



Comparative Economic Analysis of Cotton Cultivation in Adilabad and Nalgonda Districts of Telangana, India: Insights for Sustainable Farming Practices

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

Aims: Cotton plays a significant role in livelihood of cotton farmers and unskilled workers who depends on cotton textile industry. Knowing the cotton crop's profitability at the farmer level is therefore equally crucial. The following study is aimed at estimating and analysis the cost of cultivation of cotton crop in Adilabad and Nalgonda districts of Telangana and compare the cost structure of the selected districts.

Methodology: The study is based on primary data that was gathered using a pretested schedule from a sample of 120 farmers, with 60 of them coming from each chosen district. Descriptive statistics, including averages, percentages and other basic statistical techniques, were utilized in the study. Various cost concepts and different farm income measures were also used to achieve the objectives of the study.

Results: The study showed that cost of cultivation in Adilabad was Rs. 99,077.86 ha⁻¹ which is more than Nalgonda district estimated at Rs. 93,884.78 ha⁻¹ and net revenue generated by cultivation was also following the same trend which was Rs. 25,394.54 ha⁻¹ in Adilabad and Rs. 18,521.97 ha⁻¹ in Nalgonda district. It was also noticed that yield was reduced drastically during the survey period *i.e.*, 2021-2022, because of unseasonal rainfall that damaged the cotton crop heavily. While the prices were almost doubled compared to previous year.

Conclusion: It can be concluded from the study that the cost of cultivation of cotton is increasing because of inappropriate usage of the inputs like plant protection chemicals and fertilizers and cultivation become less remunerative for cultivators. It is necessary that extension system to take lead role in creating awareness about optimal utilization of the resources.

Keywords: Cotton cultivation; economics; Telangana; cost C2; net returns.

1. INTRODUCTION

Cotton is a multipurpose crop grown under various agro-climatic conditions [1]. Nearly 25 percent of the world's total production of fibers is cotton. It contributes significantly to India's sustainable economy and to the livelihood of the country's cotton farmers. The most popular fiber used by Indian textile mills as a primary raw material is cotton. Cotton accounts for over 60 percent of the raw materials consumed by the Indian apparel sector. India grows all 4 cultivated species of cotton *Gossypium arboreum*, *Gossypium herbaceum* (Asian cotton), *G. barbadense* (Egyptian cotton) and *G. hirsutum* (American upland cotton) in addition to their intra and inter specific hybrids on the commercial scale [2,3]. In terms of area (130.49 lakh hectares) and production (329.96 lakh bales) India tops the list of the largest cotton-producing nations in the globe contributing approximately nearly 40 percent of total production and 23 percent of total acreage under cotton.

Table 1 shows that most of the cotton produced in India is come from states Gujarat, Maharashtra, Telangana, Rajasthan, Karnataka, Madhya Pradesh, Andhra Pradesh and Haryana. Furthermore, some of the non-traditional regions, like West Bengal, Orissa, Assam and Bihar also practice cotton production [4]. Among all cotton

growing states, Gujarat occupies first place by producing 87.12 lakh bales from 24.49 lakh hectares. Maharashtra producing 81.85 lakh bales in 42.29 lakh hectares and Telangana is producing 54.41 lakh bales from an area 20.24 lakh hectares. These are the three major cotton producing states contributing around 60 percent and 70 percent to the country's production and area respectively [5,6].

In terms of area as well as production Telangana is the third-largest cotton-producing state in the country. During 2022–2023, Telangana produced 54.41 lakh bales of cotton over an acreage of 20.24 lakh hectares. Table 2 provides information on the acreage, production and yield of cotton in Telangana's major cotton-producing districts. Districts namely Nalgonda, Adilabad, Sangareddy, Nagarkurnool, Kumuram Bheem, Khammam, Vikarabad, Jougulamba Gadwal, Narayanpet, and Nirmal are the main cotton-growing areas. The Nalgonda district recorded the highest cotton production of 6.04 lakh bales from 2.65 lakh hectares. Adilabad ranked second in production with 4.02 lakh bales from 1.57 lakh hectares [7]. Since cotton accounts for a sizable portion of the state's gross cropped area, it is crucial to study the costs associated with cotton production and returns obtained by the farmers in order for the government to implement the appropriate policy measures.

Table 1. Statistics of cotton cultivation in India in the year 2022-2023

States	Area (Lakh hectares)	Production (Lakh bales)	Productivity (kg/ha)
Andhra Pradesh	6.95	18.85	461.08
Gujarat	24.49	87.12	581.03
Haryana	6.47	17.20	451.93
Karnataka	8.97	21.48	407.09
Madhya Pradesh	5.99	15.19	431.10
Maharashtra	42.29	81.85	329.03
Punjab	2.41	4.54	320.25
Rajasthan	7.77	25.51	558.13
Tamil Nadu	1.56	3.56	387.95
Telangana	20.24	54.41	457.00

Source: www.indiastat.com

Table 2. Statistics of cotton cultivation in Telangana state 2021-2022

Districts	Area (Lakh hectares)	Production (Lakh bales)	Productivity (kg/ha)
Nalgonda	2.65	6.04	387.79
Adilabad	1.57	4.02	434.72
Sangareddy	1.46	3.34	387.79
Nagarkurnool	1.43	2.95	350.74
Kumuram Bheem	1.26	3.43	461.89
Khammam	0.79	2.23	479.18
Vikarabad	0.77	1.74	382.85
Jougulamba Gadwal	0.77	2.03	444.60
Narayanpet	0.67	1.89	476.71
Nirmal	0.66	1.32	340.86

Source: www.tsdps.telangana.gov.

2. MATERIALS AND METHODS

2.1 Sampling Method

Adilabad and Nalgonda districts were specifically chosen for the study since they are the main cotton-producing regions with highest production in the state. A multistage random selection approach was utilized to choose the districts, mandals, villages and eventually the respondents. Two mandals-one with high production and the other with low production-were picked under each district in order to give equal representation to both high production and low production areas within the district. The villages within each mandal were chosen using the same methodology. Eight villages in all were selected from four mandals, two districts and fifteen farmers from each village, for a total of 120 farmers. We obtained essential information through personal interviews using a pretested schedule [8].

2.2 Analytical Tools Employed

Descriptive statistics including averages, percentages and other basic statistical

techniques were utilized in the study to produce results that were easy to comprehend. The cost of cultivation was divided into two categories variable cost which is going to vary with level of production and fixed cost which does not vary with level of production. Various cost concepts and different farm income measures were also estimated [9,10].

2.3 Cost concepts

Cost concepts were used to estimate the cost of cultivation. The cost concepts like Cost A1, Cost A2, Cost B1, Cost B2, Cost C1, Cost C2 and Cost C3 were calculated as given below [11].

1. Cost A1: This cost includes value of hired human labour, owned and hired bullock labour, owned and hired machine labour, cost of seeds, fertilizers, farmyard manure, plant protection chemicals, depreciation, land revenue and interest on working capital.
2. Cost A2: Cost A1 + rent paid on leased in land
3. Cost B1: Cost A1 or A2 + interest on owned fixed capital assets (excluding land)

4. Cost B2: Cost B1+ rental value of owned land
5. Cost C1: Cost B1 + imputed value of family labour
6. Cost C2: Cost B2 + imputed value of family labour
7. Cost C3: Cost C2 + 10 per cent of Cost C2 (To account for the managerial input of the farmers).

2.4 Farm Income Measures

The return over different cost concepts were calculated as given below [12].

1. Farm business income = Gross income - Cost A1/A2
2. Family labour income = Gross income - Cost B2
3. Net income = Gross income - Cost C2
4. Farm investment income = Farm business income - imputed value of the family labour

3. RESULTS AND DISCUSSION

3.1 Costs and Returns of Cotton Cultivation in the Study Area

Table 3 shows variable and fixed cost incurred during cultivation of cotton in the chosen districts. The per hectare cost of cultivation in Adilabad and Nalgonda districts were Rs. 99,077.86 ha⁻¹ and Rs. 93,884.78 ha⁻¹ and the percentage of variable and fixed expenses in the total cost of cultivation was 77.42 and 22.58 percent and 79.47 and 20.53 percent respectively. Hired human labour costs made up the majority of the variable costs in both districts (Fig. 1). This was primarily driven by the requirement of more workers for tasks like sowing, applying fertilizer and plant protection chemicals, weeding and picking/harvesting. The human labours cost was Rs. 29,293.79 ha⁻¹ in Adilabad which is slightly less compared to Rs. 30,257.91 ha⁻¹ in Nalgonda district. Out of total labour expenses the major share obtained by hired labour [13,14] also found the similar results in their studies.

Expenditure on the bullock labour in Adilabad and Nalgonda districts accounted 5.83 percent and 5.13 percent respectively. It was noticed that bullock labour utilization was more in Adilabad district (5.83%) because frequent inter cultivation practices, when compared to Nalgonda district (5.13%). The expenditure on machine labour was

Rs. 7,652.06 ha⁻¹ in Nalgonda and Rs. 7,405.47 ha⁻¹ in Adilabad. Machine labour usage in both districts is quite more because most of the land preparation activities like ploughing, clod crushing and harrowing were done using the tractor. Bullock labour is mostly restricted to inter cultivation operations.

Comparing the two districts the cost of chemicals for plant protection was much higher in Adilabad Rs. 14,326.00 ha⁻¹ accounted 14.46 percent of total expenses and in Nalgonda Rs. 9,715.33 ha⁻¹ accounted 10.35 percent. This was mostly due to the fact that many cultivators were applying more than the advised dosage of the pesticides to protect their crop from pink bollworm and other pests and diseases infestation. Fertilizer cost was high in Nalgonda (Rs. 10,578.19 ha⁻¹) as compared to Adilabad (Rs. 9,255.34 ha⁻¹) and expenditure on seeds was also more in Nalgonda Rs. 5,496.16 ha⁻¹ accounting 5.85 percent of the total expenses compared to Rs. 3,454.30 ha⁻¹ in Adilabad. This is mainly because in Nalgonda district cotton being grown in red soil farmers were applying more fertilizer and using more than recommended seed quantity [1,15] were also remarked similar results in their studies.

In fixed costs rental value of land accounts maximum share which was Rs. 14,614.17 ha⁻¹ in Adilabad and Rs. 12,350.00 ha⁻¹ in Nalgonda. It was noticed that rent for leased land was significantly high in Adilabad Rs. 3,705.00 ha⁻¹ contrast to Nalgonda Rs. 2,964.00 ha⁻¹. As Adilabad is dominated by the black soils which is best suited for cotton, soybean and maize all of which are primary crops of the district. This accord higher rental value per unit land. Interest on fixed capital was calculated at 10 percent accounted Rs. 2,832.50 and Rs. 2,577.18 ha⁻¹, depreciation accounted Rs. 1,222.49 ha⁻¹ and Rs. 1,383.75 ha⁻¹ and overall fixed expenditure accounted 22,374.15 ha⁻¹ and Rs. 19,274.94 ha⁻¹ in Adilabad and Nalgonda respectively [16,17] obtained similar outcomes in their respective studies.

3.2 Cost of Cultivation in Terms of Cost Concepts (in Rupees per hectare)

Table 4 presents various cost concepts that were estimated in the study. Cost C2 is the highly comprehensive cost as it encompasses both variable and fixed cost. Cost C3 has been adjusted to reflect the farmers' managerial services.

Table 3. Cost of cultivation of cotton

Particulars	Adilabad		Nalgonda	
	(Rs./ha)	%	(Rs./ha)	%
A. Variable Costs				
a. Labour Costs				
Hired labour	23,302.39	23.52	24,096.91	25.67
Family labour	5,991.40	6.05	6,161.00	6.56
Animal labour	5,771.57	5.83	4,816.50	5.13
b. Machine Cost				
Machine labour	7,405.47	7.47	7,652.06	8.15
c. Material Costs				
Seed	3,454.30	3.49	5,496.16	5.85
Farm yard manure	4,343.08	4.38	3,252.94	3.46
Fertilizer	9,255.34	9.34	10,578.19	11.27
Plant protection chemical	14,326.00	14.46	9,715.33	10.35
Irrigation charges	450	0.45	480	0.51
Interest on variable capital at 7%	2,404.17	2.43	2,360.75	2.51
Total variable cost	76,703.71	77.42	74,609.85	79.47
B. Fixed Costs				
Rental value of land	14,614.17	14.75	12,350.00	13.15
Rent paid for leased in-land	3,705.00	3.74	2,964.00	3.16
Depreciation	1,222.49	1.23	1,383.75	1.47
Interest on fixed capital at 10%	2,832.50	2.86	2,577.18	2.75
Total fixed cost	22,374.15	22.58	19,274.94	20.53
Total cost	99,077.86	100	93,884.78	100

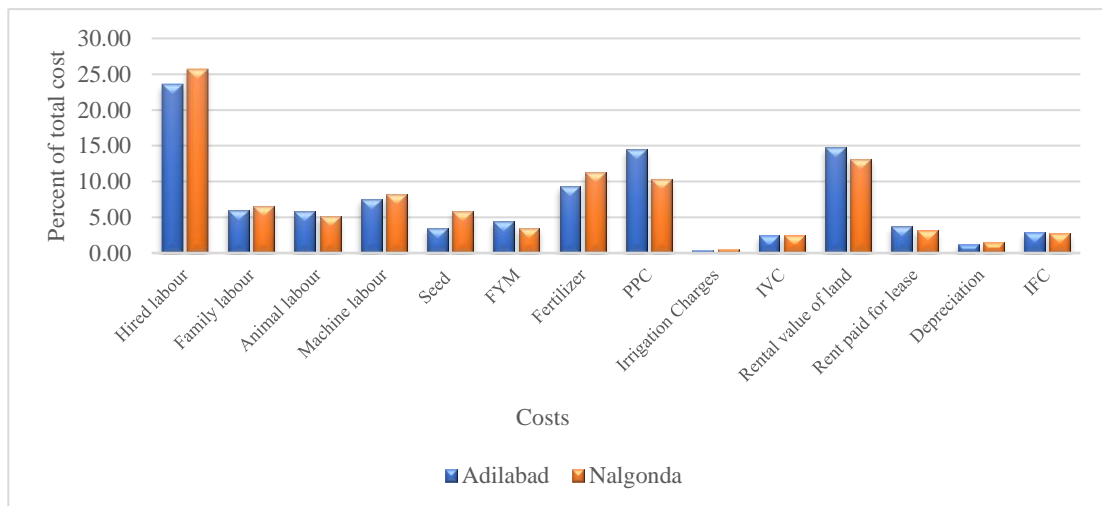


Fig. 1. Costs comparison between Adilabad and Nalgonda districts

Table 4. Cost of cultivation of cotton in terms of cost concept

Particulars	Adilabad (Rs./ha)	Nalgonda (Rs./ha)
Cost A1	71,934.80	69,832.60
Cost A2	75,639.80	72,796.60
Cost B1	78,472.30	75,373.78
Cost B2	93,086.46	87,723.78
Cost C1	84,463.69	81,534.78
Cost C2	99,077.86	93,884.78
Cost C3	1,08,985.65	1,03,273.30

Table 5. Returns from cotton cultivation

Particulars	Adilabad	Nalgonda
Total cost (Rs./ha)	99,077.86	93,884.78
Yield (q/ha)	13.13	12.99
Price (Rs./q)	9,480.00	8,653.33
Gross returns (Rs./ha)	1,24,472.40	1,12,406.76
Farm business income (Rs./ha)	48,832.60	39,610.16
Family labour income (Rs./ha)	31,385.94	24,682.98
Net income (Rs./ha)	25,394.54	18,521.97
Farm investment income (Rs./ha)	42,841.20	33,449.16
B:C ratio	1.26	1.20

The cost A1 include all variable costs except family labour cost and it also includes depreciation and land revenue. It was estimated at Rs. 71,934.80 ha⁻¹ and Rs. 69,832.60 ha⁻¹, cost A2 includes cost A1 and rent paid for leased land it was worked out at Rs. 75,639.80 ha⁻¹ and Rs. 72,796.60 ha⁻¹ and cost B1 encompasses cost A1 or A2 and interest on fixed assets excluding land it was calculated at Rs. 78,472.30 ha⁻¹ and 75,373.78 ha⁻¹ in Adilabad and Nalgonda districts respectively.

Cost B2 comprises of rental value of land owned by the farmers along with the cost B1 which was estimated at Rs. 93,086.46 ha⁻¹ and Rs. 87,723.78 ha⁻¹, Cost C1 worked at Rs. 84,463.69 ha⁻¹ and 81,534.78 ha⁻¹ and Cost C2 was calculated at Rs. 99,077.86 ha⁻¹ and Rs. 93,884.78 ha⁻¹ in Adilabad and Nalgonda districts respectively. Finally, cost C3 include managerial input services rendered by the cultivators which is taken as cost C2 plus 10 percent of cost C2. Which was estimated at Rs. 1,08,985.65 ha⁻¹ in Adilabad, Rs. 1,03,273.30 ha⁻¹ in Nalgonda. [1,18] also confirmed the similar findings with respect to various cost concepts, furthers concluded that all cost concepts were high in large farms.

3.3 Returns from Cotton Cultivation

The instruments used to estimate the economics of cotton cultivation include yield in quintals, gross returns, net returns, and returns per rupee spent. The cotton returns were calculated and shown in Table 5. Farmers harvested 13.13 and 12.99 quintals of cotton per ha in Adilabad and Nalgonda districts respectively.

Yield has reduced drastically during the survey period *i.e.*, 2021-2022, because of unseasonal rainfall that damaged the cotton crop heavily. Growers reported that they were unable to get

even half of the yield of previous year. While the prices were almost doubled compared to previous year. The price hike was more in the Adilabad (Rs. 9,480.00 q⁻¹) compared to Nalgonda (Rs. 8,653.33 q⁻¹) due to higher demand for the seed cotton as many ginning mills are located in Adilabad and there was significant increase in demand for seed cotton from the ginning mills located in neighbouring Maharashtra state. The gross returns (Rs. 1,24,472.40 ha⁻¹) and net returns (Rs. 25,394.54 ha⁻¹) were high in Adilabad than gross returns (Rs. 1,12,406.76 ha⁻¹) and net returns (Rs. 18,521.97 ha⁻¹) in Nalgonda district.

Estimates of various farm income measure were depicted in the Table 5. farm business income is the revenue received by the farmers over the cost A2 which was estimated at Rs. 48,832.60 ha⁻¹ and Rs. 39,610.16 ha⁻¹ and income of the family labour is the returns over the cost B2 worked out at Rs. 31,385.94 ha⁻¹ and Rs. 24,682.98 ha⁻¹ in Adilabad and Nalgonda districts respectively. Farm investment income was also high in Adilabad (Rs. 42,841.20 ha⁻¹) compared to Nalgonda. (33,449.16 ha⁻¹) and the benefit to cost ratio also follow the same trend which was 1.26 in Adilabad and 1.20 in Nalgonda. The results are in similarity with [19,20] arrived at the same conclusion and reported the net profit in the range of Rs. 14,224.60 to Rs. 24,153.49 per hectare for small to large farmers and further estimated overall output to input ratio as 1.34.

4. CONCLUSION

In the Adilabad and Nalgonda districts, the estimated cost C2 was Rs. 99,077.86 ha⁻¹ and Rs. 93,884.78 ha⁻¹ respectively. It is clear that cultivation costs in Adilabad district were greater by Rs. 5193.08 ha⁻¹ than those in Nalgonda district. Human labor made up the majority of the cost C2 in both districts. In the Adilabad district, it

was noted that spending on chemicals for plant protection was relatively expensive (Rs. 14,326.00 ha⁻¹). Whereas, expenditure towards fertilizers (Rs. 10,578.19 ha⁻¹) and seeds (Rs. 5,496.16 ha⁻¹) were high in Nalgonda districts. Among the fixed cost rental value of land occupied major portion and it was high in Adilabad (Rs.14,614.17 ha⁻¹) compared to Nalgonda (Rs. 12,350.00 ha⁻¹). Because of unseasonal rainfall the yield during the survey period reduced drastically while the prices doubled compared to previous year's cotton price. The price hike was more in the Adilabad (Rs. 9,480.00 q⁻¹) compared to Nalgonda (Rs. 8,653.33 q⁻¹) because many ginning mills located within the district. The net returns (Rs. 25,394.54 ha⁻¹) were also high in Adilabad than the net returns (Rs. 18,521.97 ha⁻¹) in Nalgonda district.

It is critical to educate farmers on the best use of resources because the cost of growing cotton is rising while its profitability is declining. Awareness about the appropriate use of plant protection chemicals should be given through suitable extension activity like demonstrations. Farmers should be encouraged to practice high density planting system (HDPS) to maximize their yield. To motivate the farmers to adopt HDPS result demonstrations and field days can be conducted in their locality. Mechanization of harvesting/picking can be done in order to reduce the need for human labour. Therefore, harvesting machine must be made available to the farmers through custom hiring centres.

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc.) and text-to-image generators have been used during the writing or editing of this manuscript.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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