

Resources Productivity and Systems Profitability of Selected Coffee-Based Farms in Upland Cavite, Philippines

Gilchor P. Cubillo

Cavite State University, Cavite, Philippines

The study aimed to: (1) characterize the existing coffee-based cropping systems in the three municipalities of Cavite; (2) assess the productivity of land, labour, and other variable inputs in coffee-based farms; (3) evaluate the profitability of coffee-based farms; and (4) determine if there are significant differences in resources productivity and systems profitability across different types of systems. Data revealed that farms in Alfonso (cropping pattern 1) had the biggest average farm size, the oldest coffee trees, and the highest coffee cropping intensity per hectare. Alfonso also had the highest man-labour employment, the highest average operating capital per hectare, and the highest total value of produce. Silang farms had the highest average volume of fertilizer utilization. Comparing the resource productivity, Silang farms were the most efficient in the use of land and labour while Amadeo farms were the most efficient in the use of fertilizer with the highest average value product. The average profit per hectare and profitability were highest for Silang cropping systems. While certain cropping systems were more efficient and productive, others were more profitable. This could be attributed to the prices and quantities of inputs used and the prices and quantities of the intercrops produced.

Keywords: multiple cropping, coffee-based farms, resources productivity, systems profitability

Recent developments forced the government to endeavour in multiple-commodity programs for obvious reasons that from the standpoint of the national economy, the multiple system of farming can contribute to economic development through increased total production per unit of land, increased employment on the farm, increased rural family income, and a more egalitarian distribution of income. Another benefit that could spring out of the multiple-cropping system is the diversity of food crops that can be made available to farm families and urban consumers. Aside from these reasons, a multiple-cropping systems approach was introduced and promoted by the government because the overall efficiency of single commodity approach of government programs tends to decrease over the years since various crops could already be covered by one program to reduce government expenditure.

The Multiple-Cropping Systems

Multiple-cropping, or the practice of growing several crops on the same piece of land in one year, is an ancient strategy for crop production among farmers in the Philippines and other countries in the tropics. Traditionally, it is used by subsistence farmers primarily to increase the diversity of their products and the stability of their annual output. However, with the rapidly increasing consumer population despite limited

Corresponding author: Gilchor P. Cubillo, Ph.D., associate professor, Department of Economics, Cavite State University, Cavite, Philippines; research fields: agricultural economics, business management, and entrepreneurship.

supply of agricultural land for cultivation, multiple cropping is being looked upon as an excellent system for intensifying land use and for absorbing excess farm labour. Aside from this, multiple cropping is expected to gain more importance because of the following reasons (Arizala & Gonsalves, 1990):

(1) The multiple cropping index is generally higher with smaller farm size. With the expected decrease in farm size, the intensity of land use is expected to increase;

(2) Multiple cropping is a simple and inexpensive strategy for absorbing the rapidly increasing number of farm labours;

(3) With the more productive and fertile flat lands already cultivated, expansion to new areas will have to use the erosion-prone hilly lands. For these areas, multiple cropping is an excellent strategy for reducing soil erosion by rapidly providing adequate vegetative cover;

(4) With the rainfall pattern in the humid tropics of Asia such as the Philippines characterized by excess water during rainy season and too little water during dry months, multiple cropping is a natural strategy for maximizing land use through the proper choice of crop species to fit to this cyclical change in water regimes;

(5) With the already large and still increasing number of rural population and inadequate capital resources in developing countries of the humid tropics such as the Philippines, multiple cropping is an excellent alternative to capital-intensive industrialization for increasing the income among the least privileged rural population.

Statement of the Problem

Realizing the many advantages and expected benefits that the multiple cropping system offers, policy makers and agricultural development officers have paid their attentions to the rain-fed and upland areas in the country. These areas are envisioned to have the potential for conversion into more productive agricultural resource base. Moreover, the upland areas where multiple cropping possibilities exist provide a leeway for increasing resource utilization and rural employment, especially when these resources are under-employed during certain periods of the cropping season.

Nevertheless, even though multiple cropping is a relatively well-developed technology package, at least in experimental terms and in the multiple-crop farms, most multiple cropping studies dealt with annual and short-season base-crops such as rice and corn. Very few productivity and profitability studies have been conducted in the province on perennial base-crop cropping systems such as coconut- and coffee-based systems. These system types are worth being studied because of the inherent complexities of these agricultural production systems requiring the use or application of more external inputs such as labour, inorganic fertilizer, and other variable inputs including tools and equipment. These may result to higher production cost thereby affecting productivity of resources and the profitability of the farm.

Scope and Limitations

The study covered three municipalities in the province of Cavite namely Alfonso, Amadeo, and Silang where coffee-based farming systems are widely practiced for quite some time and considered to be successful at least in terms of productivity and profitability. The reference period covers the cropping year 2010 to 2011. It should be noted however that the multiple crop farms were not established during these periods and not established in the same cropping season—some farms have been in operation longer than the other farms.

The crops included in the analysis were those widely cultivated in upland Cavite and those which were existing during the survey period. These included coffee, pineapple, papaya, black pepper, fruit trees, vegetables, root crops, and non-food crops. Lastly, this study did not attempt to quantitatively estimate the possible effects of each component crop on the performance of the whole coffee-based farming system. It may be assumed that there exist possible competition effect, complementary effect, residual effect, and the planting date effect among the component crops which could influence the level of resource productivity and system profitability. There might be interactions among component crops in the system that the study did not take into account, which may have affected the level and efficiency of resource utilization.

Review of Related Literatures

This section presents some of the related literatures and findings of previous studies related to multiple cropping systems and other pertinent information which serves as the guide in the conduct of this study. This part also includes some insights about the multiple cropping in the Philippines and other countries in the tropics and issues related to crop diversification and sustainability of multiple crop farms.

Sajise and Ganapin (1990) mentioned in their report that the role of upland development cannot solely be measured in terms of increased productivity or income. Because of the fragile nature of the uplands, stability and sustainability need to be taken into account. They added that stability as a goal for upland development is not difficult to assess. It presents the ability to recover from minor and regular occurring stresses. Cruz (1985), in her study, attempted to examine three different types of cropping systems in the upland rainfed areas of Eastern Visayas in the Philippines. The primary concern of her study was their profitability and efficiency of a subset of the rice-, corn-, and coconut-based cropping systems in the region. Results revealed inefficiency in the resource allocation in all the cropping systems. However, the analysis of profitability indicates that in general, the coconut-based cropping system (coconut is a perennial crop), was the most profitable.

Price, Gonzaga, and Acebedo (1984), in their study, asserted that a specific cropping system is often described by the dominant cropping pattern that it includes. A cropping pattern presents the spatial and temporal combination of crops on a plot in such a way that, at all times, during a year, plants of each cultivar at the same stage of growth are uniformly spaced throughout the plot. The profitability and productivity of a cropping pattern are related to the effectiveness of resource use in a pattern and output response.

Ton (2013), in his study on productivity and profitability of organic farming systems in East Africa, considered productivity at the level of individual farm indicated by total production per hectare, family labour input per hectare, production costs (including seeds, inputs, and hired labour), and gross and net margins. On the other hand, the profitability indicators considered at the farm level included price, income, gross margin, and net income. He claimed that productivity is very location-specific and dependent on factors such as soil quality, water availability, mono or mixed cropping, plant density, etc. For proper comparative research, it is essential to have a good context description of a particular system and the reference systems. He added that it is important also to look at profitability because a production system may be very productive but may be very marginal in terms of profitability. Conversely, a production system may be profitable while not being particularly productive. Profitability is particularly dependent on sale price per unit and the costs of production. According to Gunasena (2001), there are several advantages of crop diversification, which include: (1) comparatively high net return from crops; (2) higher net return per unit of labour; (3) optimization of resource

use; (4) higher land utilization efficiency; and (5) increased job opportunities. Fisher (1990) suggested that the model of system should be looked at for its ability to provide sustained yield over time, to produce immediate returns or benefits, and to continue to produce over the medium- and long-term. He added that an emphasis should be placed on stable systems which are adaptable to the local environment and are not easily threatened by sudden changes in socio-economic and environmental factors and that the system should address conservation aspects.

According to Hoang (1999), the productivity of any agricultural system is very important in efficiently providing foods and other products needed by people. Productivity is important in farming system management. However, with the development of sustainable agricultural concepts, there is a growing concern to find a trade-off between the productivity and ecological soundness of agriculture. So far, agricultural systems with high productivity generally tend to exploit natural resources causing natural resource degradation. The study of Goswani (1997) revealed that continuance of shifting cultivation in hill slopes led to soil erosion, denudation of forest, and decline in income. The physical destruction in natural resources is a serious setback for the economy and therefore, there is an urgent need to develop suitable farm plans for the hill areas where shifting cultivation is practiced for augmenting the income of farmers.

A number of economic studies, particularly on resource productivity, efficiency, and profitability, have been conducted on rice and rice-based cropping systems in the Philippines. Few attempts were made to analyze systems performance of rainfed upland areas but involve crops such as corn-, coconut-based, and agroforestry systems. Some studies dealt with coffee monoculture cropping system and analyzed resource productivity and system profitability. Moreover, there are instances of inconsistencies in the results of some studies where there are production systems which were very productive yet very marginal in terms of profitability. Conversely, there are cropping systems that were profitable but exhibited low productivity. This is due to other factors such as other economic variables as prices of inputs and products affecting costs and profitability. As such, this study is an attempt to quantitatively and qualitatively analyze the coffee-based cropping systems in Cavite, Philippines in terms of productivity and profitability.

Conceptual Framework

Figure 1 shows the conceptual framework which served as the foundation in analysing resource productivity and system profitability across the coffee producing municipalities in upland Cavite representing the types of cropping systems. The nature or type of coffee-based cropping system is greatly dictated by the physical endowments and physical characteristics of the farms. The characteristics determine the differences in the cropping patterns that farmers adapt to. These differences in the organization of the coffee-based farms subsequently result to varying levels of farm performance in terms of input or resource productivity and overall system profitability. The input productivity of the coffee-based farms would subsequently contribute to the level of profit generated and the efficiency of the use of capital. On the same note, the improved profit generating capacity of the coffee-based farms contributes to a more efficient use of other variable inputs.

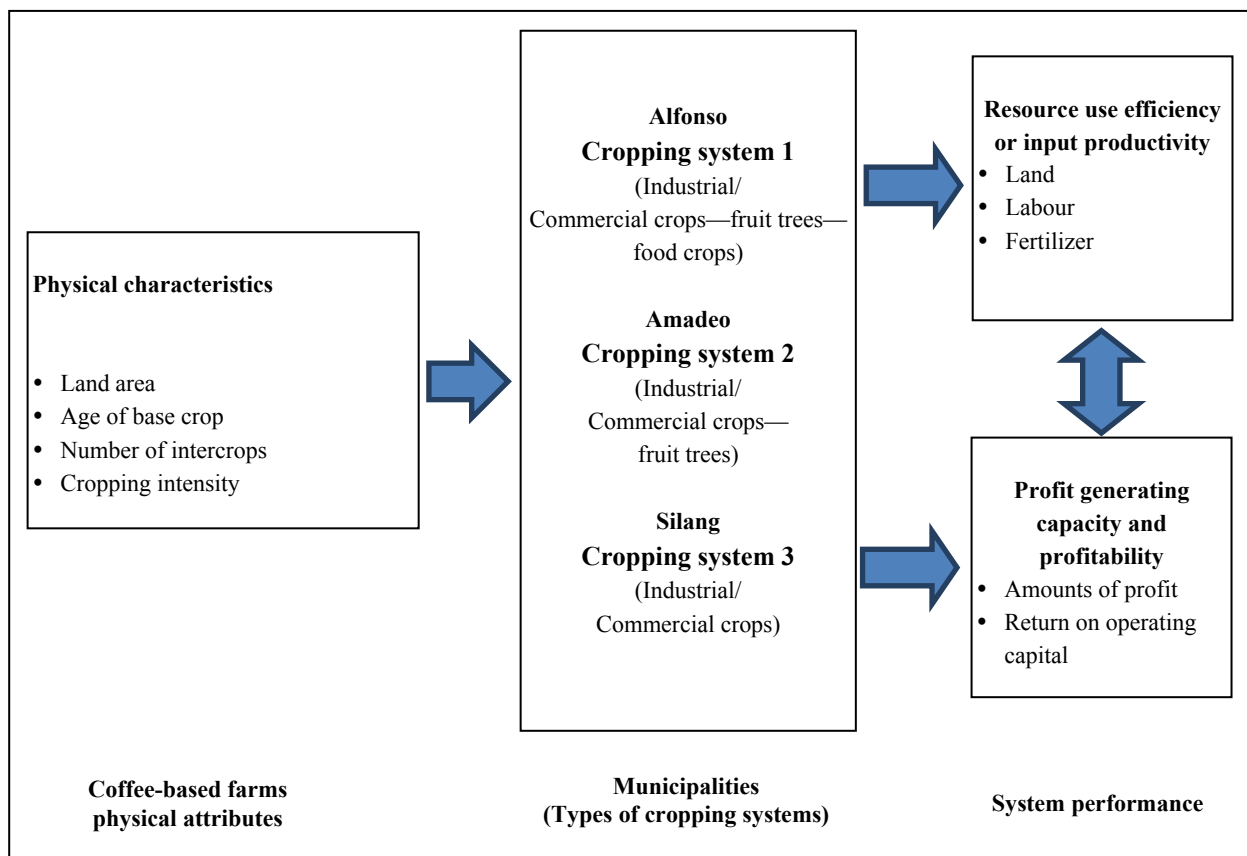


Figure 1. Conceptual framework showing the differences in input use efficiency and overall system profitability across municipalities representing systems types as influenced by farm physical characteristics.

Research Methodology

Research Design

The descriptive normative survey was conducted in order to classify and enumerate collated information with the aid of some descriptive statistics such as means, percentages, and simple accounting tools. Farms were grouped according to the various systems' characteristics such as: (1) cropping pattern (represented by the municipalities); (2) farm size; (3) age of coffee trees; and (4) the number of coffee trees per unit area. An accounting procedure was employed in order to determine the level of resource use, revenues generated, the costs incurred, and the level of profit realized in the various farms.

The study made use of the comparative method of analysis with the aid of Analysis of Variance (ANOVA-F test). This test was employed to determine if there are significant differences across types of cropping systems in terms of: (1) the physical attributes; (2) mean levels of input use and factor productivity; (3) total revenue, costs, and profit; and (4) systems profitability (return on operating capital).

Population and Sampling Procedure

Three towns in upland Cavite were preselected based on the volume of production or quantity of outputs, particularly coffee. These areas include Amadeo, Alfonso, and Silang which are shown in Figure 2. After selecting the study areas, quota sampling was done by randomly selecting 20 respondents from each town. Sample-farmers were chosen from the list of coffee-based farmers in the Office of the Provincial Agriculturist

in Trece Martires City. The selected farmers comprised the samples and later were interviewed with the use of a structured interview schedule.

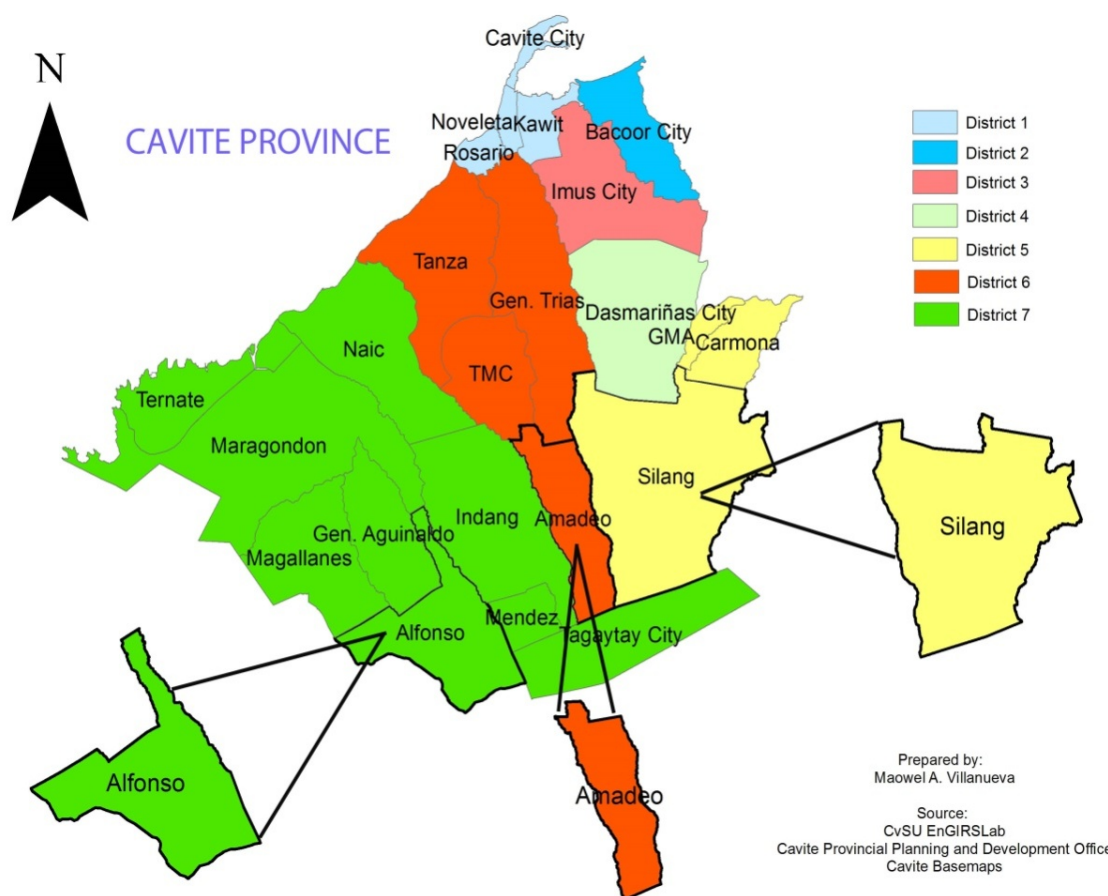


Figure 2. Map of Cavite showing the three municipalities of Alfonso, Amadeo, and Silang which served as the study areas.

Research Instruments and Data Gathering

The data were gathered with the aid of interview schedule. Respondents were asked to give information on production, expenses, income, and other pertinent data covering 2010-2011 cropping season. Data gathering instrument was pre-tested to make sure that the survey material is sufficient. The study used cross-section data in evaluating the systems performance in terms of resources productivity and overall systems profitability of the coffee-based cropping systems in upland Cavite. Data about the coffee-based farms were gathered to assess the systems performance. The information was utilized in evaluating productivity of resources and profitability of the systems in selected areas mentioned.

Data Analysis Techniques and Statistical Treatments

The following methods and tools of analysis were employed:

- (1) Frequency counts, percentages, ranges, and means were used in describing and presenting the characteristics of the cropping systems, levels of resource use, production and profit from coffee-based cropping systems, as well as the degree of input productivity and system profitability;
- (2) Cost and return analysis was employed in determining the level of profit and the degree of profitability of the various coffee-based cropping systems in the province. Total revenue (TR) was computed using the

formula $TR = \sum P_i Q_i$, where P_i is the price of product i and Q_i is the quantity of product i sold in a year. Total cost (TC), on the other hand, was computed using the formula $TC = \sum P_j X_j$, where P_j is the price of input j and X_j is the quantity of resource j employed. Profit (Π) was computed by deducting TC from TR;

(3) Resources productivity of the systems was evaluated through average value products (AVPs) or the total value of products divided by the amount of physical resources such as land, labour, and fertilizer used to produce it while system profitability was measured using the ratio analysis by computing for the return on operating capital (ROOC);

(4) Comparative analysis was employed to compare significant differences across municipalities representing the various types of cropping systems in terms of the mean levels of total value of outputs and profit per hectare as well as the extent or degree of input productivity and system profitability using the ANOVA as shown in Table 3 below. The F-values were tested at five percent (5%) level of significance.

Coffee-Based Cropping Systems in the Three Municipalities

Alfonso coffee-based cropping systems are characterized by intercropping with some commercial or industrial crops such as coconut, banana, black pepper, peanuts, papaya, and some fruit-bearing trees such as mango, santol, lanzones, jackfruit, and guavano (soursop). Some farmers included vegetables such as stringbeans, squash, sayote, and even corn and root crops in their coffee-based farms. The cropping system in Alfonso may be considered as combining some of the industrial or commercial crops, fruit-bearing trees, and few food crops in the coffee-based cropping system (cropping system or pattern 1).

Most coffee farms in Amadeo practice multiple cropping with deep-rooted fruit-bearing trees such as mango, santol, jackfruit, guavano or soursop, and some other fruit trees such as lanzones, rambutan, guava, caimito, and citrus. Some farms had commercial or industrial crops such as peanuts, papaya, and black pepper. Most of the local farmers practice intercropping to increase land productivity and lessen soil erosion. Based on these, the cropping system in the municipality of Amadeo is basically intercropping coffee with industrial or commercial and fruit-bearing trees (cropping system or pattern 2).

The primary crops grown as intercrops for coffee in Silang are coconut, banana, black pepper, and pineapple which are basically commercial and industrial crops. Few farms had fruit trees such as soursop (guavano), lanzones, star apple (caimito), jackfruit, guava, and avocado. The cropping system in Silang may be categorized as a system which integrates commercial and industrial crops into coffee-based farms (cropping system or pattern 3).

Physical Characteristics and Resources Utilization of Coffee-Based Cropping Systems in the Three Municipalities

The cropping systems were grouped into three municipalities taking into account the peculiarities of the systems considered in the study. Cropping systems in each municipality basically had more or less the same characteristics in terms of the kinds of crops planted with coffee. The three municipalities, therefore, represent three types of coffee-based cropping systems, with Alfonso as the industrial—fruit—food crops pattern (cropping system 1) coffee-based cropping system while Amadeo as the industrial—fruit crops pattern (cropping system 2) coffee-based cropping system. Silang farms are generally characterized by intercropping coffee with commercial and industrial crops. As such Silang farms are categorized as industrial crops pattern (cropping system 3) coffee-based cropping system.

Mean values of the physical characteristics of the coffee-based farms were computed by municipality representing a particular cropping pattern. Data showed that Alfonso had the biggest average land area of coffee-based farms among the three municipalities with 1.465 hectares followed by Amadeo with an average of 1.375 hectares. Average coffee-based farm size in Silang was the lowest with only 1.193 hectares. The average farm size for all the 60 farms was 1.34 hectares. Coffee trees in Silang were relatively younger than in the other municipalities with an average of 34.86 years. Trees were oldest in Alfonso averaging to 44.7 years while the average age of coffee trees in Amadeo was 44.45 years. Average age of trees in all the farms was computed at 41.33 years which was categorized as very old. In terms of the number of coffee trees per hectare, Alfonso ranked first with cropping intensity of 1,109 trees per hectare followed by Amadeo with 809 coffee trees per hectare. Silang had the lowest cropping intensity of only 737 coffee trees per hectare on the average. Average of 60 farms was 884 coffee trees per hectare.

Mean values of resource and material input utilization were also computed to determine which system employed the most resources in their farms. Table 1 suggested that man-labour employment was highest in Amadeo with an average of 84.43 man-days for the year. Alfonso had the next highest labour utilization at an average of 79.47 man-days while Silang farmers employed only 72.02 man-days on the average. Average labour employment considering all the farms was computed at 78.64 man-days. Comparing the use of inorganic fertilizers, Table 1 showed that average fertilizer applied in farms was highest in Silang which was registered at an average of 765 kilograms per hectare. Amadeo farms used an average of 750 kilograms of inorganic fertilizer while farms in Alfonso utilized only an average of 687.50 kilograms per hectare which was lower than the overall average fertilizer utilization of 734.17 kilograms per hectare. Lastly, operating capital per hectare was highest in Alfonso with an average of P30,861.57 per hectare. This was followed by Silang farms with an average operating expense of P25,672.00 per hectare. Amadeo had the lowest operating expenditure of P24,061.29 per hectare on the average. Average operating capital for all the farms was registered at P26,864.95.

Table 1

Mean Values of the Physical Characteristics and Resource/Material Input Utilization of Coffee-Based Cropping Systems by Municipality

System characteristics	Average/mean			
	All farms (N = 60)	Alfonso (Pattern 1)	Amadeo (Pattern 2)	Silang (Pattern 3)
Physical characteristics				
Area (hectares)	1.34	1.465	1.375	1.193
Age of coffee trees (yrs)	41.33	44.70	44.45	34.86
Number of coffee trees per hectare	884	1,109	806	737
Resource/input utilization				
Man-labour/hectare (m-d)	78.64	79.47	84.43	72.02
Inorganic fertilizer/ha. (kg)	734.17	687.50	750.00	765.00
Operating capital/hectare (P)	26,864.95	30,861.57	24,061.29	25,672.00

Economic Performance of Coffee-Based Cropping Systems by Municipality

Economic performance indicators include total value product of the systems, average value products of inputs or resources, and the level of profit and the rate of system profitability. Table 2 presents the average

economic performance of the systems by municipality. It could be noted that total value product per hectare was highest in Alfonso with an average of P73,792.50 followed by Amadeo with P68,292.50, which were both higher than the overall average total value product of P67,469.17. Silang farms had the lowest averaging only to P60,322.00. However, the values of the average value products of both land and labour reflected the efficiency in the use of the production factors such as land and labour, Silang was the highest with a mean AVP of land amounting to P51,657.71 per hectare and mean AVP of labour of P725.21 per man-day. Alfonso farms' mean AVP of land amounted to P50,701.35 and mean AVP of labour was P664.14. Farms in Amadeo had the lowest AVP for both land and labour with average AVP for land of only P47,408.75 and average AVP for labour of P612.63. In terms of the efficiency in the use of inorganic fertilizer, however, Amadeo farms ranked first with an average AVP for fertilizer of P162.46 while Silang and Alfonso farms had P137.73 and P123.57, respectively. Mean AVP for fertilizer considering all the 60 farms was computed at P141.26.

Table 2 also shows the comparative level of profit and rate of profitability across the different cropping systems represented by the three municipalities. Average profit per hectare was highest in Silang farms with an average of P25,985.71 per hectare as against the other two municipalities with mean profit per hectare of only P23,347.46 per hectare for Amadeo and P19,839.77 per hectare for Alfonso farms. Subsequently, ROOC as a measure of system profitability was highest in the farms of Silang with an average of 110% followed by farms in Amadeo with an average of 103%. Alfonso farms were the lowest with only 65% ROOC per annum which is much lower than the overall mean of 93%.

Table 2

Mean Values of the Economic Performance per Hectare of Coffee-Based Cropping Systems by Municipality

Economic performance indicator	Average/mean			
	All farms (N = 60)	Alfonso (Pattern 1)	Amadeo (Pattern 2)	Silang (Pattern 3)
Economic performance				
Total value product	P67,469.17	P73,792.50	P68,292.50	P60,322.00
AVP of land	P49,922.60	P50,701.35	P47,408.75	P51,657.71
AVP of labour	P667.32	P664.14	P612.63	P725.21
AVP of fertilizer	P141.26	P123.57	P162.46	P137.73
Profit	P23,057.65	P19,839.77	P23,347.46	P25,985.71
ROOC (%)	93%	65%	103%	110%

Differences in Resources Productivity and Systems Profitability Across the Three Municipalities Representing the Different Types of Coffee-Based Cropping Patterns

As shown in Table 3, differences in the average annual operating capital in the three systems were compared. Analysis of variance test resulted in significant F value of 17.63 suggesting that the use of capital differed significantly across municipalities or system types with Alfonso (cropping system 1) exhibiting the highest annual operating capital during the period covered by the study. Amadeo (cropping system 2) had the lowest operating capital for the year. Results of the analysis also showed that the differences were highly significant in terms of labour utilization. It was highest in Amadeo (cropping system 2) with 84.43 man-days per annum. This was followed by Alfonso (cropping system 1) with 79.47 man-days while Silang (cropping system 3) was the lowest with only 72.02 man-days per hectare per year. The use of inorganic fertilizer was highest in Silang (cropping system 3) with 765 kilograms per hectare per year. This was followed by Amadeo

(cropping system 2) with 750 kilograms while Alfonso farms (cropping system 1) applied the least amount of inorganic fertilizer during the cropping year 2010 to 2011.

Productivity of land in terms of the average value of produce per hectare for the year was compared across system types. There were significant differences in the productivity of land with cropping system 3 (Silang) having the highest at P51,657.71 per hectare followed by cropping system 1 (Alfonso) with P50,701.35 per hectare per year. Productivity of land was lowest in cropping system 2 (Amadeo) with all the farms generating an average productivity of land of only P47,408.75 per hectare. Productivity of fertilizer (inorganic) also differed significantly across system types. Farms in cropping system 2 (Amadeo) were the most efficient in terms of the use of fertilizer generating an average value product of fertilizer amounting to P162.46 per kilogram of commercial fertilizer per hectare. This was followed by cropping system 3 (Silang) where farms had an average productivity of fertilizer valued at P137.73 per kilogram. Farms in Alfonso (cropping system 1) were the least efficient in the use of fertilizer with an average value product of only P123.57. Results showed that the average value product of labour differed significantly. Labour was most efficiently utilized in Silang farms (cropping system 3) valued at P725.21 per hectare followed by Alfonso farms with an average value product of labour of P664.14 per hectare. Amadeo farms showed the least average value product of labour valued only at P612.63 per hectare.

Profit per hectare was highest in cropping system 3 (Silang) amounting to P25,985.71. Likewise, profitability in terms of the rate of ROOC was highest in Silang with an average rate of ROOC of 110%. This was followed by cropping system 2 (Amadeo farms) with an annual rate of ROOC of 103%. Rate of return was lowest in cropping system 1 (Alfonso farms) which generated least rate of return of only 65% per year.

Table 3

Analysis of Variance for the Differences in the Mean Values of Economic Variables per Hectare in Coffee-Based Cropping Systems by Municipality

Economic variables	Pattern 1	Pattern 2	Pattern 3	F value	Differences at $\alpha = 0.05$
Operating capital	P30,861.57	P24,061.29	P25,672.00	17.638*	S
Labour use (m-d)	79.47	84.43	72.02	563.90*	S
Fertilizer use (kg)	687.50	750.00	765.00	5.09*	S
Gross income	P73,792.50	P68,292.50	P60,322.00	3.00	NS
Profit	P19,839.77	P23,347.46	P25,985.71	9.27*	S
AVP of land	P50,701.35	P47,408.75	P51,657.71	21.64*	S
AVP of labour	P664.14	P612.63	P725.21	13.12*	S
AVP fertilizer	P123.57	P162.46	P137.73	2.56	NS
ROOC	65%	103%	110%	10.68*	S

Notes. α = level of significance; S = significant (means $\alpha > 0.05$); NS = not significant (means $\alpha < 0.05$); * means $\alpha > 0.05$.

Conclusions and Recommendations

Farms in cropping system 3 (Silang) had the highest overall levels of production efficiency as evidenced by topping two of the efficiency indicators such as the average value products of land and labour while cropping system 2 (Amadeo) had the highest average value product of fertilizer. Cropping system 1 (Alfonso) had the highest total value product of outputs produce. Silang farms also had the highest level of profit per hectare and the highest rate of profitability or ROOC per hectare.

The following may be recommended to be implemented in the coffee-based cropping systems especially to those farms with lower levels of productivity, efficiency, and overall systems profitability:

(1) Adjusting cropping calendar and patterns when applicable and changing management and farming practices directed toward improved efficiency and profitability;

(2) Practicing diversified farming, more intercropping, crop rotation in order for the system to provide a wider variety of crops in the system especially those which are considered as high-value crops that are sold at higher prices, hence increasing productivity and subsequently a more profitable system;

(3) Considering intercropping coffee farms with other industrial and commercial crops which command higher market prices, thereby increasing the productivity and profitability of the coffee-based farms.

References

- Arizala, L., & Gonsalves, J. (1990). Multistoried cropping system: A farmer derived agroforestry system. Resource book on sustainable agriculture for the uplands. International Institute for Rural Reconstruction (IIRR), Philippines.
- Cruz, E. B. (1985). An economic analysis of cropping systems in selected upland areas of Eastern Visayas. MS thesis, UPLB, Laguna, Philippines.
- Curry, G. (2013). Improving livelihoods of smallholder families through increased productivity of coffee-based farming systems in the highlands of Papua New Guinea. Australian Centre for International Agricultural Research.
- Duwayri, M. A. (2011). Alternative crops and cultivars for new opportunities. In M. K. Papademetriou and F. Dent (Eds.), *Crop diversification in the Asia-Pacific region*. FAO Regional Office for Asia and the Pacific, Bangkok, Thailand, April.
- Fisher, L. A. (1990). Developing small-scale afforestation: Guidelines for farmers and facilitators. Resource book on sustainable agriculture for the uplands, International Institute for Rural Reconstruction (IIRR), Philippines.
- Goswami, S. N. (1997). Economic appraisal of indigenous farming systems of West Garo Hills District of Meghalaya, India. *Indian Journal of Agricultural Economics*, 52(2).
- Gunasena, H. P. M. (2011). Intensification of crop diversification in the Asia-Pacific region. In M. K. Papademetriou and F. Dent (Eds.), *Crop diversification in the Asia-Pacific region*. FAO Regional Office for Asia and the Pacific, Bangkok, Thailand.
- Hallam, D., Bailey, A., Jones, P., & Errington, A. (1999). Estimating input use and production costs from farm survey panel data. *Journal of Agricultural Economics*, 50(3), 440-449.
- Hoang, V. P. (1999). Farming systems analysis of farm-households at Dinh Hoa District, the Northern Uplands of Vietnam. Unpublished doctoral dissertation, University of the Philippines, Laguna, February.
- Kumbhakar, S. C. (2001). Estimation of profit functions when profit is not maximum. *American Journal of Agricultural Economics*, 83(1), 1-19.
- Le, V. L. (1999). An economic analysis of crop production systems in Lamdong Province, Vietnam. Unpublished master thesis, University of the Philippines, Laguna, January.
- Price, E. C., Gonzaga, R., & Acebedo, V. (1984). Testing cropping pattern for economic criteria.
- Sajise, P., & Ganapin Jr., P. (1990). Overview of upland farming issues. Resource book on sustainable agriculture for the uplands. International Institute for Rural Reconstruction (IIRR), Philippines.
- Ton, P. (2013). Productivity and profitability of organic farming systems in East Africa. IFOAM, Bonn, Germany.