Content

Crop-goat intergration in upland farming systems of southeastern Vietnam

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Summary

Models of crop-goat integration in uplands were developed in southeastern region of Vietnam to determine the benefits of raising goats in poor small farms and the technology adoption for farmers,. One farm of 1 ha, was divided into four parts: one for home-garden and growing cash crops, the others for *Guinea grasses* and the boundaries of farm were planted with different leguminous shrubs and trees such as *Erythrina variata*, *Gliricidia maculata*, *Leucaena leucocephala* for shading and as a source feed for goat. The goats for meat production were raised under this system and gave an annual net farm income of more than US$ 1 100.

Keywords: crop, goat, leguminous trees, farming system, income

Introduction

Most Vietnamese farmers are traditional smallholders. Their main activity is growing food crops and livestock production is a sideline activity. The farming systems are very complex, especially in areas where the environment is favourable for producing many types of crops and livestock products. A typical farm is generally small and the land area ranges from 0.5 ha to 2 ha per household. It consists of a cropping area, a homestead with the house, trees, vegetables and livestock. The livestock production is concentrated to smallholder farms and the crop residues from the farm are utilised as livestock feed. The manure is applied to the crops as sole, or as a supplemental fertiliser.

One of the factors, which limit livestock production, is inadequate supply of good quality feeds during the whole year, especially in the dry season. The value of leaves from leguminous trees as forage supplements in feeding systems based on crop residues have been discussed by Chadhokar and Kantharaju (1980) and Devendra (1981). Tree legumes are locally adapted, require minimal inputs for establishment and maintenance and may be utilised in mixed farming systems (Atta-Krash and Sumberg, 1988; Chen et al., 1991). Advantages additional to the nutritional effects occur where they are available on the farm and, hence, are easily accessible and relatively cheap, and in that they reduce requirements for other supplements (Lowry and Petheram, 1992). The relevance and potential importance of integrated systems is associated with the complementarity of the crop and animal systems resulting in increased total productivity. Ecological and economic sustainability is achieved when the natural biodiversity of land, crops and animals are used to reinforce each other (Devendra, 1995).

In upland farming systems of southeastern Vietnam, the species of leguminous shrubs and trees grow either along borders as fences, living poles for black peppers, or in the home-gardens.
The objectives of this study were to develop appropriate methods to integrate crops with goat production, and thereby diversifying farms, to develop and disseminate appropriate technological solutions that will lead to sustainable growth of upland farming and to develop in collaboration with local farmers, agricultural production systems that are environmentally safe, socially acceptable and economically viable.

Materials and methods

Using a prepared questionnaire, researchers interviewed 30 farmers about their farming systems and economic activities in 2001. The project co-operated with 10 poor small farmers to develop the models of crop-goat integration. The main research activities of these models were on-farm systems testing of farmer's income and a technology transfer model.

The area is located in southeastern Vietnam, and is at Xuan Son village, Chau Duc District, Ba Ria-Vung Tau province, about one hundred kilometres from Ho Chi Minh City The topography in the area is undulating, with slopes ranging from 10 to 15%. The dominant soil types are red and red-yellow podzols with low fertility and organic matter and with a pH of about 4.2. The annual rainfall is 1 600mm. The wet season starts in May and ends in October, while dry season commences in November and ends in April.

One hectare of each farm model was divided into four parts: 0.3 ha was used for vegetables and 0.5 ha for black pepper growing. The distance between two rows of *Erythrina variata* as living poles for black peppers was 2 x 2m (2 500 plants/ha). The pruning frequency was 2 months. The remaining 0.2 ha was planted with *Guinea grass*. The boundaries of the farms were planted with different leguminous shrubs and trees, such as *Erythrina variata,Gliricidia maculata* and *Leucaena leucocephala* for shade and as a source feed for goats. They were planted with a spacing of 50x50 cm. Five does and one buck (local x Anglo-Nubian) were raised in each farm and produced crossbreds for meat production. All the waste from the goats was utilised for fertilising cash crops and grasses.

Results and discussion

Crop production is the main occupation of the smallholders and the average land-holding was 1.2 ha. The farmers used their land to grow crops. They planted black pepper, cashew, cassava, yellow corn and vegetables. All farmers practised simultaneous planting to make the most efficient use of the rain water supply. The opportunities of farmers to expand their farms, including livestock, are limited, thus making their production system less sustainable. People have to buy more rice from outside using money derived from selling cash crops and livestock. Most farmers raise livestock as a " walking bank account". In times of family difficulty, a pig, goat or chicken may be sold to generate the necessary cash. A farmer may invest minimal capital for keeping livestock.

The problems leading to poor production of livestock in the region include shortage and low quality of feed, poor genetic potential, high disease incidence and subsequent mortality. These problems are further aggravated by the lack of substantial capital investment, lower technological inputs and slow transfer of technologies. The farmers in the region spend a substantial amount of time to maintain their livestock, particularly feeding the animals. The average gross farm income was $420 per year (Table 1).

All leguminous species that were grown on the farms can withstand poor soil or drought stress and provide green foliage throughout the year because of their deep root systems. They are an important source of foliage for goats, particularly during the dry season (Table 2). when forages from other sources are in short supply. The recurrence of heat and pregnancy of does in dry season were longer than in the wet season. The birth weight and daily gain of kids were lower in the dry season (Table 3).

The income of the farms increased very significantly (Table 4), as the goat manure mixed with the forage residues makes a very good fertiliser for improving soil fertility. Before the farm model came into existence, the average annual gross income was $420. Four years after implementing the model, the average annual income had increased to $1 211 with a return on investment of 71%.

Process of technological adaptation by farmers

Four years after the establishment of simple crop-goat integration models, the model farms had a very good impact among the upland farmers and local authorities (Table 5). This was because farmers who were involved in the study have benefited from their increased production and income, which was 2 times higher compared to those who had not adopted the system.

Conclusions

Crop-small ruminant integration is regarded as an important agricultural activity for small land holders. Recently there have been large increases in goat numbers in the region. Goats are of particular value to upland farmers since the manure can be used to fertilise the land and there is a good supply of agricultural crop residues and tree leaves throughout the year. The overall trend was an increase in net income in farms that adopted the introduced farming system.

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Table 1. Average farm size, crops, livestock and gross income of farms.

	N	Mean	Minimum	Maximum
Average family size	30	6	4	8
Average landholding,ha	30	1.2	0.6	2.1
Homegarden, ha	30	0.4	0.6	0.8
Perennial crops, ha	30	0.5	0.4	1.2
Annual Crops, ha	30	0.3	0.2	0.5
Livestock ownership (head/farm)				
Pigs	4	3	2	5
Goats	2	4	3	5
Native chickens	30	20	10	60
Gross farm income (USD/year)	30	420	400	520

Table 2. Dry matter biomass yield of leguminous leaves and Guinea grasses intercropping on crops (ton/ha/year).

Species	Wet season	Dry season	Total
Erythrina variata	1.30	1.10	2.40
Leucaena leucocephala	1.20	0.70	1.90
Gliricidia maculata	1.10	0.60	1.70
Guinea grasses	0.72	0.25	0.97

Table 3. Performance of goats fed with fodder tree legumes on farms

	Wet season	Dry sesaon
Recurrence of heat and pregnancy (days)		
Heat	120	134
Pregnancy	121	136
Weight gain of kids at four months (kg)		
Average birth weight	3.62	3.15
Average final weight	15.70	14.20
Gain, g/day	101	92

Table 4. Cost and return analysis of farm model (in US$)

	2001	2002	2003	2004
I. Returns				
1. Cash income				
a. Crops sales	580	862	1425	1,400
b. Goats kids	450	675	900	1,012
A. Total cash income	1,030	1,537	2,325	2,412
2. Value of non-cash income				
a. Added value to the stock	656	875	1,093	1,312
b. Manure	94	100	100	120
B. Total non-cash income	750	975	1,193	1,432
C. Total gross returns	1 780	2 512	3 518	3 844
II. Costs				
1. Cash				
a. Seedlings	150	50	50	50
b. Insecticides	30	30	30	30
c. Chemical fertilizers	94	60	60	60
d. Veterinary supplies	10	10	20	20
e. Tool and equipment	20	20	20	20
f. Goat house	125	20	20	20
g. Loan interest	65	53	41	29
h. Loan payment	200	200	200	200
D. Total cash costs	694	443	441	429
2. Non-cash costs				
a. Labor	1 200	1 200	1 200	1 200
E. Total non-cash costs	1 200	1 200	1 200	1 200
F. Total costs	1 894	1 643	1 641	1 629
Net profit (C-F)	**-114**	**869**	**1 877**	**2 215**
Net cash returns (A-D)	336	1 094	1 884	1 983
Return on investment (C/Fx100)%	-6	53	114	136
Benefit cost-ratio (C/F)	0.9	1.5	2.1	2.3

Table 5. Number of farmers adopted the system and goats increased population.

	Years			
	2001	2002	2003	2004
Farmers	15	130	310	570
Goats	120	460	1 540	2 350