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ECONOMIC EFFICIENCY OF MANGOES-BASED AGROFORESTRY SYSTEMS IN BUZAYA COUNTY, KAMULI DISTRICT UGANDA

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ABSTRACT

This study analyzed the economic efficiency of mango (*Mangifera indica*) growers in Buzaya country, Kamuli District, Uganda. It estimated the existing scales of mango growers, their relative resource-use efficiency, the relative profitability of their operations and their determinants using the profit function. Results showed that the identified scales of growers are inefficient in their use of resources, but the potentials still exist for increases in their levels of mangoes output. The hypothesis that the various scales of growers are equally efficient in their resource allocation was rejected at 5% probability level. The hypotheses that there was no significant difference in their level of profitability as well as the factors influencing their operations were also rejected at 5% probability level. It is recommended that micro-financial institutions should give credit preference to the mango growers because of their relatively higher profit margin, which reflects their potentials for repayment. Necessary adjustments should be made in their levels of resource use for enhanced level of mangoes output and profitability were also recommended.

Keywords: Farmers, efficiency, mangoes production, marginal value; Uganda

INTRODUCTION

Mangoes are produced in over 90 countries worldwide. Africa account for approximately 13% and 9%, respectively (FAOSTAT 2007). Mangoes are an important commercial crop in many tropical countries. Mixed cropping was identified as a common practice among the peasant, resource-poor farmers in the tropics (Maxwell 1995; Buyinza 2008) and was argued to be a

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balanced farming practice. Its extensive practice was recognized in the eastern region of Uganda. Varieties of fruits including mangoes, paw paws, avocadoes, bananas, jackfruit, oranges, lemons and tangerines crops grown under the agroforestry-based system in the area are intercropped with root tubers such as cassava, sweet potatoes, leafy vegetables, and a variety of cereals including maize, sorghum and finger millet, ground nuts, sim sim, and other smallholder legumes (Otim-Nape 1999; Buyinza 2007; Buyinza 2008), not only in intensive small-holdings, but also at the medium and large scales. As a nutritious fruit, mangoes are widely accepted by the local farmers and identified as the most important, among the fruit trees cultivated and consumed in Uganda, followed by pine apples, paw paws, jack fruit and avocadoes (Mubiru 1996; Nabbumba 1998). Efforts had been made to enhance its utility (Otim-Nape 1999) and to establish the influence of a number of variables on the yield performance of the crop under sole crop condition (Boesen *et al.*, 2004). The influence of a number of other factors, such as the labour supply and wage rate, amount and cost of capital available to the farmers, the cost of complementary inputs such as fertilizer, planting materials, insecticides have not being satisfactorily established empirically. This knowledge gap was inadequately addressed by previous policies of government resulting in failure to reflect its potentials for the transformation of the economy.

Following the expanded significance, which the mango fruit has recently assumed in international trade circles, Uganda government made a bold policy shift that gave production of the fruit an unprecedented attention, with particular emphasis on its large-scale production through the Farm Income Enhancement and Forest Conservation Programme It is however, not certain if this concern of government to reposition the status of mango fruit production can be realized in Kamuli district given the level of inefficiency in resource-use by the farmers (Buyinza and Nabalegwa 2007). The situation is particularly worrisome in view of the comparative advantage of this geographical location in mango fruit production, evidenced by its abundant human and natural resources.

Mangoes are one of the most important tropical fruit trees brought very early to East Africa. In Uganda, it is widely cultivated in Northern and North eastern regions. It does not tolerate flooding and prefers sand-loamy soil which is well drained, but it can do quit well in dry areas. Roots penetrate deeply, so rocky subsoil should be avoided. The extensive shallow roots collect water and nutrients in upper soil levels. Its altitudinal range is from 700 to 1,800 m absl. Mangoes are used as firewood, charcoal, food (fruits,), bee forage, ornamental, shade, windbreak, soil conservation, and gum. Mangoes are propagated by direct sowing at site, grafting or seedlings. It is fast growing and for quicker growth and early production of fruits, fresh seeds are used.

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Mangoes can be processed locally into juice that is sold fresh in homes, restaurants and on the streets. The most popular fruit for juices preparation are mangoes and passion fruit. Others are pineapple, orange and banana. Banana juice is a special variety prepared through the local technology but its marketing is limited to village level. Currently, the demand for fruit juice exceeds production. The demand is met through import of fruit juices. There is a strong indication of existence of investment opportunities in fruit processing for local and export markets. A few industries have come up to utilise locally produced fruits to produce juice, for example, Reco Industries in Kasese processes passion fruit juice concentrate and jam; Britannia Ltd in Kampala deals in mango juice and passion fruit juice, whereas Craft Bazaar Ltd in Kampala and Elgonia Ltd in Mbale processes pineapple and passion fruit juice concentrates. There are investment opportunities in the fruit-subsector both for the local market and export.

Through the Plan for Modernisation of Agriculture (PMA) and National Agricultural Advisory Services (NAADS), farmers have been encouraged to treat farming as a viable business. Findings from NAADS evaluation reports suggest that the existing scales of operation and level of resource-use efficiency cannot match the opportunities offered in international markets for mangoes production (Nabbuba 1999). They cannot, as well, cope with the expanded domestic market for the crop as a food staple unless the location and magnitude of resource-use inefficiency among the growers are identified for proper action by government. It is not known whether the reported level of resource use inefficiency and profitability profile are similar for the various scales of growers. However, while only a small proportion of total mango production enters international trade (less than 4%), the volume traded has risen substantially over the last decade. Among the factors responsible for increased mango production, trade, and consumption are lower prices, year-round availability, fewer trade barriers, longer shelf life, and consumer interest (Sauco, 2004).

This study therefore, generally analyzed the resource management of mango-based mixed farm growers and more specifically, estimated the existing scales of mango fruit growers, their relative resource-use efficiency, the relative profitability of their operations and their determinants. It was warranted by the recent government policy emphasis of on mangoes production and the need to establish the relative potentials of the various scales of growers towards the achievement of the policy objectives of government. It was hypothesized that the various scales of mangoes farmers in the area are equally efficient in their resource allocation, that they do not differ significantly in the level of profit from their operations and that their levels of profit are not significantly influenced by the scale of operation, their pattern of use of loans acquired for mango production, the wage rate, cost of capital, cost of such other inputs as fertilizer, planting materials, and insecticides.

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MATERIALS AND METHODS

Description of study area

Kamuli district (Figure 1) is part Busoga region and one of the 84 districts of Uganda and is located in the south-eastern part of the country with a population of 552,665 people of which 52% are females (UBOS 2002). It is located in south-eastern Uganda, it lies at an average altitude of 1083 m above sea level and extends from 00 - 56' North / 330 -05' East up to 01 - 20' North / 330 - 15' East. The district borders River Nile and Kayunga district in the west, Jinja district in the South, Iganga district in the Southeast, Kaliro District in the East and Soroti district and Lake Kyoga in the north. Kamuli District has a total land area of 3,444 km^2.

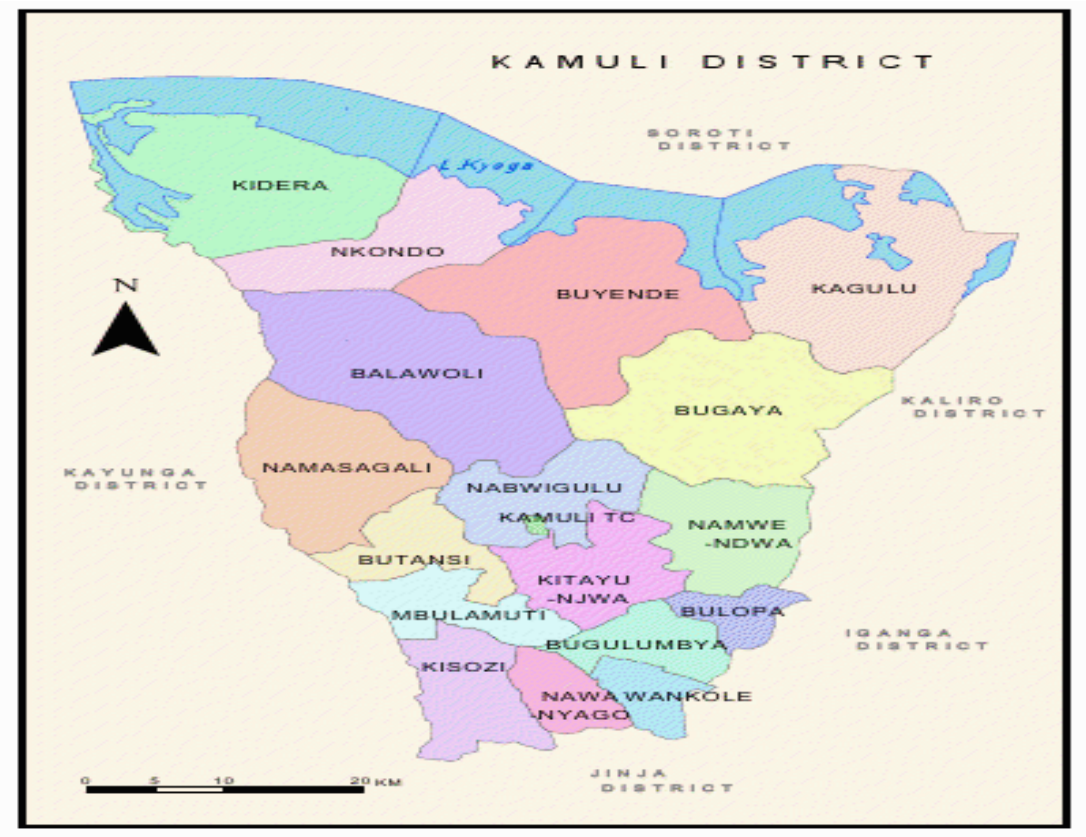

Figure 1: Kamuli District, eastern Uganda

Buzaya county, the study area is found in Kamuli district, it lies between latitude $0^0 09^I$ and $0^0 11^I$ N and longitude $31^0 50^I$ E. Annual rainfall varies from 900 – 1200 mm with two marked dry seasons and the average temperature ranges between 22.6^0 C and 24.6^0 C. Kamuli District is composed of three counties namely: Budiope, Bugabula and Buzaaya. Buzaya County was

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selected because it has characteristics typical of the diverse social, economic, cultural, rural and urban setting found in the Busoga region. It has a population density of 230 persons per km^2, and the growth rate is 2.3 %. (UBOS, 2002). Subsistence agriculture is the major economic activity employing about 84% of the population (MAAIF, 2000). The bulk of agricultural production is from manually cultivated rain-fed crops. Inter-cropping is a prevalent practice (MAAIF, 2000). Mixed cropping is widely practiced with maize, cassava, sweet potatoes, sorghum and finger millet as the main crops and with bananas, rice as minor crops. Most households keep livestock including goats, poultry, pigs, sheep and rabbit thus, making them typical mixed farmers.

The multistage sampling technique was adopted in sample selection. The district was first stratified into three agricultural zones in line with Plan for Modernization of Agriculture (PMA) zoning. Three parishes of Bugulumbya, Kasambira and Nawandhyo were purposively chosen based on the intensity of mangoes production in mixed crop operations in the area following a pilot survey of the area. Using a stratified random sampling technique, two villages were selected in each parish giving a total of six villages. The list of mangoes farmers from each village was drawn with the assistance of the NAADS workers and from this sampling frame 10 mango growers were drawn from each selected village through simple random sampling thus giving a total of 60 respondents in all.

Data were collected using questionnaire surveys, focused group discussions, key informant interviews, participant observation and review of secondary literature and reports. Data were collected on such variables, as the scale of operation, amount of loan advanced for mangoes production, the pattern of investments made by the farmers from loans acquired for mangoes production, wage rate for add farmer, quantity and costs of inputs such as fertilizer, planting materials, insecticides, herbicides.

Data were analyzed using descriptive statistical tools including the statistical means, percentages, frequency distribution as well as inferential statistical tools which included production and profit functions. To estimate the allocative efficiency of resource-use for the various scale of mango growers, an efficiency index was used, specified as (Bolton and Ockenfels, 2000):

$$K_{ij} = P(MPP)_{xi} = (MVP)i/P_{xi} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (1)$$

Where:

K_{ij} = Allocative efficiency index
P = Price of the output
MPPxi = Marginal Physical Product
$(MVP)_{xi}$ = Marginal Value Product from the specific input used in production

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P_{xi} = Price of specific input

Maximum or absolute allocative efficiency is established for a particular scale of operation with respect to a given input if K_{ii} = 1. if K_{ij}> 1, there is an indication that less than profit maximization level of that input is being utilized and therefore, efficiency could be increased by an increased use of that particular input. Conversely, if K_{ij}<l, there is indication that more than profit maximization level of that input is being utilized, suggesting that a reduced use of that input is required to increase efficiency.

The required level of input reduction or increase to attain profit maximization was estimated as:

$$D_{ij} = (l-K_{ij})\ 100 \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (2)$$

where, D_{ij} is required percentage change to attain allocative efficiency or the percentage deviation from optimal use of the ith input for the jth scale of operation. A negative value implies that an increased use of that input was needed, while a positive value signaled that the reduction of that input was called for. A zero percentage indicated that the maximum or absolute efficiency was achieved.

To test the hypothesis that the various scales of mangoes growers were equally efficient in resource allocation their mean allocative efficiency indices were compared using the Z-test at 1% probability level, specified as:

$$z - cal = \frac{k_i - k_j}{\sqrt{s_i^2 + s_{ji}^2 / n_i + n_j}} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (3)$$

Where:

Ki and Kj = Mean efficiency ratios for each category

$s_i^2 + s_j^2 =$ Variance of efficiency ratios in resource use by the corresponding category

$n_i + n_j =$ Sample size of the respective categories

A pair of scale of operations was deemed to have equal allocative efficiency, if the mean values for all the inputs obtained for K;J were equal, i.e.,

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$Ki_1 = Ki_2 = Ki_3$ ……. (4)

A scale of operation was more allocatively efficient than the other if the mean value of K;, for that scale was greater than the K_{ij} of the other scale.

To establish their relative economic efficiency and the influencing factors a profit function was estimated, following Foster *et al.* (1984), modeled in linear form as:

$$\text{LI} = b_0 + b_i x_i (i = 1...5) + b_i D_i (i = 1...2) + b_i D_i x_i (i = 1.....5) + \ell_i \quad \text{..... (5)}$$

Where:

LI = Profitability index per farmer (Uganda shillings value of farm output less the farm cost)
X_l = Wage rate (Uganda shillings per man-day for an adult farm worker)
X_2 = Cost of Capital (amount of interest payment)
X_3 = Capital utilized (amount of loans and depreciated value of assets)
X_4 = Cost of other input (planting materials, fertilizers and other agro-chemicals)
X_5 = Pattern of loan use (% of investment in current assets relative to total assets)
D_i = Dummy for scale of operation (i = 1 for small-scale and zero, otherwise i = 2 for medium scale and zero, otherwise; i =3 assuming zero value for the excluded large scale group).
b_0 = intercept term
b_i = Coefficient of the variables
e_i = Stochastic error term

It was hypothesized, a priori that X_1 and X_2 will be negatively singed, while X_3, X_4, X_5, D_1 and D_2 would be positively related to profitability.

The Z – test (adjusted from Eq. 3 to compare profits rather than mean efficiency ratios) and an F-test (as specified in Eq. 6) were used, respectively to test the hypotheses of no significant difference in the profit earned by the various categories of producer (the Z-test) and the factors affecting the level of profit of the various scales of producer (the F-test). The F-test statistic was specified, in line with Olayeni (2005) and Gugarati (1995) as:

$$F = \frac{SSR_a - SSR_b)/(a-b)}{SSE_a/(n-a)} = \frac{(R^2 a - R^2 b)(n-a)}{1 - R^2 a(a-b)} \quad \text{..... (6)}$$

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Where:

SSRa = Regression sum-of squares, when $\prod$ is regress on all explanatory variables

SSRb = Regression sum-of squares, when $\prod$ is regress on non-dummy variables only

SSEa = Sum-of-squares of error when $\prod$ is regress on all explanatory variables

a = Total number of parameters estimated

b = Total number of non-dummy parameters only

R^2 = Co-efficient of multiple determination

n = Number of observations in the entire sample

RESULTS AND DISCUSSION

Production scales of mangoes growers

Uganda is one of the biggest mango producing countries in the tropics. In Busoga region mango is produced mainly in small to medium sized farms for the domestic market. The distribution of the various scales of mangoes growers identified in the study area is as shown in Table 1. There were three categories of mango growers in the Buzaya county and about 20, 70 and 10% of the growers were small, medium and large-scale growers, respectively. This suggests that medium-scale production is the dominant mode of production in this mangoes agroforestry systems, followed by the small-scale and then, the large-scale production. This corroborates with the widely reported view that medium-scale farmers constitute the back-bone of food production in the Ugandan economy (MFPED 2000; Maxwell 1995; Buyinza, 2007), with farm size ranging from 2-6 ha (MFPED 2000). This makes a strong case for medium-scale growers and the imperative of using the affirmative action under the Plan for Modernization of Agriculture (PMA) aimed at commercialization of mangoes production. This fits well in overall government policy to deliberately encourage and stimulate this vital sector through several agricultural advisory services, agro-processing, micro-finance and marketing and direct agricultural education services.

Table 1: Distribution of the scale of mangoes production

Scale of production	Frequency	Percentage
Small	12	20
Medium	42	70
Large	6	10
Total	60	100

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If however, the policy is to be tilted in favour of large-scale growers, as being contemplated by the designers, a number of factors must first be addressed to justify the government's intervention in the farming systems in the area. This may call for measures to ensure that the allocative efficiency of the large-scale growers, indexed by their marginal physical product, out-ways that of the medium and small-scale growers. The implications for the profitability and risk of financing the different scale of growers will need to be ascertained to ensure that the loss in earnings to be sustained by dropping other crops cultivated along with mangoes in the mixed cropping systems in the area will be sufficiently compensated for by the expected net-farm income arising from making mangoes the sole crop in large-scale production. The frictional unemployment, arising from the greater number of farm labour that would be displaced and poured in the labor market as surplus labour, should also be given adequate consideration.

Resource-use efficiency of categories of mango growers

The estimated resource-use efficiency of the various scales of growers is as shown in table 2. Incase of the small-scale mangoes growers, the index of allocative efficiency for land, labour, planting materials, capital and other inputs were 2.32, 0.2, 1.38 and 2.28 respectively. For the medium-scale growers, the corresponding index were 5.02, 0.05, 2.31, 2.54 and 1.82 respectively while, for the large-scale producers the respective values were 3.334, 0.6, 1.67, 5.02 and 1.84. These statistics suggest that in terms of allocative efficiency, none of the 3 categories of growers was efficient in the use of their resources. On a relative basis, however, the small-scale growers were more allocatively efficient in the use of land, planting materials and capital, while the medium-scale growers were more efficient in the use of labour and other inputs. These two categories were more allocatively efficient than the large-scale growers in the use of each of these specific resources.

To attain the required efficiency, the medium-scale growers need to reduce their use of land, planting materials, capital and other inputs by 402, 131, 154 and 82%, respectively and increase their use of labour by 95%. The small-scale growers, on the other hand, need to reduce their use of land, planting materials, capital and other inputs by 159, 44, 139 and 114%, respectively and increase their use of labour by 90%.

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Table 2: Estimated resource-use efficiency of various categories of mango growers

	Scale of growers (scale)		
Item	Small	Medium	Large
Production elasticity for:			
Land (ha)	0.246	0.228	0.374
Labour (man-days)	0.217	0.314	0.213
Planting materials *(UGx)*	0.321	0.442	0.496
Capital *(UGX)*	0.524	0.702	0.798
Other inputs *(UGX)*	0.215	0.232	0.326
Sample means for			
Land (ha)	2.146	2.331	2.449
Labour (man-days)	206.11	225.36	108.21
Planting materials(UGX)	19884	14820	14820
Capital *(UGX)*	22981	1243	1243
Other inputs *(UGX)*	4798	1356	1356
Marginal Value Products for:			
Land (ha)	61323	60311	60311
Labour (man-days)	378	324	324
Planting materials (N/N).	3.46	3.24	3.24
Capital (N/N)	2.39	2.66	2.66
Other inputs (N/N)	2.14	1.97	1.97
Factor prices of:			
Land (ha)	23674	13742	13742
Labour (man-days)	3976	3680	3680
Planting materials (UGX)	2.4	1.3	1.3
Capital (UGX)	1	1	1
Other inputs (UGX)	1	1	1
Allocative efficiency Indices			
Land (ha)	2.59	5.02	3.14
Labour (man-days)	0.1	0.05	0.4
Planting materials (UGX)	1.44	2.31	1.53
Capital (UGX)	2.39	2.54	4.73
Other inputs (UGX)	2.14	1.82	3.33
Mean allocative efficiency	1.73	2.35	2.63

Field survey data, 2008

The large-scale growers need to reduce their use of land, planting materials, capital and other inputs by 214, 53, 373 and 233%, respectively and increase their use of labour by 40%. The needed reduction in capital, as suggested by this result, is rather paradoxical since large-scale operation is synonymous with increased use of capital. The behavior of this variable needs to be further investigated to establish the extent the level of inefficiency in the use of the other

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resources has brought an overwhelming influence on its use. This notwithstanding, the result shows that potentials still exist for increasing the levels of mangoes output under existing resource base if the necessary adjustments are made in levels of their use. As mango trees are drought stress tolerant, production without supplementary irrigation is possible. However, where applied, irrigation ensures high yields and good fruit quality. This corroborates with what was reported by Sauco, (2004).

Mean Efficiency Indices for the different categories of mango growers

The hypotheses that the various scales of mangoes growers were equally efficient in their resource allocation were rejected when examined in relation to the *Mean Efficiency Indices* (MFI) as specified in equation 3 and shown in Table 3. The computed Z-scores for each pair of growers were significantly different from their critical Z-values at 1% level, leading to the rejection of the null hypothesis in each case.

Table 3: Distribution of the MFI for the various scales of growers

Pairs of scales of growers	Null hypothesis	Computed Z-score	Critical Z-value at 1% sign. level	Decision
Medium-scale versus small	1.73 = 2.35	3.33	2.44	Reject
Medium-scale versus large scale	2.32 = 2.63	2.58	2.44	Reject
Small scale versus large scale	1.73 = 2.63	3.51	2.44	Reject

The analysis suggests that, on the basis of aggregate resource use, the level of inefficiency was least among the medium-scale growers, followed by the small-scale growers and then, the large-scale growers. The index for the small-scale growers, was closest to unity, followed by that of the medium-scale growers and then, by that of the large-scale growers. This means that the level of inefficiency needs to be reduced by 0.73, 1.35 and 1.63 for small, medium and large scale growers, respectively. This result is an early signal that the supercilious ideals of government in promoting large scale production of mangoes may not be realized by reliance on the present large-scale growers. This result indicates that the best allocative efficiency of resources by the farmers would be obtained, when they operate as small-scale growers. So, unless adequate measures are urgently taken to improve the current level of resource-use efficiency of large-scale growers, the small and medium-scale growers, as presently constituted, appear to offer a better alternative for the realization of the objectives of this policy. More enlightenment campaigns are

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needed for the large-scale growers to educate them on techniques for improving their performance in aggregate resource-use.

Economic efficiency of mango growers and their determinants

The estimated function for the economic efficiency of the various scales of growers and their determinants were found as follows:

$$Ln\prod = \underset{(3.22)}{78.14^*} + \underset{(0.34)}{0.68\chi_1} + \underset{(0.31)}{0.39\chi_2^*} + \underset{(0.03)}{0.58\chi_3^*} + \underset{(0.43)}{1.32X_4^*} + \underset{(0.02)}{0.87\chi_5^*} + \underset{(0.16)}{0.38D_6^*} + \underset{(0.22)}{0.69D_7^*}$$

Where: R' = 0.78021; n = 60; Figures in Parentheses are Standard Errors of Estimates.

The estimated function in Eq. 5 shows that the variables included in the function explained about 78% of the variations in the level of profit earned by the various scale of growers in the study area. The function shows that, except for the wage rate (X_1), which was not significant at 5% probability level, all the other variables, including the Dummies, were significant at 5% probability level. The variable D_1 however did not conform with the apriori expectation, being inversely related to farm profitability, while D_2 conformed with the apriori expectation, being positively related to farm profitability. This means that although the scale of operation had significant influence on the level of profit earned by the different categories of farmers in the study area, it did not influence farm profitabili1y in the same direction. In comparative terms, the intercept term for the small-scale growers (with Dummy, i = 1 for small-scale growers and zero otherwise) was least, decreasing by 38% per farmer, followed by the medium-scale growers (with Dummy, i = 1 for medium-scale-growers and zero otherwise), which increases by 69% per producer. The estimated level of profitability was higher for the large-scale producers (the excluded category, with Dummy, i = for all scales of growers). This translates, respectively to marginal rate of increase of UGx. 1166; 1182 and 1172 per small, medium and large-scale growers. This suggests that the level of profitability is highest among medium-scale growers, followed by the large-scale growers and then the small-scale growers. From the results of the Z-test as well as the F-test conducted at 5% probability, the hypotheses of no significant difference in the level of profit earned by the various scale of growers, as well as that of their influencing factors were rejected. The result showed that the medium-scale growers earned significantly high level of profit, followed by the large-scale growers and then, the small-scale growers. The result also showed that the level of influence of the determining factors followed the same profit trend for the various scale of growers.

The result further shows that cost of capital(X_2) was significant and appropriately signed capital

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utilized (X_3) was positively signed, showing that profitability was increased following increased use of capital. Although, this does not fall in line with the earlier result that suggested the need for these growers to reduce the use of capital, it conforms to economic theory and suggests the need for further empowerment of these farmers by way of increased loan facilities to enable them acquire more farm assets. Cost of other inputs (X_3) was significant and positively related to farm profitabili1y among all scales of growers. This did not conform to the a priori expectation and suggests that profitabili1y increased as cost of other inputs increased. This would only mean that the returns earned from increased use of other inputs exceeded the cost of financing them. The pattern of investment made from loans obtained for mango production (X_4) significantly influenced the level of profitability of the farm growers in the study area. Results showed that the small, medium-scale and large-scale growers invested 65, 85 and 45% of their loan capital in current assets, respectively, while the balance of 35, 15 and 35% of the loans were invested in fixed assets.

CONCLUSION

Although, some degree of inefficiency exists among the three categories of mango growers, the level of inefficiency was least among the medium-scale growers and highest among large scale growers. The present level of resource-use efficiency, suggests that the lofty ideals of government in promoting large scale production of mangoes may not be realized by reliance on the present large-scale growers. Medium and small scale growers, as presently constituted, appear to offer a better alternative for the realization of the objectives of this policy. The farmers would not attain the best level of efficiency unless they operate at a medium scale. The significant factors that affect profitability of mangoes production include the wage rate for an adult farm worker, the cost of capital, type and magnitude of capital utilized, cost of other input and pattern of loan use.

RECOMMENDATION

To attain allocative efficiency, all categories of growers should make some necessary adjustments in their resource-use. The small scale mango growers should reduce their use of land, planting materials, capital and other inputs by 339, 149, 166 and 97%, respectively and increase their use of labour by 91%. The medium scale growers, on the other hand, should reduce their use of land, planting materials, capital and other inputs by 159, 44, 139 and 114%, respectively and increase their use of labour by 90%. The large-scale growers should reduce their use of land, planting materials, capital and other inputs by 214, 153, 373 and 114%, respectively and increase their use of labour by 60%. More enlightenment campaigns should be carried out, with particular reference to the large-scale growers; on modem farm management techniques that

would enable them improve their performance in resource-use. Further empowerment should be selectively extended to the farmers by way of enhanced loan facilities to enable them acquire more productive farm assets.

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