



Responses of Cotton Crop in Andhra Pradesh: An Econometric Analysis

KEYWORDS

Cotton Crop, Responses, Andhra Pradesh.

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ABSTRACT Cotton is considered to be one of the prominent principal cash crops in India and enjoys a pride of place and unique position in our economy and it can be gauged from the extent of area under the crop, trade, processing manufacture, export of raw material, cotton textile goods etc. Cotton in India is largely grown during the tropical monsoon season. It is largely cultivated under rain fed conditions and 65 per cent of the area is entirely dependent on rainfall, while the supplementary irrigation existed for about 35 per cent only. Andhra Pradesh occupies a prominent position among cotton producing states in India as it accounts for around 11 per cent of the nation's cotton production and occupies third place in terms of area and production in the country. An attempt has been made in this paper to study the responses of area, production and productivity of cotton crop in the three regions of Andhra Pradesh and all-India.

INTRODUCTION

Cotton, also known as 'white gold', dominates India's cash crops, and makes up 65 per cent of the raw material requirements of the Indian textile industry. India is the third largest cotton producer in the world behind China and the United States, accounting for 25 per cent of the world acreage but only 14 per cent of world production (USDA 2001). Cotton occupies a significant position in Indian economy as a commodity that forms a means of livelihood to millions of cotton cultivating farmers, provides direct employment to over 35 million people in the secondary manufacturing textile industry that contributes to 14 per cent of the country's industrial production, 20% of total work force, 17% of country's exports earning and 4 per cent of its gross domestic product (GDP).

Cotton crop occupies about 5-6 per cent of the total cropped area and is second to rice in India. Only one-third of the area under cotton cultivation in India is under irrigation, and this causes cotton output to vary considerably from year to year response to the vagaries of weather and pest attacks. The key role that cotton plays in our economy can be gauged from the fact that and nearly 15 million farmers in more than 10 states are dependent on cotton cultivation. The major cotton growing states are Maharashtra, Gujarat, Andhra Pradesh, Punjab, Haryana, Madhya Pradesh, Rajasthan, Karnataka and Tamil Nadu. Among the cotton growing states, Andhra Pradesh occupies third position in the country in respect of area, production and productivity of cotton.

Andhra Pradesh occupies a prominent position among the principal cotton producing states in India, as it accounts for around 11 per cent of the nation's cotton production and occupies third place in terms of area and production of cotton in the country. Cotton is mostly raised as a kharif crop in the state and the crop is predominantly grown in Guntur, Adilabad, Kurnool, Prakasam, Anantapur, Cuddapah, Krishna, Mahaboob Nagar and Warangal districts. Most of the area under cotton in these districts of the state is traditionally rain-fed. The state of Andhra Pradesh is made up of three agro-climatic regions namely, Rayalaseema, Coastal Andhra and Telangana. Thus, in this paper an attempt has been made to study the responses of area, production and productivity (yield) of cotton crop over time and space in the above mentioned regions of Andhra Pradesh and all-India. In view of the importance of the cotton crop in India, the present study analyzed the responses of area, production and productivity over time and space in the three regions (Coastal Andhra, Rayalaseema and Telangana) of Andhra Pradesh and all-India during the period 1969-70 to 2003-04.

SOURCE OF THE DATA

The present study have been made use of secondary data, such as Reports of East India Cotton Association, Andhra Pradesh Cotton Association, Season and Crop Reports, CMIE Reports, Statistical Abstracts of Andhra Pradesh and An Outline of Agricultural Situation in Andhra Pradesh.

METHODOLOGY

To study the responses of area, production and productivity of cotton crop the following three different Nerlovian Lagged Adjustment Models have been used.

Area Response Model

$$A_t^* = \alpha_0 + \alpha_1 A_{t-1} + \alpha_2 H P_{t-1} + \alpha_3 P_{t-1} + \alpha_4 R_t + \alpha_5 I_t + \alpha_6 Y_{t-1} + u_t$$

$$A_t - A_{t-1} = \gamma (A_t^* - A_{t-1}) \quad 0 < \gamma < 1$$

$$A_t = \beta_0 + \beta_1 A_{t-1} + \beta_2 H P_{t-1} + \beta_3 P_{t-1} + \beta_4 R_t + \beta_5 I_t + \beta_6 Y_{t-1} + v_t$$

Where,

A_t^* = Desired Acreage.

A_t = Actual Acreage of Crop in the Current Year.

A_{t-1} = Last Year Acreage of the Crop.

$H P_{t-1}$ = Harvest Price of the Competing Crop, Lagged by One Year.

P_{t-1} = Farm Harvest Price of the Crop, Lagged by One Year

R_t = Rain fall in the Current Year.

I_t = Percentage of Irrigation Available to the Crop.

Y_{t-1} = Yield of the Crop Lagged by One Year.

γ = Coefficient of Adjustment.

Production Response Model

$$Q_t^* = \alpha_0 + \alpha_1 A_t + \alpha_2 P_{t-1} + \alpha_3 R_t + \alpha_4 I_t + \alpha_5 Q_{t-1} + u_t$$

$$Q_t - Q_{t-1} = \gamma (Q_t^* - Q_{t-1}) \quad 0 < \gamma < 1$$

$$Q_t = \beta_0 + \beta_1 A_t + \beta_2 P_{t-1} + \beta_3 R_t + \beta_4 I_t + \beta_5 Q_{t-1} + v_t$$

Where,

Q_t^* = Desired Quantity in the Current Year.

- Q_t Actual Production in the Current Year.
- At = Actual Acreage of Crop in the Current Year.
- P_{t-1} = Farm Harvest Price of the Crop Lagged by One Year.
- R_t = Rainfall in the Current Year.
- I_t = Percentage of Irrigation Available to the Crop.
- Q_{t-1} = Quantity of the Crop Lagged by One Year.
- γ = Adjustment Coefficient.

Yield / Productivity Response Model

$$Y_t^* = \alpha_0 + \alpha_1 P_{t-1} + \alpha_2 I_t + \alpha_3 R_t + \alpha_4 Y_{t-1} + u_t$$

$$Y_t - Y_{t-1} = \gamma(Y_t^* - Y_{t-1}) \quad 0 < \gamma < 1$$

$$Y_t = \beta_0 + \beta_1 P_{t-1} + \beta_2 R_t + \beta_3 I_t + \beta_4 Y_{t-1} + v_t$$

Where,

- Y_t^* = Desired Yield
- Yt = Actual Yield in the Current Year
- Pt-1 = Lagged Farm Harvest Price of the Crop
- I_t Percentage of Irrigation Available to the Crop
- Rt = Rainfall in the Current Year
- Yt-1 = Yield of the Crop Lagged by One Year
- γ = Coefficient of Adjustment

Table-1: Estimated Area Response of Cotton Crop

Region	Constant	At-1	Pt-1	Rt	It	Yt-1	R2
Rayalaseema OLE	-3.1625	0.6482** (0.1104)	0.1385* (0.0649)	0.0121 (0.0436)	0.1026* (0.0482)	0.8409** (0.1307)	0.6924**
ALE	-2.2811	0.6584** (0.0902)	0.1409* (0.0621)	0.0134 (0.0290)	0.1152** (0.0369)	0.8482** (0.1168)	0.7153**
Costal Andhra OLE	-2.0829	0.4918** (0.0817)	0.0178 (0.0165)	0.0016 (0.0203)	0.1937* (0.0952)	0.7942** (0.1533)	0.8426**
ALE	-3.2437	0.5139** (0.0679)	0.0185 (0.0137)	0.0015 (0.0071)	0.2008* (0.0936)	0.8795** (0.1261)	0.9201**
Telangana OLE	-8.0693	0.5821** (0.1265)	0.0214* (0.0108)	0.0486* (0.0138)	0.0927* (0.0463)	0.9025** (0.1008)	0.7620**
ALE	-9.1162	0.5990** (0.1173)	0.0267* (0.0130)	0.0506 (0.0105)	0.0960* (0.0458)	0.9160** (0.0873)	0.8019**
Andhra Pradesh OLE	-6.0852	0.4836** (0.1408)	0.0299* (0.0146)	0.0348 (0.1873)	0.0805* (0.0420)	0.8430** (0.0992)	0.7346**
ALE	-4.7369	0.5271** (0.1329)	0.0281* (0.0122)	0.0352 (0.1401)	0.0822* (0.0409)	0.8523** (0.0706)	0.7915**
All India OLE	-3.2704	0.5218** (0.1511)	0.0264* (0.0146)	0.0503 (0.0891)	0.1041* (0.0429)	0.7928** (0.1040)	0.7226**
ALE	-3.9201	0.5403** (0.1290)	0.0289* (0.0139)	0.0529 (0.0607)	0.1103* (0.0421)	0.8065** (0.0906)	0.7808**

Note: ** and * indicates significant at 1 per cent and 5 per cent level respectively

From table-1, it is seen that the coefficients of the last year acreage of cotton crop (P t-1) and last year production of cotton crop (Y t-1) are all positive and significant at 1 per cent level for Coastal Andhra, Rayalaseema and Telangana regions of Andhra Pradesh and all-India. It indicates that there is a positive influence of these two variables on the

In social sciences, particularly in economics, most of the data contain observational errors. This is a serious problem to researchers. Kamat (1969) pointed out that this type of data invariably contains measurement errors. Hence, the Adjusted Linear Estimator Method is employed for estimating the parameters of Nerlovian models and also comparisons were made with OLE on the basis of the standard error of the estimates.

Adjusted Linear Estimator (ALE)

The Adjusted Linear Estimator was proposed by V.B. Naidu, et al., (1992) and the estimator is

$$\hat{\mathbf{a}}_A = L \hat{\mathbf{a}}^* \quad L = M_x^{-1} M_{x^*}$$

Where

$$M_{x^*} = \text{Plim } n^{-1} (X^{*T} X^*)$$

$$= \text{Plim } n^{-1} [X^T X + X^T Z + Z^T X + Z^T Z]$$

$$= M_x + B$$

with asymptotic variance

$$\text{Asy var } (\hat{\beta}_A) = n^{-1} \sigma^2 M^{-1} M_{x^*} M_x^{-1}$$

It was established that this estimator is unbiased and consistent under the assumption that B is known.

Assuming that B is known, it was proved that the estimator

$$\tilde{\beta}_A = \hat{M}_x^{-1} \hat{M}_{x^*} \hat{\beta}^* = [\hat{M}_x - B]^{-1} \hat{M}_{x^*} \hat{\beta}^*$$

is unbiased and consistent estimator of b.

RESULTS AND DISCUSSION

In view of the above objective, the results are presented in the following.

current year acreage of cotton crop. There is no significant effect of rainfall (Rt) for all the regions of Andhra Pradesh. The farm harvest price of the crop lagged by one year (P t-1) is significant at 5 per cent level for all the regions except Coastal Andhra. The Irrigation (It) has no impact on the acreage of cotton crop of the current year. The coefficient of the determination indicates that the variables are explained more than 70 per cent variation to the current year acreage of the cotton crop.

Table-2: Estimated Production Response of Cotton Crop

Region	Constant	At	Qt-1	Pt-1	Rt	lt	R2
Rayalaseema OLE	7.4915	0.6149** (0.1346)	0.7263** (0.1650)	0.0427* (0.0209)	0.0018 (0.0024)	0.1254* (0.0629)	0.6483**
ALE	5.86398	0.6405** (0.1019)	0.7291** (0.0096)	0.0508* (0.0254)	0.0017 (0.0019)	0.1318* (0.0614)	0.6691**
Costal Andhra OLE	4.2937	0.4092** (0.0805)	0.8956** (0.1082)	0.0197 (0.0105)	0.0064 (0.0073)	0.1673* (0.0811)	0.7503**
ALE	2.7421	0.4352** (0.0697)	0.9006** (0.1132)	0.1078 (0.1023)	0.0068 (0.0055)	0.1703* (0.0740)	0.8217**
Telangana OLE	5.2249	0.5346** (0.1044)	0.8615** (0.1527)	0.0114 (0.0089)	0.0086 (0.0103)	0.0803* (0.0417)	0.6928**
ALE	6.1189	0.5380** (0.1268)	0.8721** (0.1216)	0.0124 (0.0079)	0.0088 (0.0082)	0.0839* (0.0414)	0.7342**
Andhra Pradesh OLE	5.0166	0.5424** (0.0977)	0.8670** (0.0738)	0.01834* (0.0095)	0.0150 (0.0170)	0.0612* (0.0313)	0.7089**
ALE	4.7438	0.5474** (0.0728)	0.8692** (0.0691)	0.0189* (0.0087)	0.0163 (0.0146)	0.0658* (0.0308)	0.7642**
All India OLE	3.7948	0.4391** (0.1280)	0.8894** (0.1394)	0.0162* (0.0073)	0.1028* (0.0495)	0.0097* (0.0046)	0.6711**
ALE	5.1126	0.4401** (0.1009)	0.8902** (0.1320)	0.0169* (0.0068)	0.1213* (0.0581)	0.0105* (0.0042)	0.7426**

Note: ** and * indicates significant at 1 per cent and 5 per cent level respectively.

Table-3: Estimated Productivity Response of Cotton Crop

Region	Constant	Yt-1	Pt-1	Rt	lt	R2
Rayalaseema OLE	7.5032	0.6845** (0.1962)	0.1458* (0.0590)	0.0136 (0.0259)	0.1178** (0.0264)	0.6012**
ALE	8.9240	0.7190** (0.1827)	0.1602** (0.0526)	0.0149 (0.01240)	0.1203** (0.0187)	0.6145**
Costal Andhra OLE	14.7438	0.8409** (0.2283)	0.0185 (0.0208)	0.0021 (0.0017)	0.1962** (0.0736)	0.7824**
ALE	16.1975	0.8496** (0.2094)	0.0197 (0.0196)	0.0027 (0.0015)	0.2138** (0.0680)	0.7883**
Telangana OLE	4.5398	0.6711** (0.1560)	0.0292** (0.0074)	0.0548 (0.0391)	0.0940** (0.0318)	0.6851**
ALE	7.0391	0.6938** (0.1485)	0.0358** (0.0087)	0.0562 (0.0378)	0.0979** (0.0288)	0.7148**
Andhra Pradesh OLE	7.8039	0.6204** (0.1399)	0.0319* (0.0154)	0.0354 (0.0327)	0.0844** (0.0129)	0.7386**
ALE	9.1022	0.6678** (0.1258)	0.0342* (0.0168)	0.0379 (0.0301)	0.0891** (0.0117)	0.7472**
All India OLE	6.2750	0.7132** (0.2318)	0.0290* (0.0138)	0.1167 (0.1053)	0.1029** (0.0341)	0.6605**
ALE	7.4461	0.7315** (0.2159)	0.0307** (0.0119)	0.1390 (0.0946)	0.1152** (0.0294)	0.6927**

Note: ** and * indicates significant at 1 per cent and 5 per cent level respectively.

As per the results shown in table-2 the coefficient of the determination indicates that more than 65 per cent variation is explained by the independent variables, suggesting a positive influence of the independent variables on the current year cotton production in Coastal Andhra, Rayalaseema and Telangana regions of Andhra Pradesh and all-India. The independent variable of rainfall (Rt) has not shown any significant influence on the production of cotton crop in all the regions in Andhra Pradesh. It is also clear from the table-4.8, the independent variables i.e., current year acreage (At-1), quantity of cotton crop lagged by one year (Qt-1) and irrigation (lt) are having significant influence on the production of the cotton crop in the current year.

It is evident from the table-3 that the coefficients of the variables, last year production of the cotton crop (Yt-1), farm harvest price of the cotton crop lagged by one year (Pt-1) and irrigation (lt) are having significant influence on the current year productivity of cotton crop. But, the coefficient of farm harvest price lagged by one year (Pt-1) is not having any significant influence on the current year productivity of cotton crop in Coastal Andhra region. The rainfall (Rt) does not have significant influence on the current year productivity of cotton crop. The coefficient of determination in Rayalaseema region is small (60 per cent) when compared to the other regions (more than 66 per cent) and all are significant at 1 per cent level. This implies that the four independent variables (Yt-1, Pt-1, lt, Rt) jointly have a significant influence on productivity of cotton crop.

CONCLUSION AND SUGGESTIONS

The state of Andhra Pradesh is made up of three agro-climatic regions namely Coastal Andhra, Rayalaseema and Telangana. In case of area response, the coefficients of the last year acreage of cotton crop (P_{t-1}), last year production of cotton crop (Y_{t-1}), farm harvest price of the crop lagged by one year (P_{t-1}) and Irrigation (I_t) are having positive and significant influence on current year acreage of cotton crop in Coastal Andhra, Rayalaseema and Telangana regions of Andhra Pradesh and all-India, while rainfall (R_t) is not having significance influence on the acreage of cotton crop in the current year. The independent variable rainfall (R_t) has not shown any significant influence on the production of cotton crop in all the regions in Andhra Pradesh. The independent variables i.e., current year acreage (A_{t-1}), quantity of cotton crop lagged by one year (Q_{t-1}) and irrigation (I_t) are having significant influence on the production of the cotton crop in the current year. In respect of Yield response, the coefficients of the variables, last year production of the cotton crop (Y_{t-1}), farm harvest price of the cotton crop lagged by one year (P_{t-1}) and irrigation (I_t) are having significant influence on the current year productivity of cotton crop. But, the coefficient of farm harvest price lagged by one year (P_{t-1}) is not having any significant influence on the current year productivity of cotton crop in Coastal Andhra. It is observed that the Standard Errors

of the Adjusted Linear Estimator is less than the Ordinary Least Square Estimators for all the three response models.

Based on the above analysis, the following are the suggestions for profitable farming of cotton crop. Steep decline in productivity in main cotton growing states can be prevented by stepping up research and extension efforts. The price of the cotton in the international market is highly volatile, and this can be reduced if not totally removed by providing minimum cotton support price by the Government, which will be particularly helpful to the small farmers. Small farmers' agriculture can be made viable by increasing the insurance coverage and other such measures, so that suicides deaths may decrease to some extent. The Government has to take necessary steps for providing the transonic varieties in cotton, which are resistant to water stress and drought. Also Government has to appoint a technical officer (Agriculture officer) to create awareness in cotton growers regarding the use of fertilizers, pesticides and insurance coverage of the crop. Lastly, the irrigation is also found to have significant influence both on cotton production and productivity. Thus irrigation is a policy variable, and there is large scope to increase cotton production and yield in the state and the entire country by extending irrigational facilities to cotton crop.

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