COMMERCIAL USE OF BEEF PRODUCTION TECHNOLOGY IN CENTRAL QUEENSLAND

INTRODUCTION

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During the past seven years beef producers have experienced fluctuating prices for their product and constant increases in cost of production. It has been suggested that instability in beef prices will continue during the next decade (Bain and Longmire 1980). Price instability combined with fluctuations in production due to seasonal variation demands astute managerial skills to ensure economic viability.

During periods of depressed prices, the maintaining of pastures, structures and machinery must be either reduced or deferred. This has the effect of reducing herd productivity in both the short and long-term. In turn, benefits of higher prices are reduced. The extent to which this occurs depends on the capacity of the management system to produce surplus cash for maintenance and development during the preceding period of high prices. Indications have been that producers who used the higher returns during the late 1960's and early 1970's to improve herd productivity and pasture capacity suffered least during the recession and benefited most when prices improved.

Significant reduction in cost of production on a unit basis is possible only through increased herd productivity to utilize economies of scale. Major costs of production such as wages and salaries, land rents and rates, return on capital are fixed. Variable costs, such as herd health, cartage and supplementary feeds are minor components of total costs and only marginal benefits can be obtained by reduced spending on these.

Major improvements in herd productivity in central Queensland are possible by changing from Bos taurus to better environmentally adapted cattle (Taylor et al. 1980). This technology is now widely adopted with more than 70% of cattle in central Queensland being Bos taurus x Bos indicus (Anon 1977). The aim of this series of papers is to discuss methods producers can use to improve productivity of tropically-adapted animals. Although these papers are directed towards the central Queensland situation some aspects within them have wider applicability.

FACTORS AFFECTING BREEDER HERD PRODUCTIVITY

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Under commercial conditions mating periods are often extended over the whole year. In addition there is a time span of approximately 15 months between conception and weaning during which time mortalities and sales occur. Reproductive rates are therefore difficult to measure accurately and many producers have only an approximate idea of the reproductive rate of their herd.

Experience with Bos indicus x Bos taurus breeding cows on well-developed and well-managed commercial properties shows that calving rates of 75% to 85% can be achieved with breeder mortality rates of less than 3%

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The major production system in central Queensland is breeding and fattening cattle suitable for export markets (Anon 1976). In this situation increases in weaning rates above 77% have little effect on gross income because there are sufficient surplus females in the herd to join to produce a given number of calves (Taylor et al. 1980). However, at lower reproductive rates surplus females are not available and improvement in reproductive rate is important. Also, as age of sale is reduced income becomes more sensitive to increases in reproductive performance.

TECHNIQUES FOR IMPROVING REPRODUCTIVE RATES

The primary reason for low reproductive rates is probably the low nutritional status of female cattle during the pre-joining period. Variation in capacity to reproduce and effect of disease are usually of less importance.

Live weight at mating

From the commercial view point live weight at mating is the best indicator of desirable nutritional levels. However definition of appropriate target live weight to ensure high reproductive performance is not well-documented under Queensland conditions. South African work with Bos taurus lactating breeders suggested prejoining live weights of 390, 440, 460 and 510 kg for two, three, four years and older respectively because conception rates are low at low prejoining weights (Meaker et al. 1980). Target weights for maiden heifers at joining are equally important. Information from the above report suggesting 270 kg for maiden heifers is a value which agrees with American work with Bos indicus x Bos taurus heifers (Reynolds 1972). Under the most favourable central Queensland situations joining to calve at two years is feasible but in most cases heifers will not attain a suitable joining live weight until two years of age.

Local information about desirable prejoining live weight is limited. There are reports showing that as live weight increases, pregnancy rate increases and that conception occurs earlier in the joining period (Rudder and Barnett 1979). Unpublished data from yearling maiden joinings suggest that prejoining live weight of 250 kg is the minimum for satisfactory reproductive rates and probably 280 kg would be more desirable. There is a need to obtain a better definition of target live weights for different genotypes.

Where live weights of lactating cows are markedly lower than suggested target weights, a large proportion of cows will fail to conceive while lactating because liveweight gain during lactation is unlikely to restore live weight to an effective level. This situation results in extended inter-calving intervals reflecting reproductive rates of 50 to 65%. In this situation the most important consideration is improvement of nutrition through pasture improvement. Use of high protein supplements are likely to reduce mortalities under nutritional stress but unlikely to increase prejoining live weights sufficiently to improve reproductive performance (Rudder and Barnett 1979).

Managerial techniques

Managerial techniques outlined below were developed from results of trial work in commercial herds and research from the Tropical Cattle Research Centre, CSIRO, Rockhampton. All these herds had reproductive rates of 75% or more with breeder mortalities of less than 3%.

(i) Controlled mating A controlled mating period should be designed to match nutritional requirements of breeder cows with pasture availability. Distribution and reliability of rainfall indicate that pasture availability is likely to be most abundant during November-March in the south and January-March in the north-west of the region (Rudder 1977). These periods set the desired time for joining. When a controlled mating period of approximately four months is implemented other management considerations, e.g. branding, weaning, culling cows, selecting replacement heifers and tick control, can be programmed to use labour more efficiently.

While it has been demonstrated that reproductive rates of 75% and higher can be maintained with controlled joining (Rudder and McCamley 1972; Rudder *et al.* 1976; Rudder and Barnett 1979) such a practice has not been widely adopted (Hall and Bryant 1976). This is partly due to lack of property development, but there is a need to determine the reasons for lack of adoption.

(ii) Strategic weaning The purpose of strategic weaning is to reduce stress on breeders to allow recovery in body condition before pasture quality declines below productive levels for non-lactating cattle. In central Queensland calves born from August to December are unlikely to receive significant quantities of milk after April/May. After April lactating cows lose live weight rapidly (Arbuckle 1959). Experience has shown that calves can be weaned at five months of age in April/May with a minimum of supplementation and minimum effect on live weight after the following pasture growing season. Hall and Bryant (1976) showed that strategic weaning was adopted more widely than controlled mating, but there were many producers who did not strategically wean calves.

(iii) Selection practices All breeding herds contain a proportion of sub-fertile individuals and the frequency is highest in tropically-adapted breeds derived from Brahman, less in British breeds and in those derived from Africander and unknown in the case of Sahiwal. Where reproduction rates are in excess of 70%, a proportion or all sub-fertile individuals can be culled and replaced with maiden heifers. This results in a phenotypically fertile group in the five to nine year age group (Rudder and Seifert 1977; Seifert et al. 1980). Usually subfertility is the major reason for culling breeders, but physical defects as well as temperament and physiological ageing should not be overlooked. Age at which to cull cows is not well-documented and there is a need to gather information about liveweight changes as age increases.

Replacement heifers should be selected on the basis of live weight with some selection for temperament and physical soundness.

(iv) Disease control In central Queensland brucellosis is virtually eradicated. Vibriosis is not uncommon but vaccination is simple and effective. Trichomoniasis occurs infrequently and can be controlled by restricted mating, heifer segregation and the use of young bulls where the management of cattle is adequate (Clark et al. 1974, Christensen et al. 1977).

(v) Bull and cow ratios The proportion of bulls used at mating varies markedly according to stocking rates, number of watering points and breed of bull. In general one would expect that 3 to 5% bulls would be sufficient but there is no data available to support this opinion.

In the past recommendations have been made concerning supplementary feeding bulls prior to joining. More recent experience shows that tropically adapted bulls will maintain and restore their live weight sufficiently to be capable of serving the herd without supplementary feeding by the time cows commence cycling, following commencement of pasture growth.

ECONOMIC USE OF HERD BULLS

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The cost of bulls to service a breeding herd is usually concealed in normal property accounts. It can represent a significant proportion of the cost of maintaining a breeding and fattening/store producing herd. Prices paid for herd bulls commonly fall into the $1000 to $2000 range while the current (November 1981) salvage value of culled bulls was about $350.00 following a working life of four to five years. The number of progeny produced over this period could range from 75 to 135 depending on herd reproduction rates and the proportion of bulls to breeding cows. These figures indicate a cost per calf branded of from $4.80 to $22.00. Under favourable conditions, mortalities in the breeding herd and from birth to sale in fattening cattle, results in the sale of approximately 94% of calves born. This raises the cost per head sold to $5.10 to $23.40.

The costing method outlined by Rudder (1979) indicates the current costs of objective selection of herd bulls from within a breeding and fattening herd is unlikely to exceed $45.00 per head. The difference between the value of a cull bull and its value if it had been sold as a steer should be added to this cost. Currently this value is approximately $55.00 bringing the maximum cost of selecting bulls from within the herd to $100.00. This represents a cost of $0.80 to $1.40 per head sold.

The primary concern of producers who breed and fatten or sell stores should be whether home-bred bulls are as good as or superior to purchased bulls. This paper presents information to support the concept of breeding bulls from within the herd.

Source of bulls

Conventionally herd bulls are purchased from producers who maintain a recognised stud that sells registered stud bulls and unregistered herd bulls. Selection of stud bulls is biased towards the requirements of the particular breed society. These requirements stress colour and specific breed characteristics, in addition to pedigree and conformation (Seifert 1981).

The producer who fattens steers or produces stores should be interested mainly in weight for age. When selection is diluted by attention to a large number of traits, improvement in any one trait is likely to be small. Colour, pedigree, and registration status are of no value in terms of meat produced. There is also evidence showing that apparent conformation differences do not significantly influence yield of muscle and that the breeds now commonly used will meet the fat cover requirements at normal weights acceptable for slaughter (Wythes and Ramsey 1979). The majority of studmasters rely on visual appraisal to evaluate animals for selection. Errors in subjectively estimating weight and not accurately accounting for age of the animal or that of its dam mask genetic differences. Genetic improvement in weight for age in stud cattle has therefore probably been slow with relatively small differences between commercial and stud cattle.

Performance ratios of more than 300 bulls offered for sale at auction showed that the average performance ratio was 102 $\pm$ 8. If there are only small differences between bulls from recognised studs and commercial cattle, about 50% (7102 ratio) of bulls sold would make some improvement, 20% would make no

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improvement and 30% (< 98 ratio) would lower the herd in terms of liveweight performance. Animals with a ratio of 117 or higher represent the best 5% of a group (Venamore unpublished data).

Information in terms of comparative weight for age and carcase acceptability of progeny by bulls from registered studs and progeny by bulls from commercial herds is scarce and should be obtained (Seifert 1981).

Breeding herd bulls

Seifert (1975) showed that realized heritability of weight for age at 18 months was 0.52 and Mayer et al. (1980) showed that this information could be successfully applied commercially. Daly (1977) suggests that herds of 150 cows and 5 bulls or more can supply their own bull requirements and outlined the procedure for implementing this practice. Obtaining the best genetic gain from weight for age selection depends on a large selection differential, a short generation interval, and a few commonsense considerations.

(i) Selection differential The selection differential for live weight at two years is the difference between the mean live weight of the whole group of animals and the mean live weight of those animals retained for breeding purposes. To maximise genetic gain a high selection differential is required so that only a small proportion of a group should be selected for breeding purposes.

Figure 1 shows the relationship between the expected genetic gain per generation for two year old weight and the proportion selected for breeding. It is based on a standard deviation of 38 kg for two year old weight, heritability of 0.50, and group size of 50 or more at selection.

From Fig 1 it can be seen that if the top five per cent of bulls are selected on weight for age, predicted gain per generation is 20 kg per animal, however if the top 15% are selected, the predicted gain drops to 13 kg per animal per generation. If 60% of the heifers are selected on weight for age, their contribution of 6 kg would be added to that of the bulls. It can also be seen that potential gains drop rapidly as the proportion retained for breeding increases.

(ii) Generation interval The generation interval is the average age of the cows and bulls when their progency are born. Reducing the generation interval improves the genetic gain per year. However lowering the generation interval must be compatible with a number of other considerations in the herd.

Limiting the use of bulls to only one mating season lowers the average age of bulls so that the generation interval will be reduced. However, this requires a high replacement rate of bulls which increases the annual bull requirements and this decreases the selection differential. Bulls should not be used for more than two or three mating seasons. Joining bulls at 27 months is feasible and deferring first joining to three years and older only lengthens the generation interval. The use of bulls as young as possible is the most effective method of reducing the generation interval and hence increasing the genetic gain per year.

Reducing cow age by culling and substituting heifers reduces generation interval but must be balanced against the need to join a higher proportion of heifers. Increasing the proportion of heifers selected for the breeding herd reduces the selection differential. A high proportion of heifers and first calf cows can result in lower average herd reproductive rates. Reproductive rates in the younger age groups are often lower than those amongst older cows that have been selected for reproductive efficiency (Rudder and Seifert 1977).

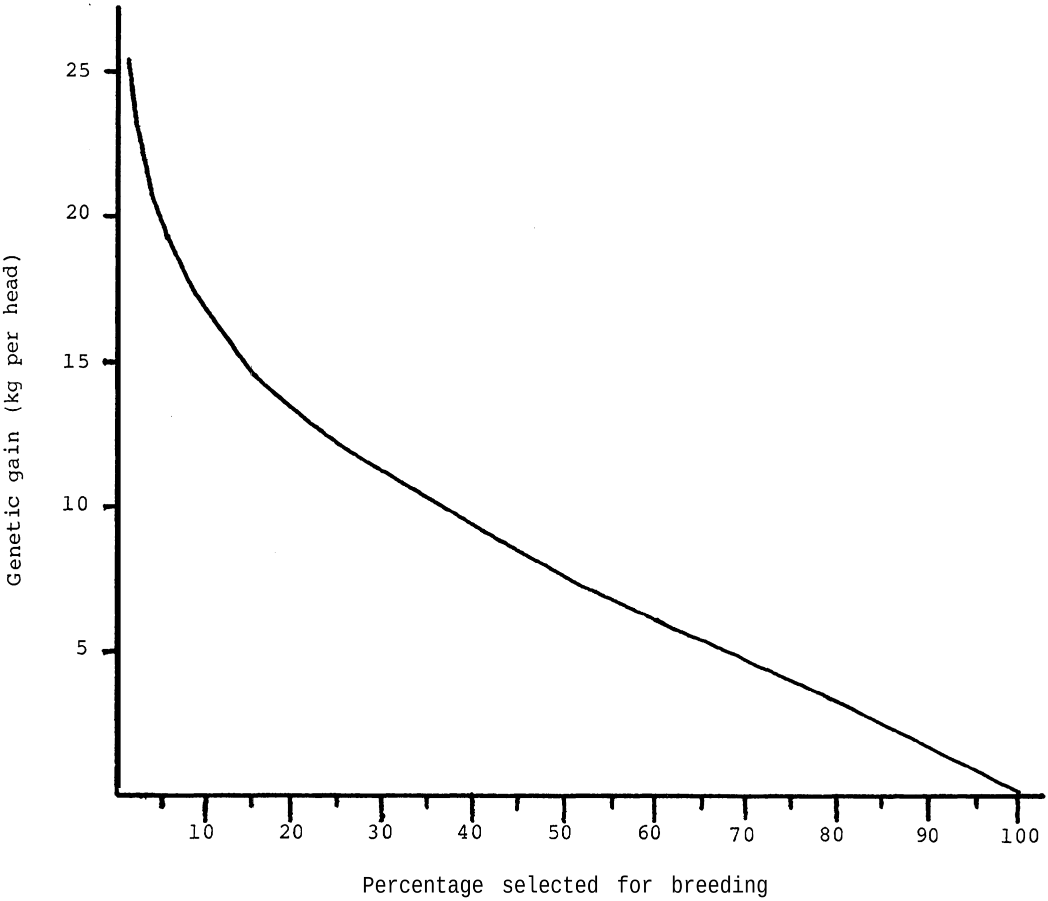

Fig. 1. The relationship between the expected genetic gain per generation for two year old weight and the proportion selected for breeding.

(iii) Secondary selection criteria Conventionally bulls have been evaluated after considerable fat deposition has occurred. Bulls selected for weight for age at 18 to 20 months under pasture grazing will rarely reach the weight at which fat deposition occurs. Therefore, conformation and general appearance is not as attractive as at older ages and higher weights but conventional assessment is neither appropriate nor necessary. Obviously bulls that have gross physical defects, e.g. extremely pendulous sheaths, small testicles, undesirable temperament should not be retained.

In tick endemic areas the importance of tick resistance will vary according to the tick populations. Tick resistance is heritable (Seifert 1971a) but the importance of selection for this trait will vary from very little to at least rejecting extremely susceptible animals.

MANAGEMENT OF GROWING CATTLE AND SELLING STRATEGIES

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A large proportion of cattle in central Queensland are grown on native pastures. The region is characterized by rainfall of summer dominance (60-70%) with relatively high variability. The mean annual rainfall varies from over 1000 mm on the humid, coastal strip in the north down to 700 mm some 100 km inland, which is the beginning of a sub-arid inland area of the region. Grass pastures grow rapidly during the spring-summer period but decline in nutritive value during the autumn and this seasonal variation in quality is more marked with the native than with the introduced species.

The emphasis on beef production at low cost under extensive raingrown pasture conditions means that low, conservative stocking rates of 4 to 12 hectares per beast are normally used on the areas of native pasture which predominate.

Production is mainly export-orientated with producers aiming to turn off steers at live weights of 540 to 560 kg which yield carcases of 280 kg or higher. Surplus heifers and cows are usually slaughtered at live weights of 375 to 450 kg to yield carcases of approximately 200 kg. These targets are usually achieved between two to four years of age on improved pasture. The market for the traditional domestic carcase (180 to 200 kg) is limited and some export carcases yield cuts suitable for the domestic trade.

Producers breeding cattle on poorer classes of country without access to suitable country for fattening usually sell steers for fattening at 12 to 18 months of age. Some properties sell a combination of fat and store cattle because the amount of fattening country available and/or the stage of development is not sufficient to fatten all the cattle produced. Producers with surplus fattening capacity often purchase stores to make best use of their country. Heifers surplus to herd replacement requirements are usually fattened for sale at two to three years of age. Cull breeders which are non-pregnant or cast for age are usually sold when fat following weaning of the calf. Because cows take up to 12 months after weaning to fatten, spaying to prevent unwanted pregnancies is often practiced,

Pasture productivity

Low winter rainfall and low temperatures cause a sharp decline in quality of native pastures during winter. Cattle generally lose weight during this period and gain weight at varying rates over the remaining eight months of the year when grazing these pastures. This results in annual liveweight gains of 54 to 136 kg per head annually and steers may be four years old at slaughter. Grass-legume mixtures will improve productivity in the coastal areas. At a stocking rate of 1.2 ha per beast steers reached slaughter weight at less than four years of age on fertilised Townsville sty10 pastures (*Stylothansus spp*) (Shaw and Norman 1970).

Large areas of cleared Brigalow (Acacia harpophylla) country have been sown to improved grass pastures of Rhodes (*Chloris* gayana) Buffel (Cenchrus *ciliaris*) and Green Panic (*Panicum* maximum var. trichoglume). Liveweight gains of 150 to 180 kg per head per year are possible at stocking rates of 1.5 to 4.0 ha per beast depending on rainfall, condition and age of pasture (Wegener et al. 1970). Liveweight gains per head are sensitive to stocking rate which should be adjusted according to the pasture stand. For example, annual liveweight gains of 142, 172, 180 kg per head from stocking rates of one beast to 0.7, 1.4, 2.1 ha respectively were recorded over a four year period (Trial BRG-CH63 unpublished).

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Use of crops

Forage crops can be used to extend the flexibility of turn off after the normal March to July peak from pastures. This enables a more even spread of income and avoids carrying cattle through the next wet season. Because of more reliable summer rainfall, summer forage crops, e.g. forage sorghums and legumes such as Dolichos (*Lablab* purpureus) and grain sorghum stubble are more reliable than winter forage crops. Winter crops such as oats, barley, safflower and rape are more common in southern areas and can provide grazing in late summer and early winter.

In the long term, there is little difference in productivity between oats and forage sorghum. Sorghums produce a longer period of grazing while the gains from oats are higher but more variable owing to crop failures. Rudder (1977) summarised estimates of beef production from forage crops during the period 1958-67 and the production from oats, forage sorghum and grain sorghum stubble was 167, 165 and 52 kg liveweight gain per ha, respectively. These values represent the annual productivity of the land used because land preparation, growth, and grazing periods add to approximately 12 months.

Finishing cattle on high quality improved pastures rather than forage crops will become more attractive as costs of production continue to rise and as suitable land is used for grain and oilseed production.

Use of feedlotting

Lot feeding is usually confined to the final fattening stage. Typically cattle would be fed a high grain ration for the last three months of fattening to produce a carcase of about 300 kg or to supply the domestic market with well finished lighter carcases. Plasto (1975) reviewed methods available for Australian conditions, and the highest levels of liveweight gain were obtained from high grain levels in the ration. The economics of lot feeding cattle have been estimated (Anon 1969). Profitability of lot feeding is very sensitive to cattle and feed prices, but. when considering this approach benefits such as reduction of pasture stocking rates should be considered.

Use of growth promotants

Two growth promotants "Rumensin" and Ralgro", are registered for use in growing stock in Australia.

Rumensin (monensin sodium) is claimed to improve animal performance by altering rumen fermentation patterns thus reducing energy losses associated with V.F.A. formation. It is expected that with Rumensin liveweight gains should improve on low quality feeds with no change in intake. On high energy diets liveweight gains would be constant with a reduced feed intake. Witt et al. (1980) showed a 5.2% reduction in feed intake and 4.8% improved feed efficiency with no change in gains or carcase parameters but there is no comparable central Queensland work. Use of the anabolic agent Ralgro (Zeranol) has expanded rapidly during the past two years. Venamore et al. (1982) reported central Queensland trials evaluating Zeranol implants and found comercially significant results from cattle grazing improved pasture and forage crops but small response under feedlot conditions. Observation of the recommended withdrawal period and correct site of implantation is essential to avoid unacceptable residue levels in meat and uniform response. Implantation of anabolic agents into breeding stock causes permanent, detrimental changes in reproductive organs (Reynolds 1980).

Disease control

Generally annual mortality rates are low in non-lactating adapted cattle. Preventative vaccination programmes are available to control losses from the tick fevers or clostridial disease such as blackleg. Trials have shown that treatment to control cattle ticks (Boophilus microplus) has little effect on liveweight gain of Bos indicus x Bos taurus non-lactating cattle (Seifert 1971b; Turner and Short 1972; Corlis and Sutherland 1976). This fact is apparently not appreciated as Hall and Acutt (1978) found that producers were treating cattle for ticks more frequently than necessary. Further, the use of anthelmintic treatment to control internal parasites needs to be evaluated on economic grounds because responses are not always significant (Seifert 1971b; Turner and Short 1972; Corlis 1980). Ephemeral fever is endemic in the region as is buffalo fly (*Haematobia* exigua) but the effects in terms of liveweight losses are not well-documented. Unpublished data indicates that liveweight gain may not be economically affected by buffalo fly infestation and special mustering for control may not be warranted.

Marketing

Producers have the choice between selling direct on weight and grade, open auction, liveweight auction and paddock sales. Each method has its advantages and disadvantages and producers should carefully assess each as it relates to the specific situation. The use of scales to determine live weight is more efficient than eye appraisal.

It is important that producers are aware of current prices for cattle offered by different meatworks in addition to saleyards. Reliance on market reports from one source is not necessarily indicative of the price that can be obtained.

The optimum time to sell cattle is governed by a combination of the weight of the cattle, expectations of price movement and prevailing seasonal conditions. Deferred sales in expectation of higher prices can affect the productivity of the herd through overstocking.

PLANNING PASTURE MANAGEMENT AND RECLAMATION

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Owing to the high degree of dependence on pastures for beef production reclamation and development of pastures is one of the most important factors in property management. Overgrazing, timber regrowth, and general decline in vigour continually take their toll of many pastures. The magnitude of the problem and appropriate remedial measures vary according to class of country and there is a continual need for pasture reclamation.

Relatively large areas of pasture development are needed to accommodate a sufficient number of- cattle to make an impact on income and this demands injection of large amounts of finance. Costs vary markedly but can be $150 to $250 per beast area plus watering and indirect costs through lost income during the development and reclamation phase. Pasture reclamation and development depends on beef prices and seasonal variation, and owing to the instability in these factors productivity tends to be cyclic. During periods of favourable prices development programmes accelerate but slow down during periods of depressed prices.

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The high cost of pasture development and reclamation together with the instability of many of the vegetation communities demands that each situation needs to be closely evaluated. Implementation of pasture programmes needs to be carefully planned to achieve most effective results.

Development and Reclamation

There are large areas of land suitable for cultivation in central Queensland (Gillies 1978) and cropping is expanding rapidly. On many properties this places a greater importance on the non-arable soils for beef production. However, cropping can be integrated with beef production to give a more stable income and enhance overall property productivity.

Many soils are either unsuitable for cultivation or suitable for only short term cultivation prior to establishment of pasture. Soils associated with Eucalyptus communities are unstable and large-scale clearing of forest country may not be desirable. Soil erosion is an ever present problem. On some soil types salting appears to be an inevitable result of timber clearing. Generally, over clearing of the slopes and ridges results in water moving down beyond the root zones of pastures and raising the water table further down the slope. Even if salting is reversible it may take many years to restore the land to its former state.

(i) Native pastures In the 500-600 mm rainfall environment Walker et al. (1972) showed that two to six poplar box (Eucalyptus populnea) trees and 360 shrubs per ha were the critical values for grass suppression. Evidence demonstrating short and long-term effects of timber treatment in euclayptus forest communities on long term production is still scarce. Existing information on timber control methods (Moore and Walker 1972; Walker et al. 1972; Anderson and Beetson 1974) cannot be refined at present and care must be exercised when clearing slopes and ridges.

The philosophy of pasture improvement has changed from one of complete replacement of native species by introduced species to one of legume introduction into native pastures. A regional legume screening programme has isolated lines of Stylosanthes scabra that offer not only ease of establishment without the need to remove stock, but also good persistance and fire tolerance. Of these Stylosanthes lines "Fitzroy" appears well-suited to large areas in the region down to 600 mm average rainfall and grazing trials have been initiated to evaluate it in terms of liveweight gains. Leucaena leucocephala has also shown promise as a dry season supplement but its exact role has not been clarified.

(ii) Improved pastures Large areas of timbered country have been cleared, burnt, and established with improved pasture species during the past 20 years. These areas now vary from highly productive pastures to areas of thick regrowth with little or no pasture remaining. Rejuvenation methods for pastures include periodic burning to delay the need-for more costly regrowth control methods such as chemical treatment of regrowth and deep ploughing with or without a cropping phase and pasture re-seeding (Johnson 1968). Grass species suitable for pasture establishment following cultivation are Buffel, Green Panic and Rhodes grass. Creeping blue grass (*Bothriochloa* insculpta) offers promise especially in heavier soils where other grass establishment has been a problem. On the more fertile soils capable of growing dense pastures, legume establishment is still difficult.

Implementation

Pasture establishment and cropping must be timed according to seasonal conditions as well as availability of finance and labour to implement the proposed programme.

A logical sequence of operations needs to be established so that critical operations such as soil preparation and planting can be executed on time.

The availability of surplus funds for pasture development is uncertain, therefore reliance on borrowed money is often necessary. Borrowed money can be difficult to obtain, and is expensive. Therefore, careful planning is required for each situation to maximise chances of successful establishment.

(i) Definition of priorities The classes of stock in the herd most responsive to improved nutrition must be carefully defined. As a generalization, increasing weight at sale or reducing age at sale of growing/fattening classes by improved nutrition offers the quickest return. However as age at sale is reduced performance in the breeders increases in importance. Obviously opportunities with the best cost benefit should be given highest priority even if it means diversifying into alternative production systems. Taxation concessions while important should not be the primary influence on priorities.

(ii) Budgeting Probable costs and returns are difficult to budget and are often avoided by producers and their advisers. However, it is possible to budget within certain limits. When comparing two or more alternatives, errors are likely to be equally distributed. Therefore, reasonably reliable indications of the best alternative to take can be determined. Budgeting is also useful because it gives an opportunity to list all the factors to consider and reduces the chance of over-looking important items.

When land is taken out of grazing for regeneration, consideration must be given to the alternatives of redistribution or sale of surplus cattle. The availability of cattle best suited to generate cash flow when pasture again comes into production must be considered.

(iii) Funding When beef prices are favourable much of the reclamation and development can be funded by surplus cash flows taking advantage of taxation concessions. Following periods of depressed prices borrowed funds are often necessary because reclamation has been deferred and a catch-up phase is needed. Sources of funds are many and varied (Donnet 1981) and it is important to determine the most favourable for each situation. The most attractive terms are most likely to be obtained when expenditure and cash flows have been carefully projected.

Conclusions

Pasture reclamation and development are an important and continuous feature of property management. On many properties it represents a major cost of production. While much of the cost effective technology is available implementation is made difficult by fluctuating beef prices. Alternatives need careful economic evaluation and implementation to enhance chances of profitability.

SUMMARY AND CONCLUSIONS

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Useful technology is available from research stations and from co-operative trials with commercial beef producers. However, there are indications that a large proportion of producers are still not using the available technology to the fullest extent. Hall and Bryant (1976) indicate low levels of adoption of two main factors in breeder management and Hall and Acutt (1979) reported that cost-saving recommendations regarding tick control are not as widely adopted as desirable. There also remains scope for wider adoption of environmentally adapted cattle (Anon 1977).

Lack of adoption in part is probably due to insufficient empirical information to demonstrate benefits to the producers. Optimum liveweight prejoining and breeding and selection of herd bulls, are two examples where further demonstratable evidence is desirable. On the other hand the advantages of use of environmentally adapted cattle and pasture development programmes have been widely demonstrated in research and under commercial management and the lack of, or a slow rate of adoption in these cases must be due to social, financial or communication factors.

Across a geographical region, producers vary markedly according to scale of operation, enterprise mix, financial resources, capacity of the soils, managerial ability, and personal aspirations. It is unrealistic to expect that all technology is equally applicable. However there is a need to determine the extent to which beef production technology is adopted, and more importantly establish reasons for non-adoption so that research and extension programmes can be directed to the areas of greatest need.

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