# COMPARATIVE ECONOMICS OF FRESH AND RATOON SUGARCANE PRODUCTION ACROSS SELECTED DISTRICTS OF CENTRAL PUNJAB

Sonila Hassan, Arshed Bashir, Irfan Mehmood*, Muhammad Rizwan Yaseen**
and Muhammad Qasim*

## ABSTRACT

Comparative economics and net return differentials of fresh and ratoon sugarcane crop were investigated at Social Sciences Research Institute, PARC, Ayub Agricultural Research Institute, Faisalabad Pakistan during the year 2014. For this purpose three districts ie. Jhang, Faisalabad, and Chiniot were selected as study area. The study also investigated the contributing factors that affect the net revenues earned by sugarcane growers. The study sample consists of 150 sugarcane growers and for the purpose of analysis descriptive as well as empirical analysis was incorporated to attain the results. The estimates of descriptive analysis of average cost and returns exhibited total cost of fresh seed crop and ratoon crop as Rs. 95660 and Rs. 73961 per acre with net revenue of Rs. 28363 and Rs. 27429 per acre, respectively. Total cost of fresh seed sugarcane production was found higher in Faisalabad district (Rs. 97966) followed by Jhang and Chiniot. Gross and net revenues were estimated higher in Jhang district (Rs. 136405 and Rs. 40404.7/acre). In case of ratoon crop sugarcane growers of Jhang district had higher cost and net revenues i.e. Rs. 73359 and Rs.41473 per acre, respectively. The results of regression analysis for both fresh seed and ratoon sugarcane crop indicate inverse and significant relationship of cost indicators (fertilizer and irrigation cost) and significant positive relation between yield and price per kg of sugarcane with net return attained by sugarcane growers. Dummy variable analysis, however, indicates significant variation of net revenue earned by sugarcane growers of selected districts. In the light of regression estimates for dummy variables it can be concluded that sugarcane production is more profitable for growers of Jhang district followed by Faisalabad and Chiniot.

*Social Sciences Research Institute, PARC, AARI, Faisalabad .
**Department of Economics, Government College University, Faisalabad, Pakistan.

## INTRODUCTION

Sugarcane crop occupies an important position in national economy of Pakistan and it drives the large sugar industry. It also provides raw materials to clip board, paper and ethanol industry (6, 14). As an industrial crop, it is a significant source of livelihood through farming, processing and trading activities (4). Punjab province shares about 29 percent of the total reported area, 57 percent of total cultivated and 69 percent of the total cropped area of Pakistan. The contribution of Punjab in sugarcane production is prominent as it contributes 63 percent of total production (1). In 2012-13, area under sugarcane in Punjab was 767.7 thousand hectares with 42982 thousand tons of production. Yield of sugarcane in Punjab is 56 tonnes per hectare. Share of Punjab in area sown under sugarcane and sugarcane production is 68.0 and 67.4 percent, respectively (2).

Sugarcane being the second important cash crop, has the strong influence on the wellbeing of sugarcane growers as it contributes a major proportion of their derived income from agriculture. The returns to farmers are very important factor for the adoption of any cropping system. Various factors contribute to determine the net return of crop production for farmers like fixed cost, variable costs, output production, price and yield per acre. According to Girei and Giroh (5), despite all production constraints, sugarcane growers can retain their investment cost and generate positive

farm income from sugarcane cultivation keeping in view its ratooning impact with deduce cost of land preparation for at least one year.

Various studies have been conducted in the past to analyze the factors determining net revenue for sugarcane growers in different countries. Nazir *et al.* (10), identified input cost such as DAP, farm yard manure (FYM), land preparation, seed and its applications, weedicide and irrigation costs as the important factors influencing net returns to sugarcane growers. Masuku (8) observed that yield per acre, sucrose content and farmers quota have positive impact on farmers gross margin. Other factors affecting sugarcane grower's gross income include farming experience and distance to mill. Waswa *et al.* (13) reported that any increase in input cost depresses the net income attained by the sugarcane growers whereas any increase in yield per acre help them to retain their optimum level. According to Narayan (9), the factors affecting long and short term production and profitability of the sugarcane include harvested area, fertilizer use, labor force applied and prices paid to the sugarcane growers.

Keeping in view the importance of sugarcane crop in Punjab's economy and strong dependence of farmer's income on this annual crop; the present paper was designed to estimate the cost and revenue of fresh and ratoon sugarcane production and to identify the factors that significantly affect the net revenue earned by sugarcane growers across selected districts.

## METHODOLOGY
This study was conducted at Social Sciences Research Institute, PARC, Ayub Agricultural Research Institute, Faisalabad, Pakistan during the year 2014 in mixed cropping zone of central Punjab. Three districts viz Faisalabad, Jhang and Chiniot were selected for data collection. The study sample was consisted of total 150 sugarcane growers; 50 sugarcane growers from each district. Simple random sampling technique was used for sample selection and a pretested questionnaire was used for interview. The field survey for data collection was conducted in April,

2013. The cost of production of sugarcane fresh and ratoon were estimated by incorporating all costs such as land preparation cost ($LPC_s$), seed cost ($SC_s$), irrigation cost ($IC_s$), fertilizer cost ($FC_s$), miscellaneous cost ($MC_s$) (includes FYM cost, weeding cost, earthing up cost and furrow cost), harvesting cost ($HC_s$), land rent ($LR_s$) and opportunity cost of capital ($OCC_s$).

The variable cost (VC) for sugarcane production was calculated by following expression;
$$VC_s = LPC_s + SC_s + IC_s + FC_s + MC_s$$

Further the total cost was calculated by incorporating land rent ($LR_s$), harvesting cost ($HC_s$) and opportunity cost of capital (OCC) in variable cost ($VC_s$). The estimated expression is given below.

$$TC_s = VC_s + LR_s + HC_s + OCC_s$$

In the next step gross revenue of sugarcane crop was calculated by multiplying gross yield per acre with price per kg received by sugarcane growers. Furthermore net returns to sugarcane growers were estimated by following expression.

$$NR_s = GR_s - TC_s$$

Further the benefit cost ration was calculated to estimate the return on per rupee investment through division of net revenues to total cost.

To identify the factors affecting net returns attained by sugarcane growers (fresh and ratoon) a log linear model was used to obtain regression coefficients. The empirical estimation was based on profit function stated by Rahman *et al.* (11) and Samiullah *et al.* (12). The general functional form is as follows;

$$II = f(P, Q, C)$$

Here II is profit (net revenue Rs/acre), P is output price (Rs/kg) and C is cost per unit (Rs/acre)
Based on profit function the general econometric model may be given as;

$ln\ Y = \beta_0 + \beta_1\ ln\ X_1 + \beta_2\ ln\ X_2 + \beta_3\ ln\ X_3 + \beta_4\ ln\ X_4 + \beta_5\ ln\ X_5 + \beta_6\ ln\ X_6 + \beta_7\ ln\ X_7 + \beta_8 D_1 + \beta_9 D_2 + \mu_i$ ..................... *(equation 1)*

Here Y is the dependant variable and $X_1$.............. $X_7$ are other explanatory variables, $D_1$ and $D_2$ are Dummy variables.

The specified estimated model for fresh and ratoon sugarcane crop is as follows;

$ln\ Y_F = \beta_0 + \beta_1\ lnLC_F + \beta_2\ ln\ SC_F + \beta_3\ lnIC_F + \beta_4\ ln\ FC_F + \beta_5\ ln\ Yld_F + \beta_6\ ln\ SP_F ++ \beta_7\ D_1 + \beta_8\ D_2 + \mu_i$ ..................... *(equation 2)*

In equation 1 the dependent variable is net returns (Rs/acre) of fresh seed crop ($Y_F$), the independent variables are labor cost Rs/ac ($LC_F$), seed cost Rs/ac ($SC_F$), Irrigation cost Rs/ac ($IC_F$), Fertilizer cost Rs/ac ($FC_F$), sugarcane yield kg/acre ($Yld_F$), sugarcane price Rs per kg ($SP_F$), dummy for district Faisalabad ($D_1$) and dummy for district

Chiniot ($D_2$). We use the costs as the proxy of input prices. $D_1$ states 0 for Faisalabad and 1 for otherwise whereas $D_2$ states 0 for Chiniot and 1 for otherwise. District Jhang was omitted from the estimated equation and take it as the reference. The estimated equation for sugarcane ratoon crop incorporated all the above mentioned variables except seed cost.

## RESULTS AND DISCUSSION

The combined average age of sugarcane growers was 49.5 years with 5.7 years of schooling and 27.3 years of farming experience (Table 1). Mean age of sugarcane growers in Jhang, Faisalabad and Chiniot district was 49.6, 52.1 and 56.8 years, respectively. As far as the education is concerned all sugarcane growers just completed their primary education. Average farming experience of sugarcane growers was almost same across districts. The difference in the age and education across districts is statistically significant at 10 and 1 percent level, respectively.

Table 1. Socio-economic characteristics for sugarcane growers (years)

| Variables | Jhang | Faisalabad | Chiniot | Overall | F-stat |
|---|---|---|---|---|---|
| Respondent's age | 49.6 (11.7) | 52.1 (8.9) | 56.8 (14.1) | 49.5 (11.8) | 2.620* |
| Education | 6.7 (3.1) | 6.7 (4.4) | 3.6 (1.8) | 5.7 (3.6) | 15.030*** |
| Farming experience | 27.2 (11.4) | 26.9 (8.6) | 27.7 (12.7) | 27.3 (11.1) | 0.066 |

Figures in parenthesis are standard deviations, ***and *shows 1 and 10 percent level of significance respectively

Overall mean operational holding, own land, rented in land, rented out land and land rent was 14.1 acres, 11.2 acres, 3.1 acres 0.1 acres and Rs.28193/acre, respectively. Sugarcane growers in Chiniot district had the highest mean operational holdings of 15.6 acres, followed by Faisalabad (14.4 acres) and Jhang (12.2 acres). Average own land was 11.8 acres in Faisalabad,

11.4 acres in Chiniot and 10.3 acres in Jhang. Average rented in land was also prominent in Chiniot district (4.2 acres), followed by Faisalabad (2.7 acres) and Jhang (2.3 acres). Average land rent per acre was recorded as the highest in Faisalabad (Rs. 30580), followed by Chiniot (Rs. 29000) and Jhang (Rs. 25000) (Table 2).

Table 2. Farm characteristics of sugarcane growers (acres)

| Variables | Jhang | Faisalabad | Chiniot | Overall | F-stat |
|---|---|---|---|---|---|
| Operational holding | 12.2 (7.1) | 14.4 (9.4) | 15.6 (9.4) | 14.1 (8.7) | 1.995 |
| Own land | 10.3 (8.2) | 11.8 (9.3) | 11.4 (8.7) | 11.2 (8.7) | 0.425 |
| Rented in land | 2.3 (3.5) | 2.7 (3.4) | 4.2 (5.3) | 3.1 (4.2) | 3.013* |
| Rented out land | 0.3 (1.3) | 0.1 (0.7) | 0 (0) | 0.1 (0.9) | 1.518 |
| Land rent (Rs./acre) | 25000 (0) | 30580 (905.5) | 29000 (4948.7) | 28193.3 (3724.9) | 49.025*** |

Figures in parenthesis are standard deviations, ***, *1 and 10 percent level of significance, respectively

Sugarcane cost of production includes land preparation cost, seed cost, irrigation cost, input cost (fertilizers like urea, DAP, Potash and SSP), miscellaneous costs (FYM cost, weeding cost, earthing up cost, furrow making cost) and harvesting cost. Seed cost was the highest variable cost with combined average of Rs. 14473.8 per acre, followed by irrigation cost, input cost, land preparation cost and miscellaneous costs with combined average of Rs. 12268.5, Rs. 9834.7, Rs. 8278.7 and Rs. 7085.3 per acre, respectively (Table 3).

The data (Table 3) clearly indicate that average land preparation cost and input cost were estimated higher in Faisalabad i.e. Rs. 8668.0 and Rs. 11376

per acre, respectively than Jhang and Chiniot. Jhang district estimates show higher irrigation cost (Rs. 14842.0/acre) and miscellaneous cost (Rs. 8024.0/acre), whereas seed cost was higher in Chiniot district (Rs. 13838/acre). Total variable cost was highest in Jhang district (Rs. 61220), followed by Faisalabad (Rs. 67836.2/acre) and Chiniot (Rs. 50729.7/acre). Harvesting and loading cost was estimated higher in Chiniot (Rs. 13228.0/acre) followed by Faisalabad (Rs. 10311.0/acre) and Jhang (Rs. 9780/acre). Total cost of fresh seed sugarcane production was found higher in Faisalabad district (Rs. 97966.2/acre) followed by Jhang (Rs. 96000.3/acre) and Chiniot (Rs. 93013.7/acre).

**Table 3. Sugarcane production cost fresh seed crop by districts (per acre).**

| Variables | Jhang | Faisalabad | Chiniot | Overall | F-stat |
|---|---|---|---|---|---|
| Land preparation cost | 8124.0 (876.3) | 8668.0 (836.0) | 8044.0 (1225.1) | 8278.7 (1027.2) | 5.817*** |
| Seed cost | 13821.0 (953.2) | 13838.0 (768.7) | 15762.4 (1201.1) | 14473.8 (1324.9) | 63.494*** |
| Irrigation cost | 14842.0 (4388.0) | 9520.0 (2632.3) | 12560.0 (3863.3) | 12268.5 (4337.7) | 26.328*** |
| Input cost | 9850.0 (2782.7) | 11376.0 (2699.7) | 8278.0 (2195.9) | 9834.7 (2853.1) | 18.129*** |
| Miscellaneous cost* | 8024.0 (1400.3) | 7558.0 (1450.4) | 5674.0 (864.2) | 7085.3 (1619.1) | 48.265*** |
| Interest cost | 6559.3 (833.8) | 6115.2 (602.1) | 5435.3 (795.1) | 6036.6 (877.9) | 28.448*** |
| Total variable cost | 61220.3 (7782.3) | 57075.2 (5619.9) | 50729.7 (7419.5) | 56341.7 (8194.1) | 28.448*** |
| Land rent | 25000.0 (0) | 30590.9 (908.1) | 29000.0 (4948.7) | 27784.5 (3962.4) | 49.025*** |
| Harvesting cost | 9780.0 (473.4) | 10311.0 (1300.0) | 13228.0 (2682.4) | 11106.3 (2304.1) | 56.753*** |
| Total cost | 96000.3 (8024.8) | 97966.2 (6248.1) | 93013.7 (5379.4) | 95660.1 (6907.1) | 7.047*** |
| Selling price/kg | 4.19 (0.10) | 4.05 (0.26) | 3.78 (0.21) | 4.00 (0.26) | 52.945*** |
| Yield (Kg/acre) | 32600.0 (1577.91) | 29440.0 (2425.71) | 28840.0 (5452.42) | 30293.3 (3907.57) | 16.064*** |
| Total revenue | 136405.0 (6745.5) | 121680.0 (10676.0) | 113985.0 (12653.7) | 124023.3 (13863.8) | 60.913*** |
| Net revenue | 40404.7 (7014.3) | 23713.8 (9218.2) | 20971.3 (9987.7) | 28363.2 (12295.4) | 70.937*** |
| Benefit cost ratio | 1.4 (0.1) | 1.2 (0.1) | 1.2 (0.1) | 1.3 (0.1) | 61.701*** |

Figures in parenthesis are standard deviations, *Miscellaneous cost includes FYM cost, weeding cost, Earthing up cost and furrow cost, ***shows 1 and 5 percent level of significance respectively

Average selling price per kg was reported higher in Jhang district (Rs. 4.19) followed by Faisalabad (Rs. 4.03) and Chiniot (Rs. 3.78). According to the estimates sugarcane growers of Jhang district had higher average gross and net revenues

i.e. Rs. 136405.0/acre and Rs. 40404.7/acre, respectively than other districts. The estimates of benefit cost ratio indicate that sugarcane growers in Jhang earned Rs.1.4 against each rupee investment whereas the sugarcane growers of

Faisalabad and Chiniot earned Rs.1.2 on per rupee investment. The differences in all the costs and benefits estimates across districts were statistically significant at one percent level (Table 3).

**Table 4. Sugarcane production cost per acre in ratoon crop (District wise)**

| Variables | Jhang | Faisalabad | Chiniot | Overall | F-stat |
|---|---|---|---|---|---|
| Cultivator Cost | 817.0 (73.1) | 945.5 (327.7) | - | 859.8 (204.8) | 6.230*** |
| Irrigation Cost | 17944.2 (5174.8) | 9136.4 (3069.6) | 13833.3 (3449.5) | 14606.3(5468.70 | 32.091*** |
| Input Cost | 10922.7 (2827.5) | 9600.0 (1714.6) | 8276.0 (2187.6) | 9531.0 (2644.3) | 14.485*** |
| Miscellaneous Cost* | 6630.7 (1570.0) | 5211.8 (1345.1) | 5638.0 (825.3) | 3711.7 (1365.9) | 11.854*** |
| Interest cost | 4117.8 (915.4) | 2987 (472.1) | 3329.7 (926.5) | 3711.7 (1161.1) | 49.310*** |
| Total Variable cost | 38432.4 (8544.1) | 27.880 (4406.7) | 31077.0 (8647.5) | 34642.5 (10836.5) | 49.310*** |
| Land Rent | 25000.0 (0) | 30590.9 (908.1) | 29000.0 (4948.7) | 27784.5(3962.4) | 27.305*** |
| Harvesting Cost | 9927.3 (524.9) | 10261.4 (1273.4) | 13510.0 (2664.5) | 11534.9(2533.7) | 49.421*** |
| Total Cost | 73359.7 (8862.2) | 68733.2 (4184.7) | 73587.0 (5362.7) | 73961.9(7746.8) | 19.154*** |
| Price/kg | 3.7 (1.38) | 3.8 (2.05) | 3.7 (0.90) | 3.6 (1.66) | 27.695*** |
| Yield Kg/Acre | 31120 (10985.41) | 27304.3 (14961.11) | 28473.7 (4688.10) | 28164.2 (12604.57) | 16.881*** |
| Total Revenue | 114832.8 (8042.4) | 104575.4 (12480.90 | 104213.7 (16972.0) | 101391.0 (19399.3) | 64.750*** |
| Net Revenue | 41473.1 (7097.7) | 35842.4 (11355.7) | 30626.7 (14668.8) | 27429.2 (15535.0) | 45.207*** |
| Benefit Cost Ratio | 1.6 (0.2) | 1.5 (0.2) | 1.4 (0.2) | 1.4 (0.2) | 22.265*** |

Figures in parenthesis are standard deviations, *Miscellaneous cost includes FYM cost, Weeding cost, Earthing up cost and Furrow Cost, ***shows 1 percent level of significance

Sugarcane ratoon crop cost of production including irrigation cost, input cost, miscellaneous costs and interest cost was found higher in Jhang district. Average irrigation cost was Rs. 15944 in Jhang district followed by Chiniot (Rs. 13833.3) and Faisalabad (Rs. 9136.4) (Table 4). Average input cost was estimated higher (Rs. 10922.7) in Jhang district followed by Faisalabad (Rs. 9600) and Chiniot (Rs. 8276). Average miscellaneous cost of Rs. 6630.7 was in Jhang, followed by Chiniot (Rs. 5638.0) and Faisalabad (Rs. 5211.8). Average of total variable cost and total cost of ratoon sugarcane production was also estimated higher (Rs.38432) in Jhang district, followed by Faisalabad (Rs.27880 and Chiniot (Rs. 31077.0). Jhang district also witnessed that highest average total cost and gross revenue for sugarcane ratoon production i.e. Rs. 73359.0 and Rs. 114832, respectively. Mean total cost was estimated at Rs. 73587.0 in Chiniot and Rs.68733 in Faisalabad (Table 4).

Similarly average gross revenue was Rs. 104575.6 in Faisalabad and Rs. 104213.0 in Chiniot. The sugarcane ratoon growers in Jhang district got higher net revenue of Rs.41473 per acre followed by Faisalabad (Rs. 35842) Chiniot (Rs.38632.1) The benefit cost estimates of ratoon crop shows higher per rupee return (Rs. 1.6) in Jhang, followed by Faisalabad (Rs. 1.5) and Chiniot (Rs.1.0) The economic analysis of sugarcane fresh and ratoon crop postulates that all sugarcane growers recovered their investment cost and earned profit from sugarcane crop to meet their socio-economic need, No grower reported loss in case of cane cultivation (Table 4).

## Empirical analysis

A regression model was incorporated to reach the more accurate estimations of data set regarding fresh seed and ratoon sugarcane production. The dependent variable is the net return (Rs/acre) earned by sugarcane grower which was regressed upon different cost parameters such as labor cost, seed cost, fertilizer cost and irrigation cost, alongwith yield of sugarcane (kg/acre), price/kg and dummy for district Faisalabad and Chiniot.

The results of regression analysis indicated negative relationship of all cost variables with the net returns whereas yield per acre and price per maund shows positive association with dependant variable.

The coefficients of fertilizer cost and irrigation cost are highly significant which postulates that one percent increase in these costs will reduce the sugarcane fresh crop net return by 0.317 and 0.267 percent, respectively (Table 5). The coefficients of yield per acre and price per maund are statistically highly significant and indicate 2.375 and 3.112 percent increase in net return due to one percent increase in sugarcane yield and price per maund, respectively. These results are justified by Waswa *et al.* (13) who stated that increase in cost of farm input depress net returns to sugarcane growers whereas any increase in yield per acre uplift the net returns to farmers. Higher yield resulted in higher income and somehow outweigh the negative effect of increased cost. Masuku (8) also highlighted positive effect of yield on farmer's earned profit by sugarcane production. Langemeier *et al.* (7) also observed that per acre profit was dependent on output price, yield and cost of production.

Table 5. **Factors affecting sugarcane growers net return (fresh seed crop)**

| Independent Variable = Profit | | |
|---|---|---|
| **Variables** | **Coefficient** | **t-statistics** |
| Constant | -12.768 | -4.308*** |
| Labor cost | -0.010 | -1.367 |
| Seed cost | -0.027 | -0.092 |
| Fertilizer cost | -0.317 | -4.341*** |
| Irrigation cost | -0.267 | -4.393*** |
| Yield per acre | 2.375 | 13.355*** |
| Price per maund | 3.112 | 8.744*** |
| District Faisalabad | -0.273 | -4.819*** |
| District Chiniot | -0.227 | -2.587** |
| R-square=0.840 | Adjusted R²=0.830 | F-statistic= 79.525*** |

Source: Author's Survey, ***1 percent level of significance

Dummy variables (Faisalabad and Chiniot) show negative sign which postulates that Faisalabad and Chiniot sugarcane growers earned 0.273 percent and 0.227 percent less net return than net return earned by sugarcane growers of Jhang district (reference category) respectively (Table 5). The coefficient of dummy for Faisalabad is significant at one percent level. However for Chiniot it is significant at 5 percent. Dummy variable analysis clearly indicates that sugarcane production is more profitable for growers of Jhang district, followed by Faisalabad and Chiniot. These empirical estimations are aligning with the results of descriptive analysis. The mentioned model for sugarcane fresh seed crop is overall statistically highly significant at one percent level with calculated F-value of 79.525. The value of R-square and adjusted R-square showed that model is good fitted and almost 83 percent variation in dependant variable is explained by the independent variables (Table 5).

For ratoon cost regression estimates different costs such as labor cost, fertilizer cost and irrigation cost are incorporated alongwith yield kg per acre, price per kg and dummies for Faisalabad and Chiniot to analyze their impact on net return attained by sugarcane growers. All costs have negative association with profit and coefficients show that one percent increase in fertilizer cost and irrigation cost will bring 0.343 and 0.263 percent reduction in sugarcane (ratoon crop) net returns (Table 6). The yield and price coefficients show 1.971 and 2.386 percent increase in sugarcane ratoon crop net return due to one percent increase in yield and price respectively. The association between labor cost and net return is insignificant.

**Table 6. Factors affecting sugarcane growers net return (ratoon crop).**

| Variable | Coefficient | t-statistics |
|----------|-------------|--------------|
| Constant | -1.261 | -3.457*** |
| Labor cost | -0.068 | -0.890 |
| Fertilizer cost | -0.343 | -4.141*** |
| Irrigation cost | -0.263 | -3.416*** |
| Yield kg/ac | 1.971 | 11.090*** |
| Price/kg | 2.386 | 3.956*** |
| District Faisalabad | -0.007 | -0.087 |
| District Chiniot | -0.187 | -1.858* |
| R-square=0.819 | Adjusted R²=0.802 | F-statistic= 50.270*** |

Source: Author's Survey, ***, **, * shows 1, 5 and 10 percent level of significance respectively

The estimated negative association of cost with net revenue and positive impact of yield and price on sugarcane grower's net revenue is also justified by previous studies (11, 12) which reported that revenue is significantly affected with output price, quantity produced and cost of production. These studies conclude that price and yield has direct positive impact on revenue whereas production has negative impact on crops profitability.

The coefficient of dummy for Faisalabad is significant at one percent level; however for Chiniot it is insignificant. The coefficient of dummy for district Chiniot indicates that sugarcane growers in Chiniot district earned 0.187 percent less net return than Jhang district sugarcane ratoon growers (Table 6). The mentioned model for sugarcane ratoon crop is overall statistically highly significant at 1 percent level with calculated F-value of 50.270. The value of R-square and adjusted R-square showed that model is good fitted and almost 80 percent variation in dependant variables is explained by mentioned independent variables.

## CONCLUSION AND RECOMMENDATIONS

Sugarcane being a cash crop promises a subsistence income being generated for growers. With the passage of time cost per acre of sugarcane has been remarkably increased with increase in the prices of fuel, electricity and fertilizers. It's being difficult for the marginal farmers to utilize all the recommended practices for sugarcane crop to attain the potential yield to earn the sufficient net income from cane production. It can be concluded that cost per acre of both fresh and ratoon crop

has been expanded. Sugarcane production, is however, hindered by many factors including high production cost such as seed cost, fertilizers and insecticides cost and irrigation cost coupled with low return on investment. Sugarcane cost of production estimates show higher cost and net revenues generated by farmers in Jhang district followed by Faisalabad and Chiniot. Sugarcane prices also deviate across districts which also affect the net returns gained by sugarcane growers. Costs are found to be inversely related with net revenue earned by sugarcane growers whereas yield per acre and price per maund have positive impact on net revenue.

It is recommended that Government should provide subsidy on inputs especially on fertilizer. Due to shortage of canal water, farmers have to use tubewell water which induces high irrigation cost as compared to canal irrigation. So it is recommended that Government should reduce the per unit electricity charges especially for farmers growing water intensive crops like sugarcane. The production of sugarcane must be encouraged in district Jhang as it promises high returns to growers and can be helpful to uplift their living standards. It is also recommended that government research and extension departments should responsibly check the reasons for low prices per maund and return to farmers in Faisalabad and Chiniot districts to keep the sugarcane growers of these districts to the recommended levels of crop management options to uplift their net returns. Price regulation authorities should also see the price differentials prevailing in different districts to make sure the adoption of government announced prices by the buyers of sugarcane in the benefit of cane

growers. To ensure farmer an attractive price for their produce is the prerequisite for the production enhancement. On the other hand the availability of cost effective technologies and inputs is also important to increase the productivity of agricultural sector in general and sugarcane crop in particular.

## REFERENCES

1. Ahmad, M. 2001. Agricultural productivity growth differential in Punjab, Pakistan: A district-level analysis. Pak. Dev. Review. 40(1):1-25.

2. Anon. 2013. Agricultural Statistics of Pakistan 2012-13, Federal Bureau of Statistics, Ministry of Finance, Government of Pakistan, Islamabad, Pakistan.

3. Anon. 1997. Proceedings of Fiji/FAO 1997 Asia Pacific Sugar Conference."Produced by FAO Economic and Social Development Department.

4. Fernandez, M. D. and P. L. Nuthall (2009). Technical efficiency in the production of sugarcane in central negros area, phillipines: An application of data envelopment analysis. J. Int. Soc. Southeast Asian Agric. Sci. 15(1):77-90.

5. Girei, A. A., and D. Y. Giroh (2012). Profitability analysis of sugarcane (*Saccharum officinarum*) production in numan local government area adamawa state, nigeria. J. Res. in National Dev.10(3):141-145.

6. Khan, A. A. 2007. Comparative evaluation of two anticoagulant and two acute rodentisides in sugarcane fields. Sarhad J. Agric. 23(3):713-18.

7. Langemeier, M. R., M. W. HAlet and F. D. Delano. 1998-99. The determinants of wheat profitability in Kansas. J. ASFMRA. p:63-69

8. Masuku, M. B. 2011. Determinants of sugarcane profitability: the case of smallholder cane growers in Swaziland. Asian J. Agric. Sci. 3(3):210-214.

9. Narayan, P. K. 2004. An empirical analysis of sugarcane production in Fiji, 1970-2000. J. Econ Ana & Pol.34(1):53-62.

10. Nazir, A., G. A. Jariko and M. A. Junejo. 2013. Factors affecting sugarcane production in Pakistan. Pak J. Com and Soc. Sci. 7(1):128-140.

11. Rahman, Q. L., M. Sajjad, N. Khan, Shahenshah and M. Nazir (2011). Costs and net returns of tobacco production in district Swabi (Khyber Pakhtunkhwa) Pakistan. Interdisciplinary J. Cont Res. In Business. 3(8):160-171.

12. Samiullah., M. Shah, K. Ullah, R. Ullah and Ibrarullah (2014). Profitability of wheat production in Dera Ismail Khan. Pak. J. Agric. Res. 27(3):244-249.

13. Waswa, F., J. P. G. Onyango and M. Mcharo (2012). Contract sugarcane farming and farmers' incomes in the Lake Victoria Basin, Kenya. J. App. Biol. Sci. 52:3685-3695.

14. Zaidi, M. R., A. Saeed and S. M. Shahid (2013). Impact of low sugarcane yield on sugar industry of Pakistan. Interdisciplinary J. Contem. Res. in Business. 4(12):58-86.

**CONTRIBUTION OF AUTHORS**

| | |
|---|---|
| Sonila Hassan | Conceived the idea, analysed data, wrote results and discussion |
| Arshed Bashir | Helped in data analysis and write up |
| Irfan Mehmood | Helped in data collection and analysis, reviewed literature |
| Muhammad Rizwan Yaeen | Helped in developing methodology and provided technical guidence |
| Muhammad Qasim | Reviewed the paper periodically and provided technical comments |