CHAPTER - VII

PRODUCTION RESPONSE OF COTTON CROP
Since the agricultural sector is the largest sector of the nation's economy affording two-thirds of population employment, income and living standards, improvement of productivity and efficiency, of agriculture was called for not by mere shift away from agriculture but directly through investment of capital and improvement in technique bearing on the day-to-day operations of agriculture. Agriculture in developing economies was believed to be tradition-ridden and hence non-responsive to economic stimuli. In a developing economy, the growth of agricultural produce assumed critical importance due to raising demand for them generated by rapidly growing population, and accelerated by rising levels of income. This is a wider problem and depended on the expanding potential of the agriculture sector as well as on increasing flow of resources into agriculture. The demand for agricultural products is increasing day by day. It is necessary to study about the production responses of agricultural crops. Cotton crop is no exception to this notion. Hence, it is proposed to study the production responses of cotton crop in Kurnool district of Andhra Pradesh.

Agriculture being the predominant sector of its economy, the level and pace of economic development in Andhra Pradesh are still continuing to be significantly influenced by the pace of its agricultural development. The growth in area however had not been uniform or steady. There had been considerable fluctuations in both area and production which had led to the fluctuation in yield. Fluctuation in area
of crop was caused by variation in price, weather conditions, availability of irrigation facilities and other inputs also. It is the fact that area of crop varying systematically in response to inter-crop price movement was widely accepted on the basis of area response studies. Most of the studies implicitly or explicitly assumed a close and direct relationship between area under cultivation and output. An increase or decrease in area was regarded as a proxy for an increase or decrease in output of agricultural crop. Although such assumption was generally valid, it was worth pointing out that in subsistence agriculture, where yield could fall, an increase in area did not guarantee a rise in output. Hence, a direct test of relationship among output, area, price and some non-price variables seems to be both necessary and important to form a better judgement about output response in under developed agriculture.

In the present study it is proposed to study the output response of cotton crop in Kurnool district. The quantity produced of the cotton had been assumed to be a linear function of the hectarage, lagged price and the rainfall. This traditional relationship between cotton production and some important variable is shown in equation form (given in methodology equation No. 16). To study the relative impact of different input factors on cotton production in Kurnool district, the adoptive expectation model was adopted. This model is based on the behaviour hypothesis of the farmers which stated that the present level of output depends not on the present price level but on the expected price level.
After the incorporation of the expected prices the final regression model is given in methodology.

The time series data for the period of 20 years (1984-85 to 2004-05) has been used to the present study, the production responses of cotton crop. The collected data related to cotton crop was fed to the equation and the parameters were estimated by adopting OLS method. The results were expressed in equation form. Both linear and log linear models were estimated. The log linear model comparatively is giving better results hence the analysis is related to log linear model only.

**Multiple Linear Regression:**

\[ Y_t = 15961.1797 + 1.6454 A_t - 23.2374 P_{t-1} - 16.5354 R_t \]

\[ (5.9839) \quad (1.0416) \quad (0.3605) \]

\[ R^2 = 0.78983^* \quad F = 20.0434 \]

**Cobb – Douglas model:**

\[ Y_t = 1.124 + 1.4155 A_t - 0.3636 P_{t-1} - 0.1101 R_t \]

\[ (3.2414) \quad (1.1394) \quad (0.4404) \]

\[ R^2 = 0.8621^* \quad F = 33.3301 \]

In the above estimated log linear model the coefficient of area is positive (1.4155). This positive coefficient express a positive relationship between area and cotton output. For every one hectare increase in cotton area will increase cotton production by nearly 1.42 bales. This increase in cotton production is a significant increase. It is proved by the t-test.
statistic, therefore the cotton production in Kurnool district was significantly responded by its current area under cultivation. The estimated coefficient of lagged price is negative (-0.3636). An inverse relationship was noticed by the price variable; therefore the price effect is negative on cotton production. It reveals that in Kurnool district the prevailing prices are not encouraging the cotton growers to raise the cotton production. A unit increase in lagged price will decrease the current cotton output. Therefore the lagged cotton prices influencing the cotton growers negatively, but this lagged price effect is not a significant effect. The coefficient of rainfall is negative (-0.1101). It is observed that there exists an inverse relationship between rainfall and cotton production. A unit increase in rainfall will decrease the cotton output by 0.11 bales. But this decrease is not a significant decrease. Therefore, an adverse effect of rainfall was noticed on cotton production in Kurnool district. It is inferred that cotton production was negatively influenced by excess rainfall or lack of rainfall or untimely rainfall. Finally, it may be concluded that the cotton growers in Kurnool district are not responded by its market prices. It may be suggested that by providing better marketing conditions and attractive prices the cotton growers are motivated to raise the cotton production in Kurnool district.

The aggregate effect of three independent variables, area under cotton crop, lagged price and rainfall on cotton production was estimated by Multiple Correlation Coefficient ($R^2$). The estimated value of $R^2$ is
The significance of aggregate effect of selected three variables was tested for its significance. F-test statistic was adopted and it is found to be that the combined effect of three independent variables on cotton production in Kurnool is significant at 5 percent probability level.

To study the relative impact of input factors on cotton production, the adaptive expectation model was used. This model is based on behaviour hypothesis of farmers which states that present level of output depends not on the present price level but on expected price level. After incorporation of expected prices, the modified regression model (Equation No.23) is given in the methodology. The time series data was fed to the equation and the parameters were estimated. The estimated results were expressed in functional form. Both the linear and log-linear models were estimated. The analysis is based on log-linear model only.

**Multiple Linear Regression:**

\[
Y_t = 0.4913 + 0.01164 \times A_t - 0.00304 \times A_{t-1} + 0.131 \times P_t - 0.15156 \times R_t - 0.50862 \times R_{t-1} - 0.49282 \times Y_{t-1}
\]

\[
(4.2147) \quad (0.7432) \quad (0.8065) \quad (0.4074) \quad (1.4119) \quad (2.1630)
\]

\[R^2 = 0.97181 \quad F = 74.6979\]

**Cobb – Douglas Model:**

\[
Y_t = 5.059 + 1.649 \times A_t - 0.0856 \times A_{t-1} + 0.0794 \times P_t - 0.0649 \times R_t - 0.2431 \times R_{t-1} + 0.3274 \times Y_{t-1}
\]

\[
(4.9659) \quad (0.2372) \quad (0.2577) \quad (0.2258) \quad (0.8772) \quad (1.1913)
\]

\[R^2 = 0.8919 \quad F = 17.8766\]
From the above estimated log-linear model the coefficient of area under cotton crop is positive and significant at 5 percent probability level. It indicates that there is direct relationship between the quantity of cotton production is positively and significantly influenced by its area. For every one hectare increase in area, 1.649 bales of cotton output may be increased. This increase in cotton production is a significant increase observed by t-test statistic.

The coefficient of lagged area is negative (-0.0856) but not significant. An insignificant negative effect on lagged area on cotton production was noticed in Kurnool district. For every one hectare increase in lagged area, the cotton production will decrease by 0.0856 bales. The coefficient of price is 0.794. An insignificant positive effect of price on cotton production was noticed by the estimated coefficient of price. A unit increase in price will increase the cotton production by 0.08 units. This increase in production is an insignificant increase. The coefficients of rainfall and lagged rainfall variables are negative and insignificant. They are -0.0649 and -0.2431 respectively. It is observed that an increase in these rainfall variables will decrease the cotton production. The coefficient of lagged output is positive (0.3274) and insignificant. A direct relationship was recorded between current and lagged outputs. This relationship is not a significant relationship.

The aggregate effect of these six variables on cotton production was estimated and denoted by $R^2$. The value of multiple correlation
coefficient (R²) is 0.8919. It indicates that nearly 89.2 percent of production variation was observed by the collective effect of these selected independent variables. From ‘F’ test statistic, the combined effect of these six variables on cotton production is significant at 5 percent probability level.

**Production responses of cotton in Andhra Pradesh**

Time series data for the period 1985 – 2005 has been used in the present study. The data related to Andhra Pradesh as a whole was fed to the equation. The parameters were estimated by OLS method and results are expressed in the equation form. Both linear and log linear models were estimated and it is observed that log-linear model yields the better estimates comparing to linear models. The analysis is based on log-linear model only.

\[ Y_t = 3.689 + 0.334 \times A_t + 0.508 \times P_{t-1} + 0.314 \times R_t \]

\[ (3.729) \quad (4.132) \quad (1.634) \]

\[ R^2 = 0.5769^* \quad F = 9.545 \]

In the above equation, coefficients of area and lagged price are positive and significant at 5 percent probability level in Andhra Pradesh state. It indicates that the cotton production is directly and significantly influenced by its area and its lagged price. A unit increase in area and lagged price may raise the cotton output by 0.334 and 0.508 units respectively. The coefficient of rainfall is positive. This means the cotton
output is directly responded by rainfall. For every one unit increase in rainfall will raise the cotton output by 0.314 units. The combined effect of all independent variables on cotton output is expressed by the multiple correlation coefficient ($R^2$). The value of $R^2$ is 0.5769. This shows that all independent variables explained more than 57 percent of variation in total output. F-test was carried out for the significance of $R^2$. it is noticed that the combined effect is significant on cotton output. Hence, it is concluded that the cotton output is significantly responded by area and lagged price but it is insignificantly responded by rainfall. The value of intercept term is 3.689.

The price and non price factors are influencing the farmer's decision in allocating the area to the cotton crop. Among these factors expected prices will motivate the growers more than the other factors. The expected price may be used as an explanatory variable in the model with the belief that they may get more profits. This suggests the use of adoptive expectation model. The adoptive expectation model which is used in the study is given in the methodology. The estimated results for cotton crop in Andhra Pradesh are given in the equation form.

$$Y_t = -1.241 + 0.378^* A_t + 0.030 A_{t-1} + 0.369 P_t$$

(4.3245) (0.1321) (0.1652)

$$+ 0.481 R_t + 0.153 R_{t-1} + 0.197 Y_{t-1}$$

(0.2277) (0.4356) (1.1513)

$R^2 = 0.5623^*$

$F = 3.853$
From the above equation, the estimated coefficient of area under the cotton crop is positive and significant. The coefficient of lagged area, price rainfall, lagged rainfall, and lagged output are positive but not significant. This states that all independent variables directly influencing the cotton production in Andhra Pradesh. For every one unit increase in each of these variables may raise cotton output by 0.378, 0.030, 0.369, 0.481, 0.153, and 0.197 units respectively. The combined effect of all independent variables on cotton output, i.e., the value of $R^2$, is 0.5623. It shows that all independent variables effect on dependent variable is 56.23 percent. More than 56 percent of variation in total output of cotton was noticed by these variables. F-test was carried out and it is found to be significant. It is inferred that the combined effect of all variables is significant on cotton output. Hence, it is concluded that cotton output is responded positively by all independent variables. The value of intercept term is negative i.e., -1.241.

**Co-efficient of Expectation:**

The term ‘Expectation’ itself relates to the future events. To some extent, this expectation depends on past events. In our present study, $\lambda$ is the coefficient of expectation of cotton prices. If the value of $\lambda$ is sufficiently high, there is a greater possibility of the expected prices to be accurate. Since only the prices of recent years’ will be considered and the value of earlier years’ prices be negligible, shall be ignored. Contrary
to this, if the value of the $\lambda$ is low, the value of expected prices of earlier years' can be included in computing expected prices and they will possess greater accuracy. In the case of higher values of $\lambda$, more importance is to be attached to the recent years' prices than the earlier years' prices. Thus, lower the value of $\lambda$, greater is the memory concerning the prices of earlier years'. In short, the expectation coefficient indicates only the psychological behaviour of producer. If the value of $\lambda$ is greater than 1, the over expectation takes place in future prices of the output. If $\lambda = 0$, the expectation of future prices are static i.e. the expected value adjusts period by period to the current observation and all previous history is irrelevant. If $\lambda = 1$, the expectations are realized immediately and fully, i.e. in the same period. In other words, an expectation once formed continuously unchanged, irrespective of current or earlier observations. The positive fraction of $\lambda$ means that the expectations are get adjusted each period by same proportions of the discrepancy between the latest observations and expectation for that period.

The coefficient of expectation with respect to cotton crop was calculated with the help of the estimated coefficient of the variable, lagged output in the equation (23), i.e.

$$b_6 = 1 - \lambda, \lambda = 1 - b_6.$$ The calculated value of $\lambda$ are given in the table 6.1.

157
Table No. 7.1

The Co-efficient of Expectation of Cotton Output

<table>
<thead>
<tr>
<th>Kurnool</th>
<th>Andhra Pradesh</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.4928</td>
<td>0.80</td>
</tr>
</tbody>
</table>

From the table, it is observed that the value of $\lambda$ is greater than 1 in Kurnool District. It indicates that over expectation of cotton crop growers about future prices of cotton output in Kurnool District.

In Andhra Pradesh state, the value of $\lambda$ is 0.80. It is sufficiently high. The cotton growers in the state are influenced by very recent years’ prices for their future cotton price expectation.

**Conclusions:**

Commercial crops play a significant role in Indian Agriculture. Commercial crops account for 25 percent of cropped area in the country. The value of production is 40 percent in the total value of agricultural production in India. Cotton is one of the important commercial crop in Andhra Pradesh. One of the major commercial crops in Kurnool District is cotton. To analyse the performance of cotton cultivation, the growth and instability of cotton cultivation was studied in previous chapters. In the present chapter, the production responses of cotton crop was analysed with a traditional functional relationship, cotton production is a function of area, lagged price and rainfall. In a subsistence economy,
crop production is determined by a number of input factors. Here, the Cagan's Adoptive Expectation Model was utilized to study the production responses of cotton. From the estimated equation, the following conclusions are made.

Observing the estimates of the traditional model, almost same results were observed in both linear and log linear models. The coefficient of area, established a positive and significant relationship with cotton production in Kurnool District. The remaining two variables - lagged price and rainfall are having negative relation with production. These two variables express that a unit increase will decrease the cotton production. Therefore, the effect of price and rainfall is not observed on cotton production. From the coefficient of rainfall, cotton is cultivated more under irrigated area than the rainfed area. Finally, it is infer that the cotton production was responded by its area only. Market prices are not encouraging the cotton growers to rise the production.

The estimated coefficient of the equation (23), both the models gave the same results. Only the coefficient of the area expresses the significant and positive relation with the cotton production. Price factor reveals an insignificant positive relationship and the remaining variables lagged area, rainfall and lagged output having inverse relationship with the cotton production. Hence, the cotton production in Kurnool was responded by area only but not the prices. Therefore, the area is the major output determinant factor. A negligible price effect was noticed.
More than 90 percent of cotton variation was recorded by these explanatory variables. The aggregate effect of the variables on cotton production is significant.

The cotton production in Kurnool District was mainly area responsive but not price responsive. Similarly, rainfall’s effect on production is negative. The cotton output is mainly responded by irrigation factor. It may be suggested to rise the production in Kurnool by providing minimum support price, better marketing conditions etc.

Considering Andhra Pradesh as a whole, it is observed that the cotton production was mainly affected by area only. But, in traditional relationship, cotton production in Andhra Pradesh was responded by its area and price. The remaining variables establish an insignificant positive relationship with cotton production. 57 percent of production variation was recorded by these variables and this variation is found to be significant.