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STRATEGIES TO IMPROVE BALI CATTLE IN EASTERN INDONESIA

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Strategies for Using Improved Forages to Enhance Production in Bali Cattle

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Abstract

There is increasing demand for livestock products in Indonesia, but this can be met only by increasing the quality and quantity of forages for animals. In this paper we consider three options and their potential for improving production of forage. 1. In natural grasslands some improvement of *Imperata* grasslands may be possible with introduced legumes such as *Brachiaria* and *Stylosanthes*. However, under the traditional communal grazing of these regions, improvement will be difficult. 2. Forages as an understorey in estate cropping are likely to provide the greatest opportunity to improve forage production in Indonesia. In addition, they can provide feed when other systems become unproductive because of the dry season or the need to keep livestock away from crop areas. 3. Rotation with other crops in intensive cropping areas, where selected forage crops can be grown in the short period between harvest of the main crop (usually rice) and the end of the wet season. There are many regions where this strategy could be attractive in Indonesia. The emphasis here is to provide high quality forage only in the regular dry season because of its relatively higher value at this time. The best combination of systems to obtain maximum benefit depends on ameliorating a number of factors, but the major ones are the lack of experience of farmers in using these strategies and the fact that farmers have had little input into the development of farming practices in which these strategies might be used.

Introduction

BEEF cattle production is an important component of many smallholder farming systems throughout Indonesia. As well as providing income from sales, cattle also provide draught power and manure for fertiliser. As with most smallholder animal production systems in the developing world, animal production in this farming system is constrained by seasonal quantitative and qualitative feed shortages, genetic potential of the animal, and animal health and management issues. This paper considers options for overcoming some of the seasonal feed shortages by the introduction of sown forages into the farming system.

The feed sources for Bali cattle are extremely variable: grazed forage from grasslands and estate cropping, cut and carry forages from on and off the farm, and crop residues. Without substantial additions to the diet in the form of mineral, protein and energy supplements, both reproduction and animal production are invariably poor. Despite this, dietary supplements including sown forages are not widely used because of farmers' perceptions that they are not needed, the lack of capital or planting material, or the absence of a financial incentive to invest labour and capital in forage production. For many years, this lack of incentive for forage investment resulted in poor adoption of almost all new forage technologies in smallholder systems in Indonesia.

In the past ten years there have been remarkable increases in demand for livestock products across the tropical world and this trend is predicted to become even more pronounced in the future. It has been estimated that milk consumption across the tropics will increase by about 3.2% per annum to the year 2020 (Delgado et al. 1999). Similarly, consumption of beef and pork is expected to double in developing countries between 1993 and 2020. This increased demand is already having, and will continue to have, a major impact on the household, farm and even regional economies throughout the tropics. The mixed crop–livestock farming systems of the tropics

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will be most affected by and will benefit most from this phenomenon. These systems already produce more than half the world's meat and most of its milk (Blackburn 1998; CAST 1999), and in the tropics more than 85% of cattle, sheep and goats are held in these mixed systems (Gardiner and Devendra 1995).

Changes in demand for livestock products have already had a profound impact on the beef industry of South Sulawesi. The increased demand for beef in Java has resulted in a rapid decline in the local herd size on the islands of Lombok and Sulawesi. High beef prices have encouraged farmers to market a significant proportion of the breeding herd for slaughter. Consequently, beef cattle numbers in South Sulawesi have declined from 1.23 million in 1991 to only 841 000 in 1997 (FAO 1999).

The rapid increase in demand for livestock products is providing opportunities for farmers to derive or increase income from livestock production and to improve the economic sustainability of their farming enterprise. In order to harness these opportunities, however, farmers need to tackle the major constraints to livestock production enterprises, especially in the areas of animal feed, health and management. Improved planted forages have the capacity to provide quality feeds for livestock; this paper looks at some of the possibilities farmers might use to meet the increasing demand for such forages.

Improved Forages into Smallholder Crop–livestock Farming Systems

Fujisaka (1994) listed four situations within Asian upland farming where the use of improved forages has potential:

- in naturally occurring grasslands;
- in regions where shifting cultivation is being practised;
- as an understorey in plantations or estate crops;
- in rotation with other crops in intensive cropping areas.

Naturally occurring grasslands are important in some regions such as Kalimantan, and improved forage species such as *Stylosanthes guianensis*, *Brachiaria decumbens* and *B. humidicola* are being used there to reclaim *Imperata* grasslands and increase animal production (Horne and Stür 1997). The benefits of increasing livestock production in regions with *Imperata* grasslands by this means should not be dismissed, but experience in Asia and elsewhere has shown that the introduction of new forage species into grasslands that are communally grazed is notoriously difficult. Shifting agriculture is not important in the vast majority of Indonesia and opportunities for forage production in that system will not be addressed here.

Forages as an understorey in estate cropping, or grown in rotation with other annual crops in intensive cropping systems, are likely to offer the greatest opportunities for improving forage production in Indonesia as these land uses account for most of the farmed land area and are currently under-utilised in this respect. They also provide a contrast in strategies for increased livestock. Use of improved forages under estate crops targets greater livestock numbers during the growing season, while strategies in intensive cropping systems tend to target the provision of high quality forage to overcome protein deficiencies during the dry season.

This paper will focus on these two interventions for improving livestock production.

Forages in Estate Cropping

Estate crops such as cashew, coconut, cocoa and coffee are important components of many smallholder farming systems. There are more than 5 million ha of tree crops in Indonesia and more than 20 million ha of coconut, rubber and palm oil plantations in South East Asia (Stür et al. 1994). In south east Sulawesi alone there were 230 000 ha of plantation crops in production in 1990. These crops can occupy a large proportion of individual farms and hence have the potential to produce significant forage yields.

In densely planted and mature estate crops such as cashews and cocoa the success of forages will be limited by competition for light, water and nutrients. However, light is considered the major limiting factor in determining long-term persistence and productivity of pastures. Wilson and Ludlow (1991) reported that the canopy of most low-density and immature estate crops and mature coconut plantation transmits between 50 and 80% of light, which is sufficient to maintain forage production. This means that in crops such as rubber, oil palm and cashews the period when significant forage production can be achieved is limited to the first five years of plantation establishment (Horne and Stür 1997).

Choice of species for use in estate crops is critically important, and tropical grass and legume species vary considerably in their ability to persist and produce under light limitations. A range of grasses including *Stenotaphrum secundatum*, *Brachiaria decumbens*, *B. humidicola* and *B. brizantha* have been identified as among the best adapted to this shaded environment, while the best adapted legumes include *Arachis pintoi* and some other perennial *Arachis* spp., and a range of *Desmodium* spp. including *D. ovalifolium* and *D. hetercarpon* (Stür and Shelton 1991; Stür 1991).

Shelton et al. (1987) and Shelton (1991) reviewed data on liveweight gains from improved pastures in

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estate crops in South East Asia and the Pacific and found that liveweight gains ranged from 94 kg/ha/yr to 500 kg/ha/yr, most falling in the 200 to 300 kg/ha/yr range depending on location, species composition (especially the legume content of the pasture), light transmission and stocking rate. While these liveweight gains can be <50% of the production obtained from pastures in full sunlight in the same region, daily liveweight gains in *Bos indicus* cattle of around 0.3 kg/head/day measured under coconut and immature oil palm plantations in the Solomon Islands and in Malaysia respectively (Shelton et al. 1987) indicate a feed intake adequate to sustain Bali cattle livestock production. In the more common mixed farming systems, a major value of understorey forages is that they provide significant forage when other areas/sources are limited. For example, in South Sulawesi there is limited feed during the dry season on the cropping fields and hence quality feed in the upland plantation/estate areas is useful. Alternatively, when crops are in the ground or the fields are being prepared for planting, animals are excluded from the cropping areas. Once again, having a source of quality forage in the upland/estate areas is useful.

Relay Cropping Options in Intensive Farming Systems: an Example from Barru Regency, South Sulawesi

Horne and Stür (1997) identified the possibilities of using both fodder banks and hedgerow systems to improve forage production in intensive upland cropping systems. However in Indonesia and elsewhere in South East Asia there are opportunities for forage production in the lowland and upland cropping areas. The focus here will be to explore these opportunities using the Tanete Riaja district of Barru Regency, South Sulawesi as an example.

The Tanete Riaja district is located in central South Sulawesi. Soils, topography and farming systems are all highly variable and the region has a mean annual rainfall of about 3200 mm of which approximately 80% falls between December and May. Individual farm size ranges from one to two hectares, about 40% of it bunded and intensively cropped with rice and other secondary crops. The remaining area is upland/dryland comprising open fields for annual cropping, mixed farming areas and backyard. Rice is the major crop and peanuts, maize and sweet potato the most important secondary crops. Lowland rice is produced in bunded fields under flooded conditions. Villages operating under rainfed conditions typically produce one rice crop per year, and where residual soil moisture and rainfall permit will plant a secondary crop thereafter ((b) in Fig. 1). Fields are then left fallow for the remainder of the year. Where farmers have access to irrigation, they will often plant a second rice crop (May to August) and may even plant a third secondary crop of maize or peanuts (September to November) ((a) in Fig. 1). Upland fields set aside for annual cropping are typically unbunded and rainfed, supporting just one secondary crop during the wet season and left fallow for the remainder of the year ((c) in Fig. 1).

Farmers typically have one to three Bali cattle, which are usually tethered in open areas for grazing or fed in pens with feeds ranging from stored crop residues (rice straw, peanut and maize stover), banana stems, gliricidia and roadside/bund volunteer grasses. Free grazing of crop stubble occurs in some lowland areas post-harvest and in some upland areas that have been fenced off. Throughout the year, and especially in the dry season, many commonly used feeds are of low quality (protein contents typically <8%). Mating normally occurs in October–December, with calving in July to September at the start of the dry season. Calves are weaned in November.

There are a number of periods during the year when animal production and performance are likely to be restricted by dietary constraints. The most critical is in November–December, when conception and lactation coincide with use for draught. Labour demands are high at this time of year, when rice is being planted, so cutting and carrying forages to supplement tethered or housed animals is a relatively low priority for farmers.

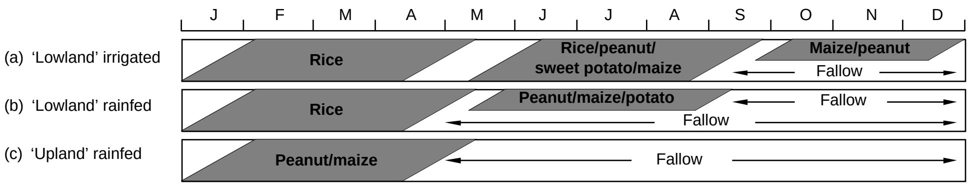

Figure 1. Typical annual crop sequences in the Tanete Riaja district, Barru Regency, South Sulawesi for upland and lowland fields.

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Since calving takes place in July to September, the lactation of about five months begins at the onset of the dry season when high quality feed is in short supply. This is especially so in October and November, just prior to the start of the wet season. Consequently the condition of lactating cows rapidly declines, calf growth rates are low and reproductive ability of cows is reduced.

On arable land where only one rice or secondary crop is grown per year, the wet season continues for at least two months after harvest. Sowing a forage legume such as cowpea (*Vigna unguiculata*), lablab (*Lablab purpureus*) or mucuna (*Mucuna pruriens*) as a relay crop after the harvest of the first crop would enable at least three months of growth before water availability would restrict growth. Based on published yields of lablab from elsewhere in the tropics, it would be possible then to produce approximately 3 t/ha dry matter (DM) of legume with an average protein content of about 15%. If sown in May after the harvest of the first crop, this feed resource would become available in a fresh state in late July and early August. Assuming that a lactating Bali cow with a liveweight of 280 kg requires a diet of c. 7 kg/day DM with a protein content of c. 10%, feeding 3 kg/day of legume to supplement 4 kg/day of dry season grass and crop residue would raise the overall diet protein to >10%. For two lactating cows to be supplemented for 120 days would require 960 kg legume, which could be produced on 0.3 ha of land.

The economic viability of such a strategy will depend on the relative market prices and the costs of production for crops and livestock products. At present there is a surplus of rice production in Indonesia and the market price for rice is comparatively low, while conversely, the price of beef is elevated. These market conditions may make an increased investment in livestock production an economically attractive option for farmers. However, a more detailed holistic study of potential yields, soil water availability after rice or secondary crops, soil fertility and fertiliser requirements, opportunity costs of not cropping, and sensitivity of the practice to commodity prices and interest rates is required before advancing this approach further. This is the subject of an ACIAR-funded research initiative being undertaken by BPTP, Hassanuddin University, Makassar, Indonesia and CSIRO Sustainable Ecosystems, Brisbane, Australia.

Conclusions

Strategies which enable the increased production of forage to feed Bali cattle in estate and intensive cropping systems appear to be most appropriate for eastern Indonesia, given its widespread use of these systems. However, the benefits of these strategies arise in contrasting ways. Although experimental evidence shows that improved forages in estate cropping provide improvements in liveweight gain over the course of the year, forage quantity and quality are likely to remain limiting factors during the dry season. In areas with a short growing season such as <6 months, the shortage of high quality forage for the dry season will remain a major constraint to production.

Targeting increased forage production in intensive systems provides an alternative strategy. Here the focus is on making more high quality forage available to the animal during the dry season, and there is less emphasis on improving forage quantity and quality during the growing season. This strategy applies not only to the case outlined here of relay cropping in lowland rice, but also to the use of hedgerows and fodder banks in upland cropping systems as outlined by Horne and Stür (1997). Opportunities for forage conservation should also be considered as part of this strategy.

Which combination of strategies is best for a particular region or farming system will depend on many factors, including of course the existing farming system, climate and soil characteristics, labour supply and the availability to farmers of well-adapted species. Unfortunately, the evidence is that few farmers are investing in improved forage production. Horne and Stür (1997) argue that the most important reason for this is that in most cases farmers have had little input into the development of farming practices in which these strategies can be applied.

Farmers will use improved forages provided it can be demonstrated that they meet their needs and provide enhanced livestock production and economic benefits. Given the range of well-adapted forages available and the variation in farming systems across Indonesia, it would appear that a large number of farming practices that enable the inclusion of improved forages should be possible. It is imperative that researchers and development workers involve farmers in the formulation of sustainable strategies so that acceptable practices can be identified and implemented.

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