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SUPPLY RESPONSE OF COTTON IN ANDHRA PRADESH*

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ABSTRACT

The supply response of cotton in three regions viz., Coastal Andhra, Rayalaseema and Telangana of Andhra Pradesh was assessed by applying a Nerlovian Lagged Adjustment Model for area, production and yield separately. The results revealed that in general the farmers' area and resource allocation decisions for cotton was influenced by its own price. In case of Rayalaseema, the price of competing crop had negative impact on area while price risk surprisingly exerted positive influence on yield. These results imply that the farmers' area and resource allocation decisions for cotton could be influenced through remunerative price policies. The supply response is also found to be influenced by traditional behaviour of farmers in allocating the area and resources for cotton cultivation. The price elasticities indicated that the growers in Coastal Andhra are more price conscious than in the other two regions. The adjustment mechanism showed that the Coastal Andhra required less number of years for production and yield adjustments while area adjustment is quick in Rayalaseema region.

Introduction

The supply behaviour of crops, specially commercial crops like cotton depends on institutional and technological factors such as support prices, price fluctuations, availability of irrigation facilities, rainfall etc. Among all, the role of support price in area and resource allocating decisions of farmers has been studied by Raj Krishna (1963), Ramesh (1965), Jha (1970), Madhavan (1972), Cummings (1975), Sawant (1978), Umakapila (1982), Raju (1986) and Sidhu and Sidhu (1988) covering different commercial crops in different regions and States of India. Such location and crop specific supply response studies are extremely useful in formulating appropriate policy strategies at various levels. This study analyses the supply response of cotton in Andhra Pradesh, which occupies about 22 per cent of the total area under cash crops. Three regions of Andhra Pradesh namely Coastal Andhra, Rayalaseema and Telangana are selected for present study to analyse the supply response and adjustment mechanism of cotton for the period 1956-57 to 1985-86.

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Methodology

Secondary data relating to area, production, yieid, farm harvest prices and irrigated area of cotton and rainfall for the period 1956-57 to 1985-86 were collected from Season and Crop Reports and Statistical Abstract of Andhra Pradesh published by Government of Andhra Pradesh. The farm harvest prices of chillies which is the competing crop for cotton were also collected for the same period.

Nerlovian Lagged Adjustment Model (in double-log form) was used to assess the supply behaviour of area, production and yield for cotton, as follows.

(i) $\log A_t = \log b_0 + b_1 \log P_{t-1} + b_2 \log P^C{}_{t-1} + b_3 \log PR_t + b_4 \log TRF_t + b_5 \log T_t + b_6 \log A_{t-1} + \log V_t,$

(ii) $\log Q_t = \log b_0 + b_1 \log P_t{}^{-}{}_1 + b_2 \log TRF_t + b_3 \log I_t + b_4 \log T_t + b_5 \log Q_{t-I} + \log V_t,$ and

(iii) $\log Y_t = \log b_0 + b_1 \log P_{t-1} + b_2 \log PR_t + b_3 \log TRF_t + b_4 \log I_t + b_5 \log T_t + b_6 \log Y_{t-1} + \log V_t.$

Where,

A_t = area of cotton in 000' hectares in the current year,

Q_t = production of cotton (lint) in 000' bales of 180 kg in the current year,

Y_t = yield of cotton (lint) in kg/ha in the current year,

P_{t-1} = farm harvest price of cotton kapas (Rs./Q) lagged by one year,

$P^C{}_{t-1}$ = farm harvest price of chillies (Rs/Q) lagged by one year.

PR_t = price risk of cotton in the current year (squared deviation of expected value ($P^e{}_t$) from the actual value (P_t) was taken as price risk. $PR_t = (P_t - P^e{}_t)^2$. The expected values are derived from observed values through three-year moving average model.

TRF_t = total rainfall in 'mm' in the current year,

I = irrigated area of cotton in 000' hectares in the current year,

A_{t-1} = area of cotton in 000' hectares lagged by one year,

Q_{t-1} = production of cotton (lint) in 000' bales of 180 kg lagged by one year.

Y_{t-1} = yield of cotton (lint) in kg/ha lagged by one year, and

V_t = error term,

T_t = trend variable.

The adjustment mechanism was examined by applying formula $(1\text{-}B)^N = 0.05$, where, 'B' is coefficient of adjustment derived from regression coefficient of lagged

dependent variable and 'N' is number of years required to realise the gains of 95 per cent price effect.

In case of double-log form of Nerlove's model, regression coefficients of price variables represent their short-run elasticities and long-run price elasticities are estimated by dividing the short-run price elasticities with their corresponding coefficients of adjustment.

Two major estimation problems, arising out of the use of time-series data, are multicollinearity and autocorrelation. The former one was tested by Zero-order correlation matrix and variables causing multicollinearity are dropped through step-down analysis while autocorrelation was tested by applying Durbin-Watson's d-statistic.

Results and Discussion

Area Response

The results obtained from supply response functions for cotton are presented in Tables 1 to 3 and discussed below :

Table 1. Area response of cotton in different regions of Andhra Pradesh (1956-57 to 1985-86)

Variable	Coastal Andhra	Rayalaseema	Telangana	Andhra Pradesh
Intercept	—2.1302***	5.3636***	2.3290**	2.8666***
	(0.6346)	(1.4648)	(0.9496)	(0.8894)
P_{t-1}	0.8778***	0.1633	0.1927***	0.2724***
	(0.2595)	(0.1322)	(0.0509)	(0.0913)
PC_{t-1}	—	—0.4555***	—	—0.1990*
		(0.1500)		(0.1048)
PR_t	—	—	—0.0199*	—
			(0.0177)	
TRF_t	—	—	—0.2095	—
			(0.1301)	
T_t	—0.4095*	—	—	—
	(0.2247)			
A_{t-1}	0.6126***	0.3164*	0.6073***	0.4640***
	(0.1017)	(0.1930)	(0.1332)	(0.1584)
R^2	0.9553	0.7015	0.8369	0.6831
d-statistic	2.4386^{NS}	2.0646^{NS}	1.7772^{NS}	1.8134^{NS}

Note : Figures in parentheses indicate standard error.
*** Significant at 1 per cent level.
** Significant at 5 per cent level,
* Significant at 10 per cent level.

Table 1 reveals that the previous year's area as well as price had exerted significant positive influence on current year's cotton area in the State as a whole and its regions except in Rayalaseema where previous year's price had not influenced the area response significantly. This implies that the farmers are responsive to economic incentives which further emphasises the role of remunerative price policy as an essential prerequisite for expanding cotton area which suggests that the area under cotton is likely to be expanding in the presence of support and remunerative price policy.

The price of competing crop (chillies) in Rayalaseema region and the State as a whole was observed to have negative relationship with current year's cotton area. In Telangana the price risk had a negative impact on area. This also indicates the rational outlook of the farmers towards price movements of alternative crops while allocating area under a particular crop. But the negative association of trend variable with area indicates that the area under cotton is declining over a time period in Coastal Andhra region.

Production and yield response

Similar to area behaviour, price of cotton is the important factor positively influencing the resource allocation for its production in the State and its regions except in Rayalaseema (Table 2 and 3). Lagged production was found to have

Table 2. Production behaviour of cotton in different regions of Andhra Pradesh (1956-57 to 1986-87)

Variable	Coastal Andhra	Rayalaseema	Telangana	Andhra Pradesh
Intercept	—5.5638***	4.2447***	7.9824***	—0.3826
	(1.7577)	(1.4818)	(2.7798)	(0.8851)
P_{t-1}	1.8063***	—0.0135	0.3607***	0.7488**
	(0.6062)	(0.2949)	(0.1261)	(0.3356)
TRF_t	—	—	—1.0306***	—
			(0.3858)	
I_t	—	0.4624***	—	0.2039
		(0.1685)		(0.1766)
T_t	—0.8862*	—0.4988***		—0.6260**
	(0.5295)	(0.1923)		(0.2686)
Q_{t-1}	0.5241**	0.1516	0.2100	0.5305***
	(0.1317)	(0.1710)	(0.1778)	(0.1443)
R^2	0.9188	0.5064	0.5442	0.8494
d-statistic	2.7460^{NS}	2.0192^{NS}	2.1185^{NS}	2.2301

Note : Figures in parenthesis indicate the standard error.
*** Significant at 1 per cent level.
** Significant at 5 per cent level.
* Significant at 10 per cent level.

significant and positive impact on cotton production at State level and in Coastal Andhra region. This indicated that, farmers while making production decisions, respond to price variations in allocating the resources on the one hand and also opts for improved agronomical practices to boost up production level. The results confirm that the cotton production can be increased if the price policy is remunerative

The inverse relationship between rainfall and production in Telangana implied that heavy rains at critical stages of cotton growth namely (flowering, boll formation and boll development) causes flower and boll drops resulting in reduced production. But, irrigation had played important positive role in production of cotton in scarce-rainfall Rayalaseema region.

As in the cases of area and production responses the farmers are responsive to

Table 3. Yield behaviour of cotton in different regions of Andhra Pradesh (1956-57 to 1985-86)

Variable	Coastal Andhra	Rayalaseema	Telangana	Andhra Pradesh
Intercept	—0.8139	1.0529	9.3420***	—0.4513
	(1.0081)	(0.9399)	(2.5424)	(0.6029)
P_{t-1}	1.0894***	0.3025	0.1138	0.7139***
	(0.4354)	(0.2143)	(0.0971)	(0.2516)
PR_t	—	0.0675***	—	—
		(0.0199)		
TRF_t	—	—	—0.9383***	—
			(0.3409)	
I_t	—	0.1394	—	—
		(0.1228)		
T_t	—0.5445	—0.3924***	—	—0.3853*
	(0.4144)	(0.1431)		(0.2199)
Y_{t-1}	0.2936*	0.4799***	0.1538	0.4925***
	(0.1707)	(0.1363)	(0.1815)	(0.1550)
R^2	0.7550	0.7994	0.3251	0.8222
d-statistic	2.3674^{NS}	2.3726^{NS}	2.0906^{NS}	2.3237^{NS}

Note : Figures in parentheses indicate standard error.
*** Significant at 1 per cent level
** Significant at 5 per cent level
* Significant at 10 per cent level,

price changes in allocation of resources and adoption of yield increasing technology in Coastal Andhra region as well as in the State as a whole.

It is interesting to note that the relationship between yield and price risk was found to be positive and significant in Rayalaseema which is unexplainable. Rainfall and trend variables exerted same influence as discussed under production behaviour.

Price Elasticities

The price elasticities obtained from present analysis are presented in Table 4. These parameters for supply behaviour revealed that the higher price elasticities in short-run and long-run were recorded in Coastal Andhra region compared to State as a whole and Telangana region. This explains that the farmers in Coastal Andhra region are more price conscious and adjust area and resources to realise gains from price variations as the price elasticity is nearer to or greater than unity. On the contrary, farmers in Telangana responded less to price incentives to re-allocate the area and resources for cotton.

Table 4. Estimated price elasticities of supply behaviour for cotton in Andhra Pradesh

Price elasticity	Coastal Andhra	Rayalaseema	Telangana	Andhra Pradesh
Area behaviour				
Short-run	0.8778	—	0.1927	0.2724
Long-run	2.2658	—	0.4907	0.5082
Production behaviour				
Short-run	1.8063	—	0.3607	0.7488
Long-run	3.7955	—	0.4566	1.5945
Yield behaviour				
Short-run	1.0894	—	—	0.7139
Long-run	1.5422	—	—	0.4067

Adjustment Mechanism

The rapidity with which the farmers adjust the acreage, production and yield of a crop in response to the movements in selected variables may be examined from the adjustment mechanism (Table 5). The values of adjustment coefficients, in general, indicated that the commercial crops like cotton have quicker adjustment compared to cereal crops like paddy (Madhavan, 1972). A higher coefficient of adjustment implies, in Nerlovian sense, a general lack of rigidities which inhibit equilibrium output.

The highest coefficient of adjustment for area (0.6836) in Rayalaseema region indicated that the higher discrepency, between desired and actual dependent variables

(area) eliminated in a year, was observed in this region compared to other regions. This suggests that the adjustment is quicker in respect of area decisions (2.60 years) to realise 95 per cent price effects. In contrast to area behaviour, the adjustment mechanism for production and yield behaviour implied that the farmers in Coastal Andhra region are quick in adjusting the resource allocating decisions and adopting the new technological innovations to realise the economic incentives.

Table 5. Adjustment mechanism for cotton supply behaviour in different regions of Andhra Pradesh

	Coastal Andhra	Rayalaseema	Telangana	Andhra Pradesh
Area behaviour				
B	0.3874	0.6836	0.3927	0.5356
N	6.1100	2.6000	6.0100	3.9100
Production behaviour				
B	0.4759	—	—	0.4696
N	4.6400	—	—	4.7200
Yield behaviour				
B	0.7064	0.5201	—	0.5075
N	2.4500	4.0800	—	4.2300

Note : 'B' refers to coefficient of adjustment.
'N' refers to number of years required to realise 95 per cent price effect.

Conclusions and Policy Implications

It can be concluded from above results that the farm harvest price of cotton is the key factor influencing the area and resource allocating decisions of the farmers in the State and its regions except in Rayalaseema. In Rayalaseema and the State as a whole, the price of competing crop played negative role on the area under the crop. The area and resource allocating decisions are also influenced by lagged area, production and yield which indicated growers' traditional behaviour. Irrigation is one of the key inputs affecting the cotton production in scarce-rainfall, Rayalaseema region Whereas, annual rainfall exerted negative influence on production and yield in Telangana region. The price elasticities explained that the farmers in Coastal Andhra are more responsive through yield, to realise the gains of price variations. The adjustment mechanism indicated that the farmers in Coastal Andhra are quick in adjusting production and yield while area adjustment is quick in Rayalaseema region.

The following policy implications may be considered for further improvements of cotton production in the State. They are (a) policy makers should formulate

remunerative long run support price policy for cotton to provide better incentives to the farmers, (b) the government should take necessary steps such as procuring the cotton at support prices, setting up of more Co-operative markets, and providing more storage facilities to safeguard the farmers during price fluctuations, and (c) the government should make efforts to improve the irrigation facilities in backward regions like Rayalaseema to minimise the inter-regional disparities.

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