INTEGRATION OF NATIVE AND SOWN PASTURES FOR INCREASED ANIMAL PRODUCTION

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ABSTRACT

Research on the integrated usage of native and sown pastures for increased animal production has been quite limited. Native pasture research has been neglected and more emphasis must be given to evolving efficient pasture grazing systems incorporating predominantly native pasture. A modelling approach is suggested.

INTRODUCTION

In this paper it is my intention to concentrate on the beef industry, with only limited reference to dairy cattle or sheep.

Traditionally, the beef industry of northern Australia has been based on native pasture, where animal performance has been highly seasonal and production per beast and per unit area have been low (Alexander and Chester 1956; Shelton 1956; Norman and Arndt 1959; Sutherland 1959). Despite the fact that large production increases result from replacement of the native pastures by improved species, the area sown to improved species represents less than five per cent of the potential area estimated by Davies and Eyles (1965) (Norman 1974). The industry continues to rely heavily on native pastures and sown pasture areas are often used to complement or supplement the native pastures. It is the aim of this paper to consider the feasability of this practice.

Within the pasture situation, one can consider this integration of pastures as:—

(a) *Integration of pastures*

This involves the situation where separate areas of native and sown pastures are combined for grazing either together or at strategic times during the year e.g. an area of lucerne plus an area of native pasture. This approach will be considered in detail. The "Classical" approach to integrated use of pasture i.e. breeding on native pasture and growing and fattening on sown pasture will not be considered.

(b) *Integration of species*

In this situation a species, invariably a legume, is broadcast or sod-seeded into native pasture e.g. Townsville stylo (*Stylosanthes humilis*), lucerne (*Medicago sativa*) or Siratro (*Macroptilium atropurpureum*). I would regard these as "improved" pastures.

INTEGRATION OF PASTURES

The performance of stock on native pasture under standard grazing management is quite well-documented for most areas, and an ever-increasing volume of data on performance on sown pastures is becoming available (Norman 1974). However, these pastures have been studied in isolation in most cases. Some attempts have been made at integrated research. Most of these studies have had serious limitations but they do indicate what happens in a particular set of circumstances. These will be considered on a regional basis:—

Southern spear grass region — *Queensland*

Some of the earliest published attempts at an integrated approach to usage of native and sown pastures were made at Brian Pastures Research Station, Gayndah. The value of lucerne as a component of mixed swards had been demonstrated by Christian and Shaw (1952) and Young *et al.* (1959) so Humphreys (1962) com-

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bined separate areas of native pasture (83%) and lucerne (17%). By conserving the legume for hay in summer and grazing in conjunction with native pasture during the autumn-spring period, annual liveweight gain was increased by 73 kg head^{-1} over that on native pasture, an 80% increase. Bloat was a problem and legume persistence was poor despite grazing on a rotational basis. Unfortunately only one combination of grass and legume and one stocking rate (0.41 beasts ha^{-1}) were used.

Scattini (1973) adopted a modelling approach to the use of native pastures for grazing November to May and sown pastures, green panic (*Panicum maximum* var. *trichoglume* cv. Petrie) and lucerne, for winter-spring grazing. As lucerne failed to persist, green panic plus nitrogen fertilizer was substituted. From grazing systems models derived from biological data for the separate components, liveweight gain per head on the integrated system was estimated to be 35% greater than on native pasture alone, accompanied by a 70% increase in carrying capacity. With hay conservation and feeding back, the level of increase in gain was 50%. At optimum stocking pressures, 5% of the area available for cattle grazing had to be converted to improved pastures for weaners. Despite the demonstrated technical feasability of marked production increases through the integrated usage of native and sown pasture, net income was greater from native pasture. These principles have been applied with success on commercial properties in the area. However, the systems have not been evaluated under controlled conditions.

A reversal of the above approach was advocated by Addison (1970) with grazing of sown pastures from November to May and native pastures with nitrogen supplements from May to November. Testing of the separate components indicated an estimated performance of 144 kg annum^{-1} compared with 82 kg on native pasture, a 76% increase. Improved pastures were green panic with siratro, lucerne or bag nitrogen. When time of grazing was advanced to September to February on green panic plus nitrogen and to March to August on native pasture with nitrogen supplements, estimated annual gain was 180 kg. *Leucaena leucocephala* and fine stem stylo (*Stylosanthes guyanensis*) have given results comparable with those obtained with peanut meal or cottonseed meal. Systems have not been tested.

At Narayen Research Station, Mundubbera, 't Mannetje and Coates (1973) are comparing the performance of breeders grazing native pastures, green panic-Siratro or a combination, where native pasture (75%) is grazed in summer and the "saved" sown pasture (25%) is opened up from April-November. At stocking rates of 6 ha cow^{-1} on native pasture and 4 ha cow^{-1} on the combination, preliminary results indicated that liveweight performance of breeders and weaning weights of calves were higher on the combination than on native pasture. Again only one combination of pastures and one set of stocking rates was used.

Two surveys of dairy farms in south-east Queensland (Cook and Dolby 1970; Rees *et al.* 1972) revealed that planting of sown tropical pastures on these farms increased both milk and fat production on the farm. The latter authors showed as well that irrigation produced a greater response than introduction of the pasture, mainly through an increase in carrying capacity.

Traprock country

In native pastures dominated by *Bothriochloa decipiens* and *Dicanthium humilis*, Lee and Rothwell (1966) compared native pasture stocked at 1.25 and 2.5 sheep ha^{-1} with native pasture (83%) and lucerne (17%) stocked at 2.5 and 3.75 sheep ha^{-1}. On the combined pasture, sheep had access to both pastures at all times, but only one-sixth of the lucerne area was available at any one time. Bodyweight gains and greasy wool production were superior, 40% and 16% respectively, on the combination at the 2.5 sheep ha^{-1} stocking rate. Highest greasy wool production ha^{-1} was recorded at the higher stocking rate on the combination. The study was again limited as only one combination of pasture types was employed.

Northern spear grass region

Very little work has been carried out in this region. Winks (1973) suggested the grazing of native pasture for 6-8 weeks after the storm rains, followed by heavy grazing of Townsville stylo during the wet and joint grazing of "saved" native pasture and Townsville stylo with nitrogen supplements from May-June to the storms. A study was commenced in January 1974 to test this hypothesis with varying proportions of native and sown pasture and with and without restricted access. It is unfortunate that only one stocking rate which is based on previous findings can be employed.

At Parada Research Station, Mareeba, Jackson (pers. comm.) compared native pastures with either 25 or 50% oversown with Townsville stylo and found that performance was superior with the larger percentage of oversown pasture. Performance at 0.5 beasts ha^{-1} and 25% Townsville stylo was similar to that at 0.82 beasts ha^{-1} and 50% Townsville stylo. There was no advantage from deferring grazing of the Townsville stylo area during the autumn.

Northern Territory

Most of the work carried out in the Northern Territory has been done in the Katherine area and has concentrated on the seasonal use of Townsville stylo—either as dry season standover forage or as wet season grazing. Norman and Stewart (1967) grazed steers on native pasture and Townsville stylo pasture on a complementary system for varying numbers of days per week during the dry season and found that performance was directly related to the time spent grazing the Townsville stylo area. After grazing steers on varying sequences of Townsville stylo and native pasture, Norman (1968) concluded that performance was related directly to the length of time spent grazing Townsville stylo. These findings prompted Norman and Begg (1973) to suggest that "the biological aim of pasture agronomy and management in that area should be to encourage maximum *sustained* production of Townsville stylo".

From a review of a series of studies at Katherine Experiment Farm in which Townsville stylo areas were used to supplement native pasture, Woods (1970) concluded that the sowing of Townsville stylo on 2.4% of the area increased the liveweight gain ha^{-1} during the growing period by 60%. However, a feed-gap existed between mid-October and the time when effective use was made of new feed, usually early December. Rotation of stock so that pregnant cows and weaners have the best pastures during this period, pasture saving and feeding of sorghum grain and Townsville stylo or *Vigna sinensis* hay have been used to overcome the problem.

Wesley-Smith (1972) reviewed grazing studies at Upper Adelaide River and advocated the following system—graze native pasture at low stocking rates from the storms until the end of December, then allow access to Townsville stylo during the wet. Some Townsville stylo may be "saved" for grazing during the dry but perennial legumes are preferred. Irrigated pastures would overcome the stress period during the late dry—early wet season. The theoretical maximum annual liveweight performance with Shorthorn steers would be 180 kg $head^{-1}$, compared with the "normal" gain of 18 kg on native pasture. However, the author does not suggest percentages of the total area devoted to the various pastures or stocking rates to be employed. Subsequently combinations of Townsville stylo (20 and 40%) and native pasture (80 and 60%) have been compared. Best results were obtained when Townsville stylo was grazed during the wet but there was a tendency to graze out the legume. As an alternative to "saving" standing Townsville stylo, Sturtz and Parker (1974) demonstrated an advantage in favour of conserving the material as fodder rolls for feeding back during the dry season.

INTEGRATION OF SPECIES

Oversowing of native pastures with a legume has been under study for many years, and the legume to receive most attention has been Townsville stylo. In general, oversowing of native pasture with this legume with the application of superphosphate

has resulted in increased carrying capacity and improved animal performance (Shaw 1961; Shaw and 't Mannetje 1970; Norman 1970; Woods 1970; Graham and Mayer 1972; Wesley-Smith 1972; Winks *et al.* 1974; Allan pers. comm.). Norman and Stewart (1964) compared Townsville stylo-native grass pastures containing varying percentages of Townsville stylo and found that liveweight performance was directly related to the percentage of Townsville stylo in the pasture. However, problems have arisen in some areas in maintaining a stable pasture mixture as annual grasses have invaded, suppressing legume growth. Norman and Begg (1973) suggested limited phosphate application and moderate grazing pressure as means of maintaining the Townsville stylo component. In areas where fogs and dews are prevalent during winter spoilage of dried-off Townsville stylo is a problem.

More recently some success has been recorded with other legumes. Preliminary studies with the perennial *Stylosanthes hamata* indicate that it performs better than Townsville stylo in some areas (Anon 1973). Lucerne has been sod-seeded into native pasture stands but persistence has not been good and it is doubtful if it will have any use in these extensive situations (Cameron 1973). Siratro has been used for sod-seeding into native pasture and has resulted in increased carrying capacity and greater liveweight production, especially in autumn and spring (Lowe 1974; Tothill 1974).

GAPS IN KNOWLEDGE

It is evident from the preceding section that very little is known of the integrated usage of native and sown pastures. Most of the systems mentioned have been developed from fragmented studies on the various components, and surprisingly few have been tested. Where systems have been tested, the studies have been of limited value as, in most cases, only one stocking rate or combination of native and sown pastures has been employed and the studies have been relatively short term. In most grazing studies insufficient evidence is available to explain animal performance, which makes extrapolation to a different set of environmental conditions virtually impossible.

The major deficiency in our knowledge at present is in the area of utilization of native pasture. While animal performance on native pasture with set-stocking over the whole year is quite well-documented, there is limited information on the effects of varying the management system. With the exception of isolated areas, there is little information on the productivity of the native pastures and their reaction to time and intensity of grazing. Basic information of this type is essential for the development of successful systems incorporating native and sown pastures.

The advantages in terms of pasture and animal production of oversowing native pasture with legumes, e.g. Townsville stylo and Siratro, and applying superphosphate are well-documented, but problems arise in maintaining stable pastures. There is a general lack of knowledge of the desirable grass-legume ratio in a mixed pasture and the effect of various management practices on this ratio. Overfertilization of trial pastures by research workers has been common, but what is needed is research to determine the minimum fertilizer requirements.

Haggar *et al.* (1971) favour the sowing of small areas of pure legume at strategic points rather than oversowing of savanna in Nigeria. Information is lacking on the merits of these two systems but maintenance of the pure legume stands could be a problem in some areas.

A big percentage of northern Australia still does not have a satisfactory legume for use under grazing. The new perennial *Stylosanthes* and the improved strains of *Leucaena leucocephala* offer some hope. In the past, research has aimed at finding highly-productive legumes, which have high fertilizer requirements and generally require special management. The legumes of the future for much of northern Australia should probably be easily established without soil disturbance, be drought-tolerant, competitive with grasses, have low fertilizer requirements and tolerate heavy grazing.

Studies on integrated usage of native and sown pastures have demonstrated improvements in performance, but do not indicate the desirable proportions of the two pastures, the management systems and stocking rates to employ, and the modifications necessary for different classes of stock for the various regions. Most studies attempted have been done with steers, and must be repeated with breeders because of differences in nutrient requirements, especially during late pregnancy and lactation. In the industry, sown pastures are used for specific classes of stock at specific times e.g. for fattening bullocks during the wet season and for weaners and first-calf cows during the dry. However critical studies are needed to determine whether this use of sown pasture is more effective than grazing by all classes of stock. The roles of supplementary feeding, fodder crops and small areas of irrigation should also be examined in these integrated studies.

As is the case with most research projects, there is very little information on the economic aspects of these systems. Scattini (1973) obtained a better financial return from native pasture than from the integrated system. In view of the additional costs involved with an integrated system, it is imperative that economic aspects be considered in addition to absolute production responses.

One important factor which seems to have been overlooked in many suggested systems is the phenomenon of compensatory growth. It is essential that there is a better understanding of compensatory growth if satisfactory systems are to be synthesized.

FUTURE RESEARCH

The logical approach to the question of integrated usage of native and sown pastures would seem to be a modelling approach similar to that adopted by Scattini (1973). This approach has not been used extensively to date, because of the lack of sufficient basic data on which to base the model. The pool of knowledge must be increased if simulation techniques are to be used. Simple models could be used initially to highlight deficiencies in our knowledge, from which research could be planned to provide the necessary data. Development of more-complicated models would proceed as further information came to hand. Strategically-sited and well-planned studies would have to be conducted to test the efficiency of the systems developed.

The two main areas needing research would seem to be native pasture production and management and the production of suitable legumes for use in native pastures. Unfortunately, it has become fashionable for pasture research workers to concentrate on evaluating introduced sown pastures and native pastures have been sadly neglected. It is high time that pasture workers realised the value of our native pasture resource and made maximum use of it rather than trying to replace it with high-cost improved pastures.

The lack of research into integrated usage of native and sown pastures has been attributed to the limitless combinations possible and the difficulty in reaching conclusions that can be extended beyond the particular treatment combinations studied. It behoves pasture research workers to overcome these problems as increased production with minimal increase in costs seems possible only with an integrated usage of pastures.

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