FACTORS RESPONSIBLE FOR DECLINE IN GUAVA (*PSIDIUM GUAJAVA*) YIELD

Ishtiaq Hassan* , Wasif Khurshid** and Khalid Iqbal***

ABSTRACT

A study was conducted during the year 2009 to find out the factors responsible for decline in guava (*Psidium guajava*) yield. For this purpose three districts Sheikhupura, Kasur and Faisalabad, Pakistan were selected being core area for guava cultivation. To examine impact of various inputs on guava production, the Cobb-Douglas production function model was used. Factors which caused decline in guava yield were found to be physical beating of flowers, excessive intercropping and number of sprays. The physical beating of flowers (-0.317 coefficient value) and intercropping (-0.200) proved as two major depressing factors. Intercropping in both summer and winter seasons went in a long way in depressing yields. Flower shedding by beating with clubs proved to be more significant (-0.317). It was found that productivity decline can be arrested as well as be reversed with adequate number of irrigations, proper use of fertilizers and adopting good management measures.

KEYWORDS: *Psidium guajava;* intercropping; yield decline; Pakistan.

INTRODUCTION

Guava (*Psidium guajava* Linn.*)* belongs to the family *Myrtaceae* and is one of the most gregarious fruit trees. Guava fruit contains high amounts of vitamins A, B1 (Thiamin), B2 (Riboflavin) and C. The vitamin C contents of guava fruit are four times higher than those of citrus. Guava is believed to be originated in tropical America (Mexico to Peru). At present, it is mainly produced in South Asian countries, the Hawaiian Island, Cuba, Brazil, Pakistan and India. In Pakistan, it is grown on an area of 62.3 thousand hectare giving 512.3 thousand tons total annual production and 8223 kg per hectare yield. The Punjab province shares 49.7 thousand hectare in area with a total production of 422.3 thousand tons and 8497 kg yield per hectare (1).

***Executive District Officer (Agriculture), ***Agriculture Officer (Extension), Faisalabad, **Additional Secretary Planning, Govt. of Punjab, Agriculture Department, Lahore, Pakistan.**

Guava can be grown on a wide variety of soils from heavy clay to light sandy and with a range of pH 4.5 (acidic) to 8.5 (alkaline). Guava is a very productive and highly profitable fruit crop. It is liked by fruit growers due to its wide adaptability and higher returns per unit area.

The major guava growing areas include Shariqpur, Kasur, Lahore, Sheikhupura, Sangla Hills and Gujranwala in Punjab; Kohat, Haripur and Bannu in Khyber Pakhtunkhwa, and Larkana and Hayderabad in Sindh. Thus, it has attained the status of the fourth most important fruit of the country and the third most important fruit of the Punjab.

Since last decade the guava production has been adversely affected by a decline problem (Table 1). Decline of guava is a national problem in Pakistan and has resulted in yield reduction from 8920 kg per hectare in 2003-04 to 8223 kg per hectare in 2008-09 (1). In many orchards, a large number of guava plants has declined and become unproductive, particularly in different guava growing districts of the Punjab, namely Lahore, Sheikhupura, Faisalabad, Jhang and Sargodha.

Table 1. Statistics regarding production and yield of guava in Pakistan.

S. No.	Year	Area (000 hectare)	Production (000 tonnes)	Yield (kg/ha)
1	2003-04	61.6	549.5	8920
2	2004-05	63.5	570.6	8986
3	2005-06	61.7	552.2	8950
4	2006-07	62.5	555.3	8885
5	2007-08	63.3	538.9	8513
6	2008-09	62.3	512.3	8223

Source: Anon (1).

The yield reduction occurs due to poor management practices and post harvest losses. Post harvest losses are estimated at 20 to 40 percent of total fruit production in Pakistan (7). Old planting material, extensive fruit drop and attack of insect pests and diseases are major factors that affect guava production badly (5).

The studies on guava are scanty in the literature, however, few studies have been carried out to investigate yield potential in guava (10), effect of deblossoming on fruit size and quality (9) and its nutritional status on substandard soil sites (3, 8).

The present study was conducted to investigate the factors responsible for decline in guava yield in major guava growing area. The results of study may

be helpful for the policy makers and planners to design befitting strategy to improve the situation.

METHODOLOGY

This study was conducted during the year 2009 by selecting three districts i.e. Sheikhupura, Kasur and Faisalabad (Pakistan) as these have major acreage of guava. The data were collected through a questionnaire. Sample comprised 110 guava growers. They were selected wittingly so as to get information on all aspects affecting guava yield. To examine the impact of these factors, the Cobb-Douglas production function model was used as it estimates real contribution of each and every factor affecting yield positively or negatively.

Important factors affecting yield i.e. yield per acre, number of irrigations, number of sprays, urea and DAP fertilizer, split application of fertilizer, experience of guava growers, intercropping, physical beating of flowers and spreading of guava plant branches, were incorporated in the analysis. Many factors have been still left out to keep study within manageable limits. Cobb Douglas production function was fitted, which is detailed below.

Ln YLD = b_0 + b_1Ln Irrino + b_2 Ln Sprayno + b_3 Ln Urea + b_4 Ln DAP + b_5 Ln Guava exp + b_6 DumySpitfertilizer + b_7 Dumyphysbeat + b_8 Dumyintercrop + b_9 Dumyspread + U

Ln YLD = Natural logarithm of yield per acre in kg

b_0 = Constant

Ln irrino = Natural logarithm of No. of irrigations

Ln Sprayno = Natural logarithm of No. of spray

Ln Urea = Natural logarithm of urea

Ln DAP = Natural logarithm of DAP

Ln Guava exp = Natural logarithm of guava growing experience

DumySpitfertilizer = Dummy for split fertilizer application

Dumyphysbeat = Dummy for physical beating of flowers

Dumyintercrop = Dummy for intercropping

Dumyspread = Dummy for spreading the branches of guava plant

U = Random error term independently and identically distributed with zero mean and constant variance.

b_1 to b_9 are coefficient of the parameters.

Regression analysis

The factors that affect the guava yield were investigated through multiple regression analysis. This technique is widely used to understand which of the independent variables are related to the dependent variable, and to explore

the forms of these relationships. Further, it is a cheap, easy-to-perform measurements as a substitute for more expensive or time-consuming ones. It has an additional advantage to describe precisely the response levels according to the values of a few controlled factors.

The Cobb-Douglas production function was estimated using the ordinary least square (OLS) method. It can handle multiple inputs in its generalized form. Further, it can handle different scales of production. Various econometric estimation problems, such as serial correlation, hetroscidasticity and multicolinearity can be handled adequately and easily. It is further argued that it facilitates computations and has the properties of explicit representability, uniformity, parsimony and flexibility (2, 11).

The results (Table) show that R^2 value of 0.51 can be regarded as quite a good fit in view of the cross sectional data since it implies that about 51 percent variation in yield is explained by the independent variables on guava yield included in the model.

RESULTS AND DISCUSSION

Function analysis indicates that following factors contributed positively in order of their significance.

1. No. of irrigations
2. Split fertilizer application
3. Experience of guava growers
4. Urea
5. DAP
6. Spread of plants (plant canopy)

The factors which had depressing effect on yield, are given below in order of harmful effect.

1. Physical beating of flowers
2. Intercropping
3. No. of sprays

It is evident from the quantitative results (Table) that value of co-efficient for number of irrigations is 0.699, which indicates that one percent increase in this factor results in increase in yield upto 0.70 percent. However, this increase is statistically non-significant. As far as the number of sprays is

concerned it had -0.081 coefficient value indicating that one percent increase in number of sprays results in decrease in yield upto 0.081 percent. The value of coefficient for application of urea and DAP are 0.151 and 0.048, respectively. These values indicate that one percent increase in urea and DAP results in increase of guava yield by 0.15 and 0.05 percent respectively, which is statistically significant.

Table. Regression analysis of guava production functions, Cobb-Douglas type.

Variables	Coefficients	Std. Error	Significance
Constant	1.652	0.623	0.010
Lnirrino	0.699	0.155	0.000
Lnsprayno	-0.081	0.084	0.339
Lnurea	0.151	0.119	0.208
Lndap	0.048	0.027	0.086
Guavaexp	0.008	0.002	0.000
DumySplitfertilizer	0.206	0.075	0.008
Dumyphysbeat	-0.317	0.080	0.000
Dumyintercrop	-0.200	0.076	0.011
Dumyspread	0.158	0.077	0.043
R^2	0.512		
F value	61.236		
Number of observations	110		

Dependent variable = logarithm of yield (kg per plant)

The value of coefficient for guava growing experience is 0.008 which is positive but statistically non- significant. The positive values for split fertilizer application (0.206) and spread of plant (0.158) indicate that one percent increase in these factors results in 0.21 and .016 percent increase in guava yield, respectively. The physical beating of flowers and the intercropping are the two depressing factors on guava yield with negative values of coefficient. The value of coefficient for physical beating of flowers is -0.317 which is highly significant while it is -0.200 for intercropping.

These results agree to the findings of Khushk *et al.* (5) who concluded that major production inputs and management practices affect guava production. If inputs are applied at right time and according to the recommendation and orchards are managed properly, a positive increase in guava production can be achieved.

CONCLUSION AND RCOMMENDATIONS

The study concludes that physical beating of flowers and intercropping are two major depressing factors responsible for decline in guava yield followed

by number of sprays. Intercropping in both summer and winter seasons went in a long way in decreasing yields. Flower shedding by beating with clubs proved defy productive. It was found that productivity decline in guava can be arrested as well as be reversed with adequate irrigations, proper use of fertilizers and adopting good management measures.

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