

Dynamics of labour use in cotton farming in India: an economic appraisal

Abstract

In India, a large proportion of the workforce is still dependent on the agricultural sector (63.32% employment share in 1990-91, which reduced further to 42.61% in 2019-20). A gradual diminishing pattern has been observed in percentage of agricultural workers to the total workforce in the country and it is projected to reach 25.7% by 2050 creating a critical shortage of farm labour. This paper is intended to understand the dynamic changes in the labour utilization, farm mechanisation and labour productivity across the States in cotton farming during the years 2007 to 2019 by using cost of cultivation scheme data. Eleven major cotton growing States have been selected for the study. The data on cost of cultivation scheme of Government of India was used to calculate the changes in crop profitability, labour use, labour costs and labour productivity indices. In spite of increased growth in wage rate, the labour productivity growth is not that significant in most of the States. Selective mechanization wherein the labour shortage is crucial affecting the crop productivity should be identified and given impetus.

Key words: Labour scarcity, farm mechanization, labour productivity, labour cost

JEL : D24, J21

Key words: cotton farming, labour, diminishing pattern, labour productivity

1. Introduction

Around 43% of India's population primarily depends on agriculture for its livelihood. The agriculture sector accounts for a 15.9% share of India's USD 2.7 trillion economy and 49% of the total employment. Though India has seen high levels of production of foodgrains as well as other cash crops, there have been symptoms of stagnation in the per unit productivity in the recent past due to systemic constraints and other factors such as lack of farm manpower, urbanisation, migration of farm labourers to the non-farm sector, and reduced livestock rearing on farms. These shifts in the sector emphasise the need for technological interventions for ushering in the next revolution. According to World Bank Planning Commission, NSSO estimates, a gradual diminishing pattern has been observed in percentage of agricultural workers to the total work force in the country and it is projected to reach 25.7% by 2050 gradually decreasing from 60% in 1990-91, 58% in 2000-01, 54% in 2011-12 and 40% in 2019-20 creating a critical shortage of farm labour in general. Moreover, the population pressure for increased production is compounded by the shrinking amount of arable land due to diversification of farmland into non-farm usage. Latest details from Census of India report released in 2013 paints a bleak picture of Indian agriculture. It rings the alarm on an agrarian crisis—the number of farmers has dipped by over 8.6 million in the past decade. Only 54.6% of total workers in India are now part of the agriculture sector. The data shows more than 37 million people have taken to

farm labour in the past ten years. Compared to 2001 census, there has been increase of 44% in the male population of agricultural labourers, while for females the number has increased by 24.5%. This rise in agricultural labour attributes to the falling size of land holdings over time. At the world level, India excels in the share of agricultural labour when compared to other countries mainly due to mechanization in the latter. In India, a large proportion of the workforce is still dependent on the agricultural sector (63.32% employment share in 1990-91, which reduced further to 42.61% in 2019-20. Farmers have responded to the challenge in three complementary ways: by replacing human and bullock labor with machinery, increasing cultivation of less labor intensive crops and increasing the use of herbicides to control weeds,

Table 1: Employment in Agriculture to total employment at world level (%)

| Countries | % of employment in agriculture to total employment | | | | |
|--------------|--|---------|---------|---------|---------|
| | 1990-91 | 2000-01 | 2010-11 | 2015-16 | 2019-20 |
| India | 63.32 | 59.1 | 49.26 | 44.56 | 42.61 |
| China | 59.7 | 50.01 | 34.81 | 27.72 | 25.33 |
| Pakistan | 44.81 | 42.75 | 43.72 | 42.27 | 36.92 |
| Brazil | 19.64 | 16.62 | 12.35 | 10.14 | 9.08 |
| Uzbekistan | 40.67 | 38.17 | 27.09 | 27.7 | 25.71 |
| Burkino faso | 89.78 | 78.35 | 43.49 | 28.93 | 26.21 |
| Greece | 21.96 | 16.42 | 12.35 | 12.37 | 11.61 |
| S.Africa | 11.51 | 9.32 | 4.16 | 5.57 | 5.28 |

Source: www.worldbank.org

One example in the Vidarbha region of Maharashtra illustrates this trend – particularly in relation to the cultivation of less labor intensive crops. Farmers in this region have traditionally cultivated cotton which up until 2006-07 occupied three-fifths of the total cropped area. Now they have switched to soybean cultivation which occupies 70 % of the total crop area in the rainy season. This is also supplemented by growing chickpea in 14 % of the crop area. The benefits of this shift are tangible: cotton growing requires around nine months for production and is harvested over four or more pickings. Soybean on the other hand requires only 80 to 105 days depending on the varieties used for cultivation. The dramatic shift in cropping patterns during the period 2007-8 to 2014-15 resulted in per hectare labor use in cotton production reduced by 43% (from 153 person-days to 87 person-days). During the same period labor use in soybean production was reduced by 58% (from 55 person-days to 23 person-days) and in pigeonpea production by 52% (from 48 person-days to 23 person- days), due to the increased reliance on machinery for tillage, harvesting and threshing operations and the introduction of herbicides to control weeds. The impact of labour scarcity is more pronounced in case of certain crops like paddy, wheat, groundnut, cotton and sugarcane which require significant amount of labour hours per unit area cultivated and are also widely grown in the country.

India is extremely heterogeneous which means that different kinds of situations exist in different parts of the country. Some places are labour abundant while some others are labour scarce. Labour shortage results in delayed harvest of the crop affecting the timeline of subsequent crops, reduction in crop intensity, increased crop holidays and change in traditional cropping system (ICRISAT). The ageing agriculture workforce necessitates faster mechanisation of Indian agriculture going ahead, but fragmented farm sizes in India may pose a problem.

2. Methodology

This paper is intended to understand these dynamic changes in the labour utilization, farm mechanisation and labour productivity across the States in cotton farming during the years 2007 to 2019 by using cost of cultivation scheme data. Eleven major cotton growing States have been selected for the study with specific objectives of the paper (i) to assess the State wise labour use and farm mechanisation in cotton (ii) To examine the extent of casualisation of labour and (iii) To assess labour productivity across the States. Simple mean and annual compound growth rates were calculated. The cost C2 has been considered for calculating net returns and comparing labour share in total cost of cultivation. The data on cost of cultivation scheme of Government of India was used to calculate the changes in crop profitability, labour use, labour costs and labour productivity indices. All costs and output prices were converted in to constant prices of 2019 by deflating with the consumer price index for agricultural labourer. The triennium ending 2010 and 2019 were used to compare the absolute change in the labour use and other labour productivity indicators. The annual compound growth rates were used to measure the changes in the labour productivity indicators by using the standard formulae. The real wage rates have been calculated by using Agricultural Wages in India data collected from Labour Bureau from 2001 to 2012. The wage rates were taken from Agricultural Wages in India and converted in to real prices by dividing the series by Consumer price index for agricultural labourer to arrive at real prices before calculating the compound growth rates” [Reddy et al. 2014].

3. Results

3.1 Growth in Real Wage Rates

Gender wise farming activities were compared during the years 2007-2013 and 2014-2020. The annual compound growth rates of wage rates from 2007-2013 were positive for all types of farm activities right from ploughing to harvest (Table 1). But the labour shortage has been well depicted with decreased growth rate during the year 2014 to 2020 in ploughing from 6.13 to 1.43

% in case of male labour and 7.67 to 2.65 % in case of female labour. The labour use growth rate for weeding by male labour is to the tune of 2.25 from 2.65 % during the period of study.

TABLE 2 Annual CGR of Wage rates of farm activities in cotton farms

| Year | Male | | Female | | |
|----------------------|--------------------------------|---------|--------|---------|---------|
| | Ploughing and land preparation | Weeding | Sowing | Weeding | Picking |
| 2007-2013 | 6.13 | 2.65 | 7.67 | 8.12 | 6.52 |
| 2014-2020 | 1.43 | 2.25 | 2.65 | 1.86 | 4.39 |
| % of mechanization * | 90-95 | 50-60 | 90-95 | 50-60 | 0 |

*Source: Tiwari et al. (2017)

The trend in female labour shows a drastic decrease in their contribution towards weeding and picking of cotton during the years 2014- 2020 compared to 2007-2013. To cope with the rising wage rates and labour shortage, farmers are adopting labour saving technologies like increasing farm mechanisation to the tune of 90 to 95 % in land preparation and sowing and around 50 to 60% in weeding operations which replaced human and bullock labour.

3.2 Cost of Cultivation and Profitability

State wise cost of cultivation per hectare (C2), value of product (VOP) were calculated based on triennium 2010 and 2019 (Table 3).

Table 3 VOP, Cost C2 and Profitability at Constant prices of 2019 (Rs./ha)

| States | Cost C2 | | | VOP | | | BC Ratio | |
|----------------|----------|----------|----------|----------|----------|----------|----------|---------|
| | TE 2010 | TE 2019 | % change | TE 2010 | TE 2019 | % change | TE 2010 | TE 2019 |
| Andhra Pradesh | 37935.93 | 39569.71 | 4.31 | 45312.38 | 38443.65 | -15.16 | 1.19 | 0.97 |
| Gujarat | 33328.52 | 36454.54 | 9.38 | 46577.28 | 42810.52 | -8.09 | 1.40 | 1.17 |
| Haryana | 37555.69 | 34047.23 | -9.34 | 46553.58 | 33787.52 | -27.42 | 1.24 | 0.99 |
| Karnataka | 18500.65 | 31717.39 | 71.44 | 23019.50 | 34712.92 | 50.80 | 1.24 | 1.09 |
| Madhya Pradesh | 25029.10 | 39408.18 | 57.45 | 31475.47 | 35081.21 | 11.46 | 1.26 | 0.89 |
| Maharashtra | 27386.37 | 39472.11 | 44.13 | 29318.10 | 37446.19 | 27.72 | 1.07 | 0.95 |
| Odisha | 23048.51 | 32693.34 | 41.85 | 27655.21 | 31654.75 | 14.46 | 1.20 | 0.97 |
| Punjab | 42552.57 | 42551.23 | 0.00 | 52541.50 | 51715.44 | -1.57 | 1.23 | 1.22 |
| Rajasthan | 25102.53 | 35729.42 | 42.33 | 39508.52 | 43394.56 | 9.84 | 1.57 | 1.21 |
| Tamil Nadu | 34077.83 | 54220.96 | 59.11 | 38564.92 | 41701.47 | 8.13 | 1.13 | 0.77 |
| All India | 30666.93 | 38724.54 | 26.27 | 38356.57 | 38839.97 | 1.26 | 1.25 | 1.00 |

In the past decade, there was significant increase in cost of cultivation for cotton (26.27 %) in real terms but the net returns per hectare (VOP) increased only at the rate of 1.26 %. It shows that the yield increase was not in tandem with escalated input costs during the TE 2019. Overall, it indicates that cotton yielded higher returns but with more expenditure per hectare emphasizing

the fact of higher input use pattern especially in irrigated areas of Punjab, Haryana, Gujarat, Andhra Pradesh and Tamil Nadu.

3.3 Human Labour Use

The expenditure on human labour per hectare from Table 4 is Rs. 9848.31 in 2010 increased to Rs. 13938.78 during 2019. Its share in cost C2 at All India level was 32 % in 2010 which remained more or less near to 36 % during 2019. The share of human labour was highest in Odisha (46 %) and Tamil Nadu (47 %) with the least in Punjab, Karnataka, Andhra Pradesh and Telengana hovering around 28 to 29 %. Labour usage was higher in MP and Maharashtra comparatively during the periods 2010 and 2019.

Table 4 Wage rate (Rs./day)

| States | Human labour (Rs./ha) | | Share of human labour in Cost C2 | | HL (days/ha) | | Wage rate (Rs./day) | | | |
|----------------|-----------------------|----------|----------------------------------|-------|--------------|---------|---------------------|-----|--------|-----|
| | I | II | I | II | I | II | Male | | Female | |
| | | | | | | | I | II | I | II |
| Andhra Pradesh | 11275.96 | 11536.51 | 29.72 | 29.15 | 721.66 | 532.48 | 94 | 158 | 69 | 112 |
| Gujarat | 10248.57 | 12531.85 | 30.75 | 34.38 | 1152.91 | 908.27 | 86 | 102 | 75 | 91 |
| Haryana | 13502.27 | 11974.91 | 35.95 | 35.17 | 785.92 | 517.63 | 144 | 194 | 113 | 162 |
| Karnataka | 5409.92 | 9056.79 | 29.24 | 28.55 | 696.50 | 694.09 | 90 | 166 | 88 | 149 |
| Madhya Pradesh | 6280.29 | 14704.21 | 25.09 | 37.31 | 595.15 | 897.50 | 67 | 113 | 59 | 97 |
| Maharashtra | 6972.07 | 13133.68 | 25.46 | 33.27 | 843.59 | 938.95 | 67 | 104 | 60 | 66 |
| Odisha | 9030.30 | 15067.03 | 39.18 | 46.09 | 1360.56 | 1196.21 | 60 | 123 | 53 | 102 |
| Punjab | 11335.26 | 12312.16 | 26.64 | 28.93 | 745.30 | 620.44 | 125 | 189 | | |
| Tamil Nadu | 15305.36 | 25746.91 | 44.91 | 47.49 | 1116.90 | 1153.83 | 89 | 163 | 48 | 78 |
| Telengana | | 11897.05 | | 28.95 | | 496.64 | | 147 | | 100 |
| All india Av. | 9848.31 | 13938.78 | 32.11 | 35.99 | 848.37 | 794.56 | 97 | 146 | 72 | 115 |

Period I TE 2010; Period II TE 2019

The least labour use was reported in AP and Telengana to the tune of 500 to 530 mandays/ha.

Table 5 Share of different types of labour components in Cost C2 (%)

| Labour components | Year | AP | Guj | Har | Kar | MP | Mah | Odi | Pun | Raj | TN | Tel | All India |
|-------------------|------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-----------|
| Family labour | I | 5.84 | 9.77 | 16.64 | 6.20 | 9.53 | 6.37 | 10.31 | 6.71 | 18.46 | 17.81 | | 10.96 |
| | II | 6.62 | 13.49 | 21.39 | 9.51 | 17.95 | 12.73 | 25.75 | 8.43 | 30.79 | 21.37 | 10.21 | 16.35 |
| Attached labour | I | 1.02 | 0.27 | 1.25 | 0.09 | 0.18 | 0.57 | 0.17 | 2.23 | 2.31 | 0.25 | | 0.96 |
| | II | 0.70 | 0.05 | 0.34 | 0.00 | 0.56 | 0.82 | 0.20 | 2.19 | 0.39 | 0.00 | 0.15 | 0.53 |
| Casual Labour | I | 14.39 | 11.56 | 6.68 | 13.18 | 8.55 | 10.00 | 8.56 | 9.55 | 2.76 | 11.07 | | 10.06 |
| | II | 21.84 | 20.84 | 13.44 | 19.04 | 18.80 | 19.71 | 24.46 | 18.32 | 9.72 | 26.11 | 18.60 | 19.12 |
| Human labour | I | 29.72 | 30.75 | 35.95 | 29.24 | 25.09 | 25.46 | 39.18 | 26.64 | 36.31 | 44.91 | | 32.11 |
| | II | 29.15 | 34.38 | 35.17 | 28.55 | 37.31 | 33.27 | 46.09 | 28.93 | 40.90 | 47.49 | 28.95 | 35.99 |
| Animal Labour | I | 6.42 | 6.60 | 3.37 | 7.58 | 7.80 | 16.99 | 9.00 | 1.74 | 3.53 | 5.27 | | 6.27 |
| | II | 6.56 | 5.83 | 1.71 | 7.94 | 7.22 | 10.17 | 1.91 | 1.44 | 4.04 | 3.27 | 7.09 | 5.26 |

| | | | | | | | | | | | | | |
|-------------------|----|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| Machine labour | I | 4.52 | 5.06 | 5.34 | 4.53 | 2.18 | 3.14 | 1.13 | 8.18 | 5.86 | 7.32 | | 4.97 |
| | II | 5.66 | 8.20 | 7.76 | 7.58 | 4.86 | 6.45 | 5.02 | 7.82 | 5.65 | 5.90 | 6.18 | 6.40 |
| Total labour cost | I | 39.48 | 40.98 | 43.87 | 42.15 | 36.57 | 47.85 | 46.48 | 35.21 | 42.85 | 52.57 | | 42.41 |
| | II | 40.78 | 45.61 | 43.24 | 42.65 | 49.61 | 49.10 | 53.59 | 36.90 | 47.59 | 53.68 | 42.32 | 46.20 |

Period I TE 2010; Period II TE 2019

It is also to be noted that the wage rates on an average increased from Rs.97/- to Rs.146/- during 2010 and Rs.72/- to Rs.115/- during 2019 respectively. The share of different types of labour components has been presented in Table 5 below. On an average, the share of total labour cost (including machine labour) is 46 % in total cost among the cotton growing States in TE 2019. During the same period, the share of casual labour on an average was higher than the family labour wherein the former share increased from 10.06 to 19.12 %, respectively and the latter i.e., the share of family labour increased from 10.96 to 16.35 %, The share of animal labour decreased from 6.27 to 5.26% and that of machine labour increased from 4.97 to 6.40% during the same period confirming the fact that there has been an improvement in mechanized cotton farming in India. The share of attached labour was negligible at 0.53 % during the TE2019.

3.4 State Wise Analysis

As per Table 6 given below, increase in human labour use was noticed in the States of Madhya Pradesh from 74 to 117 days/ ha followed by Odisha 113 to 150 days/ha and Maharashtra to some extent from 105 to 117 days/ha, respectively. The growth rate in labour use per hectare from 2007 to 2013 was negative in all the cotton growing States except Gujarat, Maharashtra and Rajasthan.

Table 6 Human Labour (days/ha)

| Year | AP | Guj | Har | Kar | MP | Mah | Odi | Pun | Raj | TN | India |
|-----------|--------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| TE 2010 | 90 | 144 | 98 | 87 | 74 | 105 | 113 | 93 | 82 | 140 | 103 |
| TE 2019 | 67 | 114 | 65 | 87 | 112 | 117 | 150 | 78 | 85 | 144 | 102 |
| CGR (%) | | | | | | | | | | | |
| 2007-2013 | -0.51 | 2.50 | -4.17 | -0.03 | -5.52 | 4.05 | -1.03 | -1.50 | 5.35 | -0.13 | 2.04 |
| 2014-2019 | -13.63 | -3.86 | -4.99 | -3.94 | 9.48 | -1.30 | 0.53 | -0.71 | -6.00 | 4.33 | -1.57 |

The situation was different during the year 2014 to 2019 with a positive growth rate in the States of Madhya Pradesh, Tamil Nadu and to some extent in Odisha. The positive growth rate in human labour use may be mainly due to increase in yields or low adoption of mechanisation due to non-availability of labour.

3.5 Labour Productivity

Theoretically, the extent of agricultural labour use and wage rate are closely related with the land and labour productivity in agriculture. With the introduction of the labour saving technological change and increase in productivity, the returns to labour would increase, in physical terms, while the increase in labour productivity in economic terms would depend on the price of the output, as well. Labour productivity in physical terms can increase due to mechanization that results in lower use of labour use and to due to technological change which increases productivity or output per unit of resources. Table 6 shows the trends in labour productivity in TE 2019.

Table 7 Trends in labour productivity TE 2019

| Particulars | AP | Guj | Har | Kar | MP | Mah | Odi | Pun | Raj | TN | Tel |
|---|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Labour productivity (kg/day) | 26 | 16 | 22 | 16 | 16 | 14 | 10 | 28 | 19 | 12 | 25 |
| Labour productivity (Gross returns: Rs/day) | 578 | 377 | 522 | 400 | 313 | 319 | 212 | 667 | 513 | 289 | 549 |

The labour productivity during the TE 2019 ranged from 10 to 28 kg/day with highest in Punjab(28kg/day) followed by Andhra Pradesh (26kg/day), Telengana (25kg/day) and Haryana(22kg/day). On the contrary, low labour productivity from 10 to 16 kg/ha was recorded in the other States. In terms of rupees (gross returns/day), labour productivity was highest in case of Punjab (Rs.667/day) followed by Andhra Pradesh, Telengana, Haryana and Rajasthan hovering around Rs.510/day to Rs.580/day. This shows that major source of increase in labour productivity of cotton has been technological change on output side with special reference to Bt cotton technology, increased irrigation facilities etc. Inter State differences has also proved that the technology is not always labour displacing which authenticates human labour inevitability in spite of mechanization for that matter.

3.6 Farm Machinery Use

Machine labour dynamics has been presented in Table 8. In general, use of machine labour per hectare recorded to the tune of 65% during TE 2019 when compared to TE 2010.

Table 8 Machine labour TE 2010 and TE 2019 (Rs./ha)

| States | TE 2010 | TE 2019 | % increase from TE 2010 to TE 2019 | CGR of machine labour 2007-2019 |
|----------------|---------|---------|------------------------------------|---------------------------------|
| Andhra Pradesh | 1715.49 | 2240.13 | 30.58 | 3.14 |
| Gujarat | 1686.33 | 2989.63 | 77.29 | 7.3 |
| Haryana | 2005.39 | 2642.7 | 31.78 | 3.09 |
| Karnataka | 837.86 | 2402.62 | 186.76 | 11.57 |
| Madhya Pradesh | 545.72 | 1915.24 | 250.96 | 14.84 |
| Maharashtra | 860.46 | 2545.8 | 195.86 | 12.81 |

| | | | | |
|------------|---------|---------|-------|-------|
| Odisha | 260.13 | 1640.66 | 530.7 | 43.41 |
| Punjab | 3479.22 | 3325.89 | -4.41 | 0.27 |
| Rajasthan | 1470.81 | 2019.79 | 37.33 | 3.86 |
| Tamil Nadu | 2495.59 | 3197.11 | 28.11 | 2.2 |
| Telengana | | 2538.58 | | 39.77 |
| All India | 1524.54 | 2477.52 | 62.51 | 5.68 |

Machine labour use ranged from lowest Rs.260/ha in Odisha to highest Rs.3479/ha in Punjab during TE 2010 and during TE 2019 it was Rs.1641 /ha in Odisha to Rs.3326/ha in Punjab confirming the partial mechanization in cotton farming in India. The overall growth rate in farm mechanisation was higher in Odisha to the tune of 531% followed by Madhya Pradesh at 251% between 2010 and 2019. Growth rates in farm mechanisation were above 10% per annum in Karnataka, Madhya Pradesh, Maharashtra and Odisha, around 5 to 10% in Gujarat and less than five % in Andhra Pradesh, Haryana, Punjab, Rajasthan and Tamil Nadu.

3.7 Casualisation of Labour

Casualisation of labour is one of the important indicator of commercialisation of agriculture from input side. (Table 9). Overall, the share of casual labour in total human labour use was 54% during TE 2019 when compared to TE 2010 with 30%. During the first period i.e., TE 2010, the share ranged from 7.61% to 48% whereas during the second period i.e., TE 2019, it was almost 50 to 60% in most of the cotton growing States excepting Rajasthan and Haryana implying no crunch of family labour in these two States per se. It might also be due to low man/land ratio and less commercialisation of agriculture. Overall, the growth rate of casual labour was to the tune of 17.31% during 2007 to 2019. Though it was almost stagnant, there was significant variation across the States and crops.

Table 9 State wise share of casual labour use in human labour

| States | Casual Labour | | Human Labour | | Share of CL use in HL | | CGR of casual labour 2007-2019 |
|----------------|---------------|----------|--------------|----------|-----------------------|---------|--------------------------------|
| | TE 2010 | TE 2019 | TE 2010 | TE 2019 | TE 2010 | TE 2019 | |
| Andhra Pradesh | 5459.32 | 8640.65 | 11275.96 | 11536.51 | 48.42 | 74.90 | 15.20 |
| Gujarat | 3851.65 | 7595.86 | 10248.57 | 12531.85 | 37.58 | 60.61 | 14.45 |
| Haryana | 2507.09 | 4575.21 | 13502.27 | 11974.91 | 18.57 | 38.21 | 14.17 |
| Karnataka | 2438.71 | 6038.76 | 5409.92 | 9056.79 | 45.08 | 66.68 | 17.09 |
| Madhya Pradesh | 2139.43 | 7409.96 | 6280.29 | 14704.21 | 34.07 | 50.39 | 24.80 |
| Maharashtra | 2739.41 | 7781.36 | 6972.07 | 13133.68 | 39.29 | 59.25 | 18.07 |
| Odisha | | 7996.66 | | 15067.03 | | 53.07 | 19.49 |
| Punjab | 1974.08 | 7795.76 | 9030.30 | 12312.16 | 21.86 | 63.32 | 14.82 |
| Rajasthan | 4063.47 | 3471.80 | 11335.26 | 14612.12 | 35.85 | 23.76 | 29.45 |
| Tamil Nadu | 693.91 | 14159.19 | 9114.00 | 25746.91 | 7.61 | 54.99 | 22.60 |

| | | | | | | | |
|-----------|---------|---------|----------|----------|-------|-------|-------|
| Telangana | 3772.41 | 7640.96 | 15305.36 | 11897.05 | | 64.23 | 7.48 |
| All India | 3085.54 | 7402.79 | 9848.31 | 13938.78 | 31.33 | 53.11 | 17.31 |

Highest positive growth was reported in Rajasthan, Madhya Pradesh and Tamil Nadu hovering around 22 to 29% during 2007 to 2019. In rest of the States, it was around 7 to 15% with no negative growth in any of the cotton growing States.

3.8 Family Labour Use

There is higher degree of variation across the States in the share of family labour use in total human labour (Table 10).

Table 10 State wise share of family labour use in human labour

| States | Family Labour (FL) | | Human Labour (HL) | | Share of FL use in HL | | CGR of FL 2007-2019 |
|----------------|--------------------|----------|-------------------|----------|-----------------------|---------|---------------------|
| | TE 2010 | TE 2019 | TE 2010 | TE 2019 | TE 2010 | TE 2019 | |
| Andhra Pradesh | 2213.98 | 2618.08 | 11275.96 | 11536.51 | 19.63 | 22.69 | 11.52 |
| Gujarat | 3256.61 | 4917.95 | 10248.57 | 12531.85 | 31.78 | 39.24 | 11.26 |
| Haryana | 6249.92 | 7283.81 | 13502.27 | 11974.91 | 46.29 | 60.83 | 12.25 |
| Karnataka | 1147.29 | 3017.10 | 5409.92 | 9056.79 | 21.21 | 33.31 | 17.94 |
| Madhya Pradesh | 2385.95 | 7073.27 | 6280.29 | 14704.21 | 37.99 | 48.10 | 21.30 |
| Maharashtra | 1744.27 | 5026.72 | 6972.07 | 13133.68 | 25.02 | 38.27 | 18.82 |
| Odisha | 2376.50 | 8418.97 | 9030.30 | 15067.03 | 26.32 | 55.88 | 26.73 |
| Punjab | 2854.08 | 3585.06 | 11335.26 | 12312.16 | 25.18 | 29.12 | 12.58 |
| Rajasthan | 4634.68 | 11000.91 | 9114.00 | 14612.12 | 50.85 | 75.29 | 18.03 |
| Tamil Nadu | 6068.38 | 11585.32 | 15305.36 | 25746.91 | 39.65 | 45.00 | 18.08 |
| Telangana | | 4196.01 | | 11897.05 | | 35.27 | -3.78 |
| All India | 3360.881 | 6331.9 | 9848.306 | 13938.78 | 34.13 | 45.43 | 15.70 |

In a similar study on labour scarcity and mechanization by Amarinder et.al., the family labour use significantly during the year 2000 to 2010 was reduced in Andhra Pradesh, Punjab and Madhya Pradesh, while increased in Tamil Nadu, Maharashtra and Rajasthan. Below -5 % growth rates were observed for cotton in Tamil Nadu, Andhra Pradesh, Punjab and Madhya Pradesh. The scenario during the year 2007 to 2019 was different wherein the growth rate in family labour use is almost positive in almost all the cotton growing States hovering around 11 to 26 %. Overall the share of family labour use in human labour increased from 34 during TE 2010 to 45 % in TE 2019 maybe owing to improved technology leading to yield increase which demands higher input use like fertilizers, plant protection chemicals along with weeding and picking operations in the cotton fields.

4. Conclusions

The paper has analysed the trends in cost of cultivation, profitability, labour use (casual labour and family labour), machine use in cotton across the major cotton growing States. It was

intended to prove that there is significant change in the labour use and farm mechanisation across the cotton growing States by using the data collected from comprehensive costs of cultivation scheme for the period 2007 to 2019. The trend in female labour shows a drastic decrease in their contribution towards weeding and picking of cotton during the years 2014-2020 compared to 2007-2013. In general in the cotton growing States, use of machine labour per hectare recorded to the tune of 65% during TE 2019 when compared to TE 2010. Farm mechanisation is gaining momentum replacing both human and bullock capital resulting in increased and significant labour productivity. Increased use of casual labour was recorded in most of the States. Though the share of family labour is high, the level of farm mechanisation has also taken an upward trend paving way for mechanization in future. In spite of increased growth in wage rate, the labour productivity growth is not that significant in most of the States. In the future, labour shortages in agriculture are likely to continue to increase, due to the growing industrial sector. The number of landless labour available for crop production is decreasing, driving labour costs higher, especially for peak growing seasons. Overall, it is prominent that human labour continues to be the most important component of cost of crop production despite rise in mechanization in almost all the cotton growing States. As returns from agriculture reduces owing to increasing input costs and the benefits of price rise often not trickling down to farmers, returns from agriculture are getting impacted. The cost pull and push factors are leading to a shortage of labour in farms leading to a huge demand supply gap. As a result, agricultural wages are increasing every year at a rather high rate and in turn increasing the overall cost of cotton farming with no significant increase in returns.

5. Policy Implications

Overall, it is noted that human labour continues to be the most important component of cost of cotton production despite rise in mechanization, whereas, the use of bullock labour is on gradual decline. Timely weeding and other agricultural operations during the season have direct impact on the productivity and quality of cotton. Mechanisation, though it is in array, can be given further momentum to overcome the labour shortages during the vital operations like weeding and picking which devours maximum 60 to 70 % of the total cost of cotton cultivation. Selective mechanization wherein the labour shortage is crucial affecting the crop productivity should be identified and given impetus. It is worthwhile to point out that the yield growth in recent years has slowed down in cotton in many States. This indicates that, the concept of technological change, defined as outward shift of production function, is not happening in cotton. The

MNREGA scheme is often reported to have a significant role to play in the labour shortage and agricultural wage rise. One of the instant factors that have to be given top priority is to adopt techniques that can replace and/or reduce the requirement of human labour such as mechanization, promoting use of labour reducing use of herbicides in the short run. The problem of phenomenal land fragmentations causes impediment to mechanical picking in cotton. Strengthening linkages to agri-businesses via contract farming or custom hiring of machines can be given a push to control labour cost in States wherever labour shortage is eminent which may hold the cost in control. Also some agricultural activities such as weeding, irrigating, sowing and picking can be included into the MGNREGA concept. This can ease some of the pressure on the farmers due to increasing wage rate. Labour productivity is the least in the Central Zone cotton growing States encompassing Gujarat, Madhya Pradesh, Maharashtra and Odisha in addition to Karnataka and Tamil Nadu from South Zone. Selective mechanisation in these areas wherein labour input is the most crucial factor for cost escalation can to be emphasized in the near future to cope up with the escalating costs.

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