sorghum almum* and Zulu will be initiated while a further grazing trial is planned for the following winter.

Most of this research is of a short-term nature but a Research Station offers a unique opportunity to study long-term changes. An area has been set aside for the study of a number of land use systems such as continuous cropping and continuous pasture and from this area data on changes in productivity, in soil fertility and structure with time will be measured.

Cattle Husbandry Research

Though brigalow country offers great potential for the expansion of fodder cropping and pasture improvement, the benefit of such enterprizes can only be gained by conversion into beef. Since beef will be the main income earning product of the region the beef research programme will play an important part in the Station's overall programme.

As a starting point basic data on the productivity of the ash-sown brigalow pastures are required, and to this end a pasture productivity trial has been commenced. From this trial the relative value of the commonly used pasture species, buffel grass, Rhodes grass and green panic will be assessed. As well the decline in productivity of pastures following the initial burn will be traced and a clearer picture of the annual production pattern will be obtained. Basic productivity data from this trial will provide a yardstick against which any improvement in productivity can be measured.

Breeding will play an important part in the management of most brigalow properties. On the Station single bull mating is being carried out at various times of the year and the performance of these groups is being compared with a group undergoing continuous mating. Data obtained by regular measurement of growth and reproductive performance of the various groups will provide information useful for the improvement of calving percentages and growth of young stock throughout the district.

Soil Conservation Research

The conservation of our natural resources is essential in maintaining productivity and soil and water conservation will play an important part in the development of any brigalow property. In many areas underground water is not available at shallow depths and most properties must rely on surface water. The trapping of surface water run-off is one of the major problems confronting many brigalow settlers and a study of the effect of clearing and developing on the frequency, rate and amount of storm water run-off is being undertaken. This work is basic to soil conservation planning and information obtained will be useful in designing farm dams.

At present three similar catchments under virgin brigalow scrub have been selected and water run-off is being measured. Eventually two catchments will be pulled, one of which will be sown to improved pastures and the other will be cultivated and cropped. Changes in the run-off pattern will indicate the effect of clearing. Structures such as ironclad and roaded catchments to improve the runoff capacity of catchments are also being studied.

Another important aspect of soil conservation research is the long term study of changes in soil structure and the consequent changes in erodibility under various systems of land use. This work is being undertaken in conjunction with the land use study mentioned previously.

Brigalow country is not a uniform belt of country. Variations in vegetation occur even within single properties and these variations reflect variations in soil type and topography. It is intended eventually to repeat trials on the major land units on the Station so that the results of our research work will have wider application.

BRIGALOW CLEARING AND THE CONTROL OF REGROWTH

by

R. W. JOHNSON, DEPARTMENT OF PRIMARY INDUSTRIES,
BRIGALOW RESEARCH STATION, THEODORE.

INTRODUCTION

Before white settlement, brigalow scrubs occupied approximately 15 million acres of Queensland. Early settlers preferred the open forest and grassland to the dense scrubs. Even so, brigalow clearing is not new for development of this country was undertaken as early as the close of the last century. Skerman (1953) estimated that approximately one third of the brigalow country had been cleared by about 1950 though some of the original clearing had reverted to brigalow suckers. Most of this clearing was done with the axe, ringbarking or felling often being followed by heavy stocking with sheep or the sowing of Rhodes grass.

After the Second World War, heavy machinery became available and this greatly accelerated the development of the brigalow country. Since 1954 the accepted method of clearing brigalow scrubs has been to pull them down with a cable, chain or cable and chain dragged between two large bulldozers. This has enabled clearing to be undertaken on a massive scale and with very heavy machinery up to 400 acres can be pulled to the ground in a day.

Brigalow (*Acacia harpophylla*) is a leguminous tree with a well developed horizontal root system. Its ability to produce root suckers when damaged has made the clearing of brigalow scrubs a difficult operation. Scrubs with 600 brigalow trees and suckers an acre can be replaced after the initial clearing by 6000 suckers an acre. Regeneration by seed occurs sporadically but brigalow seedlings do not constitute a problem on cleared country.

Some brigalow regrowth invariable follows pulling and where brigalow suckers are common productivity will decline fairly rapidly unless control measures are undertaken. Control measures can be initiated in

(1) Initial Development Programmes, as an integral part of the initial clearing operation

(2) Maintenance and Reclamation Programmes either to

  (a) Maintain productivity of a sown pasture in which suckers are common

  (b) Reclaim areas in which the pasture has deteriorated and brigalow suckers are dominant.

INITIAL DEVELOPMENT

The pulling of brigalow scrubs in cattle country is normally followed by burning and the sowing of improved pastures. Johnson (1962, 1964) has shown that factors such as the type of scrub, time of pulling and soil moisture conditions and soil type influence the density of regrowth following pulling, burning and sowing. Regrowth was much less prolific during the wet years 1954 to 1956 than it has been since and sucker-free pastures on many of these old cleared areas remain as a monument to these wet seasons.

However with the rapid pace of development in the last few years, landholders have had little opportunity to undertake their clearing operations under favourable conditions while the relatively dry conditions which have prevailed have accentuated the regrowth problem. During this time much capital has been

squandered in the large scale pulling of brigalow and too little thought has been given to providing means of financing regrowth control measures and for the provision of stock to earn income on this expended capital.

Pulling is usually following by burning. This is necessary to remove most of the trash, kill the native grasses, control or kill native woody plants and to prepare a seed bed for the sowing of improved pastures. Provided the native grasses have been killed, the presence of some logs on the burnt area aids germination and establishment of the introduced grasses.

Some brigalow regrowth usually appears after burning. Recent studies have shown that during years of average to below average summer rainfall approximately 50% of the eventual sucker population has emerged 10 weeks after burning and approximately 80% 15 weeks after burning. Maximum density has occurred 20 to 25 weeks after burning.

Johnson (1964) presented evidence to suggest that the quick establishment of a pasture after burning would suppress sucker regrowth. Replicated trials over the past four years, years in which pasture establishment has been rather slow, have indicated that under relatively dry conditions the presence of improved pastures has little effect on the density of regrowth following burning though some supression of growth occurs.

Even before pulling it is possible in many cases to know that a sucker problem will develop following clearing but the ultimate extent of the regrowth problem can be judged finally 10 to 15 weeks after burning. At this stage a programme of control should be finalized. Where sucker density is more than 500–1000 suckers an acre, regrowth will seriously retard pasture growth within five years. After assessing the potential regrowth problem 15 weeks after burning a decision must be made on future regrowth control measures on those areas requiring treatment.

It is strongly recommended that the following procedure be followed:

(1) Estimate what acreage can be cultivated within the next five years and plan a cropping programme.

(2) Spray the balance of the area, 4 to 5 months after burning. Trials have shown that a kill of approximately 80% can be expected by spraying at this stage and this method is now a normal part of property management in the western brigalow areas.

In one trial on the Brigalow Research Station, areas sown to Rhodes grass have yielded 4500 lbs dry weight of grass within 18 months of sowing on plots sprayed with ½ lb 2,4,5-T per acre in 2½ gallons of diesel distillate compared with 3400 lbs dry weight of grass on unsprayed areas. On unsown areas, native grass yielded 2500 lbs on sprayed plots compared with 1000 lbs on unsprayed plots. Yields of brigalow suckers (dry weight) were 140 lbs per acre on sprayed plots and 1610 lbs per acre on unsprayed plots. The much larger amounts of brigalow on unsprayed plots will almost certainly cause progressively larger differences in pasture yields as the brigalow suckers increase in size.

A further bonus associated with spraying at this stage is the control of many of the native weeds which compete with the introduced grasses in the early stages of establishment.

MAINTENANCE AND RECLAMATION

With satisfactory pasture establishment the productivity of newly sown pastures is relatively high and stock have been fattened at rates of 1 beast to 4 acres in the first few years. Even where suckers are common grass growth in the

first few years is quite satisfactory. Brigalow suckers, however, are well able to compete with improved pasture species and where they are common will eventually become dominant. A pasture with 6000 brigalow suckers per acre can, within four years, be less productive than the original scrub.

Three methods can be used to control regrowth, burning, ploughing and spraying.

Burning

Although fire is used to knock suckers back to ground level, rarely does any marked kill of suckers occur. Burning merely kills the top growth and reduces the competing ability of the suckers. Grass growth is encouraged and a temporary improvement in carrying capacity is achieved.

If suckers are not common then occasional burning can help maintain a good pasture. Where suckers are common pasture spelling through the autumn, winter and spring is required to allow a body of grass to develop. This means an overall reduction in carrying capacity though this is balanced to some extent by improved grazing for some time after burning. Burning may be required at least every three to four years. In the long term it is difficult to see if any marked gain in productivity is achieved. On properties regarded as a living area it is generally better economics to graze pastures rather than burn them.

Once the cycle of burning, grazing and spelling is broken through the inability to burn at the critical time because of drought and overgrazing or a series of wet years, a major reclamation programme must be undertaken. Burning can delay a major reclamation programme until a more suitable time but it cannot be looked upon as anything but a temporary measure.

On a few ocasions good kills have occurred following burning and a trial to determine the influence of environmental conditions on the effectiveness of burning is being carried out.

Ploughing

Annual cropping for 3 years is the most effective method of controlling regrowth. For this reason little research has been continued along this line. Unfortunately, due to distance from railheads only a small proportion of the blocks being opened for closer settlement in the Fitzroy River basin are in a position to grow cash crops while a shortage of cattle has slowed down the expansion of forage cropping in the area. Even now large areas of regrowth are being reclaimed by ploughing and this area will increase. At present a three year cropping phase followed by the introduction of improved pastures enables large areas of suckers to be controlled on a rotational basis.

However, on many properties where ploughing is to be carried out by contract and annual cropping is not part of normal management practice it is important to know something of the effect of environmental conditions and ploughing depth on regrowth control so that maximum control may be achieved with minimum cultivation. Trials to give more information on these points are in progress. Investigations in Southern Queensland by C.S.I.R.O. indicate that no advantage is gained by ploughing deeper than 4 inches and this is also being tested in this environment.

Spraying

Many settlers, through a shortage of finance and lack of labour are not in a position to undertake large areas of cultivation and alternative methods of control

have to be found. Spraying offers the possibility of large scale control at a relatively low cost. A number of trials with knapsack misting machines, tractor-mounted misting machines and aircraft have already been established.

While good control has been obtained following the spraying of young suckers after the initial burn, the effectiveness of spraying, particularly where aircraft and tractor-mounted misters are used, decreases as the suckers become older and more bushy. If spraying is delayed for 3–4 years after burning kills of only 50% can be expected from aerial spraying and poorer results where tractor-mounted misters are used.

With older suckers spraying can be carried out at two stages:

(1) Before the pasture has completely deteriorated. This entails either grazing the pasture and spraying the standing suckers or spelling, burning and grazing the pasture and spraying the young regrowth. While the former may appear the more economic approach, the better kills following burning permit a far greater degree of control to be obtained with a single spraying.

(2) Where the pasture has almost disappeared. In this case, where ploughing is not possible, spraying offers substantial relief and the cost of spraying can be amply recouped by additional grazing as well as giving the settler the opportunity to bring his regrowth problem under control. Spraying for this purpose should be regarded in the same light as fertilizer application. Although a single treatment may only produce a temporary increase in productivity, the cost of the application is justifiable expenditure when balanced against the increased productivity achieved. Under these conditions, two or three sprayings may eventually be needed for effective control.

The decrease in kill with increase in age is partly due to the difficulty in covering all the foliage with spray and trials to improve coverage by using two suitable timed sprayings are being undertaken.

The greater benefit from aerial spraying of older suckers can only be achieved if spraying is undertaken under good seasonal conditions. Delaying spraying until soil moisture is high during the summer-autumn period is a sound investment and a trial to determine more precisely the influence of environmental control on the effectiveness of spraying has been stablished.

Hope based on the finding of a new chemical or machine that will revolutionize brigalow regrowth control is probably false hope. Though this possibility cannot be discounted, judicious use of the plough and the chemical 2,4,5-T will enable most problems to be overcome. The brigalow control research programme on the Brigalow Research Station has been devised to make best use of these tools.

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PASTURE RESEARCH PROGRAMME — BRIGALOW RESEARCH STATION

by

J. H. WILDIN, DEPARTMENT OF PRIMARY INDUSTRIES,
BRIGALOW RESEARCH STATION, THEODORE.

Sown brigalow pastures are mainly established on ash seed beds following the initial scrub burn or with some degree of cultivation subsequently. Generally some cultivation is initiated in a sucker control programme at a later stage of development.

Establishment from ash sowings of common Rhodes grass, green panic, buffel grasses and short lived grasses including forage sorghums, panicums and millets, has been successful. Various factors determine the use of these grasses in pure stands or in mixtures.

At present legumes have not been successful in ash sowings and, as well adapted species are not available, are not recommended in this severe form of establishment because of —

1. Unfavourable climatic factors for establishment of available species.
2. Problems associated with aerial sowing (seed inoculation, high temperatures on soil surface, strip planting, etc.).
3. Management problems associated with excessive initial grass and weed competition, the need for brigalow sucker control measures and lack of adequate control of stock in extensive paddocks.
4. High seed costs.

Some brigalow regrowth control is almost always necessary (Johnson 1962, 1964) and it is at this stage or immediately subsequent to it that more refined pastures can be established. Johnson (1962) for example, has shown that annual cropping for three years will reduce suckers to negligible proportions. Pastures established with cultivation following such a sucker control programme should be set aside for special purposes so that maximum realization of their extra value may be achieved.

RESEARCH PROGRAMME

A range of perennial grass species is available but pastures of these generally provide only sub-maintenance grazing over the winter-spring period due to frost and dry conditions. Because of this, the Station research programme is focused on the legume for two purposes — to supply added protein for the animals' diet, and to maintain and improve soil nitrogen levels. Some attention is also being given to the search for special purpose grasses that will maintain better winter-spring quality.

Species evaluation is being carried out in the first instance at the introduction nursery and then in small plot sward trials. A wide range of soil types occur in the brigalow region (Isbell 1962) and cognizance of this is being taken in the Station programme. Many of the soils are located on the Station.

Four main facets are receiving attention —

1. Development of special purpose, high quality pasture for intensive, strategic utilization following cultivation periods.
2. Nutrition of leguminous species on the various soil types that make up the brigalow complex.

3. Protein concentrate production.
4. Improving productivity of old ash sown grass pastures.

Special purpose pastures

On properties with extensive areas of pure grass pastures, total dry matter as such is rarely limiting in the early years of development, but there is considerable scope for relatively small areas of high quality grazing to supplement or complement the extensive grass pastures.

These areas may take the form of —

1. Pure stands of legumes to be used as a protein supplement particularly during the cool part of the year. From observations, the most outstanding species for this purpose have been the winter hardy lucerne, the shrubby perennial *Leucaena leucocephala,* and the short lived *Dolichos lablab* (late flowering varieties, e.g. Rongai).
2. Short term rotation pastures designed only to last up to five years before the area is returned to cultivation. Hunter River lucerne-green panic has been the basic mixture. Callide Rhodes grass and winter tolerant species such as the Kabulabula and Makarikari types of *Panicum coloratum* could prove of value in these pastures.
3. Long term grass-legume pastures sown after annual cropping for a number of years or with full seed bed preparation. At present, no well-adapted legume is available for these pastures as long term persistence of Hunter River lucerne cannot be guaranteed. A range of legumes is being studied in the nursery. Various forms of glycine (*Glycine javanica*) and Siratro show nursery promise but field performance is as yet relatively untested. Annual forms of *Medicago* and *Stylosanthes* are also being observed. Grass for such pastures would be similar to those already mentioned with buffel grasses, especially Molopo, particularly favoured.

Within the sphere of special pastures it is intended to initiate one study early in 1968 in which the growth of weaner animals from May until November will be compared from areas of Biloela buffel grass, alone, supplemented by an area of Hunter River lucerne, and supplemented by leucaena.. A fourth area will be Molopo buffel grass alone.

With full development, the brigalow region will continue to be an important cattle breeding area, and because of its closeness to markets, fattening, already being undertaken on many properties, will be considerably expanded. Special purpose pastures will play an important role in feed sequences for increased beef production although some reliance on forage crops will also be necessary. A separate research programme in this sphere is in progress.

Legume nutrition studies

The brigalow soils are generally regarded as rather fertile, mainly in terms of available nitrogen, but it is known (Isbell 1962) that phosphorus, sulphur and molybdenum can be limiting for maximum plant growth on some soils in this complex. Fertilizer trials are being established on the Station covering major and minor nutrients to give some preliminary information on the nutrient status of the major soil types. One is already in progress. Data from these studies will be valuable in species selection and in the establishment and maintenance of legumes in mixed pastures.

Protein concentrates

Legume hays and pulse grains will be important for protein conservation in this region. Rongai lablab (*Dolichos lablab*) is the most outstanding hay legume

for dryland production seen to date. It is high yielding, drought hardy and relatively free from pests and diseases.

A versatile pulse crop would also be invaluable. Characteristics required are high yields, drought hardiness, fairly early maturity to escape frosts, non-shattering pods and relative freedom from pests and diseases. A preliminary pulses trial with 28 varieties was planted in March, 1967, and work is to be continued this year. Some interesting material in the *Dolichos lablab* lines and the grams (*Phaseolus spp.*) was seen.

Improving productivity of old ash-sown pastures

Ash-sown pastures deteriorate in productivity due to encroachment by weedy species, especially brigalow suckers, and decline in soil fertility, especially available nitrogen.

Heavy sucker growth can be so great as to reduce carrying capacity of pastures to below that of virgin scrubs in five years. On one local property Johnson (personal comm.) has found that four years after planting into a scrub burn ground cover was of the order —

Brigalow suckers	35%
Native grasses	12%
Rhodes grass	10%

Where the plough cannot be used, some degree of control can be achieved by spraying with 2,4,5-T. On a three year old Rhodes grass stand on this Station, Johnson (personal comm.) has recorded a three-fold increase in Rhodes grass yields as a result of 2,4,5-T spraying.

The decline in productivity over a number of years due to nutrient reduction is common experience but no published data have been sighted. A grazing trial using Rhodes grass, Biloela buffel and green panic in pure stands has been established on the Station, and animal performance measurements will trace this decline.

The quality of the pasture can be improved by the introduction of more productive species, particularly legumes, and the use of fertilizers. Methods of introducing legumes by limited cultivation at critical times is under study, and replacement of the grass, mainly in the case of pure Rhodes grass stands, by more persistant species, especially more drought hardy and cold tolerant forms, is required. The role of nitrogen fertilizers on these grass pastures as they age requires investigation.

With the object of turning off young high quality beef when supply is low, efficient management of native pastures, ash-sown pasture, "special" pasture, and forage crops, will give an integrated programme leading to increased quality and quantity of beef from this region. Protein concentrates in the form of conserved pulse grains and legume hay will be valuable in hand feeding of special stock (e.g. handfeeding of weaners) and in a drought mitigation programme.

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CATTLE HUSBANDRY RESEARCH AT THE BRIGALOW RESEARCH STATION AND ITS APPLICATION TO THE FEED YEAR

by

A. J. BOORMAN, DEPARTMENT OF PRIMARY INDUSTRIES,
BRIGALOW RESEARCH STATION, THEODORE.

As the Research Station has been in existence for only a few years, there are no results yet available from projects involving cattle. However, an attempt will be made here to explain how the research programme that has been developed will fit into the feed year programme.

In order to better understand the weak points in the feed year an appreciation of both rainfall variability and distribution is necessary. For the 29 years prior to 1960 the period from May to September produces an average of less than 2 inches per month; the main part of the rainfall falling in summer following the October-November break. Thus there are two distinct periods of potential pasture activity, namely, summer and early winter.

Pasture studies

In supporting a grazing industry pasture must constitute the basis of the feed supply. Improved pasture species tend to extend the growing season and provide greater bulk than do the native species. However, there is as yet little information on the relative performance of the various species or combination of species which are promising.

In this respect an area has been planted to the three common species — Rhodes grass, green panic and Biloela buffel. Each will be stocked at three rates, namely one weaner to 2½ acres, one to 4⅝ acres and one to 7 acres. The heavy stocking rate will be reduced as the productivity of the pasture falls off so that the decline which occurs in ash-sown pastures can be traced.

Animal studies

Cattle begin to gain weight about October or November, depending upon when the first storms occur, and continue to do so until about March or April or even June in a good year. These initial changes are due to the new growth of pasture and continue until the pasture matures. Once the pasture sets seed and hays off the cattle begin to lose weight and this may continue until October or November.

The section of the herd most profoundly affected by the seasonal growth of pasture is without doubt the breeding herd. Normally cows go in calf from October to June and calve from July to March. Very few, if any, calves are conceived between June and October because of the poor plane of nutrition of the cows at this time. Routine observations are being carried out on the breeding herd to determine which is the best time of year to mate and consequently drop calves. All cattle on the station are weighed at monthly intervals and all calves are caught, weighed, identified and mothered up at birth.

Annual cropping

So far it has been demonstrated that even with improved pasture cattle still lose weight during the winter-spring period. There are several ways of reducing the effect of this stress period. One is growing of a winter crop which can be effective not only in providing out-of-season feed for maintaining or finishing

cattle but also in sucker control. Oats is the most widely used crop for winter fattening but we know nothing of the capabilities of rape, standover sorghum or even safflower. However, we hope to answer some of these questions with a trial on winter crops commencing next winter.

Pasture supplementation

Other ways of approaching the winter-spring stress period are (1), the supplementation of mature pasture with growing legumes and (2), the supplementation of mature roughage with hays and/or urea licks.

There is also a definite place for summer crops in the feed year programme for two reasons, firstly for their ability to produce high dry matter yields per acre and consequently their effect on carrying capacity and secondly, as with winter crops, for the effect of cropping on sucker control. For these reasons a trial to evaluate the three sorghum varieties Sugar drip, Sudax and *Sorghum almum* will be planted as soon as storm rains are received.

In summary, Cattle Husbandry Research is aimed at determining the productivity of Rhodes grass, green panic and Biloela buffel, evaluating breeding performance, reducing the winter-spring stress on cattle caused by the decline in nutritive value of the pasture and determining the place of summer crops in the feed year.

GENERAL DISCUSSION

What is the extent of sub-artesian water in the area?

Mr. Johnson: Roundstone and Fish Creek areas are good but west of Roundstone Creek there have been many failures. Intake beds outcrop in the Dawson and Expedition ranges, but these dip steeply and occur at very great depth in the intevening country.

Are summer crops more effective than winter crops in controlling sucker growth?

Mr. Johnson: The ideal is to plough between September-March and grow the crop between April and August. However, both types of crops can be used.

Does sucker growth vary with the type of vegetation?

Mr. Johnson: Distribution of the initial population does affect sucker growth. Larger trees are more effectively pulled and provide hotter fires.

What is the best type of plough for use in brigalow areas?

Mr. Johnson: A heavy disc type is preferred.

Can slashing be useful?

Mr. Johnson: Slashing is useful in knocking down regrowth to facilitate further essential spraying operations.

In view of the non-persistence of Rhodes grass, would it be preferable to use green panic?

Mr. Johnson: Green panic does persist better than Rhodes grass but aspects of fertility are important. Regeneration of the grasses following drought differs in that Rhodes re-establishes from seed while regeneration of green panic is mainly vegetative.

Do you consider that Leucaena leucocephala will be of value during winters with heavy frosts?

Mr. Johnson: This point still requires investigation.

Is there a place for annual medics?

Mr. Cameron: These plants have only been studied in the nursery where their performance suggests further investigation is warranted.

Why is lucerne not used more intensively?

Mr. Johnson: A good seed bed is required and the plant lacks persistence.

Has any work been done on the introduction of lucerne with the grasses?

Mr. Johnson: The initial vigorous growth of grass tends to smother the lucerne.

Has the introduction of lucerne been attempted after the grass has been established for some time?

Mr. Johnson: Yes, but results were not satisfactory. It is better to introduce lucerne after cultivation.

What strains of lucerne have been used?

Mr. Cameron: Mainly Hunter River but sward trials are in progress with several strains including Hairy Peruvian and African. Creeping types which have been investigated have performed poorly.

What are the relative economics of establishing pastures by sowing in ash and cultivated seed beds?

Mr. Johnson: Sowings into ash give quick results and are associated with the large acreage which must be pulled by the owner when he occupies a brigalow property. Cultivation costs vary from $10 to $24 per acre and a large amount of capital would be necessary if the required 6000 acres within 3 years are to be treated in this manner.

What is the optimum length of time between pulling and burning?

Mr. Johnson: 9 to 12 months.

Is 2,4,5T used with water or distillate?

Mr. Johnson: Distillate. This does not harm the pastures but has the additional advantage of controlling weeds.

Do soil moisture conditions influence the efficiency of spraying?

Mr. Johnson: It is important that there is sufficient moisture for growth when spraying is carried out. This is closely associated with sap flow.

What would be the recommended treatment for a pasture which was encroached with suckers which were too large to control with a single spraying?

Mr. Johnson: Ploughing would be the first consideration but if this were not possible the pasture should be sprayed in February and again 12 months later. A light grazing could follow the initial spraying but a rest would be necessary before burning and respraying.

What is the cost of spraying?

Mr. Johnson: $2.40 to $2.80 per acre.

Is the decision to spray or cultivate influenced by the size of the area?

Mr. Johnson: Not entirely. It is sound to pull no more than 2000 acres and make sure it is under control before extending the area.

PROPERTY OF MR. GRAHAM EWARTS

When the property was occupied some 4½ years ago, 4000 acres of brigalow had been pulled, burned, and sown with Rhodes grass and green panic. Due to a series of poor seasons the sown grasses had deteriorated and severe encroachment of the area with brigalow re-growth had occurred. Control by means of sprays was not considered in the initial instance as the height of regrowth made

this impractical and use of fire as a control measure was precluded by plant density. It was decided that stick raking followed by shallow ploughing and buffel grass establishment offered the most suitable means of improving production and the technique was demonstrated at two sites.

A 500 acre block treated in this manner had been sown during October-December 1966 with a mixture of 1¼ lb *Sorghum almum,* 1 lb buffel and ½ lb Rhodes grass seed/acre. The pasture had fattened 260 bullocks by June 1967 and has subsequently been grazed at a stocking rate of one heifer to five acres.

Although the shallow ploughing had possibly increased, rather than decreased, sucker density and would necessarily be an annual operation, the system was payable and avoided the heavier costs and machinery failures associated with deeper ploughing. Further, shallow ploughing enabled buffel grass to establish from seed shed in the previous season.

Originally shelter belts were left between blocks which had been pulled but experience had shown this to be an undesirable practice. Cattle were attracted to them and the fallen debris hampered mustering. Shelter could be more conveniently provided through several clusters of smaller trees. Large individual trees which are left to reduce clearing costs are a marked disadvantage and in certain instances obviate the aerial application of aboricides. Higher initial clearing costs of a dollar or more per acre are justified by the removal of these trees. Stick raking following pulling and burning was necessary to facilitate ploughing operations and apart from other considerations, enabled spraying to be carried out by tractors.

Would it be advisable to follow minimum cultivation with spraying?

Mr. Ewart: I do not anticipate using sprays and will concentrate on cultivation and cropping.

How many years will suckers remain a problem under the system?

Mr. Ewart: I do not know but it is possible that there are more suckers now than when I started.

What is the cost of treating land in this manner?

Mr. Ewart: Initial stick raking, ploughing, and sowing costs are $8.00 per acre while subsequent annual cultivation costs amount to $2.00 per acre. Between 2–2½ acres an hour can be cultivated.

What would be the economics of using heavier equipment?

Mr. Ewart: Heavy machinery is associated with high capital investment and may be necessary where the planting season is restricted. We have a long planting season and this favours the use of lighter equipment.

What are the grass seeding rates used?

Mr. Ewart: ½ lb U.S.A. buffel, 4 lb sugar drip and a small amount of Rhodes seed/acre. Green panic at the rate of 1 lb/acre could be included. There are no suitable legumes available.

What is the management of the pastures during summer?

Mr. Ewart: They are spelled to allow the buffel grass to seed.

Is ploughing performed when the soil is dry?

Mr. Ewart: Yes, very dry. Seventy acres which were ploughed and planted when the soil was wet in January promoted heavy suckering and poor germination.

How deep is the ploughing?

Mr. Ewart: The intention is to reduce competition from suckers and native grasses and this is achieved by ploughing to a depth of 2½ inches.

What is the cost of ploughing with a Little Giant plough?

Mr. Ewart: In the vicinity of $5.00/acre. While this might be justified by the production of cash crops, it is too expensive for the production of forage crops.

What is the carrying capacity of the treated area on the property?

Mr. Ewart: One animal to 2½ acres. The past 4 years have not been good and no difficulty has been experienced in maintaining the stocking rate.

PROPERTY OF MR. CLIFF WALLACE

This property of 5,800 acres was occupied on the 1st April, 1963, at which stage a small area of scrub had been pulled but not burned. This area was burned and seeded in December, 1963. A second area was pulled and then burned and seeded in December, 1964. The resulting pasture was very poor.

Initially stocking rates of 1 beast to 2 acres can be obtained where successful establishment has occurred after burning and sowing but there is a rapid decline in carrying capacity and an accompanying brigalow sucker problem.

Ploughing is necessary to control suckers because burning is very wasteful of pasture.

Sorghum almum is sown after ploughing. The land is subsequently ploughed and sown to oats after the *Sorghum almum* has been grazed. *Sorghum almum* regrowth from remaining plants and self-sown seedlings provides late spring and summer grazing. The land is initially cropped for three years.

Are you happy with control of suckers after 3 years of cropping?

Mr. Wallace: This method of controlling suckers is very successful.

What area of cultivation can be handled annually with the labour force of three which you have?

Mr. Wallace: 1500 acres can be cultivated annually provided the machinery is adequate.

Is the problem of supplying animals with water to be a continuing one?

Mr. Wallace: Water for stock is becoming an increasing problem as more land is brought under cultivation and more subdivision of land is carried out. Provision is being made to store as much surface run-off as possible. A bore yielding 500 gallons water per hour has been established on the property.

You are at present cash cropping with wheat. Why are you doing this in preference to growing fodder crops?

Mr. Wallace: The price of store cattle is high and cash crops are used to control the suckers and to pay the costs involved. When ploughing is completed by January and the wheat sown by May a yield of 8 bags per acre is anticipated. The gross return from this would be $33 per acre.

What are the costs involved in preparing the land for cash cropping?

Mr. Wallace: Stick raking costs $5 per acre. Burning, stick picking and tree ploughing costs $16 per acre giving a total cost of these operations of $21 per acre.

What are your ultimate aims for the property?

Mr. Wallace: A breeding and fattening enterprise is envisaged carrying 600 breeders and producing in excess of 500 calves per year. A total herd of 2000 animals is anticipated with predominantly vealer animals being produced for sale.

Producing fodder crops to the grazing stage is fairly reliable in the area whereas cash cropping is more uncertain because of possible soil water shortage during the latter stages of the crop growth.

The carrying capacity of the summer fodder crops is higher. *Sorghum almum* gives a carrying capacity of two beasts per acre during the summer period. The combination of *Sorghum almum* and oats has been found to be very successful.

Have you had any trouble from poisoning of animals grazing Sorghum almum?

Mr. Wallace: More animals die from not having *Sorghum almum* to eat than the number that die from eating it.

Has any problem been encountered with "oat tetany"?

Mr. Wallace: There have been no cases at all.

Do you anticipate using lucerne in the cropping programme?

Mr. Wallace: Lucerne sown with oats grew well but the possibility of bloat is a problem and a worse problem than that associated with grazing *Sorghum almum.*

After the initial three years of cropping is completed and pastures are sown are you considering a rotation?

Mr. Wallace: It is planned to follow three years of cropping with four years of pasture and the cycle then repeated.

Are you considering grass alone or grass-lucerne pastures in the pasture phase?

Mr. Wallace: Grass--lucerne pastures are to be used and it is expected that the lucerne will remain productive for three years.

Is there any prospect for contract fattening of cattle if a property has insufficient animals to graze a crop when this method of brigalow land development is used?

Mr. Wallace: If satisfactory terms could be arranged by which payment was made for weight gained by animals on the crop, this would be a proposition. However it is difficult to arrange satisfactory terms.

Do you anticipate using phosphate and nitrogen fertilizer?

Mr. Wallace: The nitrogen status of the soil will decline but with the rotation planned it is hoped to go a considerable time without fertilizer. When it becomes necessary to use fertilizer this will be done.

Do you now consider this brigalow property to be a good investment in the light of your four years experience?

Mr. Wallace: I consider it a good investment which when fully developed is expected to give a gross return of $50,000 per year.

Are you considering fodder conservation in your programme?

Mr. Wallace: It is proposed to conserve fodder as silage for use as a drought reserve.