Forages improve livelihoods of smallholder farmers with beef cattle in south central coastal Vietnam

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Abstract. In South Central Coastal Vietnam, on-farm research and farmer experience demonstrated the benefits of growing improved forages as a means of improving the year round quantity and quality of feed available for beef cattle. In Binh Dinh, Phu Yen and Ninh Thuan provinces, five new forage species (*Panicum maximum*, cv. TD58, *Brachiaria* hybrid cv. Mulato II, *Pennisetum purpureum* cv.VA06, *Paspalum atratum* cv. Terenos and *Stylosanthes guianensis* cv. CIAT 184) were evaluated for yield and crude protein concentration. There was not a consistent yield difference between locations for the forage grasses, but in Binh Dinh province *P. maximum* TD58 produced the highest yield. The grasses were comparable in crude protein concentration. *Stylo* CIAT 184 performed relatively well and had the highest crude protein concentration. All species have potential use, depending on the circumstances and site factors such as fertility, drainage and availability of irrigation. This work was expanded to a total of 45 farmers to gain feedback on farmer experience in growing different forages. The percentage of farmers who "liked" the introduced forages was Mulato II, 92%; TD58, 85%; VA06, 82%; Paspalum, 46%; and Stylo, 36%. By far the most important early socio-economic impact of developing perennial forage plots close to households was an average 50% reduction in the amount of labour and time that farmers spend supplying cut and carry forage to their animals. In addition, the growing of forages can meaningfully reduce the grazing pressure on common grazing lands, thereby lowering the potential for environmental degradation.

Keywords: Grass, yield, crude protein, feed quality, *Stylosanthes*

Introduction

In Vietnam, beef cattle production has been a traditional and important component of the smallholder farm system but feeding these livestock has been a major challenge and labour intensive activity. Most of the available feed has come from communal land, waste areas on roadsides and around margins of crops, and from crop residues. A combination of supervised grazing and cut and carry methods has been and is still used by many smallholder farmers.

Beef production in Vietnam has increased steadily in recent years, from approximately 100,000 t liveweight in 2001 to 290,000 t liveweight in 2011. This production is in response to a growing demand for beef due to an increasing population, improvements in disposable income and a developing tourism industry. The upward trend is likely to continue but it will depend upon appropriate Government policies (on land use, credit loans, and import tax/regulation), the contribution of the research community to create new technologies and higher quality products, and the effort of all stakeholders in the beef value chain.

There is a significant opportunity for smallholder crop-livestock farmers in South Central Coastal Vietnam to improve overall household income by changing the balance of their farming systems in favour of beef cattle. However, the availability of labour and competition for traditional feed resources, particularly communal grazing land, are emerging as major impediments to farmers making this change and progressing from cattle keepers to cattle producers. This paper reports on research in South Central Coastal Vietnam, highlighting the socio-economic benefits to smallholder farmers and the environment of introduced forages.

Current beef cattle production system

Smallholder cattle production methods vary across Binh, Dinh, Phu Yen, and Ninh Thuan, three provinces in South Central Coastal Vietnam, according to climatic factors, available resources and production goals. The dominant cow-calf breeding system has relied traditionally on extensive grazing of common lands, especially in Ninh Thuan, where farmers typically have larger herds and limited access to other feed sources. In contrast, in Phu Yen and Binh Dinh provinces, cow-calf farmers typically use a mixture of grazing and stall fed supplementation, mainly with crop residues such as rice straw, and also some rice bran and other feedstuffs including cut and carry native

Table 1. Yield and crude protein concentration of forage species in Binh Dinh, Phu Yen, and Ninh Thuan provinces in South Central Coastal Vietnam. Means within columns with different superscripts differ significantly (P<0.05) using Tukey's test.

Species	Binh Dinh		Phu Yen		Ninh Thuan	
	Yield (t DM/ha/yr)	Protein (%)	Yield (t DM/ha/yr)	Protein (%)	Yield (t DM/ha/yr)	Protein (%)
Mulato II	25.7 b	13.7 b	37.3 a	12.4 b	24.4 ab	10.6 b
Paspalum	27.2 b	10.7 b	42.1 a	9.5 b	38.6 a	6.9 d
TD58	40.0 a	12.1 b	50.3 a	10.9 b	33.9 a	9.5 c
VA06	26.4 b	12.1 b	39.4 a	10.3 b	39.0 a	8.3 cd
Stylo	11.5 c	17.5 a	17.0 b	17.9 a	15.8 b	14.7 a
SEM	1.9	0.75	4.1	0.64	3.6	0.48

grass or King grass (*Pennisetum* spp.). Smallholder farmers engaged in fattening male cattle or keeping males for draught work are more likely to rely on intensive stall-feeding of fresh grass, crop residues and concentrates. In a 2009 survey of cattle farmers, 41% of farmers in Binh Dinh and Phu Yen practiced stall-feeding, whereas in Ninh Thuan 94% of farmers utilized grazing (either with or without supplementation) (Parsons *et al.* 2013).

Development of the beef cattle industry in Vietnam has been constrained by limitations in forage supply and quality. In recent years numerous high yielding forage species have been imported and evaluated for adaptation, biomass yield and quality across Vietnam (Phan Thi Phan, *et al*. 1999, Truong Tan Khanh, 1999) but there is little evidence of their widespread adoption by farmers. Improving feeding options by utilising locally available feed resources and introducing new forages remains a key strategy for improving beef cattle production (Nguyen Xuan Ba *et al*. 2010).

Introducing new forages

Between May 2010 and December 2011 in Binh Dinh, Phu Yen and Ninh Thuan, five new forage species (*Panicum maximum*, cv. TD58, *Brachiaria* hybrid cv. Mulato II, *Pennisetum purpureum* cv. VA06, *Paspalum atratum* cv. Terenos and *Stylosanthes guianensis* cv CIAT 184) were evaluated for yield and feed quality. In each province four farms were selected as trial sites (blocks) and planted with the five forage species (treatments). Each plot was 5 m long by 1 m wide, with 0.5 m between plots. King grass was grown as buffer rows to separate the plots. An identical second set of plots was provided at each farm for farmers to experiment with. Each site was managed in a similar manner, with regular inputs of fertilizer plus irrigation in the dry season, to demonstrate potential yields under typical farm conditions. The first harvest was 60 days after establishment with subsequent harvests at approximately 40 day intervals. Grasses were harvested at a height of 15 cm and Stylo CIAT 184 at 20 cm. The mean daily temperature and mean annual rainfall for Binh Dinh, Phu Yen, Ninh Thuan for the previous 10 years were 27, 26 and 26^{o}C and 1710, 1540 and 1160 mm, respectively.

Forage yields for all species were relatively high and similar to results from other regions in Vietnam (Table 1). Site factors had a major affect on the total annual yield and relative difference between species for each of the three provinces. In Binh Dinh, the greatest yield was obtained from *P. maximum* TD58, but there were no statistically significant differences between the grasses in the other two provinces. Stylo CIAT 184 yielded relatively well, but persistence under regular cutting was less compared to the grasses. As expected, Stylo CIAT 184 had a greater protein concentration (14.7 to 17.9%) than the grasses, and there was no significant difference between the grasses in crude protein concentration except in Ninh Thuan province. All of the grass species showed suitability for cultivation, and species selection should be based on factors such as fertility, drainage, availability of irrigation and individual requirements of the cattle feeding system.

On-farm forage development

The on-farm forage trials were led primarily by researchers, with limited farmer involvement. Subsequently, 15 farmers were selected in each province to test a range of 'best-bet' interventions under real farm conditions (Lisson *et al.* 2010). Best-bet interventions were undertaken by farmers with guidance from project staff, and concentrated on the introduction and establishment of new forages (both grasses and legumes), improved management practices for existing and new forages, and more effective utilisation of other available feed resources. An improved supply of forage was an important first step in the best-bet process, due to its ability to make a rapid impact at a farm level, and also to provide a base for the implementation of other cattle management techniques that rely on improved nutrition, such as early weaning. Farmers were provided with seed or tillers of the new forage varieties to establish small nursery areas, then encouraged to expand the area of those that they preferred. Group discussions, workshops and individual household visits were used to assess available resources, constraints to and opportunities for increasing the productivity and profitability of each farm. Farms were visited regularly to work through technical issues, provide training in planting, fertilising, cutting management and feeding, and record qualitative and quantitative data.

By the end of project, 95% of the best-bet farmers were using the improved forages and 90% had expanded beyond their original planted area. By September 2012, the average area of new forages planted by best-bet farmers was around 200 m^2 in Binh Dinh, 500 m^2 in Phu Yen and 600 m^2 in Ninh Thuan. However, the area of forage grown varied considerably between farmers and between provinces as determined by the availability of land, the aspirations of the individual farmers, and the interest and support from

extension personnel. Forage preferences differed between farms, and most farmers preferred two or three species. The percentage of farmers who "liked" each of the introduced cultivars was Mulato II, 92%; TD58, 85%; VA06, 82%; Paspalum, 46%; and Stylo CIAT 184, 36%. However, these preferences did not necessarily translate into planting by farmers; for example, Stylo CIAT 184 was rarely planted by farmers. Generally farmers with cow-calf systems preferred Mulato II and TD58 because they appeared more palatable and had higher leaf stem ratios; however, farmers operating fattening systems often preferred VAO6 because it provided bulk to complement concentrate feeding.

Socio-economic impacts of forage development

Apart from improving available fresh forage supply and quality, by far the most important early socio-economic impact of developing perennial forage plots close to households was an average 50% reduction in the amount of labour and time that best-bet farmers now spend supplying cut and carry forage compared with the time spent pre-project. For example a farmer from An Chan commune in Phu Yen reported:

"I used to graze cattle 6 km from home because the grass in the back yard was not enough for 5 cattle. My wife also had to cut native grass along the dam and rice field which required 3 or 4 hours work per day. Now, I have 500 m^2 of forage in my backyard, next year I will expand to 400 m^2 of forage near my maize farm. My wife can reduce cut and carry by 2 hours and I can reduce grazing time by 3 hours."

The labour saved was used for a range of activities, including crop production, other livestock management, off-farm work, looking after children and grandparents, and housework. For instance, the daughter of a farmer at An Chan commune, Phu Yen explained:

"When my mother had to go grazing cattle, I had to cook the lunch. I sometimes went to school late and spent a part of my learning time on cooking meals. But now, my mother can cook meals for my family because she no longer needs to take the cattle grazing, and I can spend my time learning".

These stories illustrate that adaptation of technologies often takes farmers in different and divergent directions. Such stories are common throughout SE Asia (Connell *et al.* 2010), and illustrate the potential socio-economic benefits due to cultivation of high quality forages, especially when grown close to households and cattle housing facilities. Feedback from best-bet farmer interviews indicated that they also benefited from more frequent meetings, the sharing of forage planting material, accessing information on cattle feeding, breeding, markets and prices, and mutual support in techniques of forage and legume planting. Although not all the benefits are related directly to new forages, these played an important role in creating the impetus for other improvements.

Environmental impacts

By developing and promoting a system with a more reliable year-round supply of forage, better control of grazing, and a more effective use of local feeds, crop residues and by-products, the risk of environmental damage from overgrazing of common and waste land should decrease. This environmental objective is becoming more critical as the Vietnamese Government is in the process of developing rules of use for forests and other common land, forcing farmers off areas which have previously been freely available. Discussions with farmers have revealed that they see this change as inevitable, that they understand the reasons why cattle are being excluded from grazing in these areas, and that more intensive land use for forage production is desirable.

The sustainable production of viable quantities of feed from introduced forages will require regular inputs of nutrients, especially nitrogen, and irrigation. The timing and rates of fertiliser and manure applications on forage crops, particularly on sandy soils which predominate in the South Central Coastal region, will require careful consideration and management to avoid the risk of nutrient leaching and runoff which can have negative environmental effects.

Conclusions

Increasing population, improvement in disposable income, urbanization, changing dietary preferences and a rapidly developing tourism industry are factors that are driving the demand for animal products in Vietnam. Beef production is well placed to satisfy part of this demand provided smallholder crop-livestock farmers gain increased access to feeding and management technologies that can be adapted to the smallholder mixed farming system. Better knowledge about growing, managing and feeding new and existing fresh forages, utilization of crop residues and use of feed supplements will encourage greater intensification of beef cattle production and increase supply of beef to developing markets. Balanced intensification has the potential to improve the livelihoods of smallholder farmers and lessen the risk of ongoing environmental degradation due to uncontrolled and overgrazing of communal land.

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