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FACTORS AFFECTING YIELD PERFORMANCE OF BANANA FARMS IN ORIENTAL MINDORO, PHILIPPINES

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ABSTRACT

This paper aims to determine the factors affecting yield performance of banana farms located in Oriental Mindoro, identify the problems/constraints encountered by banana growers, and provide policy directions that would enhance the productivity of banana in the province. Based on survey data of 80 banana growers from the municipalities of Bansud, Socorro, Pinamalayan and Bacu in Oriental Mindoro in 2007, multiple regression analysis was conducted. The Cobb-Douglas production function was estimated using the Ordinary Least Squares (OLS) method. Explanatory variables included in the model on a per hectare basis were fertilizer, labor, planting material cost, number of stalks, tenurial status, types of banana cultivar grown, intercrops, topography, soil type, distance between hills, education, farming experience, age and gender of the banana grower, household size and distance of farm to residence of the banana grower. Results of the multiple regression analysis revealed that increased fertilizer and labor usage, tenurial status in favor of owner-operators, adoption of diversified banana farming and establishment of ideal farm characteristics (i.e., clay loam or sandy clay loam soil, distance between hills of $\geq 20m^2$ and shorter distance from farm to residence of grower) significantly and positively affect banana yield in Oriental Mindoro.

The sum of the production elasticities (0.76) is significantly different from one as verified by the t-test results. The function coefficient of the OLS model implies decreasing returns to scale where a one percent increase in all production inputs would raise banana yield by 0.76 percent. Problems and constraints cited by the banana grower-respondents in Oriental Mindoro include: (1) limited supply of high-yielding and disease-free banana planting materials; (2) high incidence of pests and diseases; and (3) inadequate knowledge on proper production practices/technologies in banana farms. Hence, the following policy directions are recommended: (1) provision of technical and budgetary support to the propagation and distribution of banana cultivars which are better yielding and highly resistant to virus and other systemic diseases; (2) adoption of site-specific IPM and dissemination of information on banana pests and diseases and their control; (3) conduct of training on good agricultural practices (GAP); and (4) formation of banana cluster to effectively forge strong linkages between banana growers and suppliers of quality planting materials and production technologies.

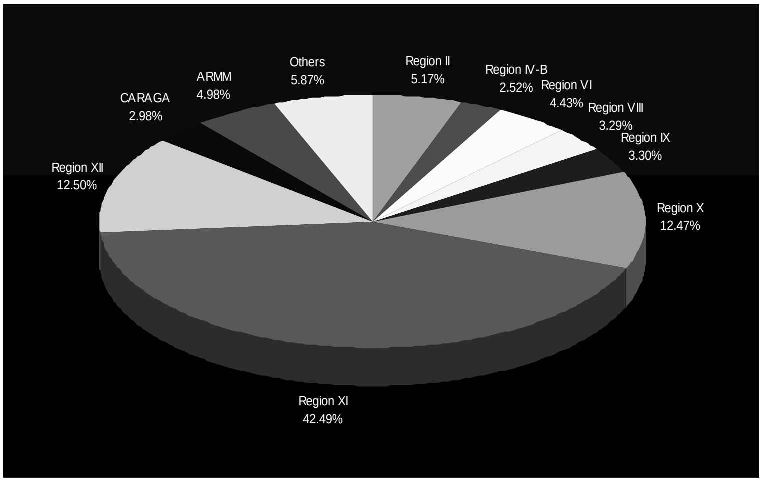
Key words: Cobb-Douglas production function, Ordinary Least Squares (OLS) method, and returns to scale,

INTRODUCTION

Banana is the most important fruit crop grown in the Philippines in terms of production and hectarage. The high demand for banana by Filipinos in their food diet owing to its nutritive value and affordable price compared to mango and pineapple has encouraged farmers to continue growing banana in many production areas. There are 80 banana cultivars in the Philippines which are grown for domestic and international markets. Cavendish is mainly produced for the export market but Señorita and Lakatan also increase their popularity among importers. Saba or Cardaba is commonly used in processing of banana chips and catsup. For the local market, Lakatan, Latundan, Bungulan and Saba emerge as the highly demanded cultivars (Rivera 2004).

According to Rivera (2004), the ideal conditions for banana growing are the following: (1) soil is deep, friable, and rich in organic matter with complete nutrient and mineral elements, and has adequate moisture throughout the year; soil texture of 40% clay, 75% silt or 85% loam; soil pH of 6.5, soil topography of flat to rolling lands up to 45 degrees gradient; (2) tropical climate with temperature range of 22 to 32 degrees Celsius; (3) land elevation from sea level to 1,000 meters above; and (4) minimal air movement. Inputs in banana farming include suckers, corms and eye buds obtained from corms that can be used as planting materials; and fertilizer and labor that are utilized for land preparation and planting, fertilization, pruning, thinning, weeding and cultivation, flower and fruit management and harvesting. The country posted an average annual banana production of 5.04 million mt from 1990 to 2008. During the same period, area planted to banana and number of hills averaged at 372,735 ha and 182.70 million hills, which resulted to an average annual yields of 13.31 mt/ha and 0.03 mt/hill. A hill is where the mat is placed which grows banana suckers The positive annual growth in banana production at 5.24 percent was attributed to yearly increases in area planted (1.92%), number of hills (3.75%), yield/ha (3.27%) and yield/hill (1.41%) in the period 1990-2008. In 2007, national production was registered at 7.48 million mt covering 436,762 ha and 250.54 million hills. (B AS 2009).

Region XI (Davao Region) topped the banana producing regions with 42.49 percent share in national banana production in 2007 (Fig. 1). Next in rank included the following regions: XII (12.50%), X (12.47%), II (5.17%), Autonomous Region of Muslim Mindanao (ARMM) (4.98%), VI (4.43%), IX (3.30%), VIII (3.29%), CARAGA Administrative Region (2.98%) and IV-B (2.52%). As Mindanao area is less visited by typhoons, Regions XI, XII (SOCCSKSARGEN) and X (Northern Mindanao) provide favorable weather condition for banana cultivation.

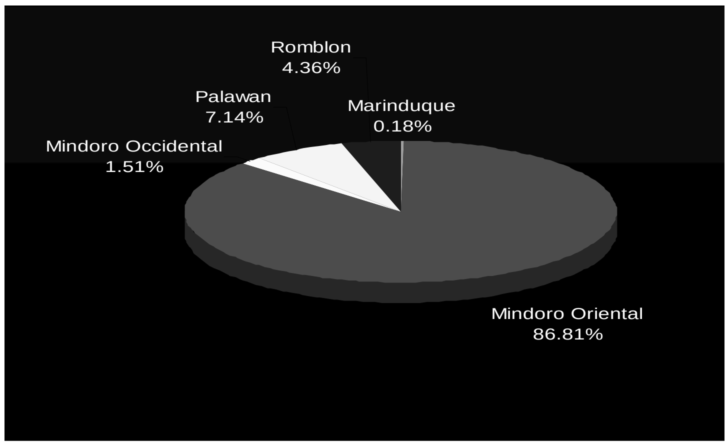


Source of basic data: Bureau of Agricultural Statistics (BAS)

Fig. 1. Share in terms of banana production, by region, Philippines, 2007

On the average, banana production in the province of Oriental Mindoro in Region IV-B reached 125,378 mt from an area planted of 14,041 ha with 5.48 million hills for the period 1990-2008. Yields averaged at 13.31 mt/ha and 0.02 mt/hill. Annual increase in banana production of 3.50 percent per annum could be due to expansion in area planted which grew at 4.10 percent per year during the same period. Yields per hectare and per hill showed negative growth rates of 0.01 and 0.44 percent annually for the past 19 years. In 2007, banana production in the province reached 163,729 mt covering 18,371 ha and 7.43 million hills. Yields were registered at 8.91 mt/ha and 0.022 mt/hill (BAS 2009). Oriental Mindoro accounted for the bulk (87%) of the total banana production in Region IV-B. The remaining 13 percent was contributed by the provinces of Palawan, Romblon, Occidental Mindoro and Marinduque (Fig. 2).

As land resources become scarce due to rapid land conversion and urbanization, higher production levels of agricultural crops including banana in the future are to be achieved through improvement in yield. As of now, no study has been done in the Philippines that identifies the explanatory variables which influence the yield of banana.



Source of basic data: BAS

Fig. 2. Share in terms of production, by province, Region IV-B, 2007

This study aims to: (1) determine the factors affecting yield performance of banana farms located in Oriental Mindoro; (2) identify the problems/constraints encountered by banana growers; and (3) provide policy directions that would enhance the productivity of banana in the province. This would enable banana growers to focus on the important yield response determinants and to address the problems/constraints identified in the study.

Several studies have identified the determinants of yield for different agricultural crops. Apart from inputs of production, other factors have influenced yield levels. Using Cobb-Douglas functional form, Ahmad et al. (2005) found that higher amounts of seed and fertilizer and sowing in the months of September and October significantly improved carrot yield. On the contrary, high input prices, limited capital and inadequate labor during peak load period contributed to the decline in yield. Javed et al. (2001) determined the factors affecting yield of sunflower. Based on the study, the seed rate and the numbers of irrigation systems and bags of urea and diammonium phosphate positively influenced sunflower yield. In addition, land preparation, sowing method (i.e., drill or broadcast) and incidence of pest attacks substantially affected yield. Grower- and farm-specific characteristics could also determine crop yield. Bakhsh et al. (2004) revealed that years of farming experience and education, household size, use of farmyard manure and inorganic fertilizer, and number of irrigation systems would increase yield of cauliflower. In the case of cotton, the years of education, land preparation, plant protection measures and quantity of nitrogen and phosphorus applied in the farms had positive relationship with yield (Bakhsh et al. 2005). Yamano (2008) examined the integration of dairy and banana farms in Uganda and the effects of selected determinants on banana yield. Results of the study revealed that the amount of organic matter, plot size, tenancy, number of male household members, farm assets, land altitude, population density, and rainfall. In estimating the yield response model for banana, this study also used the Cobb Douglas functional form (Javed et al. 2001, Bakhsh et al. 2004, Ahmad et al. 2005, and Bakhsh et al. 2005) and considered both the inputs of production and grower- and farm-specific characteristics as explanatory variables.

METHODOLOGY

The study area covered Oriental Mindoro, the leading banana growing province in Luzon in terms of area and volume of production for the past 10 years based on the statistics generated from the BAS. From this province, four major banana producing municipalities were chosen as research sites after reviewing the available information from the Office of the Local Government Units (LGUs) of Oriental Mindoro and interview of key informants. Two main banana producing barangays in each selected municipality were considered and the list of banana growers was derived from these barangays with the assistance of barangay officials and agricultural technicians. Out of 250 banana growers, 80 of them were randomly selected from eight barangays representing the municipalities of Bansud, Socorro, Pinamalayan and Bacu in Oriental Mindoro.

Primary data were collected through personal interview using pre-tested interview schedule in 2007. These include production, area planted to banana, fertilizer, labor, planting material cost, number of hills/ha, number of stalks/hill, tenurial status, types of banana cultivar grown, intercrops, topography, distance between hills, years of education and farming experience, age and gender of the banana grower, household size and distance of farm to residence of the banana grower.

Multiple regression analysis was conducted to determine the factors affecting yield performance of banana farms in Oriental Mindoro. The Cobb-Douglas production function, which provides measures of output elasticity, was estimated using the Ordinary Least Squares (OLS) method. This functional form assumes a unitary elasticity of substitution and a constant elasticity of production for all inputs (Coelli et al. 2005). As shown in Equation 1, the yield response model of the sample Oriental Mindoro banana growers considered 16 explanatory variables including inputs of production and grower- and farm-specific characteristics.

$$\ln Y = \beta_0 + \beta_1 \ln F + \beta_2 \ln L + \beta_3 \ln P + \beta_4 \ln S + \beta_5 TS + \beta_6 BC + \beta_7 I + \beta_8 T + \beta_9 ST + \beta_{10} DH + \beta_{11} E + \beta_{12} FE + \beta_{13} AF + \beta_{14} G + \beta_{15} HS + \beta_{16} DF + e \quad [1]$$

where: ln = natural logarithm;
Y = yield of banana (kg/ha);
F = amount of fertilizer applied (kg N /ha);
L = amount of labor utilized (manday/ha);
P = planting material cost (PhP/ha);
S = number of stalks/ha;
TS = tenurial status (0 if owner-operator; 1 if share-tenant/leaseholder);
BC = types of banana cultivar grown (0 if monoculture; 1 if diversified);
I = intercrops (0 if absent; 1 if present);
T = topography (0 if combination of flat and rolling; 1 if hilly to rolly);
ST = soil type (0 if clay loam or sandy clay loam; 1 otherwise);
DH = distance between hills (0 if less than 20 m^2; 1 if equal or greater than 20 m^2);
E = years of education (formal schooling);
FE = years of farming experience;
AF = age of the banana grower;
G = gender of the banana grower (0 if male, 1 if female);
HS = household size;
DF = distance between farm and residence of the banana grower (km);
β_0 = intercept;
β_is = regression coefficients; and
e = error term.

The null hypothesis[1] that the sum of coefficients of fertilizer/ha (β_1), labor/ha (β_2), planting material cost/ha (β_3), number of stalks/ha (β_4) and area planted to banana (β_5) is equal to one, which suggests constant returns to scale, was tested following the test procedure done by Mari et al. (2007). A decision rule was made where a parameter estimate of area when statistically insignificant at 10 percent probability level based on t-test result implies the acceptance of the null hypothesis. Hence, the sample Oriental Mindoro banana growers are in the constant returns to scale (CRS) stage of production. Otherwise, the alternative hypothesis of variable returns to scale is accepted where a sum of coefficients of fertilizer/ha, labor/ha, planting material cost/ha and number of stalks/ha derived from Equation 1 when less than one denotes decreasing returns to scale and when greater than one means increasing returns to scale.

[1] In a Cobb-Douglas functional form of $y = \beta_0 F^{\beta_1} L^{\beta_2} P^{\beta_3} S^{\beta_4} A_5^{\beta_5} e^{\varepsilon}$, where y is total banana production (kg); F is the amount of fertilizer applied (kg N); L is the amount of labor utilized (manday); P is the planting materials cost (PhP/ha); S is the number of stalks per farm; A is the area planted to banana (ha); the sum of β_1 to β_5 is the degree of homogeneity. This measures the returns to scale where a sum less than, equal, or greater than one suggests decreasing, constant or increasing returns to scale, respectively. To test for the significance of the sum of the coefficients, multiply and divide the right-hand side by $A_5\beta_1$ $A_1\beta_2$ $A_5\beta_3$ $A_5\beta_4$. After rearranging terms and transforming into linear equation by taking the natural logarithm, the final form of the production function becomes: $\ln y = \beta_0 + \beta_1 (F/A) + \beta_2 (L/A) + \beta_3 (P/A) + \beta_4 (S/A) + h (\ln A) + \varepsilon$, where h is the sum of β_1 to β_5.

RESULTS AND DISCUSSION

Characteristics of Banana Grower-Respondents

The sample banana growers in Oriental Mindoro reported an average production of 15.55 mt which ranged from 0.24 mt to 107 mt in 2007. This covered an area of 2.66 ha ranging from 0.25 ha to 12 ha. The minimum and maximum yields attained by the banana growers were 0.30 mt/ha and 28.80 mt/ha, respectively, with an average yield of 6.63 mt/ha (Table 1). This disparity in yield is due to differences in input utilization. There were banana growers who did not fertilize (64) and incurred planting material cost (53). This is attributed to the high cost of fertilizer and unavailability of affordable and quality planting materials. Specifically, the prices of ammophos, ammosul, complete and urea per 50-kg sack in the province were registered at PhP 764/sack, PhP 505/sack, PhP 771/sack and PhP 933/sack in 2007, which were 3.06 percent to 5.50 percent higher than in 2006. On the average, the amount of fertilizer used was 7 kg N/ha and the planting materials cost incurred was PhP 228/ha (Table 1). Other inputs such as labor, planting material cost and number of stalk/ha were also lower under the minimum yield of 0.30 mt/ha as against the input utilization in the maximum yield of 28.80 mt/ha (Table 1).

Table 1. Production and inputs utilization of 80 sample banana growers, Oriental Mindoro, Philippines, 2007.

Item	Minimum	Maximum	Average
Production (kg)	240	107,007	15,546
Area (ha)	0.25	12.00	2.66
Yield (kg/ha)	300	28,800	6,628
Fertilizer (kg N/ha)	0.00	35.00	7.00
Labor (manday/ha)	8.60	97.50	38.03
Planting material cost (PhP/ha)	0	1,600	228
No. of stalks/ha	300	5,000	1,240

Source of data: PGPA survey, 2007

Majority of the banana grower-respondents, accounting for 83 percent were males. In terms of tenurial status, only 19 percent of them were classified as owner-operators while the rest were leaseholders or share-tenants. Leaseholders are those who rent the banana farm and normally pay a fixed rental in kind. In this study however, the three leaseholders from the sample banana growers were all related to the land owners, thus the sharing arrangement was similar to that of the share-tenants wherein 33 percent of the harvest was given to the land owner and the remaining 67 percent to the leaseholder or share-tenant. This arrangement is commonly followed in Oriental Mindoro. Four banana farmers forged into an equal sharing arrangement after deducting production expenses (Table 2).

Forty-two banana growers operated monoculture farms while 38 growers cultivated diversified farms. The former included Saba banana only while the latter had three different cultivars, namely: Saba, Latundan and Lakatan. For the presence of intercrops, about 88 percent of the respondents planted coconut, lanzones, rambutan and calamansi. In terms of soil type, 57 out of 80 banana growers had clay loam or sandy clay loam type which corresponded to the ideal soil texture comprising of 40 percent clay, 75 percent silt and 85 percent loam. On the other hand, nearly 73 percent of the respondents had hilly to rolly type of topography, which is not ideal for banana farming. Fifty-nine growers had adopted a distance between hills of equal or greater than 20 m^2 vis-à-vis less than 20 m^2 by 21 growers (Table 2).

Table 2. Selected grower- and farm-specific characteristics obtained from 80 sample banana growers, by type, Oriental Mindoro, 2007.

Grower/Farm Characteristics	**Number**	**Percent**
Gender		
Male	66	83
Female	14	17
Tenurial status		
Owner-operator	15	19
Leaseholder/Share-tenant	65	81
Types of banana cultivar grown		
Monoculture	42	53
Diversified	38	47
Intercrops		
Absent	27	34
Present	53	66
Soil type		
Clay loam or sandy clay loam	57	71
Others	23	29
Topography		
Combination of flat and rolling	22	27
Hilly to rolly	58	73
Distance between hills		
Less than 20 m^2	21	26
Equal or greater than 20 m^2	59	74

Source of data: PGPA survey, 2007

As shown in Table 3, the average years of education and farming experience were 7 and 23, respectively. Education ranged from 2 years to 15 years while farming experience was from 3 years to 55 years. The average age of the banana grower was 52, which ranged from 26 years old to 93 years old. Older and more educated and experienced banana growers could have yield advantages over their counterparts, provided they applied the knowledge and skills on farming acquired through time. In terms of distance of farm to the residence of the banana grower, it ranged from 0.005 km to 10.00 km with an average of 1.42 km. Those growers who lived far may not be able to visit their banana farms more often than those who lived near their farms.

Table 3. Grower- and farm-specific characteristics of 80 sample banana growers by type, Oriental Mindoro, 2007.

Item	Minimum	Maximum	Average
Years of education	2	15	7
Years of farming experience	3	55	23
Age of the banana grower	26	93	52
Household size	1	12	4
Distance of farm to residence of the banana grower (km)	0.005	10.00	1.42

Source of data: PGPA survey, 2007

Factors Affecting the Yield Response of Banana Farms

Based on the results of the multiple regression analysis as shown in Table 4, the significant determinants of banana yield of 80 sample grower-respondents in Oriental Mindoro in 2007 were the following: fertilizer/ha, labor/ha, tenurial status, types of banana cultivar grown, soil type, distance between hills and distance of farm to residence of the banana grower. About 65 percent of the total variation in banana yield could be explained by the changes in the 16 explanatory variables contained in the yield response model. This model was significant at 1 percent probability level.

The Cobb-Douglas functional form provides measures of output elasticities. Hence, the coefficients of fertilizer/ha (β_1), labor/ha (β_2), planting material cost/ha (β_3) and number of stalks/ha (β_4) are interpreted as elasticities of output. Of these production inputs, only fertilizer and labor significantly influenced banana yield. In particular, a 10 percent increase in the amount of fertilizer per hectare applied in banana farm would bring about 0.01 percent improvement in yield, holding other factors constant. On the other hand, if the labor utilized in a one-hectare banana farm would rise by 10 percent, yield would also increase by 5.99 percent, ceteris paribus (Table 4).

The output elasticities from β_1 to β_4 summed up to 0.76, which was significant at 1 percent probability level (Table 4). This function coefficient of the OLS model denotes that banana production in Oriental Mindoro is characterized by decreasing returns to scale. Hence, a 1 percent increase in the current utilization of all inputs would bring about 0.76 percent improvement in yield. The positive sign of the coefficient of tenurial status, which was significant at 10 percent probability level, implies that owner-operators have higher banana yield as compared to leaseholders or share-tenants (Table 4). The practice of fertilizer application of all owner-operators had contributed to their better yield as against the other types of banana growers. The former were less capital-constrained vis-à-vis the latter.

For the types of banana cultivar grown, the positive and significant coefficient at 1 percent probability level suggests that the banana yield of diversified farms is greater than that of monoculture farms. This is attributed to the differences in yield among three banana cultivars (i.e., Saba, Latundan and Lakatan) and area devoted to these specific cultivars. Soil type and distance between hills also significantly influenced banana yield at 1 and 5 percent probability level, respectively. The positive sign of the coefficients means that banana growers with farms having clay loam or sandy clay loam soil or adopting a distance between hills of equal or greater than 20 m^2 have greater yield than their counterparts. These ideal farm-specific characteristics will enable the soil to maintain the right amount of moisture and provide proper drainage and the banana plant to have abundant exposure to sunlight, which are required to improve the yield of banana.

In terms of distance of farm to residence of the banana grower, the negative and significant coefficient at 5 percent probability level indicates that banana growers who live far from their farms experience lower yield. The great distance to reach the farm prevents banana growers in visiting their farms more often; hence, they could not perform the proper cultural management which includes pruning, thinning, integrated pest management, weeding and cultivation, and flower and fruit management.

Table 4. Regression results showing the effects of selected explanatory variables on banana yield using Cobb-Douglas functional form, Oriental Mindoro, 2007.

Item	Coefficient	t-value
Intercept	4.3094**	2.5901
Regression Coefficients		
Fertilizer/ha	0.0007***	3.4946
Labor/ha	0.5990***	4.0053
Planting material cost/ha	(0.00005)	(0.2916)
Number of stalks/ha	0.1607	1.3003
Tenurial status	0.3570*	1.8152
Types of banana cultivar grown	0.5163***	2.9813
Intercrops	(0.2287)	(1.4466)
Topography	(0.0073)	(0.0527)
Soil type	0.5672***	3.1002
Distance between hills	0.3948**	2.3743
Education	(0.1038)	(0.5471)
Farming experience	0.1029	0.8921
Age of the banana grower	0.0583	0.1749
Gender of the banana grower	(0.2365)	(1.2770)
Household size	0.0099	0.0522
Distance of farm to residence of the banana grower	(0.0821)**	(2.1167)
Adjusted R^2	0.6530	
F-value	10.31***	
Returns to Scale	0.76***	

***, ** and * Significant at 1, 5 and 10 percent probability level.
Source of basic data: PGPA survey, 2007

Problems and Constraints in Banana Production

Limited supply of high-yielding and disease-free banana planting materials was the foremost problem encountered by more than half (53%) of the banana respondents in Oriental Mindoro. Tissue-cultured planting materials were inadequate and costly, thus, banana growers in the province opted to use planting materials derived from their own farms or those from their neighbors or relatives. Some of these were carriers of pests and infected by diseases which result to low banana yield.

Another major problem reported by 37 percent of the banana respondents was high incidence of pests and diseases. Rats had eaten banana fruits while aphids had served as vectors of a disease called bunchy top. The common diseases occurring in banana farms located in Oriental Mindoro were bugtok for Saba and bunchy top for Lakatan and Latundan. Bugtok is caused by a virulent strain of *Pseudomonas solanacearum*. It enters the plant through tiny openings at the top of the ovary and through the ovules where intense discoloration develops. It spreads to the vascular tissues of the pedicel up to the peduncle. On the other hand, bunchy top is caused by a virus and its symptoms include stunting, yellowing of the leaf margin, bunching of the leaves and formation of dark streaks at the midrib or petiole. Other identified problems included the absence of strong banana grower-respondents (32%) and limited access to information on appropriate production technologies (27%).

CONCLUSIONS AND POLICY DIRECTIONS

This study determined the factors affecting yield performance of banana farms located in Oriental Mindoro, identified the problems/constraints encountered by banana growers, and provided policy directions that would enhance the productivity of banana in the province. Based on the trend analysis, production and area planted to banana increased both at the national and provincial levels covering the period 1990-2008. However, the yield per hectare and per hill showed an upward trend for the Philippines and downward trend for Oriental Mindoro. In 2007, this province occupied 87 percent of the total banana production in Region IV-B.

The determinants of yield performance of 80 banana farms in Oriental Mindoro in 2007 were identified as fertilizer/ha, labor/ha, tenurial status, types of banana cultivar grown, soil type, distance between hills and distance of farm to residence of the grower. Results of the multiple regression analysis of the Cobb-Douglas production function using OLS technique showed that higher utilization of fertilizer and labor; tenurial status in favor of owner operators; operation of diversified farms; and establishment of ideal farm-specific characteristics such as clay loam or sandy clay loam for soil type, distance between hills of $\geq 20\ m^2$ and shorter distance from farm to residence would significantly and positively affect banana yield. On the other hand, the function coefficient of the OLS model (0.76) denotes the decreasing returns to scale stage of banana production in the study areas.

Limited supply of high-yielding and disease-free banana planting materials of three banana cultivars hinders growers to use tissue-cultured materials and to operate diversified farms. There were banana growers who chose to utilize planting materials from their farms or those from their neighbors or relatives, some of which are infected by pests and diseases, instead of shouldering the higher cost of tissue-culture planting materials. Also, despite better yields realized in diversified banana cultivar farming, some growers still produce Saba only because of the same reason. By linking banana growers with reliable sources of quality planting materials, yield could be improved. The International Network for the Improvement of Banana and Plantain (INIBAP), Department of Science and Technology – Philippine Council for Agriculture, Forestry and Natural Resources Research and Development (DOST-PCARRD) and state universities and colleges (SUCs) could provide technical and budgetary support to the propagation and distribution of banana cultivars which were better yielding and highly resistant to virus and other systemic diseases.

Formation of banana cluster to effectively forge strong linkages between banana growers and suppliers of quality planting materials could also be facilitated. Five to ten banana growers, who undertake common production and marketing plan for identified and committed markets, will comprise a cluster. In Oriental Mindoro, two clusters can be formed: one for monoculture and another for diversified farms. Through these clusters, assistance on how to access inputs, information-sharing on sources of quality planting materials and proper cultural management, and provision of technical assistance from the government and other resource organizations will be extended to the member-growers.

High incidence of pests and diseases reduces banana yield in Oriental Mindoro. Through the adoption of site-specific Integrated Pest Management (IPM) and dissemination of information on banana pests and diseases and their control, the effects of these infestations would be minimized. chances of pathogen entering the rhizomes, roots and stem of banana plant. Rivera (2004) enumerated the pests and diseases and their control and the IPM technologies applicable for banana. To prevent the attack of aphids, chemical spraying can be employed. Control measures for banana diseases include field and mat sanitation, leaf pruning, application of fungicide, insecticide and nematicide, and removal of infected plants. On the other hand, four steps in IPM are the following: (1) reducing pests in the soil before planting; (2) minimizing the number of pests present in planting materials; (3) ensuring healthy roots and vigor in plantation; and (4) lessening the chances of pathogen entering the rhizomes, roots and stem of banana plant.

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