

# Cost Escalation in Cotton Cultivation: An Analysis

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## ABSTRACT

There is a growing discontentment among Indian cotton farmers because of declining profitability. Increase in production costs, yield stagnation and volatile output prices have affected the net incomes adversely. In this study we analysed cost of cotton cultivation to elucidate reasons for cost escalation. Cost of cultivation data obtained from the Directorate of Economics and Statistics for the period 2000-01 to 2014-15 was used for the analysis. It was found that an increase in human labour wage rates was the major factor that contributed to cost escalation. Fertilizers were another factor that contributed to cost escalation. Selective mechanization for curtailing human labour consumption and judicious use of fertilizers are options to lower the cost of cotton cultivation.

**Keywords:** cotton, agriculture, cost of cultivation, input factors, human labour, fertilizer consumption

Costs incurred in cotton cultivation have a major role in deciding the profitability of cotton cultivation. Furthermore, it affects the livelihoods of more than 6 million cotton farmers, who are mostly small and marginal. There is a growing discontentment among the Indian cotton growers because profitability has declined over the years. Several studies at various levels reported cost escalations in cotton cultivation (Shende and Thakare, 2011; Balaji and Kumar, 2016; Narayanamoorthy, 2013; Suresh *et al.* 2014; Matode *et al.* 2015). Increasing cost of cultivation has serious implications and will affect the sustainability of cotton production. Hence, there is a need for an in-depth analysis to find out the major factors responsible for the escalation in cultivation costs. This study aims to (i) analyse the cost of cotton cultivation in the nine major cotton growing states of India and (ii) elucidate reasons for the cost escalation.

## Data and Methodology

The study is based on the state-level aggregate data on cost of cultivation collected under the 'Comprehensive Scheme on Cost of Cultivation of Principal Crops' of Directorate of Economics

and Statistics, Ministry of Agriculture & Farmers Welfare, Government of India. The data on cost of cultivation was collected for cotton crop across the nine major cotton producing states in the country for the period 2000-01 to 2014-15 from the website of the directorate (<https://eands.dacnet.nic.in>). The average cost and net return from cotton cultivation were examined by constructing all-India level aggregates by using crop area in respective states as weight. The concept of Cost C2<sup>1</sup> was used to represent the total cost.

## Costs and returns in cotton cultivation

At the national level, net income over the total cost (cost C2) was very low, even negative prior to 2003-04. (Fig 1). A steady increase in net income was observed after 2003-04 and continued till 2010-11. Although there was an increase in the cost of cultivation, farmers were getting a decent profit from cotton cultivation up to 2010-11. This was due to the increased costs being offset by an increase in yield and higher market price of seed

<sup>1</sup>Cost C2 includes all actual expenses incurred in cost and kind, depreciation, rent paid for leased in land, interest on fixed capital, rental value of owned land and imputed value of family labour.

cotton. Beyond 2011-12, net income began to flatten and from 2014-15 it became negative. Stagnation in the cotton yields and output price combined with an escalation in the cost of cultivation adversely affected the net income. As a result, cotton farmers either obtained lowered profit or incurred losses (2014-15).

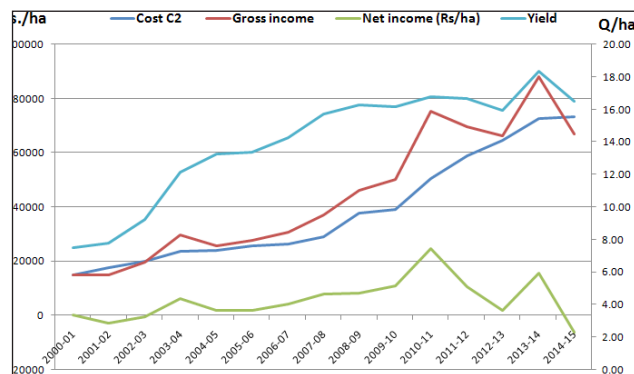


Fig. 1: Costs and returns in cotton cultivation in India

It is evident from the figure that the total cost (cost C2) started escalating from the year 2008-09. Before 2008-09, total cost was less than ₹ 30000/ha. It increased to ₹ 37745/ha during 2008-09 and continued to increase at the rate of 13.2% per annum to reach ₹ 73179/ha in 2014-15. This was true with most of the cotton growing states. In six out of the nine cotton growing states, cost of cultivation of cotton started escalating from the year 2008-09. Hence to examine the changes that occurred in cost of cotton cultivation, average cost of cultivation of Triennium Ending (TE) 2007-08 was compared with TE 2014-15 (Table 1).

Table 1: Comparison of cost of cultivation (₹ per hectare) in major cotton growing states of India

State	TE 2007-08	TE2014-15	Increase	% Increase
Andhra Pradesh	34215	77980	43765	128
Gujarat	29243	66238	36995	127
Haryana	30465	67262	36797	121
Karnataka	15258	52813	37555	246
Madhya Pradesh	30240	54027	23787	79
Maharashtra	22287	72234	49947	224
Punjab	37069	74887	37818	102
Rajasthan	21016	66401	45385	216
Tamil Nadu	28373	78816	50443	178
All India weighted average	27052	69956	42904	159

At the national level, cost of cultivation increased from ₹ 27052 in TE 2007-08 to ₹ 69956 in TE 2014-15 registering an increase of 159%. Among the different cotton growing states, increase in cost of cultivation was the highest in Tamil Nadu followed by Maharashtra and Rajasthan. In percentage terms highest increase was observed in Karnataka followed by Maharashtra and Rajasthan. The least increase in cost of cultivation was observed in Madhya Pradesh followed by Punjab and Haryana.

Factors contributing to increase in cost of cultivation

Operational and fixed costs determine the total cost. Various components such as human labour, animal labour, machine labour, seed, fertilizer, manure, insecticides, irrigation charges and interest on working capital influence the cost of cultivation. Contribution of each component to the increase in total cost is given in Table 2.

Table 2: Item wise breakup of cost of cultivation (₹ per hectare)

	TE 2007-08	TE 2014-15	Increase	% increase	Contribution to increase in total cost (%)
<b>Operational Cost</b>					
Human labour	7410	24691	17282	233	40.28
Animal labour	2804	4164	1359	48	3.17
Machine labour	1278	3789	2511	196	5.85
Seed	2072	3747	1675	81	3.90
Fertilizers	1757	5856	4099	233	9.55
Manures	654	2042	1388	212	3.24
Insecticides	1219	2729	1510	124	3.52
Irrigation charges	724	1691	967	134	2.25
Miscellaneous	19	63	44	238	0.10
Interest on working capital	458	1212	754	165	1.76
<b>Sub total</b>	<b>18394</b>	<b>49984</b>	<b>31590</b>	<b>172</b>	<b>73.63</b>
<b>Fixed Costs</b>					
Rental value of land	6756	15383	8626	128	20.11
Others	1902	4589	2687	141	6.26
<b>Sub total</b>	<b>8658</b>	<b>19971</b>	<b>11313</b>	<b>131</b>	<b>26.37</b>
<b>Total Cost [11+12]</b>	<b>27052</b>	<b>69956</b>	<b>42904</b>	<b>159</b>	<b>100.00</b>

It is evident from the data in Table 2 that the contribution of operational cost was to an extent

of 74% and that of the fixed cost was 26%. Among the individual factors, human labour contributed the maximum to cost increase in cotton cultivation. Human labour contributed nearly 40% of the increase in total cost. Cost of human labour increased by 233% from TE 2007-08 to TE 2014-15. Rental value is another component which contributed 20% of the increase in total cost. It increased from ₹ 6756 per ha in TE 2007-08 to ₹ 15383 in TE 2014-15. Among the other components, cost of fertilizers contributed 9.55% to an increase in the total cost. It is clear from the analysis that the major factor which is responsible for an increase in total cost is the cost of human labour.

### Human labour cost

Human labour is one of the major factors of production which accounts to about 30% of the total cost in cotton cultivation (Visawadia *et al.* 2006; Bhoi and Singh, 2005; Balaji and Kumar, 2016). Data in table 3 suggests that there was a substantial increase in the cost of human labour in cotton cultivation. The highest increase in the cost of human labour was observed in Karnataka followed by Maharashtra and Rajasthan. In Karnataka cost of human labour increased from ₹ 4098 in TE 2007-08 to ₹ 13595 in TE 2014-15 registering an increase of 332%. Similarly Maharashtra and Rajasthan showed an increase of 327% and 275% in human labour cost. Lowest increase in cost of human labour was observed in Punjab, followed by Madhya Pradesh and Haryana. In Punjab cost of human labour increased by 136%

while in Madhya Pradesh and Haryana it increased by 141% and 177% respectively.

From the data presented in Table 3, it is evident, that during the two periods TE 2007-08 and TE 2014-15, there was not much difference in the quantity of human labour utilized. At the national level, utilization of human labour increased by just 4% only. Out of the nine cotton growing states, only four states (Andhra Pradesh, Karnataka, Maharashtra and Rajasthan) recorded a marginal increase in human labour utilization. Where as in the other five states (Gujarat, Haryana, Madhya Pradesh, Punjab and Tamil Nadu) human labour utilization declined.

At the national level, human labour wage rate increased from ₹ 70 per manday to ₹ 227 per manday during the period of analysis. There was an increase of 224% in the wage rate during TE 2014-2015 when compared with that of TE 2007-2008. Highest increase in wage rate was observed in Karnataka (301%) followed by Maharashtra (267%), Haryana (234%) and Tamil Nadu. Lowest increase in wage rate was observed in Punjab (172%) and Gujarat (189%). Thus, our analysis clearly points out to an increase in the wage rate that contributed to an increase in total cost of cultivation.

Rise in the wage rate is not specific to cotton cultivation. Agricultural wages rose steeply after 2007-08 (FICCI 2015). As the price elasticity of human labour is the lowest among various inputs (Srivastava *et al.* 2017); there is a greater scope to reduce cost of cultivation by controlling the wage

**Table 3:** Human labour utilized in cotton cultivation in different states of India

State	Cost of human labour (₹/ha)			Quantity of human labour (mandays/ha)			Wage rate (₹/manday)		
	TE 2007-08	TE 2014-15	% Increase	TE 2007-08	TE 2014-15	% increase	TE 2007-08	TE 2014-15	% increase
Andhra Pradesh	8960	29203	226	100	102	2	93	287	209
Gujarat	8709	24102	177	131	124	-5	67	193	189
Haryana	9713	26161	169	95	78	-19	101	339	234
Karnataka	4098	17693	332	86	92	7	47	190	301
Madhya Pradesh	6889	16632	141	93	76	-19	75	212	185
Maharashtra	5544	23660	327	105	122	17	53	193	267
Punjab	9584	22620	136	98	86	-13	98	265	172
Rajasthan	7411	27813	275	82	105	28	90	265	196
Tamil Nadu	12168	39732	227	131	127	-3	94	313	234
All India	7410	24691	233	107	111	4	70	227	224

**Table 4:** Cost of fertilisers in cotton cultivation in different cotton growing states

State	Cost of fertilizers			Quantity of fertilizers (Kg nutrients /ha)		
	TE 2007-08	TE 2014-15	% increase	TE 2007-08	TE 2014-15	% increase
Andhra Pradesh	2531	7204	185	187	251	34
Gujarat	1861	4788	157	139	197	42
Haryana	1343	3095	130	105	130	23
Karnataka	1335	4549	241	91	146	60
Madhya Pradesh	2095	3385	62	158	113	-29
Maharashtra	1526	7149	368	106	237	123
Punjab	1863	3669	97	153	185	21
Rajasthan	1067	2864	168	81	115	42
Tamil Nadu	2388	6637	178	186	208	11
Wt average	1757	5856	233	129	209	61

rates. But this option is beyond the control of the farmer. Hence, the key in reducing cost of cultivation is a reduction in the utilization of human labour in cotton production. Cotton picking (harvesting) and weeding are two major field operations that requires maximum human labour. Many times farmers face labour shortage when these two operations need to be performed. Mechanical and chemical options can be exercised to curtail weeding cost (Blaise *et al.* 2005). For cotton picking, mechanical options are not available at present. Attention of the researchers needs to be focussed to develop mechanical pickers suitable to Indian conditions. Extending rural employment generation activities like MGNREGA to agriculture will also provide some support to reduce the human labour cost.

**Fertilizer Cost**

Fertilizers and manures are essential inputs for maintaining soil health and to realize potential cotton yields. Thus, these inputs also contribute to cost escalation. Data in Table 3 suggests that fertilizer costs alone contributed to 9.55% to the increase in cost of cultivation. The major fertilizers used in cotton cultivation include those that supply nitrogen, phosphorus and potassium. Apart from these, use of micronutrients such as zinc, boron and secondary nutrients such as sulphur have become prominent during TE 2014-15(Blaise *et al.* 2014). A comparison of the two periods indicates (i) an increase in the quantities of fertilizer consumed and (ii) increased fertilizer prices (Table 4). At the national level, fertilizer consumption in cotton cultivation increased from 129 kg of nutrients to

209 kg of nutrients per hectare. Highest increase in the quantity of fertilizer used was observed in Maharashtra. Amount of fertilizer consumed in cotton production in Maharashtra increased from 106 kg of nutrients per hectare in TE 2007-08 to 237 kg of nutrients per hectare in TE 2014-15. Two major factors are responsible for the increase in fertilizer usage in cotton production. Firstly, the cultivation of high yielding hybrids had great nutrient demand (Kranthi 2014). Secondly, a decline in fertilizer productivity contributed to an increase in the amounts of fertilizer use (Blaise *et al.* 2014; Venugopalan *et al.* 2017). Alternate approaches are available that can facilitate judicious fertilizer use such as soil test based fertilizer management, green manuring, integrated nutrient management to reduce fertilizer input costs. Manures added 3.2% to the increase in cotton cultivation. Cost of manures increased by 212%, while it's quantity increased by only 15% (Table 5). Recycling of crop residues and other on-farm wastes can be thought off to reduce the manure cost. Furthermore, manure application involves human labour. Retaining crop residues in the field, instead of disposing them off by burning can be thought of as a possible alternative.

**Cost of other inputs**

Cost of seed showed 81% increase while the quantity of seed used got reduced to 50% (Table 5). Increase in the area of Bt cotton hybrids resulted in the decrease in the seed quantity as the Bt hybrids require less seed per hectare (Venugopalan *et al.* 2017). But the cost of Bt hybrid seed is very high it caused increase in the seed cost. Seed cost

**Table 5:** Percentage increase in cost and quantity of other inputs during TE 2007-08 to TE 2014-15

State	Seed		Manures		Animal labour		Machine Labour	Insecticides
	Cost	Quantity	Cost	Quantity	Cost	Quantity	Cost	Cost
Andhra Pradesh	92	3	-29	-40	91	-22	127	41
Gujarat	42	-47	218	-2	42	-43	149	75
Haryana	243	-72	0	0	-44	-88	102	10
Karnataka	188	-47	23	-56	122	-27	318	201
Madhya Pradesh	-15	-26	212	21	72	-24	289	64
Maharashtra	85	-45	425	125	32	-1	551	511
Punjab	69	-18	45	-65	31	-37	95	163
Rajasthan	543	-74	572	186	91	-21	143	30
Tamil Nadu	130	-58	715	175	-44	-80	105	153
Wt Average	81	-50	212	15	48	-15	196	124

contributed 3.9% to the cost escalation. Highest increase in seed cost was observed in Rajasthan (543%) followed by Haryana (243%). Animal labour is another component which contributed 3.17% to cost increase. There was a 48% increase in the cost of animal labour used in cotton cultivation. But quantity of animal labour used reduced by 15%. Machine labour cost experienced an increase of 196% from TE 2007-08 to TE 2014-15. Increased use of tractors for field preparation and substitution of animal labour may have brought about this change. Machine labour contributed 5.85% to an increase in the total cost. Cost of insecticides added 3.5% to the cost escalation. Cotton is a crop with several insect pests affecting it such as the bollworms and sucking pests. Therefore, several insecticide applications are done to protect the crop (Kranthi, 2014). The cost of insecticides used in cotton cultivation increased from ₹ 1219 in 2007-08 to ₹ 2729 per hectare in 2014-15 (124%). Increased incidence of white flies, thrips and mealybug as well as prices of insecticides may have increased the cost.

## CONCLUSION

Our analysis of the available data clearly indicates that the reduction in the net income in cotton cultivation is mainly due to the escalation in the cost of cultivation. Increase in the wage rate of human labour is the major cause for the escalation in the total cost when compared to other components. Curtailing the human labour cost is the key to reduce the total cost. Cotton picking and weeding are the two major operations which consume maximum human labour. Alternative approaches

such as mechanization and use of chemicals can be adopted to reduce the cost. Extending the rural employment generation activities like MGNREGA to agriculture will also provide some support to reduce the human labour cost. Soil test based and new approaches such as real time application of fertilizers will help curtail fertilizer cost. Integrated pest management practices with low cost inputs need to be practiced to reduce the cost of pest management.

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