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To study the cost, returns and profitability of cotton production in Andhra Pradesh

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Abstract
A farmer uses various inputs in varying quantity depending on a type of crop grown, type of soil and type of input, etc. Therefore, it is very much pertinent that an optimum inputs mix is achieved by a farmer so as to obtain the best possible production in agriculture. The cost of cultivation or the cost of production of any crop helps the farmers in judging the profitability of the crop and accordingly changing the cropping pattern. The cost and returns of cotton cultivation have, therefore, been estimated in the present study. The cost of cultivation of cotton incurred by the sample farmers during the reference year 2013-14 included home produced and purchased impulses. The impulses implemented in the cotton varieties are seed, FYM, oil cakes, chemical/organic fertilizers, irrigation, pesticides, tractor and bullock labour, human labour, land revenue, interest on working capital and fixed capital, rental value of owned land etc. The output-input ratio over Cost C2 was 1.42 for large farmers, followed by 1.33 for medium farmers and 1.26 for small farmers with the overall average of 1.34. This indicates that on an average one rupee invested in the cultivation of cotton earned Rs. 1.34. The output-input ratio over Cost C2 had increased with increase in farm size groups. It is clearly shows that the relationship between output-input ratio over Cost C2 and farm size groups were positively related with the size of landholding groups. The co-efficient of determination (R^2) turned out to be significant at 1 per cent level, indicating that the included variables explained between 74 to 89 per cent of variation in the production of cotton for all the categories of farmers. The inputs, area under cotton, seed, human labour, manures and fertilizers, pesticides and irrigation are having significant influence on the output of cotton for all the categories of sample farmers except the input variable education.

Keywords: cost, returns, profitability, cotton production and Andhra Pradesh

Introduction
India is the largest producer of cotton in the world accounting for about 26% of the world cotton production. It has the distinction of having the largest area under cotton cultivation in the world ranging between 10.9 million hectares to 12.8 million hectares and constituting about 38% to 41% of the world area under cotton cultivation. The yield per hectare (i.e.504 kgs to 566 kgs per hectare) is however still lower against the world average of about 701 Kgs to 766 kgs per hectare. Country is expected to make more strides in cotton production in the years to come (http://cotcorp.gov.in/shares.aspx#share) [15].

Cotton plays a key role in the Indian economy in terms of income generation in the agricultural and industrial sectors by providing substantial employment and making significant contributions to export earnings. It plays very important role in State's economy also. It is an important raw material for the Indian textile industry, constituting about 65 per cent of its requirements. The Indian textile industry occupies a significant place in the country's economy with 1500 mills, 4 million handlooms, 1.7 million power looms and thousands of garment, hosiery and processing units, providing employment directly or indirectly to around 35 million people (Cotton Seasonal Report, 2009). Textiles and related exports account for nearly 33per cent of the total foreign exchange earnings (~12 billion dollars) of India and it is projected that there will be a significant increase in the coming years (Central Institute of Cotton Research. Nagpur, India, http://www.cicr.org.in/pdf/CICR_VISION_2030.pdf, accessed 25 March, 2014) [16].

Andhra Pradesh is one of the most important cotton growing states among the major cotton growing states in India. Being a commercial crop, cotton is so remunerative that it is being grown by farmers even in agro-climatic zones not suitable for cotton cultivation. The cotton area and production has shown improvement over the years since 1990 in Andhra Pradesh. In terms of area and production of cotton, Andhra Pradesh stands third position after Maharashtra and Gujarat, but in productivity of cotton, it stands only seventh position in Indian cotton producing states (CAB, 20-10-2014). Cotton is grown extensively in Guntur, Karimnagar, Kammam, Warangal, Adilabad, Mahaboobnagar, Prakasam, Krishna, Kurnool and Nalgonda districts. Of the total cotton area, around 25% is under irrigated situation

The growth in production and yield of cotton has not been equal across the different districts of Andhra Pradesh. In this context, an investigation was undertaken for in-depth study of production and yield of cotton in selected major cotton growing districts in Andhra Pradesh. Cotton crop has the prominent position in the crop pattern in these districts, in view of the fact that the area under cotton has been increasing over the years. Hence, in the present study, various components of cotton cultivation in Andhra Pradesh were examined. This study makes an attempt to identify the impact of cotton cultivation on various parameters using field survey data collected from selected cotton growers of the study. The study will be helpful to the researchers, NGOs, academicians, extension workers, farmers and policy makers to observe the trends in economics of cotton cultivation in Andhra Pradesh. It is hope that the findings of the study will be useful to a greater extent to the producers in planning for their future. It will also

be helpful to the farmers in minimizing the cost. Keeping in view of the above, this study concentrates mainly on the objectives of (i) to assess the cost, net returns and output-input ratio of cotton production among the sample farmers and (ii) to examine the production function analysis of cotton production in the area under study.

Methodology and Data

The data for the study were obtained by personal interview method from the selected cotton growers of the study area. Keeping in view the objectives and nature of the study, an extensive schedule was prepared to obtain data from the sample farmers. The selected farmers were personally contacted, interviewed and the required information was collected from them. The Multi-stage simple random sampling method was followed for the conduct of the study. At the first stage, Andhra Pradesh was purposively chosen for the study in view of the importance attached to the cotton growing state in India. At the second stage, Andhra Pradesh has three agro-climatic regions (Rayalaseema, Coastal Andhra and Telangana); we select two districts from each region. Thus, Kurnool, Kadapa districts from Rayalaseema, Guntur, Prakasam districts from Coastal Andhra, Varangal and Khammam districts from Telangana were selected for the study. At the third stage, from each of the six selected districts, 250 household cotton farmers were selected randomly for the study. Thus the total number of sample respondents for the study comes to 1500 household cotton farmers. In order to select sample farmers, all the cotton growing farmers of the selected sample farmers classified into two categories as irrigated and un-irrigated cotton growers. Further, taking into account the landholdings the cotton growers were classified into three groups namely; Small Farmers (below 2.00 hectares), Medium Farmers (2.01 to 4.00 hectares) and Large Farmers (above 4.01 hectares).

Cost Concepts Employed

The present study is mainly based on the primary field level data collected from the selected farm families in Andhra Pradesh. The cost concepts viz., Cost A1, Cost A2, cost B1, Cost B2, Cost C1 and Cost C2 were followed in the analysis as is done by the Commission for Agricultural Costs and Prices for better comparison. The concepts of costs are used in this study for estimating the average cost of production, farm business income, family labour income, net income, gross income, the input items included under each category of cost and profitability from cotton crop cultivation. The present study has also taken following concepts into consideration:

- **Cost A1:** Value of hired human labour plus attached labour + Value of owned and hired bullock labour + Charges on owned and hired machinery + Value of seed (both farm produced and purchased) + Value of pesticides, insecticides + Value of owned and purchased manures + Value of chemical fertilizers + Depreciation on implements, equipments, and farm buildings + Irrigation charges (payments made for canal water, pond water etc.) + Land revenue, cess and other taxes + Interest on working capital + Miscellaneous Expenses (Artisans etc.).
- **Cost A2:** Cost A1 + rent paid for leased in land,
- **Cost B1:** Cost A1 + interest on capital assets (excluding land),
- **Cost B2:** Cost B1 + rental value of own land,
- **Cost C1:** Cost B1 +imputed value of family labour,
- **Cost C2:** Cost B2 +imputed value of family labour,

Farm Business Measures

The farm business measures are gross income, net income, farm business income, family labour income and farm investment income. They are used in the study to arrive at the gains to the farmers as well as different social and size categories of farmers. They are calculated using the standard formulae as follows.

- **Gross income** : Value of total output (Main + by - product)
- **Net income /Profit** : Gross income – Cost C2
- **Farm business income** : Gross income – Cost A1 or Cost A2
- **Family labour income** : Gross income – Cost B2
- **Farm investment income** : Farm business income – imputed value of family labour

Output-Input Ratios over Cost A, Cost B and Cost C2

The output-input ratios are a ratio of gross value of production to different cost of cultivation i.e., Cost A, Cost B and Cost C2. It indicates cost efficiency and rate of return on investment. The output-input ratios indicate the benefit obtained by a farmer on an agricultural expenditure of Rs. 1 on any crop. In other words, the output-input ratio denotes the proportion of benefit received by a farmer on an expenditure of Rs. 1. Thus, the benefit accrued on the production of any crop in the form of agricultural investment of Rs. 1 is termed as output-input ratio. The relevant formula worked out for output-input ratio is:

$$\text{Output} - \text{Input Ratio} = \frac{\text{Gross Value of Production}}{\text{Different Cost of Cultivation (Cost A1, Cost B1, Cost C2)}}$$

Log-Linear Model (Production Function Analysis)

In this study an attempt is made to examine the effects of variation in major agricultural inputs on crop yield with the help of a log-linear regression model. The relative contribution and significance of the major factors such as area under cotton, seeds, human labour, manures and fertilizers, pesticides, irrigation and education of the sample farmers are examined. The regression model is stated with a log-linear functional form due to the fact that the agricultural production function is usually assumed to follow a Cobb-Douglas type that requires a log-linear transformation for estimation of input coefficients. Thus, the estimable equation is as follows:

$$Y = \beta_0 X_1^{\beta_1} X_2^{\beta_2} X_3^{\beta_3} X_4^{\beta_4} X_5^{\beta_5} X_6^{\beta_6} X_7^{\beta_7} e^u$$

Where,

Y = Production of Cotton (in Quintal/Hectare),
X_1= Area under Cotton (in hectares),
X_2 = Seeds (in kg.), X_3 = Human Labour (in Rs.),
X_4 = Manures and Fertilizers (in Rs.),
X_5 = Pesticides / Insecticides (in Rs.),
X_6 = Irrigation (in Hours),
X_7 = Education (in years)

β_0 is constant (intercept) and $\beta_1, \beta_2, \beta_3, \ldots\ldots, \beta_7$ are regression coefficients.

Results and Discussion

Break-up of Cost of Cotton Cultivation

The cost of cotton cultivation and percentage of input costs in total cost per hectare have been presented in the Table-1.

Table 1: Break-up of Cost of Cotton Cultivation per Hectare by Farm Size

S. No.	Particulars	Small Farmers	Medium Farmers	Large Farmers	Total Farmers
1	Seed (Owned + Purchased)	4,089	4,024	4,188	4,100.17
2	FYM (Owned + Purchased)	1,254	1,413	1,366	1,344.00
3	Chemical Fertilizers	6,447	6,625	6,588	6,553.17
4	Pesticides	3,352	3,731	3,813	3,632.00
5	Irrigation	55	54	49	52.67
6	Human Hired Labour	16,863	18,332	20,105	18,433.33
7	Bullock Labour	2,842	2,342	2,013	2,398.83
8	Tractor Labour	1,670	2,380	2,944	2,331.00
9	Transportation Charges	1,000	1,076	1,008	1,027.67
11	Miscellaneous Expenses	359	293	272	307.67
12	Interest on Working Capital	751.41	799.52	841.44	797.46
13	Cost A1	38,321.91	40,775.52	42,913.44	40,670.29
14	Rent Paid for Leased in land	1,346.00	1,455.00	1,520.50	1,440.50
15	Cost A2	39,667.91	42,230.52	44,433.94	42,110.79
16	Interest on Fixed Capital	1,595.00	1,799.50	1,928.50	1,774.33
17	Cost B1	39,916.91	42,575.02	44,841.94	42,444.62
17	Rent for Own Land	7,183.39	7,892.53	7,661.75	7,582.26
18	Cost B2	47,100.30	50,467.55	52,503.69	50,026.88
19	Value of Human Family Labor	7,104.50	6,245.00	5,022.50	6,124.00
20	Cost C1	47,021.41	48,820.02	49,864.44	48,568.62
21	Cost C2	54,204.80	56,712.55	57,526.19	56,150.88

***Source*:** Field Survey

It seems from Table-1 that the overall average per hectare cost of cultivation (Cost C2) of cotton was Rs.56,150.88. The per hectare cost of cotton cultivation and farm size groups were positively related with the land holding groups, i.e., Rs. 54,204.80, Rs. 56,712.55, and Rs. 57,256.19 in small, medium and large farmers respectively. The share of Cost A1 in the total cost of cultivation for all size of holdings was 72.60 per cent. This shows that more amounts of cash were required in cotton. The breakup of Cost C2 reveals that among the various components of expenditure, the cost of hired human labour had occupied the first position with 32.90 per cent (Rs. 18,433.33), followed by chemical fertilizers 11.70 per cent (Rs. 6,553.17), seed 7.32 per cent (Rs. 4,100.17), pesticides charges 6.48 per cent (Rs. 3,632.00), bullock labour charges 4.28 per cent (Rs. 2,398.83), tractor charges 4.16 per cent (Rs. 2331.00), rental value of own land 13.30 per cent (Rs. 7,582.26), irrigation charges 0.09 per cent (Rs. 52.67), family human labour 10.93 per cent (Rs. 6,124.00), FYM 2.40 per cent (Rs. 1,334.00), and transportation charges 1.83 per cent (Rs. 1,027.67) etc. Thus, it could be inferred that the human labour (both hired and family), tractor charges, bullock labour, chemical fertilizers, FYM, seeds and pesticides were the major cost components in the cotton cultivation.

Farm Income Measures and Output-Input Ratios of Cotton

The data regarding per hectare yield, price received, value of output, value of gross output, returns over different costs viz., farm business income, family labour income, net income/net profit, farm investment income etc., cost of production and output-input ratio of cotton by the size of operational holding groups have been presented in Table-2.

Table 2: Farm Income Measures and Output-Input Ratios of Cotton by Farm Size (Yield in Quintals/Per Hectare and Value in Rs./qtl.)

S. No.	Particulars	Small Farmers	Medium Farmers	Large Farmers	Total Farmers
1	Yield	16.12	17.30	18.01	17.14
2	Average Harvest Price	4,245.00	4,348.50	4,536.50	4,376.67
3	Gross Income	68,429.40	75,207.31	81,679.68	75,016.07
Farm Income Measures Over Different Costs (Rs. per Hectare)					
4	Farm Business Income	30,107.49	34,431.79	38,766.24	34,345.78
5	Family labour Income	21,329.10	24,739.76	29,175.99	24,989.18
6	Net Income/ Net Profit	14,224.6	18,494.76	24,153.49	18,865.18
7	Farm Investment Income	23,002.99	28,186.79	33,743.74	28,221.78
Cost of Production (Main Production) (Rs. per Quintal)					
8	Cost A1 / Main Produce	2,377.29	2,357.65	2,383.42	2,372.83
9	Cost B2 / Main Produce	2,921.85	2,918.04	2,916.06	2,918.72
10	Cost C2/ Main Produce	3,362.58	3,279.13	3,195.01	3,276.01
Input-Output ratio over different costs (per hectare)					
11	Cost A1	1.79	1.84	1.90	1.84
12	Cost B2	1.45	1.49	1.56	1.50
13	Cost C2	1.26	1.33	1.42	1.34

***Source*:** Field Survey

Table-2 depict that per hectare average gross returns of cotton varied from Rs.68,429.40 in the case of small farmers to Rs.81,679.68 in the case of large farmers with an overall average of Rs.75,016.07. In the case of medium farmers it was Rs.81,679.31. Thus, the gross return and farm size groups were positively related with the landholding groups. The average per hectare farm business income varied from Rs.30,107.31 in respect of small farmers to Rs.38,766.24 in the case of large farmers with an overall average of Rs. 34,345.78. It was Rs.34,431.79 in respect of medium farmers. Similarly, the average per hectare family labour income varied from Rs.21,329.10 for small farmers to Rs.29,175.99 for large farmers with an overall average of Rs.24,989.18. It was Rs.24,739.76 in respect of medium farmers. The overall average per hectare net income was Rs. 18865.18. It varied from Rs.14,224.60 for small farmers to Rs.24,153.49 for large farmers, while it was Rs.18,494.76 for medium farmers. The overall average per hectare farm investment income was Rs.28,221.78 for all sample farmers. It was Rs.23,002.99, Rs.28,186.79 and Rs.33,743.74 for small, medium and large farm size groups respectively. It is interesting to note that the average per hectare farm business income, family labour income, net income and farm investment income had been increased with increase in landholding groups in the study area. It was positively related with farm size groups. Thus, cotton cultivation was profitable during the reference year in the study area.

Per unit cost of production plays a significant role in determining the minimum support price. The overall average per quintal Cost C2 of cotton was worked out to Rs. 3,276.01 for all sample farmers. It was Rs.3,362.58, Rs.3,279.13 and Rs.3,195.01 for small, medium and large farm size group respectively. Thus, per quintal cost of production (total Cost C2) of cotton had declined with increase in farm size groups. If the per unit cost of cotton production is compared with the farm harvest price in the corresponding size of holding, it is observed that per quintal price of cotton received by different category of farmers was relatively high than the cost of production. The average per hectare output-input ratios over Cost A1, Cost B2 and Cost C2 was favourable for all farm size groups. The output-input ratio over Cost C2 was 1.42 for large farmers, followed by 1.33 for medium farmers and 1.26 for small farmers with the overall average of 1.34. This indicates that on an average one rupee invested in the cultivation of cotton earned Rs. 1.34. The output-input ratio over Cost C2 had increased with increase in farm size groups. It is clearly shows that the relationship between output-input ratio over Cost C2 and farm size groups were positively related with the size of landholding groups.

Production Function Analysis

Table-3 gives a picture of the estimated regression coefficients of variables for cotton output among the sample cotton farmers in the study area. It illustrates from the Table-3 that the co-efficient of determination (R^2) turned out to be significant at 1 per cent level, indicating that the included variables explained between 74 to 89 per cent of variation in the production of cotton for all the categories of farmers. The production elasticities of area under cotton in all the categories of farmers are positive and are highly significant. It is implying that there is a significant influence of these basic inputs on the output. From the production function analysis, it is concluded that the inputs area under cotton, seed, human labour, manures and fertilizers, pesticides and irrigation are having significant influence on the output for all the categories of sample farmers except the input variable education.

Table 3: Production Function Analysis of Cotton according to Farm Size

Category / Particulars	Small	Medium	Large	Overall
Sample Size	**500**	**500**	**500**	**1500**
Intercept (β_0)	3.4816	7.2315	5.8460	6.4903
Area under Cotton (β_1)	0.1263** (0.0381)	0.09721** (0.0245)	0.1439** (0.0364)	0.1175** (0.0197)
Seed (β_2)	0.4259** (0.0659)	0.3806** (0.0436)	0.5318** (0.0824)	05049** (0.1082)
Human Labour (β_3)	0.1031* (0.0472	0.1842^{NS} (0.0979)	0.1624* (0.0638)	0.1963** (0.0426)
Manures and Fertilizers (β_4)	0.1680** (0.0416)	0.1486** (0.0277)	0.1702** (0.0493)	0.1565** (0.0218)
Pesticides (β_5)	0.1634** (0.0249)	0.1258* (0.0561)	0.0960* (0.0472)	0.1349** (0.0285)
Irrigation (β_6)	0.0543** (0.0162)	0.0369** (0.0081)	0.0725** (0.0193)	0.0488** (0.0087)
Education (β_7)	0.0125^{NS} (0.0090)	0.0165^{NS} (0.0884)	0.0173* (0.0075)	0.0157^{NS} (0.0096)
R^2	0.8261**	0.7405**	0.8937**	0.8626**

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

^{NS} indicates not significant

Conclusion

The breakup of Cost C2 reveals that among the various components of expenditure, the cost of hired human labour had occupied the first position with 32.90 per cent followed by chemical fertilizers 11.70 per cent seed 7.32 per cent, pesticides charges 6.48 per cent, bullock labour charges 4.28 per cent, tractor charges 4.16 per cent, rental value of own land 13.30 per cent (Rs. 7582.26), irrigation charges 0.09 per cent, family human labour 10.93 per cent, FYM 2.40 per cent, and transportation charges 1.83 per cent etc. Thus, it could be inferred that the human labour (both hired and family), tractor charges, bullock labour, chemical fertilizers, FYM, seeds and pesticides were the major cost components in the cotton cultivation. Further, per unit cost of production plays a significant role in determining the minimum support price. The overall average per quintal Cost C2 of cotton was worked out to Rs 3,276.01 for all sample farmers. It was Rs.3,362.58, Rs.3,279.13 Rs.3,195.01 for small, medium and large farm size group respectively. Thus, per quintal cost of production (total Cost C2) of cotton had declined with increase in farm size groups. The average per hectare output-input ratios over Cost A1, Cost B2 and Cost C2 was favourable for all farm size groups. The output-input ratio over Cost C2 was 1.42 for large farmers, followed by 1.33 for medium farmers and 1.26 for small farmers with the overall average of 1.34. This indicates that on an average one rupee invested in the cultivation of cotton earned Rs. 1.34. The output-input ratio over Cost C2 had increased with increase in farm size groups. It is clearly shows that the relationship between output-input ratio over Cost C2 and farm size groups were positively related with the size of landholding groups. The co-efficient of determination (R^2) turned out to be significant at 1 per cent level, indicating that the included variables explained between 74 to 89 per cent of variation in the production of cotton for all the categories of farmers. Finally this study concluded that the inputs area under cotton, seed, human labour, manures and fertilizers, pesticides and irrigation are having significant influence on the output for all the categories of sample farmers except the input variable education on the production of cotton.

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