

Input output prices, their parity and income from cotton in Maharashtra

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ABSTRACT : In this study an attempt has been made to study input output price, their parity and income from cotton in Maharashtra. The present study used cross sectional cum time series data of Vidarbha region for cotton for the 10 years *i.e.* from 1999-2000 to 2008-2009. Every year 100 farmers were selected for the present study. To study the temporal variation in input and output prices and cost of cultivation, the simple tabular analysis was carried out by using standard cost concept. The study reveals that, prices of all inputs showed an increasing trend during the period 1999-2000 to 2008-2009. The compound growth rate of input prices for cotton was highest for seed prices (13.80% / annum) followed by prices of farm yard manure (10.51% / annum). The study also reveals that, the gross return for cotton crop has recorded an increase of 156.44 per cent during the period of study. This is attributable to the increase in the prices of main product. The cost of production of cotton has decreased from ₹ 2069.79 in 1999-2000 to 1969.52 in 2008-2009.

Key words : Compound growth rate, cotton, parity, temporal variation

Cotton is a very important fibre crop of global importance with a significant role in Indian Agriculture, Industrial development, employment generation and improving national economy. Cotton known as "White Gold" or "King of Fibre" and plays a prominent role in Indian economy. India ranks first in area in the world, it occupies third position in production and low position in productivity. The average productivity of cotton in India was 491 kg lint/ha, while in Maharashtra it is grown in an area of 4.12 million ha with production of 7.20 million bales and productivity is only 297 kg lint/ ha.

Cotton is one of the important cash crops of Vidarbha. In Vidarbha it is grown in an area of 15.32 lakh ha with production of 24.65 lakh bales of an average production and productivity is 160 kg lint/ha which is comparatively lower than India's cotton productivity.

MATERIALS AND METHODS

Study area and sample: The Agricultural Prices and Cost (APC) scheme under the guidance of government of Maharashtra provides valuable data about agriculture in Maharashtra. The data maintained by APC is made use of in the present study. The APC make use of a 3 stage stratified random sampling procedure with tahsils as the primary unit, cluster of 3 villages as the secondary unit and operational holding within the cluster as the third and ultimate unit. The present study used cross sectional cum time series data of Vidarbha region for cotton crop for 10 years *i.e.* from 1999-2000 to 2008-2009. Every year 100 farmers were selected for each crop for the present study.

Index of input prices: To study the temporal variation in input and output prices

and cost of cultivation, the simple tabular analysis was carried out by using standard cost concept. The input price indices are composite indices of prices of individual items of inputs. The indices were constructed using the cost of cultivation data for the period of last 10 years with average of first triennium ending as the base year. First, the price indices of inputs of seed, labour, bullock labour, fertilizer, farm yard manure, capital, pesticide, depreciation on implements and rental value of own land were constructed.

The composite indices of input prices for Cotton were constructed as

$$\text{Index of input price} = \sum_{i=1}^9 S_i \left(\frac{P_{it}}{P_{io}} \right)$$

Where;

S_i = average share of i^{th} input in total input cost

P_{it}/P_{io} is the price index of i^{th} input in the t^{th} year using average of first triennium as the base year,

$i=1$ stands for Human wage index, $i=2$ Bullock wage index, $i=3$ Fertilizer price index, $i=4$ FYM price index, $i=5$ seed price index, $i=6$ Interest rate index, $i=7$ Pesticide expenditure index, $i=8$ Depreciation charges index, and $i=9$ Rental value of land index.

Changes in input and output prices and cost of cultivation: The data were subjected to tabular analysis to study the changes in input and product prices, cost and returns for cotton. Simple tabular analysis has been used to analyze the structural changes in the cost of cultivation of selected crops. Cost structure of each crop was analyzed by working out the share of each item of cost in the total cost of cultivation. The changes in the structure of cost of cultivation of crops were assessed by comparing the cost

structure of each crop during the latest years with that of early years. The share of total temporal change as assignable to individual cost components has also been ascertained.

The cost of production of the grain yield/q basis has been worked out after the apportionment of total cost of cultivation between the main product and the by product in proportionate to their contribution to the gross value of output. The cost of production/q is obtained by dividing the cost of cultivation attributable to the main product by the grain yield on unit area basis. The compound growth rate of values between the initial year and the later year has also been worked out by using following exponential function

$$Y = a \cdot b^t$$

Where;

Y = Quantity / prices of inputs / yield / prices of output / value of output / cost of production.

a = Intercept

b = Regression coefficient

t = Time variable

From the estimated function the compound growth rate was worked out by –

$$\text{CGR (r)} = [\text{Antilog}(\log b) - 1] \times 100$$

Where;

r = Compound growth rate

RESULTS AND DISCUSSION

Changes in input and output prices: Transformation of agriculture from subsistence to profitable farm business is a techno-organizational process, the success of which largely depends on the relative prices of various inputs and outputs. Therefore, it would be interest to examine the changes in prices of inputs and outputs.

Compound growth rates of input and output prices: The rate of growth of average input prices and output prices for cotton at current and constant prices are presented in Table 1.

The data in Table 1 reveals that prices of all inputs showed an increasing trend during the period 1999-2000 to 2008-2009. The compound growth rate of input prices for cotton was highest for seed prices (13.80% / annum) followed by prices of farm yard manure (10.51% / annum). The per cent growth rates in wage rate and bullock labour prices were observed to be 8.42 per cent and 5.80 per cent/annum, respectively. The output prices increased at an annual compound rate of 2.20 per cent/annum for cotton during the period under study. Our results confirm institute findings of Shende and Thakare (2011).

Table 1. Compound growth rates of input and output prices at current and constant prices

Items	Current prices	Constant prices
1) Input Prices		
i) Wages rate (/ha)	8.42***	2.89*
ii) Bullock labour rate (/ha)	5.80***	0.40
iii) FYM rate (/ha)	10.51***	4.87
iv) Fertilizer rate (/ha)	3.97*	-1.34
v) Seed price (/ha)	13.80***	7.94*
2) Output price (/ha)	2.20*	-3.04**

(***, **, *denotes significant at 1%, 5% and 10% level)

The results presented in Table 1 also showed that the compound growth rates of seed prices and wage rate for cotton at constant prices is increased at an annual rate of 7.94 and 2.89 per cent, respectively.

Parity between prices received for products and prices paid for inputs: Parity prices for farm products are those prices which would give the same purchasing power to the

producer as prevailed in the base year. In order to examine the parity between the prices received for output and prices paid for agricultural inputs, parity indices were computed by deflating output price indices by the input price indices (Rao *et al.*, 1988).

Parity between output price index and input price index for cotton: The data on input-output price indices for cotton crop is presented in Table 2. It is evident from the data in Table that between 1999-2000 to 2008-2009, the input price index for cotton increased by 94 per cent, while the increase in output price was only 37 per cent.

Table 2. Parity between output price index and input price index for cotton (Base year- Average of Triennium Ending – 1999-2000 to 2001-2002)

Years	Input price index	Output price index	Parity index
1999-2000	102.99	100.91	97.98
2000-2001	90.19	101.90	112.98
2001-2002	106.82	97.19	90.99
2002-2003	90.89	102.73	113.03
2003-2004	116.93	122.99	105.18
2004-2005	97.14	105.89	109.00
2005-2006	149.14	97.10	65.11
2006-2007	163.63	101.62	62.10
2007-2008	131.88	116.69	88.48
2008-2009	194.56	136.79	70.31

Further, the output-input price parity were decreased during year 1999-2000, 2001-2002 and from 2005-2006 to 2008-2009, increased in the subsequent years, indicating thereby in the year 1999-2000, 2001-2002 and from 2005-2006 to 2008-2009, the output price were lower than input price and term of trade was unfavourable for cotton growers. However, the term of trade was favourable for the cotton growers in the remaining years.

Changes in cost of cultivation of cotton:

The results in Table 3 show the changes in the cost of cultivation of cotton in Vidarbha. The total cost of cultivation of cotton has gone up from 13660.61/ha in 1999-2000 to 24737.14/ha in 2008-2009 depicting an increase by 1.82 times during a period of study. The increase has occurred in all major items of cost like hired human labour, family labour, bullock labour, machine labour, seed, fertilizer, farm yard manure, insecticide, rental value of owned land and interest on working capital but the costs of interest on fixed capital and depreciation cost was found to have declined. The cost of human labour, machine labour, seeds, fertilizer and cost of human labour has increased at a faster rate. Among operational cost items, hired human labour (21.04) recorded the maximum share followed seed (14.23) and family labour (11.21)

in the increase in cost of cultivation over time.

Out of the total increase of 11076.53 in the total cost of cultivation/ha the operational cost items contributed about 82.33 per cent and the remaining 17.67 per cent by fixed cost items. The increase in fertilizer, farm yard manure and insecticide charges has been to the tune of 6.24, 4.30 and 1.87 per cent, respectively of the total increase in cost of cultivation (Pandey *et al.*, 1983).

The relative shares of different inputs in the cost of cultivation of cotton at 2 points of time are also given in Table 3. The share of operational cost has remained around 74.76 per cent in 2008-2009, which was higher than that in 1999-2000. But with in operational cost, the share of machine labour in the total cost increased from 1.74 per cent in 1999-2000 to 4.16 per cent in 2008-2009 and the share of

Table 3. Changes in cost of cultivation of cotton

Sr. No	Particulars	Cost of cultivation				Change in		Share in total change (%)
		1999-2000		2008-2009		2008-2009 over 1999-2000		
		/ha	Per cent	/ha	Per cent	/ha	Per cent	
A) Operational costs								
	1. Hired human labour	2551.56	18.68	4882.19	19.74	2330.63	91.34	21.04
	2. Family labour	1158.84	8.48	2400.68	9.70	1241.84	107.16	11.21
	3. Bullock labour	1568.95	11.49	2498.09	10.10	929.14	59.22	8.39
	4. Machine labour	238.19	1.74	1028.88	4.16	790.69	331.95	7.14
	5. Seed	1249.30	9.15	2825.49	11.42	1576.20	126.17	14.23
	6. F. Y. M.	461.24	3.38	937.56	3.79	476.33	103.27	4.30
	7. Fertilizer	985.26	7.21	1676.36	6.78	691.11	70.14	6.24
	8. Insecticides	31.79	0.23	238.70	0.96	206.91	650.97	1.87
	9. Incidental charges	366.77	2.68	900.39	3.64	533.63	145.49	4.82
	10. Repairs	53.09	0.39	187.99	0.76	134.90	254.11	1.22
	11. Interest on working capital	709.10	5.19	916.78	3.71	207.68	29.29	1.87
	Sub-total (A)	9374.07	68.62	18493.12	74.76	9119.05	97.28	82.33
B) Fixed costs								
	1. Land revenue and taxes	20.53	0.15	24.95	0.10	4.42	21.53	0.10
	2. Depreciation	322.69	2.36	242.30	0.98	-80.38	-24.91	-0.73
	3. Rental value of Land	3228.31	23.63	5541.48	22.40	2313.17	71.65	20.88
	4. Interest on fixed capital	715.01	5.23	435.29	1.76	-279.72	-39.12	-2.53
	Sub-total (B)	4286.54	31.38	6244.02	25.24	1957.48	45.67	17.67
C)	Cost C (A+B)	13660.61	100.00	24737.14	100.00	11076.53	81.08	100

bullock labour in the total cost decreased from 11.49 in 1999-2000 to 10.10 in 2008-2009. The decrease in the share of bullock labour is on account of substitution by machine labour also the share of fertilizers in the total cost decreased from 7.21 per cent in 1999-2000 to 6.78 per cent in 2008-2009, (Gurjar and Varghese, 2005 reported that the share fertilizer in total cost decreased from 12.57 per cent in 1981-1982 to 7.27 per cent in 1999-2000 for wheat crop in Rajasthan) though the absolute cost due to fertilizers and bullock labour has increased over the years. Out of the fixed cost items, the rental

value of land accounted highest share (*i.e.* 20.88%) which is followed by land revenue and taxes.

The extent of change in physical inputs and their prices along with changes in physical output and their prices and gross return for cotton over time is given in Table 4. It is remarkable to note that the seed rate in physical term has come down for cotton crop over the years. There for, the positive change in the cost of seed could be exclusively attributable to large increase in the prices of seed over time. The prices of seed increased at a high rate, it may

Table 4. The extent of changes in physical inputs, input prices, physical output, output prices and gross return for cotton

Sr. No.	Particulars	1999-2000 (base year)	2008-2009 (current year)	Per cent change in 2008-2009 over base year	Growth rate/ annum (%)
A	Quantity of inputs				
1	Seed (kg/ha)	3.67	1.93	-47.41	- 6.15
2	Fertilizer (kg/ha)	74.23	99.22	33.67	1.92
3	Manure (q/ha)	13.38	16.13	20.55	3.15
4	Human labour (h/ha)	938.78	1218.83	29.83	3.28**
5	Bullock labour (h/ha)	130.29	124.04	-4.78	- 0.04
B	Prices of inputs				
1	Seed (/kg)	340.62	1466.45	330.52	21.21**
2	Fertilizer (/kg)	13.27	16.90	27.35	2.01***
3	Manure (/q)	34.47	58.12	68.61	7.15***
4	Human labour (/h)	3.95	5.98	51.39	4.99***
5	Bullock labour (/h)	12.04	20.14	67.28	5.84***
C	Yield (q/ha)				
1	Main product	6.60	12.56	90.30	7.91***
2	By product	0.00	0.00	0.00	0.00
D	Price of output (/q)				
1	Main product	1969.29	2658.12	34.98	2.20*
2	By product	0.00	0.00	0.00	0.00
E	Value of output (/ha)				
1	Main product	13019.01	33385.99	156.44	10.25***
2	By product	0.00	0.00	0.00	0.00
3	Gross return	13019.01	33385.99	156.44	10.25***
F	Cost of production (/q)	2069.79	1969.52	-4.84	-0.94
G	Minimum support price	1675	2750	64.18	3.49**

(***, **, *denotes significant at 1%, 5% and 10% level)

be due to introduction of *Bt* cotton in Vidarbha region from the years 2001-2002. As far as fertilizer is concerned, the positive change in the cost of cultivation of cotton was mainly due to the increase in physical quantity of fertilizer applied for cotton. The large increase in the share of cost in cotton due to bullock labour is attributable to increase in wage rate as the use of bullock labour has declined for cotton.

The gross return for cotton crop has recorded an increase of 156.44 per cent during the period study. This is attributable to the increase in the prices of main product. The cost of production of cotton has decreased from 2069.79 in 1999-00 to 1969.52 in 2008-2009. In terms of annual growth rate of the estimated parameters of cotton during the period, the cost of seed has increased by 21.21 per cent/annum. Due to increase in the cost of seed the physical quantity of seed has declined *i.e.* -6.15. The price and physical quantity of manure has increased 7.15 and 3.15 per cent/annum simultaneously while the minimum support prices had increased 3.49 per cent/annum which recorded an increase of 64.18 per cent over the period of

time (Shende and Shinde, 2010).

Changes in costs : The cost of production per unit of output depends on/ha cost of cultivation and yield. For computing the cost of production at constant factor prices, the unit cost of production at current prices was deflated by an input price index series taking initial triennium ending average as the base year.

Changes in cost of production of cotton:

The cost of production at current and constant prices for cotton is presented in Table 5. The Table revealed that, the increase in yield in the years 2003-2004, from 2005-2006 to 2006-2007 and in year 2008-2009, resulted in substantial fall in cost/unit of output of cotton at current prices. Again in years 2000-2001 to 2002-2003, 2004-2005 and in 2007-2008, a fall in yield/ha brought about a further sharp escalation in/unit cost of output.

The examination of cost of production at constant price did not indicate any clear trend, neither upward nor downward. The remaining variation in unit cost could be explained in term

Table 5. Cost of production of cotton

Years	Cost C/q at current price (₹)	Input price index	Cost C/q at constant price(₹)	Yield (q/ha)	MSP at constant prices
1999-2000	2069.79	102.99	2009.70	6.60	1675.00
2000-2001	2255.60	90.19	2500.95	5.42	1638.75
2001-2002	2536.83	106.82	2374.86	5.61	1650.75
2002-2003	2040.79	90.89	2245.34	5.92	1562.00
2003-2004	1957.56	116.93	1674.13	7.83	1460.00
2004-2005	2025.34	97.14	2084.97	6.22	1432.20
2005-2006	1981.85	149.14	1328.85	9.07	1383.80
2006-2007	1930.12	163.63	1179.56	10.13	1353.60
2007-2008	2066.17	131.88	1566.70	8.06	1244.75
2008-2009	1969.52	194.56	1012.29	12.56	1732.50
CGR (%)	-1.49*		-8.30***		-1.80

(***, **, *denotes significant at 1%, 5% and 10% level)

(Cost C indicate the total of operational cost and fixed cost *i.e.* Cost A + Cost B)

Table 6. Changes in cost and returns from cotton

Years	Input price index	Output price index	Gross income/ha	Cost C/ha	Net income/ha	Output cost ratio
1999-2000	102.99	100.91	13019.01	13660.61	-641.60	0.953
2000-2001	90.19	101.90	10786.88	12235.45	-1448.57	0.882
2001-2002	106.82	97.19	10644.64	14236.41	-3591.77	0.748
2002-2003	90.89	102.73	11876.42	12089.09	-212.67	0.982
2003-2004	116.93	122.99	18786.65	15322.35	3464.29	1.226
2004-2005	97.14	105.89	12844.07	12588.42	255.65	1.020
2005-2006	149.14	97.10	17191.46	17979.98	-788.52	0.956
2006-2007	163.63	101.62	20079.80	19542.61	537.19	1.027
2007-2008	131.88	116.69	18359.30	16658.07	1701.24	1.102
2008-2009	194.56	136.79	33385.99	24737.14	8648.85	1.350
CGR (%)	7.42*	8.66***	10.25***	6.30***		

(***, **, *denotes significant at 1%, 5% and 10% level)

of yield fluctuation over the year. It was further observed that, whenever there was any improvement in the yield, it brought down the cost of production.

The average cost of production varied from 1930.12 with an average yield of 10.13q in the year 2006-2007 to 2536.83/q with an average yield 5.61q in the year 2001-2002. This clearly indicates that technological breakthrough in the cultivation of cotton has not compensated the cost push inflation. Therefore /unit cost of output did not decline over time. It has been hypothesized that with the improvement in productivity of crops the production function must shift upward and cost of production at constant prices must decline. The analysis revealed that the cost of production did not decline. Thus it can be concluded that the technological development in cotton has not shown its impact in reducing the cost of production in Vidarbha.

Change in cost and returns from cotton:

The data on cost and returns from cotton at different point of time are presented in Table 6. The result reveals the gross income from cotton

increased at an annual rate of 10.25 per cent/annum between 1999-2000 to 2008-2009.

The increased in gross income may be attributed to increase in output price as well as increase in yield of main product. However, the rate of increase in cost of cultivation /ha was 6.30 per cent. This resulted in an improvement in the net income/ha of cotton crop over the years. This was further reflected by output-cost ratio, which increased from 0.953 in 1999-2000 to 1.350 in 2008-2009. However, from the year 1999-00 to 2002-2003 and in 2005-2006 the output-cost ratio was not very impressive mainly due to low productivity/unit area.

It is reveals from the Table that the input price index for cotton crop increased at an annual compound growth rate of 7.42 per cent per annum while the output price index increased at an annual rate of 8.66 per cent/annum. These findings are in confirmationry with the findings of Alshi *et al.*, (1983).

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