An Assessment of Determinants Responsible for Low Mango Productivity in District Muzzafargarh, Pakistan

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Abstract: Mango which is also known as the king of fruits in the country is the second largest growing fruit after citrus in Pakistan. Although mango is being grown in more than hundred countries none of them is comparable to Pakistani mango which is famous for its unique taste all over the world. Pakistan's per hectare production is much lower than its potential. The purpose of this study was to assess those factors which are preventing mango growers from getting its potential yield. For this major mango producing area, Muzzaffargarh was selected. The 110 randomly selected farmers were interviewed with a well-designed questionnaire. The mango growers were divided into three categories on the basis of landholding. The Cobb-Douglas model was used to assess the effect of different factors on the productivity. The education level and age of large farmers was found highest among small and medium farmers. Large farmers were enjoying significant high profit per acre with US$519.58 as compared to medium farmers (US$454.15) and small farmers (US$395.10). The independent variables were explaining almost 89 percent variation in productivity of mango. The significant positive effect of orchard experience, access to extension services, the quantity of NPK, quantity of pesticides and labour cost was found. The age and intercropping practices in mango orchard had a significant negative effect on mango production. Credit facilities must be made available at lower interest rate and the range of extension services must be enhanced to increase the productivity of mango.

Key words: Mango productivity, determinants of productivity, Cobb-Douglas, Muzzafargarh, orchard.

1. Introduction

Although the share of other sectors like services sector in Pakistan is increasing (59.9%) gradually in the economy still agriculture is considered one of the most important sectors of the economy with a share of 19.8 percent in GDP of the country [1]. Thus agriculture has a vital role in Pakistan's economy because it provides an opportunity to work to a larger proportion of labour force. According to economic survey of Pakistan, 42.3 percent of the total labour force is attached directly or indirectly to agriculture [1]. Agriculture comprises of many subsectors and horticulture sector is one of the most important subsectors of agriculture. Pakistan is the 6th largest country in the world [2]. For this reason, the horticulture sector has prime importance to fulfill the

basic necessity of food of a large population. Fruit cultivation is also a part of horticulture and sub-continent is a habitat of mangoes.

Mango is also a national fruit of Pakistan along with India, Philippine and Bangladesh [3]. Mangoes are liked all over the world and also in Pakistan. Mango which is also known as the king of fruits in Pakistan is the 2nd largest produced fruit in Pakistan after citrus [4]. Mango is grown in almost more than 100 countries of the world but none of them could be compared to Pakistani mango which is famous all over the world due to its unique and delicious taste. Pakistani mango is high in fiber low in calories and a few carbohydrates, calcium iron potassium, iron and a little protein [5].

Pakistan is the 4th largest producer of mango (1,783 thousand tonnes) in the world after India (16,337 thousand tonnes), China (4,351 thousand tonnes) and Thailand (2,550 thousand tonnes). In Pakistan, Punjab

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is the major producer of mango with the production of 1,380 thousand tonnes. The demand of Pakistani mango is rising constantly. Pakistan mainly exports mango to Afghanistan, Oman, Qatar, Saudi Arabia, UAE, and Germany. UAE is the largest importer while Oman and Saudi Arabia are second and third largest importers of Pakistani mango respectively [6]. The total share of Pakistan in mango export is 7.60 percent [7].

Pakistan produces 4.61 percent of total mangoes of the world [8]. Per hectare average yield of mango is 11.20 tonnes in Pakistan which is far below than its potential yield of 15 tonnes [6]. Pakistan lies at a 13th position in per hectare yield of the mango [9]. Low productivity is due to poor management, post-harvest loses as farmer lacks in knowledge [10]. According to Saeed et al. [11], the main reason for low yield was infected trees and poor management in handling mango. According to Mohisn et al. [12] poor management and pest diseases are severe problems in mango production. In the same study, he found that people do not adopt recommended practices for mango cultivation. Most of the studies by Bakhsh [13] and Ahmad et al. [14] were conducted to determine the financial benefits of orchards in other areas of the province. All above-mentioned problems responsible for the low productivity of mango are theoretical based and none of them explained the empirical influence of social and management factors on yield or productivity. So there is little data available for mango growers about those factors affecting mango productivity. That's why this study is planned to assess those social and management factors affecting mango productivity. It is hoped that this study will help to manage those problems in an effective way to increase the mango productivity. The specific objective of this study was to assess the factors affecting the mango productivity in Muzzafargarh district of Pakistan.

2. Methodology

2.1 Study Area and Sample Size

According to the objective of the study, the selected study area was Muzaffargarh. This district is one of the major contributors to the mango production [15]. The district has four tehsils and due to significant share in mango production of the district, tehsil Ali pur was considered appropriate for this study. The Ali pur tehsil has four union councils and from each union council, sampled mango growers were nominated. For sample mango growers the random sampling technique was applied and total 110 mango growers were interviewed by a well-designed questionnaire which was modified before final data collection according to the results of preliminary study confined to a limited number of interviews with mango growers.

2.2 Data Analysis

After data collection, the variables were coded and data about variables were entered into computer software SPSS to make data available in an easy form for data analysis. After data entry, the descriptive analysis was performed. For comparison, three categories have been developed based on land holding by the farmers. Farmers having less than 12.5 acres land were categorized as Small Farmers, those who had farms between 12.5 and 25 acres of land were regarded as Medium Farmers and farmer having land greater than 25 acres were characterized as Large Farmers. In a previous study of guava orchard, growers were divided into three small, medium and large categories according to their land holding [16]. Generally, in Pakistan, the farmers having land holding less than 12.5 acres are considered as Small Farmers and those having land holding between 12.5 to 25 acres and more than 25 acres are considered as Medium and Large Farmers respectively [17]. Table 1 presents frequency and percentage of farmers. In study

Table 1   Sampled farmer categories.

Farmer categories	Frequency	Percent
Large Farmer	32.00	29.09
Medium Farmer	31.00	28.18
Small Farmer	47.00	42.73

area the percentage of small farmers was high. Large farmers' proportion was 29.09 percent while 28.18 percent of farmers were medium landholders. The variable comparison was performed by using one-way Analysis of Variance (ANOVA).

2.3 Conversion of Yield/Plant (Peti) into Yield/Acre (kg)

Locally farmers have no idea about the yield per plant in Kilograms (kg). Actually, they know yield per plant in form of an average number of peti (a type of wood made box using for packing of mango at the farm). So one peti of mango contains 7 kg mangoes. The following formula was applied for getting the yield per acre.

Yield per acre = (Average number of peti per plant) × (7) × (Number of plants per acre)

2.4 Factors Affecting Mango Productivity

Factors affecting the productivity of mangos were assessed by Cobb-Douglas production function. The model specifications are considered for this study. Ebiowei et al. [18] also had applied the same model in assessing the factors affecting the banana productivity. The general form of model that shows the relationship between dependent and independent variables is as:

$Y = f(X_iD_j)$

where:

Y = Log of mango output per acre (kg)

X_i = Vector of quantitative variables i = 1, …8

D_j = Vector of qualitative variables j = 2, …8

The more specific form of the model can be written as:

$\ln Y = \beta_o + \beta_1 \ln X_1 + \beta_2 \ln X_2 + \beta_3 \ln X_3 + \beta_4 \ln X_4 + \beta_5 \ln X_5 + \beta_6 \ln X_6 + \beta_7 \ln X_7 + \beta_8 \ln X_8 + \beta_9 D_9 + \beta_{10} D_{10} + \mu$

Xs are the independent variables and D is the dummy variable in which,

X_1= Age

X_2= No. of Schooling Years

X_3= Orchard Experience

X_4=Orchard Size

X_5= Age of Orchard

X_6= Quantity of NPK

X_7= Pesticides Number

X_8= Labour Cost

D_9= Dummy for Intercropping, 1 if respondent practicing intercropping, otherwise 0

D_{10} = Dummy for Extension Services, 1 if respondent getting extension advice, otherwise 0

In this study, ten independent variables were assumed to affect the productivity of mango. Two new independent variables NPK and labour cost were introduced to check their effect on mango productivity. These variables were not taken in previous studies. For dummy variables, the farmers who were availing extension services were assigned value 1 otherwise 0. Similarly for intercropping dummy 1 was used for those farmers doing intercropping with mango orchard and for others 0.

3. Result and Discussion

3.1 Descriptive Statistics

Table 2 represents descriptive statistics of mango growers according to their categories. The large mango growers on an average are older (50.38 years) as compared to medium (46.65 years) and small (46.89 years) mango farmers. The education level is higher among large farmers as compared to small and medium farmers. Large mango farmers are also richer in orchard experience of mango (28.38 years) as compared to medium (24.55 years) and small (20.87

Table 2 Descriptive statistics.

Farmer categories	Large farmer		Medium farmer		Small farmer	
	Mean	Standard deviation	Mean	Standard deviation	Mean	Standard deviation
Age	50.38	10.57	46.65	12.41	46.89	13.06
Education	12.44	2.71	10.81	3.64	10.74	3.93
Orchard experience	28.38	9.11	24.55	11.54	20.87	12.03
Orchard size	13.00	8.19	5.74	4.89	2.36	1.60
Age of orchard	27.91	8.64	26.26	7.46	22.94	8.54
Yield (kg/acre)	2,089.41	684.81	1,784.17	672.64	1,656.15	500.83
Working capital ($/acre)	334.97	98.25	275.55	83.33	282.25	89.08
Income ($/acre)	854.55	280.08	729.7	275.10	677.35	204.83
Profit ($/acre)	519.58	268.17	454.15	257.19	395.10	222.46

Table 3 Factors affecting mango Productivity.

Variables	β	Std. error	t-value	Sig.
Constant	6.43	0.35	18.62	0.00*
Age	-0.20	0.06	-3.16	0.00*
Education	0.03	0.04	0.93	0.36^{NS}
Orchard experience	0.14	0.04	3.83	0.00*
Orchard size	0.00	0.01	-0.16	0.87^{NS}
Orchard age	0.01	0.04	0.19	0.85^{NS}
Dummy intercropping	-0.18	0.04	-4.89	0.00*
Dummy extension	0.11	0.04	2.81	0.01*
NPK	0.06	0.03	2.04	0.04**
Pesticides	0.33	0.05	7.24	0.00*
Labour	0.08	0.03	2.37	0.02**

(*), (**) means significant at 1 and 5 percent respectively and NS means non-significant. $R^2 = 0.89$, F Value = 83.367.

years) as shown in the table. The yield of mango, as well as income per acre, was found higher in large farmers than small and medium mango growers. In a similar study, Khushk et al. [16] witnessed that large farmers were better in production than medium and small farmers. There was not much difference in the age of mango orchards among all three categories.

3.2 Factors Affecting Mango Productivity

Table 3 shows the relationship between different factors and mango productivity. The model is highly significant with the p-value 0.00 and F-stat value 83.367. Value of R square means 89 percent variation of productivity is due to included independent variables. Age was statistically significant but it is inversely related to productivity which means as age will increase production of mango will decrease. It may be due to the low concentration of old farmers

and unfamiliar with new technologies related to the mango orchard. Hassan et al. [19] found old farmers are not more likely to adopt new recommended practices of mangoes as compared to young farmers. Orchard experience is highly significant and directly related to productivity which indicates that as orchard experience will increase the productivity will increase. Education, the age of orchard and orchard size are statistically insignificant. Because it is possible that a farmer with small orchard size and low education is taking more productivity than large orchard size farmer. Intercropping has significant negative effect on productivity. Similar results were witnessed by Lachungpa [20] when he intercropped citrus with maize the yield of citrus was reduced. Extension services also significantly and positively affect the productivity of mango because extension workers may provide information about new technologies, new

mango varieties, pest control techniques etc., which all could increase the productivity of mango. In another study, Ebiowei et al. [18] found that banana production was positively affected by extension services.

4. Conclusion and Recommendations

Yield of small farmers (1,656.15 kg) is much lower than medium (1,784.17 kg) and large (2,089.41 kg) farmers. The small and medium mango farmers lack in working capital as well as the adoption of new technologies. The average age of farmers was high in all three categories. The age of farmers is significantly and negatively affecting the productivity of mango. Orchard size is insignificantly affecting mango productivity. Intercropping had a negative but significant effect on mango productivity. It was found that extension services have a strong positive significant effect on the productivity of mango. Therefore, it is recommended that credit facility must be provided to all mango farmers' especially small mango growers on less interest rate and through a simple procedure. Although most farmers are older who may not be adopting new techniques which decrease mango productivity, so the extension workers of the area should visit them regularly and convince them and provide information to those farmers about mango to increase productivity. The intercropping must be discouraged because it decreases the productivity of mango.

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