Improving farm productivity through crop intensification in a crop-animal system under rainfed environment

Nenita E. Dela Cruz[1], Edwin C Villar[2], Fe L Porciuncula[1], Edgar A Orden[1], Pablito Paulo C Pinto[2], Rodolfo V Antalan[2] and Sonny N Domingo[2]

[1]Research Office, Central Luzon State University, Nueva Ecija, Philippines, Email nenet_dc@yahoo.com
[2]Livestock Research Division, PCARRD, Los Ba?os, Laguna, Philippines

Abstract

Lack of assured irrigation in rainfed environments forces farmers to fit agricultural activities with the changing seasons. Optimum productivity in farm operations under this scenario is difficult if not impossible to achieve. Research to solve agricultural problems like this needs immediate attention. A systems approach has more opportunities to be applied when dealing with smallhold farmers. Crop productivity was significantly improved as a consequence of crop intensification, which likewise improved animal productivity that ultimately increased farm family income. The inclusion of feed-feed crop in the cropping system contributed to the sustainability of crop-animal integration and ensured more regular cash flow in the farm. Farm family income was significantly increased by 146 percent after the integration. Nutrient cycling was improved wherein manure produced was used as fertilizer for forage production and by the inclusion of food feed legumes in the system.

Media summary

Farm productivity could be increased through crop-animal integration. The integration necessitates crop intensification to ensure availability of feeds for the animals through out the year and regular cash flow for the family.

Key words

Crop intensification, Crop-animal integration, farm productivity and family income, nutrient cycling, sustainability

Introduction

Rainfed farm households usually comprise the poorest of the poor, having to contend with the small hold farms and daunting biophysical constraints. Lack of assured irrigation,forces farmers to fit agricultural activities with the changing seasons. Optimum productivity in farm operations under this scenario is difficult if not impossible to achieve. With the priorities of farm families focused on the economic survival and meeting minimum basic needs, children's education and welfare are usually sacrificed. Such contributes to the cycle of poverty, which often characterizes the marginalized sector (Villar et al 2001).

Research to solve agricultural problems like this needs immediate attention. A systems approach through crop-animal integration has more opportunities to be applied when dealing with small hold farmers. Crop–animal systems help build assets for the rural poor in terms of savings, an assured cash flow in the household and serves as a buffer against inflation and adverse climate, (Li-Pun 2000). Under this system, resources utilization within the farm is maximized through crop intensification to meet the feed requirement of the animals, nutrient recycling utilizing the animal manure and excess feedstuffs as source of nutrients.

With the general objective of improving farm productivity of small hold rainfed farmers, the project specifically aimed to: assess the contribution of crop and livestock in the farm productivity and in increasing farm family income; evaluate the use of inputs to improve soil fertility; assess the cropping patterns and crop management in the field relative to feed sourcing and availability.

Methods

The study was conducted under farmers field and was managed by the farmer under the close supervision of the project team. Technology options both for crop and goat production, based from the problems identified by the farmer and were proven to be economically viable and suitable in the area were presented to the farmer for testing. These include packages for crop-goat production systems that covered crop intensification utilizing food-feed crops , improved feeding management, crop residue utilization, complete confinement, and raising of upgraded goats. Assessment was done through a system approach. Crop-animal interaction in terms of nutrient cycling, crop residue utilization, manure utilization and its effect on some soil properties through soil analysis before and after each cropping season was assessed. Animal productivity was assessed by comparing the average daily gain in weight of the kids of a) the native vs. upgraded does; b) complete confinement vs. tethered whereas crop productivity was assessed by determining the change in cropping system and production as a consequence of the integration. Influence of goat manure on changes on some soil properties was analyzed. A simple benefit-cost analysis was done to assess the economic benefit of the integration.

Results

Farm Productivity and Farm Family Income

Crop-goat integration resulted to significant improvement in farm productivity and increased farm family income. The total annual farm family income before the integration was P107, 323. Sixty (60) percent of which was derived from crop production and 22% was from animal production. After the intervention, the annual farm family income was P264, 472 or an increase of 146 percent without the intervention. Animal production contributed P160, 420 (60.65 %) while P84, 332 (31.88%) was derived from crop production (Table 2). The increase in the farm family income was attributed to the crop intensification through improved cropping pattern and used of improved crop variety and cultural management practices that ultimately enhanced productivity of the land. This led to better animal performance due to better feeding management utilizing the crop residues of the food-feed crops.

The economic benefit of the introduced intervention was assessed. A simple cost and return analysis in a one-year operation is presented in Table 4. Animal production contributed 58 percent of the total net income, which implies the potential of livestock as a major source of farm family income, and 42% from the crop component. Likewise, cash flow (Fig. 1 and 2) revealed that cash inflow is more stable and regular due to sales derived from both the crop and livestock component.

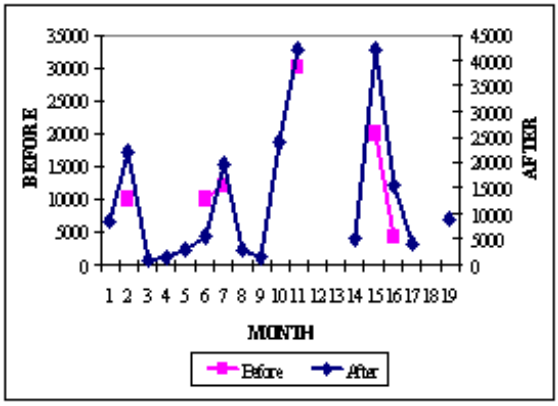

Fig. 1. Cash inflow and outflow

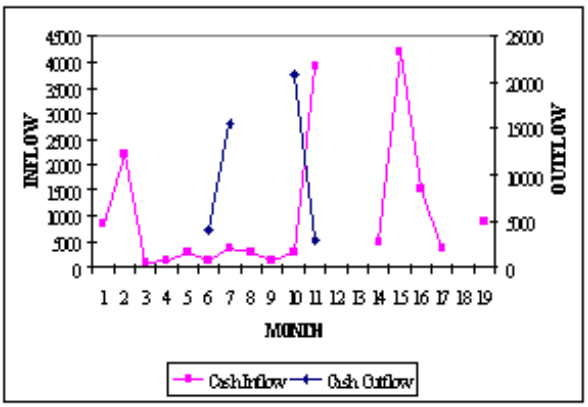

Fig. 2. Cash inflow before and after intervention

Table 1. Annual farm family income before and after crop-animal integration.

INCOME SOURCE	BEFORE		AFTER		INCREASE
	AMOUNT (PhP)	% CONTRIBUTION	AMOUNT (PhP)	% CONTRIBUTION	
Crop Production	64,123	60	84,332	31.88	20,209 (32%)
Animal production	23,480	22	160,420	60.65	136,940 (583%)
Additional Income from undertaking other jobs	19,720	18	19,720	7.47	0
TOTAL	107,323	100	264,472	100	157,149

Amount in parenthesis represents percent increase due to intervention.

Table 2. Simple cost and return analysis for one-year operation of the crop-goat techno-demo.

ITEM		VALUE
GROSS INCOME	244,752.50	
Crop production		84,232.50
Livestock Production		160,520.00
Goat Sales		10,000.00
Cattle Sales		22,000.00
Goat Inventory		91,500.00
Cattle Inventory		36,000.00
Non-cash income from Manure		1,020.00
GROSS EXPENSES	121,138.55	

Crop production		32,841.05
Goat production		39,172.50
Cattle production		49,125.00
NET INCOME	123,613.95	
Income from crops (42%)		51,391.45
Income from animals (58%)		72,222.50
RETURN ON TOTAL EXPENSES	102.04%	

Cropping Pattern and Crop Management

One of the identified problems by the farmer was the low crop productivity and limited feed availability due to limited cropping options. The former cropping pattern was limited to lowland rice and yellow corn + onion for the wet and dry season cropping, respectively. The goat upgrading and complete confinement technology interventions necessitate the assurance of feed availability throughout the year. Improving the cropping pattern and crop management with the inclusion of food feed production system alleviated this.

Nutrient Cycling and Use of Inputs

The extent to which nutrient is recycled in the farm contributes to the sustainability of the system. Crop and animal production compliment each other through the utilization of crop residues as feed for the animals as well as the use of manures as source of organic matter in the soil if not as fertilizer for crop production. Composted manure used as fertilizer for forage production amounted to 1,700 kg and 400 kg were applied in the rice paddies. Results of manure analyses showed pH of 7.99, 2.17 % total N, 14.61 % organic carbon, 0.33% total P and 1.04% total K. The high organic carbon content could contribute to maintenance of soil organic matter important in sustaining soil productivity that would eventually redound to decrease use of external input. Soil analysis showed a slight increase in the soil test values in parcel that was applied with composted goat manure as well as those that were planted to legumes. Parcels that were planted to corn showed a slight decrease in soil test values considering the fact that corn is a soil-depleting crop. Farmer was advised to give consideration to corn areas in terms of manure application.

Conclusion

Crop-animal integration indeed plays an important role in alleviating problems of low farm productivity and farm family income. It builds assets for the rural poor and ensured cash flow in the household. Increased farm productivity stemmed from the increase crop production due to improved cropping system and crop management practices like the used of improved and high yielding crop varieties, and improved fertilizer management and improved performance of upgraded kids with higher ADG compared to the native kids, less if not absence of mortality of the native breed due to scouring resulted from complete confinement and better feeding management practices because of inclusion of legumes in the diet of the animals. These improvements redound to superior genetic potential that commands higher market price. Complementation of the crop and animal components through nutrient cycling and crop residue utilization increased internal input utilization and will eventually decrease external input utilization in the whole system. Likewise soil incorporation of the composted manure in combination of the wasted feeds initially contributed to the increase in soil organic matter so important in maintaining soil sustainability.

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