QUALITY OF PASTURE AND FORAGE CROPS FOR DAIRY PRODUCTION IN THE TROPICAL REGIONS OF AUSTRALIA

2. REVIEW OF FARMING PRACTICE

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INTRODUCTION

Quality of pastures and forage crops is difficult to define, but crude protein, energy content, digestibility and intake by the grazing animal are generally regarded as important factors.

Information on which this review is based was obtained from various pasture workers listed in Acknowledgements. One of these considered persistence as an important attribute of pasture species and this is so, not only on economic grounds but also because it introduces the time factor. Why should the production of protein and energy of pastures be considered for one season only?

Dairy farmers think more in terms of a high percentage of crude protein and a high level of digestibility when they consider the quality of pastures and crops. Yields of energy or its digestibility are seldom mentioned by farmers in discussions on quality. The belief in the need for high protein supplements has probably been carried over from earlier generations when high-energy, low-protein crops such as maize, sorghums and cow-cane provided the bulk of the intake for dairy cows during winter and spring months.

MEASUREMENT OF QUALITY

The determination of quality of pastures and forage crops by farmers and extension officers has been, of necessity, by subjective or indirect means. Measures such as cow grazing hours are not reliable because intake is not a true function of time spent grazing.

The aim of measuring quality is to provide a basis for comparison in terms of dairy products; therefore an objective method of measuring milk or butterfat production per unit area in unit time would be favoured by extension officers and farmers.

There are, however, many shortcomings in this technique if comparisons of the quality of different species are made on the one farm. The main difficulty appears to be that, on many farms, two or even three different types of pastures or crops may be grazed by the herd in any one twenty-four hour period. There are even more alarming pitfalls if comparisons are made between farms. Particular reference is made to differences in milking shed management and milking techniques between farmers, which could result in differences in production between farms.

On part of the Atherton Tableland, as in other dairying areas of the tropics, there is no restriction on inputs of land and situations are developing where there are insufficient dairy cows available to utilize the increasing acreages of tropical pasture. Under these conditions production per hectare is not particularly important. However, production per hectare involves production per cow and the measurement of the quality of tropical pastures in terms of potential production per cow will be warranted when land inputs become limiting.

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In the Coffs Harbour district, crude protein percentage determinations of pastures and crops carried out by the local dairy company have provided a guide for advice by extension officers on the management of pastures and crops and on the use of grain supplements. Variations in the crude protein levels in kikuyu have varied from 3% to 18% depending on stage of growth and level of soil fertility. Heavily fertilized ryegrass in the same locality has been as high as 34% crude protein.

Inherent in any analysis technique based on sampling of pastures being grazed is the very strong possibility that, where grazing pressure is not heavy, the sample is not representative of the cow's intake. Perhaps it is this weakness which is behind the strong comment from one contributor who said "following discussions with many farmers, I am convinced that the species with the highest protein, energy and dry matter weights per acre will not necessarily produce the highest weight of milk or butterfat per acre".

It is possible that protein determinations, along with research results quantifying the decline in protein as maturity is reached in crops such as hybrid fodder sorghums, merely confirm the judgment of the advisor or farmer, if he has a knowledge of feeding dairy cows. The subjective judgment of protein percentage is usually based on the stage of growth of the species.

With the increase in sowings of legume-based pastures and an increase in the use of nitrogen fertilizers on grass pastures and forage crops there is a growing realisation by extension officers and farmers of the importance of energy in dairy cow rations; hence the need for a broader definition of quality than mere protein percentage.

QUALITY DIFFERENCES IN TEMPERATE AND TROPICAL SPECIES

Quality differences can be considered either on the basis of comparison between the performance of temperate species in temperate areas and tropical species in tropical areas or on a comparison between temperate and tropical species grown in the tropics.

If one assumes, under the first alternative, that there are some limitations to the growth and persistence of temperate species in the tropics and vice versa, and further, that the overall judgment regarding the quality superiority of the temperate species is true, surely the whole question of dairy production in the tropics revolves round economics, sociology and politics and is therefore well outside the scope of this conference.

Safer ground is the second alternative, namely, the quality differences between temperate and tropical species grown in the tropics, or more specifically, on the same farm.

Temperate pastures

Clover-based pastures are grown in most sub-tropical districts, usually on alluvial soils. On a quality basis they are rated highly. In the Lismore district the highest yields of milk per hectare are claimed for irrigated temperate pastures. The example is quoted from the Atherton Tableland on farms where irrigated, clover-dominant pastures form the basis of grazing from June to December and contribute to yields of up to 36 kg of milk per cow per day from grade cows. In the same situation "increases in production are evident at all levels of production if stock are taken from average-managed tropical pastures growing well after storm rains in November-December" on to irrigated temperate pastures.

The role of the temperate pasture is to provide, usually on land subject to frost, high quality feed during the winter and spring months when natural or tropical pastures are making limited growth. Unfortunately the tropical areas suffer from low and unreliable rainfall during the spring months so the yield of temperate pastures is also unreliable unless irrigation is available. The quality of these pastures in terms of protein however, is still valued under dry-land conditions, particularly where a source of energy is available.

As if to further emphasise the importance of the quality of clover-based pastures during winter and spring months, the grass sown with the clovers is predominantly ryegrass. There is little evidence of reliance on a clover-paspalum or clover-kikuyu combination as a basic pasture with the clover providing "quality" to the combination. A clover-kikuyu mixture, however, is seen as having little to replace it during winter in the winter-wet areas of the Atherton Tableland. Reference to this mixture's productivity in the "early days" there, recalls the historical importance of paspalum-clover pastures on the north coast of New South Wales. If reports of the productivity of these pastures have not become magnified with age and knowing the propensity of paspalum to run to seed, the clover must have contributed greatly in terms of protein.

Lucerne

Lucerne has been specifically mentioned as an excellent source of high-quality feed in the Coffs Harbour district (where difficulty is experienced in maintaining it), the Kyogle district, North and South Burnett areas and the East and West Moreton districts. In the lower rainfall Burnett area of Queensland is the only example of a temperate legume and a tropical grass combining to form a stable, basic pasture. The combination is lucerne and green panic which is seen as "the main dollar-earning stand" in the district.

Despite the unequivocal preference for the quality of temperate pastures, most contributors were at pains to point out the complementary and supplementary roles of temperate pastures and crops in the whole-farm feed supply in the tropics. Over most of the area covered by this review neither tropical nor temperate species are growing in their ideal environment. The time of calving of the herd was seen as a complicating factor in comparisons, as was the carry-over effect of body condition from autumn to spring, on spring production.

FORAGE CROPS

Little reference has been made to crops but summer and winter crops in all districts appear to be used mainly as "gap fillers" in feed-year plans. Summer growing cereals are at a distinct disadvantage because of their habit of running to head right through their growing season when compared to winter-growing cereals. Vetches, when sodseeded into summer-growing natural pastures in the autumn on the north coast of New South Wales, provide a high quality feed and also result in the intake of the low quality accompanying grass which otherwise would be unpalatable to dairy cows.

TROPICAL AND NATURALISED OR NATIVE PASTURES

Naturalised species occurring throughout the whole area under review are mat or carpet grass, paspalum, kikuyu, Rhodes grass and white clover. In the northern areas, molasses grass and guinea grass must be added to this list.

The only favourable comment on carpet grass was that it has helped prevent erosion on the Atherton Tableland. Carpet grass and Rhodes grass are high in fibre, low in protein and quickly run to seed. Paspalum is not highly regarded but on the other hand is seldom deliberately eradicated to plant newer tropical grasses. Kikuyu, in all areas receiving over 40 inches of rain annually, is probably the most popular of all the grasses used for dairy production. There are many factors responsible for its popularity but the relevant one in this discussion is its high quality and its ability to hold that quality under a wide range of management conditions. It combines with greenleaf desmodium or Tinaroo glycine to provide the best tropical pastures on the Atherton Tableland. In northern New South Wales it is seldom cultivated for over-sowing with tropical legumes, dairy farmers preferring to topdress it with nitrogen fertilizers.

Setaria and the *Panicum* species are the main grasses sown with legumes where carpet grass or weeds and regrowth timber are being replaced. Both setaria and the panics lose quality as they run to seed and then depend on the accompanying legume to maintain satisfactory levels of protein in the mixture. Setaria is less palatable than the panics when in seed. Broad-leaf paspalum is used extensively in tropical pasture mixtures on the lower north coast of New South Wales. It does not run to seed until the end of summer.

SUPPLEMENTING TEMPERATE AND TROPICAL PASTURES

Supplementary feeding is being treated elsewhere in this issue, but decisions on the need to feed supplements will be influenced by the quality of the pasture available. The strongest comment on the shortcomings of pasture came from the Coffs Harbour district with the expressed opinion that "there is a need for the ration of all lactating cows grazing all types of pasture and crops at all times to be supplemented with a high energy concentrate". Economic considerations will determine the level of production required and hence the level of supplementary feeding. However, some pastures may produce closer to the level of production required than others. Experience in the East and West Moreton districts suggests that yields from tropical pastures rarely go above 9 kg of milk per cow per day while yields of 14 kg and 18 kg have been obtained from paspalum, kikuyu and clover.

Perhaps because temperate pastures usually perform a supplementary role in the tropics no specific experiences were recorded by contributors of grain feeding with temperate pastures. Digestibility is higher than that of tropicals and one would assume that supplements would be important where, for whatever reasons, grazing pressure caused a restriction on dry matter intake.

Responses to grain supplements when grazing tropical pastures where protein is not limiting are widely reported, suggesting a general deficiency of energy in these pastures or perhaps low digestibility restricting intake.

The results of a trial at Kairi where gain and hay were used to supplement a green panic glycine pasture show that grain at 3.6 kg per cow per day gave a significant increase in total milk production and a slight, non-significant increase in total butterfat production. This trial was designed to study the effect of supplements on milk composition. Another trial is in progress to investigate the interaction between stocking rates and a supplement of 3.6 kg per day over the first 50 days of lactation.

Less frequently encountered in the dairy situation is the case where protein percentage is so low in the pasture that a high protein supplement is necessary. More common is the shortage of total digestible nutrients under drought conditions for example.

EFFECT OF MANAGEMENT PRACTICES ON QUALITY

Increased grazing pressure on temperate pastures results in higher yields and an increase in quality. Experience with tropical legume-grass pastures indicates that they will not be able to sustain the same grazing pressures as those imposed on temperate pastures.

Frequency and intensity of grazing

The manager of tropical pastures is in a cleft stick. Heavy and frequent defoliation of setaria and green panic will lift the quality of these grasses but the legume component is likely to disappear under these conditions. Most contributors were not prepared to go past the subjective view that ideally the pastures should be grazed at such intervals which will ensure the survival and growth of the legumes and also ensure that the grasses do not become too mature. More specific was the East and West Moreton area experience that "strategic heavy grazing has been found necessary for greatest returns during the fast period of pasture growth". The rider that at times reduced grazing pressure is advisable to allow regrowth and seeding of some species is practical.

Mowing and rolling

Grazing pressures lenient enough to preserve the legume component allow setaria, green panic and guinea grass to seed. Mowing or slashing will remove seedheads but the view that this promotes quality through more leaf growth is not universally held. Experience on the Atherton Tableland suggests that mowing setaria encourages more prolific seeding. Rolling grasses in seed is preferred as it aids legume development. This practice poses problems on steep slopes.

Conservation

Conservation of tropical pastures and feed back is not a common practice. The material conserved might be low in energy but the process of removing mature pasture may improve the quality of the regrowth in the same way that mowing may.

A form of conservation practiced to some extent in the Murwillumbah district is the autumn-saving of tropical pastures. With spring calving the nutritional value of the autumn pasture is carried via body condition to be utilised in the spring. The quality of these autumn-saved tropical pastures is improved when legumes dominate seeding grasses in the autumn.

Time of calving

Increased acreages of tropical pastures in dairy areas has not led to a change away from the proven late winter-early spring period of calving except to meet market milk requirements. The newer tropical grasses have the same tendency to lose quality in the autumn as do the grasses they are replacing.

Topdressing with nitrogen

Comments on the use of nitrogen fertilizer are mainly confined to its use on pure grass pastures although responses to nitrogen were reported in greenleaf desmodium at Atherton and lucerne at Kyogle. The effect of nitrogen on grass is mainly one of increased dry matter yield. At the high stocking rates necessary to utilize the extra dry matter produced, lack of quality does not appear to limit production.

PHYSICAL CHARACTERISTICS AND QUALITY

Tropical pastures have some desirable characteristics which make them preferred to temperates under most conditions in the tropics. However, they also have some characteristics which lower their quality.

Seeding

Many tropical grasses such as setaria and the panics, have the undesirable habit of running to seed during the main growing season. Kikuyu and broadleaf paspalum are simpler to manage to maintain quality but the ability to combine with a suitable legume must not be overlooked if a mixed pasture is desired. The ability of perennial tropical legumes to regenerate from seed is a desirable characteristic if for any reason the original plants are lost. Siratro is generally agreed to be superior in this respect.

Frost tolerance

Frost tolerance of grasses would improve the quality of feed available from tropical pastures during winter months. The only frost tolerant legume, lotononis, was not mentioned by any contributor. In most districts there are frost-free areas where tropicals can be grown but with the decline in dairying these areas are mainly used for beef production. In the Kyogle district it is reported that practically no dairy production comes from tropical pastures. These are largely confined to frost-free slopes away from the flood plain.

Terminal flowering of legumes

The production of high quality leafy material is reduced at flowering in species such as greenleaf desmodium which has a terminal flowering habit. Tinaroo glycine which bears its flowers in leaf axils maintains good leaf growth during flowering.

CONCLUSION

It is widely recognised that there are quality limitations in tropical pastures. Despite this, they are being used on an increasing scale in most tropical dairying areas.

There has not yet been developed a simple, easy-to-follow system of grazing management of tropical grass-legume pastures which reconciles the conflicting needs of utilizing the grass growth efficiently and yet preserving the legume component from season to season. So far the agronomic view of managing the mixed pasture in the interests of the legume seems to have prevailed but different systems of management may evolve under the stress of economic pressure. There appears to be a need for a better understanding of grazing pressure or grazing intensity. Frequency of grazing studies have not helped the farmer a great deal. Besides having to decide how often to graze, he has to decide how many cows per hectare to put on a particular tropical pasture and how long to leave them there.

The shortcomings of tropical pastures in terms of energy and digestibility when compared with temperate pastures is sufficient reason to take a closer look at grain supplements. The traditional view, developed from experience with temperate pastures, emphasises substitution effects and is in need of more detailed examination.

Traditional views on pastures take as their standard of reference the high percentage of protein, the high levels of digestibility and the high levels of total digestible nutrients found in temperate pastures. Systems of utilization developed round these attributes may not have the same relevance when applied to tropical pastures. If it is agreed that there is a valid reason for growing tropical pastures in the tropics in preference to temperate pastures, then systems have to be developed to capitalize on the lower percentages of protein, the lower digestibility and the possible higher levels of total digestible nutrients characteristic of tropical pastures. The success of this attempt will determine whether the quality of pastures and crops is a factor in limiting dairy production in the tropics.

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DISCUSSION

Limitations of milk production from tropical pastures

The nutritive value of any pasture in terms of animal productivity is a function of the quantity eaten (intake) and the quality of the pasture. It is generally accepted that unsupplemented tropical pastures are capable of high meat production (L.W. gain/animal) but only relatively low dairy production (milk/cow). The accepted reasons for this are:—

(i) The nutrient requirements for high milk production exceed that for high liveweight gain, e.g. the nutrient requirement capable of effecting liveweight gains of the order of 2 lb per day will produce approximately 2 gallons milk/cow/day.

(ii) For continuous high dairy production a continuity of high quality feed is required, dairy production being more sensitive than beef production to stress periods or fluctuations in pasture supply and quality.

(iii) The sequence of feed levels giving rise to "compensatory gains" in beef cattle produces irreversible loss of milk production in dairy cattle.

Therefore, it is concluded that tropical pastures capable of good milk production would also be suitable for high beef production but the reverse may not necessarily apply at the upper ranges of production levels.

Some instances of relatively high per cow production from tropical pastures have been noted but the specific factors contributing to these situations have not been isolated. Suggested factors involved and requiring further research are:—

(i) Breed of animal

(ii) Low stocking rates

(iii) Quality of the pasture

(iv) Management practices.

It is also recommended that, in the reporting of animal production results, a detailed description of the pasture be included.

Selection of pasture plants for higher quality

If it was accepted that little progress could be made in the improvement of the quality of tropical pastures for higher milk production, emphasis should be placed on synthesising supplementary feeding systems. However, there is evidence of wide variation in feeding value between species and cultivars of pasture plants. This is a long term research project but if successful it would be a more profitable solution than the use of supplements.

Future research should involve species selection for better milk production and the synthesis of grazing systems incorporating such improved species. However, at the same time research should be continued on productivity of presently available species, e.g. in relation to different grazing pressures and within grazing systems.

In species selection and evaluation, quality and persistence are considered to be of utmost importance. In the evaluation of plant quality the ultimate measurements should be in terms of production per animal.

Milk production and dry matter intake

Milk production is related to dry matter intake. It is also known that the important factors affecting intake from the pasture viewpoint include:—

(i) stocking rate
(ii) digestibility
(iii) species
(iv) stage of growth
(v) acceptability to stock
(vi) grass-legume balance
(vii) height and density
(viii) grazing intensity and frequency.

However, despite this knowledge there is a need for research to determine the effect that management has on these factors in relation to milk production.

The use of intake studies using penned animals has been suggested as a technique for evaluating pasture species. Unlike in grazing studies, animal selectivity is reduced in these trials; this could affect the relative ranking order of species and make the extrapolation of results to field situations difficult. Further research appears to be required both in the technology of intake studies as well as in complementary field studies to define the deficiencies associated with extrapolation to field situations.