Impact of Price Changes on Area, Production and Productivity of Sugarcane in Haryana

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Sugarcane is one of the most important crops of our economy as well of the Haryana state. How far the price is responsible and correlated with the growth behaviour of the main variables viz., area, production and yield is the basic question which has been arisen in this study. The data related to area, production, yield and prices have been obtained from various issues of Statistical Abstract of Haryana from 1979-80 to 2008-09. The data have been compiled for the whole study period. For comprehensive study, the period from 1979-80 to 2008-09 has been also split up in to three decades. The main findings emerged from the study reveal that there has been significant increase in area, production, yield and prices. However, significant negative trend has been observed during first and third periods of the study. It has also been observed that there has been remained negative correlation between farm harvest price with the area allocation and sugarcane during different sub-study periods. It has also noticed that price factor was the more responsible factor to increase the income of sugarcane.

Introduction
Agriculture sector draws the picture of any economy and all the strategies for planned economy revolves around the primary sector of any economy and India is no exception of it. Indian government also adopts different strategies for the development of our economy but more emphasise is always given on the policies, framed for and focused on the agriculture sector of the economy as the development of the maximum population depend on this fundamental and leading sector of the economy. Input subsidy and price policy has been the two instrumental ways through which government tries to affect the decision of the people having discretionary power as far as the farm and rural development is considered. So, government always tries to motivate the farmers to use better and modern technology by making expenditure in the form of input subsidy. The best direct method to raise the farm produce has always been the Minimum Support Price (MSP). Using MSP, government always try to ensure the farmers regarding the prices and profitability of their farm produce. To bring change in the area of some crops has always been another basic aim of the price policy of the government. To what extent, the government considers itself more wise and rational by making expenditure on minimum support price policy related decision is taken up main objective of our study and the yearly crop sugarcane has been selected for the study, the crop which is mostly gained glaring controversy in respect of its price.
Specific Objectives of the Study

1) To examine the growth rates of farm harvest prices, area, production, and yield of Sugarcane in Haryana.

2) To examine the correlation between Farm Harvest Prices with area, production and yield of Sugarcane in Haryana.

3) To study the impact of lagged farm harvest prices on acreage allocation, production and yield of Sugarcane in Haryana.

4) To find out the contribution of area, prices, yield and their interaction in the incremental income of sugarcane in Haryana.

Methodology

This study is pertained to whole of the Haryana state and covers the period from 1979-80 to 2008-09. The data related to Area, Production, Yield and prices have been obtained from various issues of Statistical Abstract of Haryana from 1979-80 to 2008-09. The data have been compiled and analyzed for the period 1979-80 to 2008-09 by dividing the entire study period into three periods as first period from 1979-80 to 1988-89, second period from 1989-90 to 1998-99 and third period from 1999-2000 to 2008-09. The related figures have also been computed for the entire study period.

Compound growth rates (C.G.R.) of the Area, Production, Yield and prices of the Sugarcane crop have been worked out by fitting exponential function. Using the least square method, the following form of exponential function has been used to calculate compound growth rates.

\[ Y = AB^t \]

Where, \( Y \) = Area/ Production/ yield/Farm harvest price of the crop  
\( A \) = Constant  
\( B = 1 + r \)  
\( a \) = Compound growth rate  
\( t \) = time variable in years (1, 2 ------ 30)

The compound growth rate \( r \) is equal to \((B-1) \times 100\). In log form \( B \) has been calculated by the following formula:

\[ \log B = \frac{\sum T \log Y - \sum t \Sigma \log Y/N}{\Sigma t^2 - (\Sigma t)^2/N} \]

The growth rates has been tested for significance by calculating 't' value where \( t = r/s \), 's' is the standard error. The value of standard error has been calculated by following formula:

\[ \text{S.E. (r)} = \frac{\Sigma (\log Y)^2 - (\Sigma \log Y)^2/N - (\log 10)^2 \Sigma T^2}{\log_{10} e \sqrt{(N-2) \Sigma T^2}} \]

Where; \( T = \overline{t} - t \)
To examine the correlation between area, production, yield and farm harvest prices of Sugarcane, correlation coefficient (r) has been worked out as follows.

\[ r = \frac{\Sigma XY - (\Sigma X)(\Sigma Y)}{\sqrt{\Sigma X^2 - (\Sigma X)^2/N \cdot \Sigma Y^2 - (\Sigma Y)^2/N}} \]

Where X: Harvest prices in RS. per Quintal
Y: Area, Production, yield and farm harvest prices.

The significance of the correlations has also been tested by comparing the calculated and table values of (t). The ‘t’ value of coefficient correlation has been calculated by using the following formula

\[ t_{cal} = \frac{r}{\sqrt{1-r^2}} \cdot \sqrt{\frac{n-2}{n}} \]

To study the impact of lagged farm harvest prices on the acreage allocation, production and yield, linear and logarithmic form of equations have fitted. As logarithmic type of function has found a better fit than linear function, the former has been presented here. The previous year harvest prices are being used here since these prices generally influence the farmers’ decision on acreage allocation for the current year.

In equation form, the following type of equation has been used as:
Log \( A_t = \log a + b P_{t-1} \)
Log \( P_t = \log a + b P_{t-1} \)
Log \( Y_t = \log a + b P_{t-1} \)
\( A_t \) = Area under Sugarcane at \((t)\)th period
\( P_t \) = Production of Sugarcane at \((t)\)th period.
\( Y_t \) = Yield of Sugarcane at \((t)\)th period.
\( P_{t-1} \) = Harvest prices of Sugarcane taken in per quintal at \((t-1)\)th period.

In order to decompose total change in the value of Sugarcane production \( (X) \), the price effect has also been studied in addition to the area and yield effects. Thus, to analyse price effect, the model formulated by Sharma, (1977) has been used. Further, the interaction effects between area, yield and price were also studied by using the model given below:

\[ \Delta X = (P_0 A_0 \Delta Y) + (P_0 Y_0 \Delta A) + (Y_0 A_0 \Delta P) + (A_0 \Delta P \Delta Y) + (Y_0 \Delta P \Delta A) + (\Delta A \Delta Y \Delta P) \]

Where, \( P_0 \Delta A \Delta Y \) shows the yield effect, \( P_0 Y_0 \Delta A \) give the area effect and \( Y_0 A_0 \Delta P \) give the price effect and these are divided by 100 for getting per centage contribution. Likewise \( P_0 \Delta A \Delta Y \), \( A_0 \Delta P \Delta Y \), \( Y_0 \Delta P \Delta A \), \( \Delta A \Delta Y \Delta P \) show the different interaction effects.

\( \Delta X \) was calculated by subtracting \( X_0 \) from \( X_n \)

Where,
\( X_0 = A_0 Y_0 P_0 \) and \( X_n = A_n Y_n P_n \)
Results and Discussion

The furnished results related to the growth behaviour of area, production, yield and prices and the role of prices in the incremental income is presented by the following heads:

**Compound growth rates of area, production, yield and prices:** Compound growth rates for acreage, production, yield and prices of sugarcane for the period 1979-80 to 2008-09 have been calculated and results obtained are presented in table 1.

**Table1: Compound Growth Rates of Area, Production, Yield and Prices of Sugarcane Crop (1979-80 to 2008-09)**

<table>
<thead>
<tr>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>Area</td>
<td>-2.45*</td>
<td>0.36*</td>
<td>-0.13*</td>
<td>0.31*</td>
</tr>
<tr>
<td>Production</td>
<td>0.65*</td>
<td>1.19*</td>
<td>2.03*</td>
<td>2.26*</td>
</tr>
<tr>
<td>Yield</td>
<td>3.27*</td>
<td>0.67*</td>
<td>2.18*</td>
<td>1.94*</td>
</tr>
<tr>
<td>Prices</td>
<td>8.90*</td>
<td>11.03*</td>
<td>4.52*</td>
<td>8.15*</td>
</tr>
</tbody>
</table>

*  Significant at 0.01 per cent level of significance

Regarding the area of sugarcane, significant negative trend has also been observed during first and third period. In contrast to this, the yield has positive and significant throughout the study period. It may be concluded that positive yield trend has surpassed the negative growth in area resulting in positive production trend during first and third period. During second and study period, results of all the selected variables have shown significant acceleration at 1 per cent level of probability.

**Linear growth rates of area, production, yield and prices:** it can be found from the figures in the table that maximum growth rate has been found in case of yield during all the study periods. Area of sugarcane during first and third period has shown declining trend with positive trend in yield resulting in positive trend in production. Government has adopted positive price policy as increasing trend has been observed in case of price.

**Table 2: Linear Growth Rates of Area, Production, Yield and Prices of Sugarcane Crop (1979-80 to 2008-09)**

<table>
<thead>
<tr>
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<tbody>
<tr>
<td>Area</td>
<td>-3.73                                                              0.57                                                              -0.25                                                              0.38</td>
</tr>
<tr>
<td>Production</td>
<td>2.37                                                              8.98                                                              16.27                                                              15.43*</td>
</tr>
<tr>
<td>Yield</td>
<td>134.91                                                             35.96                                                             130.79*                                                             93.95*</td>
</tr>
<tr>
<td>Prices</td>
<td>14.45                                                             53.43*                                                             45.67*                                                             38.82*</td>
</tr>
</tbody>
</table>

*  Significant at 0.01 per cent level of significance

**Correlation of farm harvest prices with area, production and yield of sugarcane crop:** The period-wise results on Correlation between Farm Harvest Prices with Area, production, yield of Sugarcane Crop are presented in Table 3. It can be observed from the figures lying in the table...
that the value of \( r \) has observed as -0.88 and – 0.47. in case of area and production while that has been 0.48 in case of yield during first period of the study. So, it is concluded here that there is negative correlation of area and production with prices. The situation has been remained same for the period second and third period. However, the relation between these variables has been remained positive during overall study period. Maximum correlation has been found in case of yield during third period in which case the value of \( r \) has been recorded as 0.89.

**Table 3: Correlation between Area, Production, Yield with Farm Harvest Prices of Sugarcane crop:**

<table>
<thead>
<tr>
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<tbody>
<tr>
<td>Area</td>
<td>-0.88*</td>
<td>-0.28</td>
<td>-0.56</td>
<td>0.03</td>
</tr>
<tr>
<td>Yield</td>
<td>0.48</td>
<td>0.41</td>
<td>0.89*</td>
<td>0.84*</td>
</tr>
<tr>
<td>Production</td>
<td>-0.47</td>
<td>-0.07</td>
<td>-0.06</td>
<td>0.68*</td>
</tr>
</tbody>
</table>

* Significant at 0.01 per cent level of significance

**Impact of Lagged Harvest Prices on Area, Production and Yield of Sugarcane:** Impact of Lagged Harvest Prices on Area, Production and Yield of Sugarcane: has been presented by the following equations:

4) **Impact of lagged harvest prices on area, production and yield of sugarcane:**

1) \[
\text{Log } At = \log a + b \text{ Pt-1}
\]

\[
\text{Log } At = 2.125169+1.0772 \text{ pt-1}
\]

\[
R^2 = .03422
\]

2) \[
\text{Log } Pd = \log a + b \text{ Pt-1}
\]

\[
\text{Log } Pd = 2.725754+1.0005\text{Pt-1}
\]

\[
R^2 = .58254
\]

3) \[
\text{Log } Yd = \log a + b \text{ Pt-1}
\]

\[
\text{Log } Yd = 3.60062+1.0004 \text{Pt-1}
\]

\[
R^2 = .65503
\]

The furnished results indicate that there has been considerable effect of lagged price on area, production and yield. It can be revealed from the equation that 1.0772 per cent increase occurs in area of sugarcane when the price increases with 1 per cent. In case of production, 1.0005 per cent increase has been noticed due to 1 per cent increase in its lagged price. 58 per cent variation has taken place due to its lagged price. 1 per cent increase in the lagged year price has caused 1.0004 per cent increase in the yield of sugarcane. 65 per cent variation in yield has taken place due to
price. Thus, it can be inferred from the analyses that the lagged harvest price lagged by one year has positively influenced the allocation of land under sugarcane but not as per expectation from this crop.

**Contribution of area, yield, price and their interaction in per hectare income of sugarcane:** The contribution of price and yield in per hectare income of Sugarcane could be reflected through Table 4.

| Table 4: Contribution of Area, Yield and Price in Production of Sugarcane |
|-------------|---------------------------------|---------------------------------|---------------------------------|---------------------------------|
| **Change in Production (ΔX)** | 454820.21 | 3646991.29 | 5384914.1 | 2095521.03 |
| **Yield Effect (P₀ΔY)** | 88038.37 (19.14) | 263347.12 (7.12) | 870280.01 (16.16) | -19950.94 (-0.95) |
| **Area (P₀ Y₀ΔAs)** | -302416.39 (-65.76) | -41776.29 (-1.14) | -32157.43 (-0.59) | -2218.59 (-0.10) |
| **Price Effect (Y₀ΔP)** | 1052221.61 (228.83) | 2973502.73 (81.53) | 3957905.04 (73.49) | 1807125.94 (86.23) |
| **Area and Yield (P₀ΔΔAY)** | -34882.48 (-7.58) | -7965.74 (-0.21) | -5322.27 (-0.09) | 433.02 (0.22) |
| **Price and Yield (A₀ΔPΔY)** | 121420.65 (26.40) | 566976.16 (15.54) | 655060.45 (12.16) | 35273.86 (16.83) |
| **Price and Area (Y₀ΔPΔA)** | 416910.24 (-90.66) | -89942.74 (-2.46) | -24204.93 (-0.44) | -39222.69 (-0.87) |
| **Area, Yield Price (ΔΔΔYΔP)** | 48109.17 (-10.46) | -17149.93 (-0.47) | -4006.08 (0.07) | -7655.46 (-0.36) |

It can be observed from the table that during first period, the price effect has been more responsible for increase in income of sugarcane crop in the state. The same case has been observed during second and third period as the contribution of price has been remained 73.49 per cent to 228.83 per cent during different study periods. For all the study periods, the contribution of area, interaction between area and price, area and yield interaction, interaction between area, yield and price have remained negative but there negative effect has been off set by the positive contribution of price. So, the position has been maintained by price. Yield effect has also observed positive during all three separated time period, but became negative during overall study period. Therefore, it may be revealed that positive contribution of price, Yield and their interaction can be observed in case of sugarcane during all periods. Price factor was more responsible for increase in total income whereas price-yield interaction has also remained main factor to contribute in incremental income of sugarcane during all study period. Maximum effect of price has been observed during first period (228.83 percent) followed by 86.23 per cent which has been the case observed during the over all study period. After that, effect of price in the incremental production has been found during second period (81.53 per cent).
Summary and Suggestions

The main findings emerged from the study reveal that there has been significant increase in area, production, yield and prices. However, significant negative trend has been observed during first and third periods of the study. It has also been observed that there has been remained negative correlation between farm harvest price with the area allocation and sugarcane during different sub-study periods. However, the relation between farm harvest price and yield has been noticed positive. It can also be inferred from analyse that the farm harvest price lagged by one year has positively influenced the allocation of land under sugarcane but it remained very below of the expectations. It has also noticed that price factor was the more responsible factor to increase the income of sugarcane. The main cause of disincentive for sugarcane farmers to put more area under sugarcane is unremunrative price. So, there is an urgent need to make correction in the price policy of the agricultural produce. Except for it, usually large farmers get preferences during the process of sugarcane over small farmers. So, it is strongly suggested that fair price for sugarcane for small farmers must be ensured. Being an irrigation-intensive crop, there is always reported irregularity in the production and supply of the sugarcane to the sugarmills. So, drip irrigation system should be another good alternate. Another claim which has always been made by the farmers of Haryana behind the decreasing area under sugarcane is the increasing cost of production especially labour cost. So, the existing price policy has not proved sufficient enough to cover the cost of production of the crop as claimed by the sugarcane growers of Haryana. So, it is also suggested that the farm prices should be remunerative in the sense that they cover the costs of production.