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Abstract

This study was undertaken to identify the factors affecting sugarcane production in Pakistan. Data were collected from 387 sugarcane growers from Sindh, Punjab and NWFP province. Data were collected during the period 2007-08. The study reveals that the costs of inputs of sugarcane i.e. urea, DAP, FYM, land preparation, seed and its application, weeding and cost of irrigation were the important factors which influenced on the returns of sugarcane growers. The effectiveness was examined by using the Cobb-Douglas production function; MVP and allocative efficiency were calculated. The coefficient of multiple determinations R^2 was 0.9249, which indicated that 92% variation in the cost of inputs was explained by all explanatory variables and the adjusted R^2 was 92%. The F-value was 666.94 and was highly significant at 5% level of significance, indicating that the regression model was well fitted. The high prices of inputs, low price of output, delay in payments and lack of scientific knowledge were the major problems in sugarcane production. In order to enhance the productivity of sugarcane in the country, government should solve the identified problems to increase the income of sugarcane growers.

Keywords: Sugarcane, urea, weeding, cost of irrigation, land preparation, seed, Cobb-Douglas function, resource allocation efficiency.

1. Introduction

Sugarcane is an important cash crop of Pakistan and plays an important role in the up lift of socioeconomic conditions of the growers. Rapid growth of sugar industry has contributed to economic development of the country. Sugarcane is the biggest source of revenue to the government because this crop fetches billions of rupees to the government in the form of duties and taxes. In recent industrial advancement sugarcane is not only

confined to sugar production, but its bi-products such as alcohol, chipboard, and dozens of others industrial chemical compound and can be manufactured during the sugarcane processing. Pakistan stands 5th position in terms of sugarcane production and 7th and 8th in terms of sugar production and consumption respectively in the world. Unfortunately, the country stands at a very low level of about 4 tone/ hectare. Currently sugarcane cultivation in Pakistan occupies 5% of the total cropped area and accounts for 17% of the gross value added by all crops.

In Pakistan sugarcane is widely planted in Sindh, Punjab and NWFP provinces. The highest sugarcane production was recorded in Punjab with the average yield of 690mds/acre during the year 2007-08, while the lowest sugarcane yield was recorded for NWFP province with an average yield of 566mds/acre during the same year. The average yield of sugarcane during the last few years ranges between 45 to 50 ton/hectare. It is one of the poorest among 16 sugarcane producing countries as a major crop. The yield of sugarcane is quite low, 500-800 mds/acre, considerably less than the potential yields. The gap between potential and actual yield is very wide due to poor management practices and post-harvest losses. It is also found that sugarcane production system has passed down from previous generations and is dominant among the growers. The traditional methods are commonly used in sugarcane management and labor is an important input in the sugarcane production process. Production process is not mechanized and is mostly labor intensive. Majority of the growers do not follow modern practices like proper use of FYM, inter-culturing, fertilizer application, sprays and timely irrigation. The problems of post harvest losses include improper handling, harvesting and inadequate transport facilities. Therefore, this study was conducted to investigate the major factors affecting sugarcane production in Pakistan.

2. Methodology

The study was conducted through primary data collected from sugarcane growers from three major sugarcane producing province of Pakistan. A survey methodology has been used to collect cross-section primary data because it is commonly used in the field of social sciences. A wide range of problems can be investigated by using this approach (Gall, *et. al*, 1996). Survey methodology provides the plan for the study and overall framework for collecting data. Survey design is an effective way to measure responses on fairly easy fashion as it uses well developed and interviewed questionnaire. The methodology includes data source, study area, sampling, data collection and data analysis procedure. Finally, it ends up with the farm cost calculation of sugarcane production.

3. Data Collection Procedure

The primary data were collected from the sugarcane growers by the use of well structured pre-tested questionnaire. Data were collected during the crop year 2007-08. With the questionnaire of sugarcane growers, information was collected on farm size, cropping pattern, labor costs, inputs costs, credit source, transportation, processing costs. This research was conducted in three major sugarcane producing provinces of Pakistan, i.e. Sindh, Punjab and NWFP. The study area consisted of 5 districts from 3 major sugarcane growing provinces. The selection of sugarcane growers was made in steps. First identified the main region(s) of the country where sugarcane production was most important in terms of volume of production. Five major districts were selected for this study.

After obtaining the lists of target population from each districts, the sample size was determined using the tables of "Selecting the samples from a given population" (Fitz-Gibbon & Morris, 1987; McCall, 1980; Wunsch, 1986) at 10% sampling error rate. From the sugarcane grower's total of 400 growers**,** 80 from each district were determined as a sample size. This sampling is called stratified sampling (McMillan, 1999). Because the groups are not equal in size, disproportional stratified sampling was performed. This sampling ensures that a sufficient number is selected from each group when groups are not equal in size (McMillan, 1999).

The questioning with growers was carried out by face-to-face interviews, which allowed very detailed insights in sugarcane growing in Pakistan. The interviews of sugarcane growers were carried out from November 2007 to May, 2008. Each interview with growers took around three hours. The study location and sample size is presented in (table1).

Table: 1 Location and Sample Size of the Study

Province	Districts	Sample Size
Sindh	Mirpurkhas	80
	Badin	80
Total		160
Punjab	Faisalabad	80
	Jhang	80
Total		160
NWFP	Mardan	80
Total		80
Grand total		400

4. Data Analysis

After completing the field survey, the data were edited and transferred from the questionnaires into worksheet as a database file. The variable names within the database file refer to the numbers of each question in the questionnaire. To measure the profitability of sugarcane production is based on the analysis of production cost.

4.1 Production Function Analysis

The term 'production function' it is mostly used as 'input-output relationship'. More specifically production function refers to the relationship between the input factor services and output of product. The purpose of this analysis is to identify the sugarcane input-output relationship in the form of mathematical function and to gain an understanding of the influences of the various inputs on sugarcane output. Once such relationships are understood then efficient use of inputs can be determined to achieve better crop yield. A Cobb-Douglas type production function has been used to estimate input-output relationship in sugarcane production.

4.2 Cobb-Douglas Production Function

The Cobb-Douglas production function in its stochastic form may be expressed as:

$$Y = \beta_1 x_{2i}^{\beta 2} x_{3i}^{\beta 3} e^{\mu i}$$

Where

Y	=	Output
X_2	=	Labour input
X_3	=	Capital input
u	=	Stochastic disturbance term
e	=	Base of natural logarithm

From the equation it is clear that the relationship between output and the two inputs is non-linear. However if we log transform this model we obtain:

$$\ln Y_i = \ln \beta_1 + \beta_2 \ln X_2 + \beta_3 \ln X_3 + \mu_i$$
$$= \beta_0 + \beta_2 \ln X_2 + \beta_3 \ln X_3 + \mu_i$$

Where $\beta_0 = \ln\beta_1$

Thus written, the model is linear in the parameters β_0, β_2 and β_3 and is therefore a linear regression model. Notice, though it is non-linear in the variable Y and X but linear in the logs of these variables. In short, it is a *log-log, double log or log linear model*, the multiple regression counter part of the two variable log linear model (Gujarati, 2003).

4.3 Analytical Techniques / Econometric Model

To determine the effects of variable input costs, Cobb-Douglas production function was estimated. This functional form of regression model used in this study was as follows for sole sugarcane production.

$$\ln Y = \beta_0 + \beta_2 \ln X_2 + \beta_3 \ln X_3 + \beta_4 \ln X_4 + \beta_5 \ln X_5 + \beta_6 \ln X_6 + \beta_7 \ln X_7 + \mu_i$$

Where, In = Natural logarithm, Y = Net Return/hectare, β_0 = Intercept, X_1 = Cost of Urea per hectare, X_2 = cost of DAP/hectare, X_3 = Cost of Farm Yard Manure, X_4 = Cost of land preparation/hectare, X_5 = cost of seed and application/hectare, X_6 = cost of weeding, X_7 = cost of irrigations/hectare, μ_i = Stochastic disturbance term, β_1 ---------- β_9 = Coefficients of respective variable.

The equation can easily be extended to include more variables. The marginal products are given as under:

$$MP_1 = dy / dx_1 = b_1 A x_1^{(b1-1)} x_2^{b2} = b_1 y / x_1$$

$$MP_2 = dy / dx_2 = b_2 y / x_2$$

The average product varies, depending on the level of input, so it is usually estimated at the average level. Where there are diminishing marginal return, b_1 and b_2 are less than 1. The Cobb-Douglas production function can be used to estimate returns to scale provided that all inputs will be included in the function. The advantages of this function are that it is easy to estimate, it may show diminishing marginal returns and it can also be used to

estimate return to scale. The possible disadvantages are that it cannot show both increasing and diminishing marginal returns in a single response curve, and that may lead to over-estimate of the economic optimum (Upton, 1996)

In order to examine the efficiency with which the sugarcane producers are using their resources, the Marginal Value Products (MVPs) for the respective factors were calculated from the Cobb-Douglas production function. The optimum allocation of resources was done under the constraint of available capital. The test for the Marginal Value Products is performed by deriving the following equation from the Cobb-Douglas function for assessing resource allocation efficiency.

$$MVP_i = A_i(Y / X)P_y = K_i P_i$$

Where:

MVP	=	Marginal Value Products of the i^{th} input, X_i
A	=	Output elasticity of the i^{th} input
Y	=	Average (mean) sugarcane net return/hectare
X	=	Average (mean) cost of the i^{th} input
P	=	average (mean) price of the i^{th} input
K	=	the allocative efficiency parameters of the i^{th} input

The input is over used if K < 1, and under-utilized if K > 1, the input is efficiently used if K=1. Results of the regression equations and a tabular form of presentation will be used to facilitate the discussion. The parameters of the regression equation are calculated using *Statistix* (Analytical Software). In addition, attempt has been made to describe and analyze the farmer's management practices in sugarcane farms. It is commonly believed that production expansion of any enterprise could be achieved by improving the existing production system.

5. Results

5.1 Sugarcane Production System

The aim of this analysis is to identify the major factors responsible for low sugarcane production and to explain various sugarcane production systems in the existing farming system in Pakistan. Also it emphasizes scope for enhanced management practices and identification of technical and socio-economic factors which limit the increase of sugarcane production in the study area. The main concern is to help assess incentives for sugarcane producers given those incentives for any product play a key role in its development and the distribution of benefits from its production. The efforts have been made to describe the management practices, input use, sugarcane varieties, insect-pests and disease problems.

5.2 Land Preparation

The use of different equipment other than simple cultivator is important for good seedbed preparation in order to get good germination and better crop stand. Sugarcane is a deep rooted crop and proper land preparation plays an important role in the development of cane root system, for achieving optimal growth of the crop. Land should be prepared by deep ploughing at least after every subsequent year. The use of more efficient equipment other than simple cultivator is important. Information about the extent of use of various types of equipment presently used by the farmers such as, disc

plough, goble plough, cultivator, leveller and bullock for land preparation were collected and it was found that the main use of modern equipment for ploughing were present in the study area. While the main source of ploughing was tractor 62.5 per cent followed by tractor and animal was 34.9 per cent and 2.6 per cent animals. An average 1 hour of ploughings of cultivator and goble and 1.5 planking were applied by the farmers respectively. Generally it was found that number of cultivator and goble ploughing and planking were used for seedbed preparation.

5.3 Planting Seasons

Sugarcane planting usually carried out in spring and autumn season. Autumn planting is recognized as high yields and high sugar recovery, compared to spring planting. In fact, October planting of sugarcane gives very luxuriant growth, which is mostly vulnerable to lodging. The crop gives good appearance till June-July but is subject to lodging in July or even earlier if there is windstorm or excessive rains. It was investigated that 27.4 percent of growers planted sugarcane in February, 20.7 percent in October, 15.8 percent in March and 11.1 percent in September. While 25 per cent of the growers in the study area planted in spring (Feb-March) and in autumn (Sept-Nov) seasons respectively.

5.4 Planting Method

The most common method of sugar cane planting is “overlapping”, “end to end” and “double set” methods. The overall per acre cost for planting/sowing was recorded Rs.872 respectively. Furthermore, it was inspected that none of the sample respondents used seed treatment before planting of sugarcane.

5.5 Soil Type

Sugarcane can be sown in all types of soil, while for better production clay loam type of soil is suggested which good in intake of water. In the formal survey, soil types were recorded according to the farmers own classification and terminology. Fore example clay soil was described as “pacci”, whereas loam and clay loam were described as “bhari”, sandy loam as “Halki” and saline patches were called as “Kallar”. While 46 per cent farmers perception was loam type soil, followed by 17.6 per cent sandy loam type of soil, and 15 per cent clay type of soils, 21.4 per cent were mixed type of soils were classified.

5.6 Farm Yard Manure

Farmers generally use quantity of farmyard manure to sugarcane crop in order to restore soil fertility for better yield as compared with other kharif crops. Well rotten farmyard manure should be applied prior to land preparation press mud from the sugar industry is another excellent source of organic matter and nutrients. It was investigated that in NWFP sugarcane growers highly applied an average 3.7 tractor trolleys per acre of farmyard manure followed by Punjab 2.5 tractor trolleys per acre, whereas very low use of farm yard manure was seen in Sindh of about 0.3 trolleys per acre. Despite the fact that the overall average usage of farm yard manure were recorded 1.9 tractor trolleys per acre.

5.7 Sugarcane Varieties

The sugarcane varietal adoption in Sindh was analyzed and found that overall THATTA-10 was the dominant variety and accounted for about 51.3 percent during 2006-07 and slightly decreased 49 percent during 2007-08. The other major recommended varieties included BL-4 and SPSG-26; were grown on 13.18 and 4.5 percent in 2006-07, while BL-4 and SPSG-26 had an increasing trend in the next cropping year acquiring 15.96 and

6.60 percent respectively during 2007-08. The varieties BL-4 and THATTA-10 were being adopted because of high sucrose content, having more than (18%). The other varieties Gulabi-95, NIA-98, L-113, L-116 and PR-1000 were in the initial stages of adoption. About 23 and 22 percent of the sugarcane acreage was allocated to non-recommended varieties during 2006-07 and 2007-08 respectively. Sugarcane varieties TRITON and CP-20/72 were the non-recommended cultivars grown on an area of 16.94 and 4.04 percent during 2006. However, the farmers are continuing cultivation of these varieties on account of certain characteristic of these varieties, especially for quality of white colour *Gur (molasses)*, etc.

Sugarcane varietial adoption in Punjab was analysed and found that overall HSF-240 was the leading variety and was planted on about 21.9 percent during 2006-07 and about 36.7 percent during 2007-08. The other major RSV included SPSG-79 and CPF-237; these are grown on 4.9 and 4.3 percent during year 2006-07, while these varieties had an increasing trend during 2007-08 acquiring 4.3 and 4.9 percent respectively. These varieties were mainly adopted because of high sucrose content. The varieties CP 43-33, CP 77-400, HSF-242, SPF-234, L-118, SPSG-26 and COJ-84 were released in the past and were in the stages of adoption. A large percent (60.8 and 44.7 percent) of the sugarcane acreage was planted under non-recommended varieties. While the figures illustrate a declining trend towards non-recommended varieties, the sugarcane varieties CPF-238 and CO-1148 were the main at non-recommended cultivars grown 56.4 and 3.9 percent during 2006, while in 2007 these varieties were prone and were growing on 37.7 and 3.9 percent area for CPF-238 and CP 77-400 respectively. However, the farmers were continuing cultivation of these varieties on account of certain characteristic of these varieties.

Sugarcane varietial adoption in NWFP was analysed and found that overall CP-77-400 was the leading variety and accounted for about 98 percent during 2006-07 and 2007-08 in the total sugarcane acreage in NWFP. A tiny area of almost 2 percent overall of the sugarcane acreage was allocated to non-recommended varieties. While the statistics illustrated that the trend was towards recommended varieties gradually.

5.8 Fertilizer

Fertilizer application is important for obtaining optimum yield of sugarcane. As mentioned earlier, the use of chemical fertilizer is unbalanced and inadequate. Most of the growers use only nitrogenous fertilizers while others use an unbalanced combination of N and P. The use of K is almost negligible in cane crop. It is very important to use proper doses of balanced fertilizers to obtain the maximum yield of cane crop. Department of Agriculture Sindh recommended the fertilizer doses of 200-300 kg, 100-125 kg P202 and 125-175 kg, K20 per hectares for various regions of the province. This is a generalized dose but to be specific it is advisable that cane fields should be got analyzed for N, P, K OM and EC level of soil. All phosphorus and potash and one fourth N should be applied at the time of planting. It is preferable that P and K may be applied in furrows where seed sets are to be placed. Rest of nitrogenous fertilizer may be applied in three equal splits i.e. during April, May and by mid June to February-March plant crop. It will be beneficial if N is applied in four equal splits to September planted crop besides one fifth applied at planting. In this it may be applied during March, April, May and June. September planted crop may be given an additional dose of 20 to 40 kg N (one to two bags of urea) per acre. It was inspected that, sugarcane growers applied urea an

average 5.48 bags per acre in Sindh followed by an average of 3.95 bags per acre in NWFP and 2.43 bags per acre in Punjab, while overall 3.91 bags per acre were used. An exceptional usage of NP, SSP SOP, Potash and zinc were observed in the study areas.

5.9 Weeding

Weeds in sugarcane restrict the light, nutrients and moisture to the crop and also serve as alternative hosts for many insect pests. These pests reduce the yield and adversely affect the cane quality. Proper land management is a key factor to control weeds. For proper weed control, Gesapax combi (80 WP) may be applied @ 1.4 kg per acre in medium textured soils and @ 1.8 kg per acre in heavy soils in 100 to 120 liters of water. The weedicide should be used with the device of the technical experts. It was investigated that averagely 3 weeding /hoeing was carried out each for manually, bullock and tractor in Sindh, similarly in Punjab 2 weeding /hoeing was carried out with tractor and bullock each, while in NWFP 4 weeding/ hoeing were carried out manually and 3 weeding/hoeing were carried out by tractor. Overall 3 weeding / hoeing were carried out in study area.

5.9 Irrigation

Irrigation water distribution and irrigation application methods are the most neglected aspects of this region. The growers of some distributaries are so favorable blessed that it is difficult for their haries to manage the surplus water in fields. The cane fields get inundated and root zones remain submerged in water. It not only depresses tillering, growth and cane yield but also leads to water logging (Malik and Gurmani, 1999). On the other hand some tracts are water stricken and lead to salinity.

The recommended number of irrigation were 26-33 for autumn crop and 21- 26 for spring crop (Sarfraz, 1999). Data shows that 62.3 per cent used canal water followed by canal and tube-well 34.9 and only 7.5 per cent used tube well for irrigation purpose. Whereas the average availability of canal water per 6^{th} turn was for 15 hours, while 79.8 per cent annual, 11.6 per cent seasonal availability of canal water.

Though the perception of 54.5 per cent of the farmers for underground water was fit for irrigation, while 45.5 per cent believed that the underground water was unfit for irrigation in the study area. Whereas the brackishness of subsoil water was also inquired form the farmers, where 49.1 per cent said there is no brackishness and 31 per cent said there is high brackishness 13 per cent said medium brackish and only 7 per cent said low brackishness in subsoil water.

5.10 Harvesting

Most farmers do their harvest without experimenting with modern techniques. Due to the lack of modernization and technology, sugarcane farmers suffer from high costs of production and low yields. Cane harvesting is done by hand, which employ labor intensively. On average, one person can harvest 25 mds (10000 kg) of cane in a day. The right time for harvesting sugarcane is when the crop is 12-14 months old. The sugarcane is cut as sticks from the ground level using a special type of knife. When the cane is harvested, it has a sugar content of about 10 percent. The roots are left in the ground as they will eventually sprout and grow to form the next crop. After cutting, the cane is stripped, topped and bound in bundles of 10-15 kg for loading. Harvested cane should be sent to the mill within 24-48 hours of cutting, since later transportation will result in

sugar loss. A high average per acre yield of sugarcane crop in Punjab was recorded 690 mds followed by Sindh 598 mds and apparently low in N.W.F.P was 566 mds. While overall average per acre yield was recorded 632 mds respectively in the study area.

5.11 Transportation

The sugar cane transportation is carried out by grower, contractor and factory. The average cost of transportation was recorded Rs.3296 respectively.

5.12 Factors Affecting of Sugarcane Production

Sugarcane production is a complex process and can be conceived as a function of several variables. The knowledge of the relative importance of the resource inputs influencing sugarcane production is essential for the sugarcane growers for introducing desirable changes in their operation at the micro level, and for the policy makers for formulating plans for improvements in agricultural sector productivity based on sound economic principles at the macro level. Production practices such as, soil type, planting time, varieties, inputs use and availability of irrigation water; they all have considerable impact on sugarcane production. While analyzing the input costs and net returns relationship of sugarcane production, the important input costs such as, urea, DAP, FYM, irrigation, seed and weeding were considered.

To assess the on-farm production efficiency, production function analysis had been carried out. This had been examined through cost of inputs and net returns relationships of the sugarcane producers in Pakistan. Thus a Cobb-Douglas type or *double log* production function was used to estimate the production function from a data set from the sugarcane producers survey carried out during, 2007-08. This approach was commonly used to assess input and output relationships (Upton, 1979; Heady and Dillon, 1961; Chennareddy, 1967). This method has easy to interpret results also provides a sufficient degree of freedom for statistical testing (Heady and Dillon, 1961; Griliches, 1963).

It has been argued that there are various problems in estimating input output relationship using survey data, because of the variables are not controlled as they are in an experiment (Upton, 1996). The environmental conditions and managerial ability vary from one to another farm. Ultimately, these factors affect the crop output. In order to achieve maximum income from sugarcane cultivation, the precise estimation of resources productivity and examination of allocation efficiency of various factors affecting sugarcane production would help the producers to allocate their resources optimally. Therefore, both inputs and output factors analysis has been carried out. For this assessment ordinary least squares regression method is widely used to estimate input and output relationships. This method enables not only to find the line of best fit, but also to measure how good a fit it is (Upton, 1996).

The factors were highly significant at 5% level for the sugarcane production cost. The cost of land preparation, FYM, seed, irrigation, urea, DAP, seed and its application, and weeding were set in the econometric model.

5.13 Cost of DAP

The regression coefficient of cost of DAP was positive (0.22510), which implied that 1% increase in the use of DAP would increase the returns by 0.2% holding other factors constant. This co-efficient was significant indicating that revenue increased significantly due to moderate use of DAP increased the profit effecting incline in the revenue shown in

Table 2. The estimated co-efficient was significant, indicating that the cost of DAP significantly influenced the sugarcane revenue due to moderate use of DAP.

5.14 Cost of Urea

The regression coefficient of cost of urea was positive (1.93717), which implied that 1% increase in the use of fertilizer would increase the returns by 1.9% holding other factors constant. This co-efficient was significant indicating that revenue increased significantly due to moderate use of urea increased the production effecting incline in the revenue (Table 2). The estimated co-efficient was significant, indicating that the cost of urea significantly influenced the sugarcane revenue due to moderate use of urea.

5.15 Cost of Land Preparation

The regression coefficient of the variable of cost of land preparation was positive (0.86008) at 5% level of significance, which is somehow significant indicating that the cost of land preparation should be reduced as it has positive impact on sugarcane revenue and returns.

5.16 Cost of Irrigation

The regression coefficient of cost of irrigation was positive (0.08484) and significant at 5% level of significance, which implied that 1% increase in use of irrigation would change in the cost of irrigation would be favourable for the production cost by 0.08%, keeping the other factors constant. Decreasing the cost of irrigation would decrease the cost of production causing a growth in the returns.

5.17 Cost of FYM and Application

The regression coefficient of cost of FYM and application was negative (-0.07020) and significant at 5% level of significance, which implied that 1% increase in the cost of FYM would benefit the returns by -0.07%, keeping the other factors constant. Increasing use of FYM it would increase production towards organic farming causing a strong crop and enrich the soil overall.

5.18 Cost of Seed and Application

The regression coefficient of the variable cost of seed and application was negative (-0.08420), which was non-significant, which implied that 1% increase in the use of seed and application would decrease the returns by 0.08%, indicating that the cost of seed and application must be improved as it has positive impact on sugarcane production and revenue.

5.19 Cost of Weeding

The regression coefficient of cost of weeding was negative (-0.16364) and significant at 5% level of significance, which implied that 1% increase in cost of weeding in sugarcane crop would decrease returns by -0.16%, and would be helpful, keeping the other factors constant. Increasing use of weedicide would help in decreasing weeds and shrubs from the sugarcane crop increasing the revenue and returns overall.

The coefficient of multiple determinations R^2 was 0.9249, which indicated that 92% variation in the input production cost was explained by all of the explanatory variables and the adjusted R^2 is 92%. The F-value was 666.94 and was highly significant at 5% level of significance, indicating that the regression model of production function fitted very well.

Table 2: Estimated value of coefficient and related statistics of Cobb-Douglas production function of sugarcane production

Variables	Coefficient	Std Error	t-Value	P-Value
Cost of Urea	1.93717*	0.28503	6.80	0.0000
Cost of DAP	0.22510*	0.02658	8.47	0.0000
Cost of land preparation	0.86008*	0.03899	22.06	0.0000
Cost of Irrigation	0.08484*	0.01507	5.63	0.0000
Cost of FYM	-0.07020*	0.02047	-3.43	0.0007
Cost of Seed	-0.08420^{ns}	0.07874	-1.07	0.2856
Cost of Weedings	-0.16364*	0.03288	-4.98	0.0000
R-Squared	0.9249			
Adjusted R-Squared	0.9235			
Resid. Mean Square (MSE)	0.48495			
Standard Deviation	0.69638			

* = 5% level of significance

The marginal value of products and allocative efficiency parameters (K) below shows that all major input cost in sugarcane production are under utilized by the growers. It appears that cost of, DAP, FYM, and Land preparation were poorly utilized and cost of urea, weeding and irrigation were over utilized in the sugarcane production. Results also suggest that there are opportunities to cut sugarcane production cost by decreasing major costs of inputs and management practices.

Table 3: Marginal value of Product and Ratio in sugarcane cost of production

Variables	**Coefficient**	**MVP**	**Ratio of (MVP) 'K'**
Cost of Urea	1.93717	5.19	0.61
Cost of DAP	0.2251	44.69	5.98
Cost of FYM	0.86008	11.70	3.67
Cost of Land Preparation	0.08484	118.58	14.23
Cost of Weedings	-0.0842	-119.48	-22.71
Cost of Irrigation	-0.16364	-61.48	-11.37

5.20 Problems and constraints of sugarcane production

Problems and constraints in production of sugarcane were asked from the growers. Further they were divided in three categories, such as economic, technical, and social problems.

The economic problems and constraints were related to the financial difficulties, which were lack of capital, high prices of input, low price of output, and late payments etc. All farmers reported that a high price of inputs was an acute problem in the way of practicing the production of sugarcane. High procurement problems were another major problem for the growers in the study area. Lack of resources was also important problem sugarcane growers' and low price of output. Technical constraints were related to production techniques and technologies, such as lack of scientific knowledge, land preparation, seeds, pesticides and insecticides, inadequate irrigation, and natural calamities, etc. Social problems were related to theft of sugarcane, cutting tops, most of the farmers reported that the villagers were habituated to cut the tops of sugarcane for using it as cattle feed. Sugarcane is an attractive and tasty crop, people; especially children are generally attracted to it. Chewing of cane was third social problems reported by sugarcane growers in the study area.

6. Conclusion

The present study was undertaken to identify the factors affecting sugarcane production in Pakistan. Data were collected from 387 sugarcane growers of Sindh, Punjab and NWFP province. Data were collected during the period 2007-08. The study reveals that the input costs of sugarcane i.e. urea, DAP, FYM, land preparation, seed and its application, weeding and cost of irrigation were the important factors which influenced the returns of sugarcane growers. Technical efficiency was examined by using the Cobb-Douglas production function; MVP and allocative efficiency were calculated. The coefficient of multiple determinations R^2 was 0.9249, and the adjusted R^2 was 0.9235. The F-value was 666.94 and was highly significant at 5% level of significance. It appears that cost of, DAP, FYM, and land preparation were poorly utilized and cost of urea, weeding and irrigation were over utilized in the sugarcane production. High prices of inputs, procurement problem, and low price of output and lack of scientific knowledge were the major problems in sugarcane production cost.

61. Recommendations

In order to enhance the productivity of sugarcane, government and other related organizations must work out the identified problems of the growers to produce more sugarcane in order to earn higher net return. Results also suggest that there are opportunities to reduce the cost of sugarcane production by decreasing the major inputs costs o and management practices.

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