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## **Labour Scarcity and Farm Mechanisation: A Cross State Comparison**

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### ABSTRACT

The paper has analysed the trends in labour use (casual labour and family labour), machine use and labour productivity for five major crops namely, paddy, wheat, cotton, sugarcane and chickpea in the major states. The paper test the hypothesis that there are significant changes in the labour use, farm mechanisation and labour productivity across the states and crops by using the data collected from comprehensive cost of cultivation scheme for the period 1997 to 2010. The labour use per hectare decreased mainly in wheat, chickpea and paddy. The farm mechanisation is speeded up replacing both human and bullock capital. This transformation started in Punjab and Haryana and spread to other states. It increased labour productivity significantly when compared to land productivity. There is also a process of casualisation of agricultural labour as reflected in the increased share of casual labour in states like Andhra Pradesh, Karnataka, Tamil Nadu, Bihar, Maharashtra, Punjab, Gujarat and Haryana. However, in most of the crops in Orissa, West Bengal and in some crops in Uttar Pradesh, Madhya Pradesh and Rajasthan still the share of family labour is high with low level of farm mechanisation and less labour productivity which reflects the prevalence of subsistence agriculture. The positive association among farm mechanisation, displacement of family labour and increased casualisation of labour is observed across many states and crops. Some less developed states are catching up in the process. In this process, there is a steep increase in the labour productivity in agriculture, but the growth rates in wage rates are not commensurate with labour productivity growth. There is huge labour productivity gap that exists across the states with Punjab and Haryana leading with Madhya Pradesh and Orissa at the lower level

**Keywords: Labour scarcity, Farm mechanisation, Employment, Cost of cultivation data.**

**JEL: J21, Q15, Q16**

### I

### INTRODUCTION

In the past decade there is significant rise in farm wage rates due to many factors like increase in non-farm employment opportunities, implementation of Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA), increase in remittances from migrant workers, and high reservation wage rates (Berg *et al.*, 2013; Imbert and Papp, 2012; Gulati *et al.*, 2013). However, the process of rising wage rates and labour shortage is not uniform across the states (Dreze and Khera, 2009; Dreze and Sen, 2013). The rising wage rates have serious implications for the farm sector (Chand and Srivastava, 2014). There is a strong evidence to indicate that the technological parameters such as cultivated area, cropping intensity, higher use of

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inputs, etc. increased labour use while mechanisation and use of herbicides significantly reduced employment. The interplay of these factors resulted in net decline in the human labour requirements (Singh and Singh, 2006). In response to rising wage rates, there is increased farm mechanisation and shift in the cropping pattern from labour intensive to labour saving crops (Reddy *et al.*, 2013). Since late 1990s with the liberalisation of the economy, there were significant changes in Indian economy. The rural economy also experienced these changes in terms of the rising real wages rates, increased rural-urban migration, labour shortage for agriculture, increased share of non-agriculture in both employment and income, increased non-farm incomes compared to farm incomes, rising input costs including labour cost and wider adoption of farm mechanisation. There was a tendency of increased casualisation of labour with the development of capitalist agricultural sector. However, these changes are not uniform across the crops and states.

## II

### OBJECTIVES AND METHODOLOGY

This paper is intended to understand these dynamic changes in the labour utilisation and farm mechanisation and labour productivity across the states and crops from 1997 to 2010 by using cost of cultivation scheme data. Thirteen major states for which data is available from 1997 to 2010 were selected for the study. The states were Punjab, Haryana, Tamil Nadu and Andhra Pradesh among developed states; Gujarat, Maharashtra, West Bengal and Rajasthan among medium developed states; Orissa, Uttar Pradesh, Bihar and Madhya Pradesh among less developed states. Keeping the importance of the crops paddy, wheat, cotton, sugarcane and chickpea were selected for intensive study. In India paddy is a major staple crop with about 44 million hectares, followed by wheat with about 29.9 million hectares. Among commercial crops cotton (12.2 million hectares), maize (8.8 million hectares), and sugarcane (5.0 million hectares) were selected keeping in view the importance of these crops in terms of area as well as value of production. Among pulses, chickpea (with 8.3 million hectares) was selected as it is the largest contributor to pulses area and production. In the recent past, area growth was much higher for maize (2.51 per cent annual compound growth rate), chickpea (1.63 per cent) and cotton (1.50 per cent) but area under paddy and wheat are also most stagnant. Yield growth is much higher in cotton (6.57 per cent) followed by maize (2.42 per cent) and paddy (1.40 per cent). Overall, growth in production is much higher in cotton (8.07 per cent) followed by maize (4.92 per cent) and chickpea (2.49 per cent).

The specific objectives of the paper are (i) to assess the labour use and farm mechanisation in major crops among different states (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 2010 by deflating with the consumer price index for agricultural labourer. The triennium ending 1999 and 2010 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 from period 2001-2012 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.

### III

#### RESULTS

##### *Growth in Real Wage Rates*

The annual compound growth rates of wage rates from 2001-07 are negative for many types of farm activities in both slack (average of April and May) and peak (average of August and September) seasons (Table 1). While growth rates are positive and much higher from 2007 to 2012 for all farm activities. To cope with the rising wage rates farmers are adopting the labour saving technologies like increasing farm mechanisation which replace human and bullock labour and also changing cropping pattern from labour intensive crops to labour saving crops.

TABLE 1. WAGE RATES OF FARM ACTIVITIES IN RURAL INDIA

Work type (1)	Mean 2012 (Rs./day) (2)	Annual compound growth rates (per cent)			
		Slack season		Peak season	
		2001-07 (3)	2007-12 (4)	2001-07 (5)	2007-12 (6)
Ploughing	184	-1.4	6.1	-1.2	7.1
Sowing	163	-1.6	6.5	-0.7	7.4
Cane crushing	162	1.5	6.3	0.5	8.2
Harvesting	161	-0.5	7.7	0.2	8.3
Threshing	158	-1.3	8.8	-0.2	7.3
Transplanting	151	0.2	7.2	0.4	7.2
Winnowing	149	0.4	6.8	0.8	7.4
Picking	148	-0.3	8.1	-0.7	7.2
Weeding	145	-0.1	6.9	0.1	7.2

### *Cost of Cultivation and Profitability*

The cost of cultivation per hectare was higher for sugarcane followed by cotton, paddy, wheat, maize and the least was for chickpea at aggregate level (Table 2). In the past decade, there was significant increase in cost of cultivation for sugarcane (39 per cent), maize (24 per cent) and cotton (19 per cent) in real terms. The gross returns per hectare were the highest for sugarcane followed by cotton, wheat and paddy. The least gross returns are reported in maize and wheat. The highest increase in gross returns was observed in maize (51 per cent), cotton (35 per cent) and paddy (28 per cent). The net returns per hectare were higher in sugarcane, followed by wheat and cotton and least was observed in chickpea and maize. However, the highest net returns were recorded in cotton, paddy and maize. The benefit cost ratio is higher in sugarcane (1.5) and wheat (1.5) followed by chickpea (1.4), paddy (1.3) and maize (1.2). Overall, it indicates that the sugarcane, cotton and wheat crops yielded higher returns but with more expenditure per hectare, while chickpea and maize are with less cost per hectare and suitable for low resource conditions.

TABLE 2. VALUE OF OUTPUT, COST C2 AND PROFITABILITY AT CONSTANT PRICES OF 2010  
(Rs./ha)

Crop (1)	Cost C 2			Value of output			B/C ratio TE 2010 (8)
	TE 1999 (2)	TE 2010 (3)	Per cent change (4)	TE 1999 (5)	TE 2010 (6)	Per cent change (7)	
Sugarcane	61769	85804	39	101944	128836	26	1.5
Wheat	27529	31427	14	36314	45788	26	1.5
Cotton	30791	36695	19	30073	40723	35	1.1
Paddy	29809	33303	12	32823	41976	28	1.3
Maize	18006	22387	24	17343	26145	51	1.2
Chickpea	15354	17171	12	20538	23854	16	1.4

### *Human Labour Use*

The expenditure on human labour per hectare is higher in sugarcane followed by cotton, paddy, maize, wheat and the least in chickpea (Table 3). Overall, expenditure on human labour is Rs.11,756/ha in 2010. Its share in cost C2 was 29 per cent, which remains unchanged since last decade. The share of human labour was higher in sugarcane (35 per cent) followed by maize and cotton (each 34 per cent of cost C2), paddy (30 per cent), chickpea (21 per cent) and wheat (17 per cent). There is a reduction in the share of human labour in wheat, maize, paddy and chickpea. The use of labour is much higher in sugarcane and increased from 192 days/ha to 231 days/ha. Next to sugarcane use of labour is higher in cotton (102 days/ha), paddy (94 days/ha) and maize (74 days/ha) in 2010. The least labour use was reported in the case of chickpea (33 days/ha) and wheat (44 days/ha). It is also to be noted that for cotton and sugarcane the wage rates are higher than for other crops, may be due to the peak season demand pressures in the local labour market.

TABLE 3. SHARE OF HUMAN LABOUR TO COST C2 AMONG DIFFERENT CROPS

Crop (1)	Human labour (Rs./ha)		Share of human labour in cost C2		HL (days/ha)		Wage rate (Rs./day)	
	TE 1999	TE 2010	TE 1999	TE 2010	TE 1999	TE 2010	TE 1999	TE 2010
	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Sugarcane	18237	30301	30	35	192	231	95	131
Cotton	9744	12507	32	34	100	102	97	123
Paddy	9162	10113	31	30	106	94	86	108
Maize	6575	7607	37	34	81	74	81	103
Wheat	5581	5264	20	17	56	44	99	119
Chickpea	3368	3549	22	21	36	33	94	107
Total	8663	11756	29	29	94	98	92	120

On an average, the share of total labour cost (including machine labour) is 40.5 per cent in total cost among selected crops in TE 2010 (Table 4). In maize labour share is 50.1 per cent, in cotton 45.3 per cent, paddy 41.2 per cent. On an average, the

TABLE 4. SHARE OF DIFFERENT TYPES OF LABOUR COMPONENTS IN COST C2

Crop (1)	Year (2)	Family labour (3)	Attached labour (4)	Casual labour (5)	Human labour (6)	Animal labour (7)	Machine labour (8)	Total labour cost including machine labour (9)		Other costs (10)
Sugarcane	TE 1999	10.2	1.3	17.9	29.5	1.9	3.4	34.9	65.1	
	TE 2010	9.5	1.4	24.4	35.3	1.8	2.9	39.9	60.1	
Cotton	TE 1999	16.9	1.6	13.2	31.7	5.0	4.1	40.7	59.3	
	TE 2010	16.8	1.5	15.7	34.1	5.4	5.8	45.3	54.7	
Paddy	TE 1999	14.5	1.2	15.1	30.7	5.2	4.8	40.8	59.2	
	TE 2010	13.4	1.2	15.7	30.4	3.9	6.9	41.2	58.8	
Wheat	TE 1999	12.4	0.8	7.1	20.3	3.0	9.4	32.6	67.4	
	TE 2010	10.2	0.7	5.8	16.7	1.4	13.0	31.2	68.8	
Maize	TE 1999	23.5	1.0	12.0	12.0	8.4	4.1	49.1	50.9	
	TE 2010	18.8	0.7	14.6	34.0	8.3	7.7	50.1	49.9	
Chickpea	TE 1999	14.5	0.7	6.4	21.5	6.3	7.7	35.6	64.4	
	TE 2010	13.4	0.3	7.1	20.7	2.6	12.1	35.3	64.7	
Total	TE 1999	15.3	1.1	11.9	28.4	5.0	5.6	38.9	61.1	
	TE 2010	13.7	1.0	13.9	28.5	3.9	8.1	40.5	59.5	

share of casual labour is higher than the family labour. The share of family labour decreased from 15.3 per cent to 13.7 per cent and the share of casual labour increased from 11.9 per cent to 13.9 per cent during the same period. The share of animal labour decreased from 5.0 per cent to 3.9 per cent. The share of machine labour increased from 5.6 per cent to 8.1 per cent. The share of family labour is higher in maize (18.8 per cent), cotton (16.8 per cent) and chickpea (13.4 per cent). The share of casual labourer is higher in sugarcane (24.4 per cent) and paddy (15.7 per cent). The share of machine labour is higher in wheat (13 per cent), chickpea (12.1 per cent), maize (7.7 per cent) and paddy (6.9 per cent). The share of attached labour is negligible at 1.0 per cent, with somewhat higher share in cotton and sugarcane.

#### State Wise Analysis

Variations in labour use crop wise hide important differences across the states in the same crops. For example, labour use in Punjab is much lower 53 days and 23 days in paddy and wheat respectively compared to 94.0 days and 44.1 days respectively at national level in TE 2010. The labour use in sugarcane ranged from 304.4 in Andhra Pradesh to 148.4 in Haryana, in cotton ranged from 74 days/ha in Madhya Pradesh to 144 days/ha in Gujarat, in paddy ranged from 53 days/ha in Punjab to 154 days/ha in West Bengal, in maize ranges from 55 days/ha in Madhya Pradesh to 84 days/ha in Uttar Pradesh, in wheat is ranging from 23 days/ha to 60 days/ha in chickpea ranged from 16 days/ha in Haryana to 52 days in Uttar Pradesh.

TABLE 5. HUMAN LABOUR TE 2010

State (1)	<i>(days/ha)</i>						
	Sugarcane (2)	Cotton (3)	Paddy (4)	Maize (6)	Wheat (7)	Chickpea (8)	Total (9)
Andhra Pradesh	304 (1.06)	90 (-1.62)	65 (-6.73)	81 (0.28)			135 (0.76)
Bihar			97 (-1.04)	76 (-2.32)	51 (-3.34)	40 (0.06)	66 (-1.70)
Gujarat		144 (3.98)			54 (-2.95)		99 (1.49)
Haryana	148 (2.33)	98 (2.81)	79 (0.56)		38 (-0.83)	16 (-5.97)	76 (1.75)
Karnataka	240 (2.15)	87 (0.15)		72 (-0.2)			133 (0.84)
Maharashtra	240 (0.9)	106 (0.03)					173 (0.65)
Madhya Pradesh		74 (2.53)	71 (-2.3)	55 (-.43)	40 (-1.7)	30 (-1.7)	54 (-0.56)
Orissa			132 (-0.39)				132 (0.39)
Punjab		93 (1.04)	53 (-0.65)		23 (-5.27)		56 (-0.61)
Rajasthan		82 (1.8)		78 (-1.66)	60 (-1.5)	29 (-0.68)	62 (-0.48)
Tamil Nadu	294 (-1.35)	140 (-2.67)					217 (-0.18)
Uttar Pradesh	160 (0.47)		102 (0.09)	84 (-0.38)		52 (0.49)	99
West Bengal			154 (0.23)				154 (0.23)
Total	231 (1.68)	102 (0.43)	94	74 (-0.92)	44 (-2.5)	33 (-1.03)	98 (0.39)

Note: Figures in parentheses are ACGR ( per cent) human labour from 1997 to 2010.

The growth rate in labour use per hectare from 1997 to 2010 is negative in all crops except sugarcane and cotton. Overall the magnitude of negative growth rate is much higher in wheat (-2.5 per cent), paddy (-1.08 per cent) and chickpea (-1.03 per cent). The positive growth in human labour use in sugarcane and cotton were mainly

due to increase in yields and low adoption of mechanisation due to non-availability of technology. For example for cotton picking no machinery is available for adoption by the farmers. A significant negative growth was recorded in Gujarat, Punjab and Bihar for wheat; Madhya Pradesh and Andhra Pradesh for paddy; in Bihar for maize; in cotton for Tamil Nadu; in Haryana for chickpea. Large positive growth in human labour is recorded in Gujarat, Haryana and Madhya Pradesh for cotton; while in Haryana and Karnataka for sugarcane.

#### *Labour Productivity*

Table 6 shows the trends in labour productivity in TE 2010. The labour productivity per day ranged from 24 kg/day in Punjab to 11 kg/day in Karnataka for cotton; for chickpea ranged from 34 kg/day in Madhya Pradesh to 19 kg/ha in Uttar Pradesh; for maize ranged from 53 kg/day in Andhra Pradesh to 19 kg/day in Uttar Pradesh; for paddy ranged from 127 kg/day in Punjab to 24 kg/day in Orissa and for sugarcane ranged from 415 kg/day in Karnataka to 257 kg/day in Andhra Pradesh. In terms of rupees (gross returns/day), labour productivity was highest in case of wheat (Rs.1194/day) followed by chickpea (Rs.786/day), sugarcane (Rs.584/day), paddy (Rs.535/day), cotton (Rs.518/day) and the lowest in the case of maize (Rs.349/day). The highest labour productivity was in Punjab followed by Haryana, Rajasthan, Gujarat, Madhya Pradesh, Bihar, Andhra Pradesh, Maharashtra, Karnataka, Tamil Nadu, Uttar Pradesh, West Bengal and Orissa.

#### *Farm Machinery Use*

In general, use of machine labour per hectare was higher in case of wheat followed by sugarcane, paddy, cotton, chickpea and the least in maize for TE 2010 (Table 7). Machine labour use in wheat and sugarcane is more than double that of maize. In wheat, machine labour use ranged from Rs.5507/ha in Punjab to Rs.1983/ha in Bihar; in sugarcane it ranged from Rs.7134/ha in Maharashtra to Rs.1111/ha in Uttar Pradesh; in paddy ranged from Rs.4852/ha in Punjab to Rs.742/ha; in cotton ranged from Rs.4525/ha in Punjab to Rs.663/ha in Madhya Pradesh. Overall, machine labour use was higher in Punjab, Gujarat, Haryana, Maharashtra, Tamil Nadu and Rajasthan, while lower in Orissa, West Bengal, Karnataka and Madhya Pradesh.

The overall growth rate in farm mechanisation is higher in maize followed by chickpea, cotton, paddy, wheat and least in sugarcane between 1997 and 2010. Growth rate in farm mechanisation in lagging states like Orissa, West Bengal, Uttar Pradesh, Bihar and Madhya Pradesh were much higher irrespective of the crop although from lower base. Growth rates in farm mechanisation were above 10 per cent per annum for paddy in Orissa and Madhya Pradesh; for chickpea in Uttar Pradesh; for cotton in Andhra Pradesh and Karnataka; for maize in Andhra Pradesh





and Rajasthan. The medium growth rate (from 5 per cent to 10 per cent) was observed for maize in Bihar; for chickpea in Haryana; for cotton in Madhya Pradesh, Haryana, Tamil Nadu; for paddy in West Bengal, Uttar Pradesh, Bihar; for wheat in Bihar and Madhya Pradesh. In the case of sugarcane no state recorded more than 5 per cent growth in farm mechanisation.

### *Casualisation of Labour*

Overall, the share of casual labourer in total human labour use is 54 per cent (Table 8). It ranged from 67.1 per cent in sugarcane followed by paddy (51.9 per cent), cotton (49.5 per cent), maize (42.7 per cent), chickpea (38.8 per cent) and wheat (35 per cent). The higher share of casual labourer was observed for sugarcane in Andhra Pradesh; for paddy in Andhra Pradesh and Bihar; for cotton in Andhra Pradesh, Karnataka, Maharashtra, Punjab and Gujarat; for maize in Andhra Pradesh, Karnataka and Bihar; for chickpea in Bihar; for wheat in Bihar, Punjab and Gujarat. Among states, in general higher casual labour use was observed in Andhra Pradesh, Karnataka, Tamil Nadu, Bihar, Maharashtra and Punjab, while lower in Rajasthan, Madhya Pradesh, Uttar Pradesh and West Bengal. Overall, less casual labour use is observed in all crops for Rajasthan and Madhya Pradesh; this might be due to the low man/land ratio and less commercialisation of agriculture in these two states. The share of casual labour in sugarcane cultivation in Uttar Pradesh is only 42.7 as against 75.3 per cent in Andhra Pradesh; for paddy cultivation the share of casual labour in Madhya Pradesh is only 40.9 per cent as against 65 per cent in Bihar; for cotton the share of casual labourer ranged from 10.9 per cent in Rajasthan to 68.3 per cent in Karnataka; for maize the share of casual labourer ranged from 13.6 per cent in Rajasthan to 61.6 per cent in Karnataka; for chickpea ranged from 10.5 per cent in Rajasthan to 74.8 per cent in chickpea; for wheat ranged from 16.6 per cent in Rajasthan to 47.4 per cent in Bihar.

TABLE 8. SHARE OF CASUAL LABOUR USE IN HUMAN LABOUR BY STATE (TE 2010)

State (1)	<i>(per cent)</i>						
	Chickpea (2)	Maize (3)	Cotton (4)	Sugarcane (5)	Paddy (6)	Wheat (7)	Total (8)
Andhra Pradesh		59.6(3.84)	66.3(-0.99)	75.3(-0.57)	64.5(-25.52)		70.2(-3.23)
Karnataka		61.6(1.04)	68.3(0.92)	66.8(-6.5)			66.2(-3.9)
Tamil Nadu			47.5(-4.12)	74.6(3.17)			65.9(-3.9)
Bihar	74.8(18.88)	57.6(-2.75)			65.7(-2.52)	47.4(1.84)	61.2(1.63)
Maharashtra			61.5(0.34)	61.1(-4.85)			61.2(-3.37)
Punjab			54.9(4.52)		51.3(2.58)	43.1(-2.79)	52.2(2.98)
Gujarat			54(5.04)			45.5(-6.44)	51.7(1.94)
Haryana	16.7(9.71)		33.9(9.09)	71.6(6.72)	51.9(4.72)	26.8(3.21)	51.0(6.69)
Orissa					51(1.49)		51.0(1.49)
West Bengal					49.8(3.13)		49.8(3.13)
Uttar Pradesh	34(11.3)	30.1(4.7)		42.7(-0.91)	42.8(-2.71)		38.9(0.44)
Madhya Pradesh	37.5(-1.02)	32.9(4.1)	41.7(2.48)		40.9(9.43)	36(-1.67)	38.4(3.29)
Rajasthan	10.5(2.21)	13.6(15.35)	10.9(-10.09)			16.6(-2.99)	13.1(0.04)
Total	38.8(11.42)	42.7(2.14)	49.5(1.25)	67.1(-0.79)	51.9(-1.64)	35(-1.9)	54.0(0.0)

Note: Figures in parentheses are ACGR ( per cent) machine labour from 1997 to 2010.

Casualisation of labour is one of the important indicator of commercialisation of agriculture from input side. Overall, share of casual labourer in total human labour use is 54 per cent. It ranged from 67.1 per cent in sugarcane followed by paddy (51.9 per cent), cotton (49.5 per cent), maize (42.7 per cent), chickpea (38.8 per cent) and wheat (35 per cent). The higher share of casual labourer was observed for sugarcane in Andhra Pradesh; for paddy in Andhra Pradesh and Bihar; for cotton in Andhra Pradesh, Karnataka, Maharashtra, Punjab and Gujarat; for maize in Andhra Pradesh, Karnataka and Bihar; for chickpea in Bihar; for wheat in Bihar, Punjab and Gujarat. Among states, in general high casual labour use was observed in Andhra Pradesh, Karnataka, Tamil Nadu, Bihar, Maharashtra and Punjab, while low use was in Rajasthan, Madhya Pradesh, Uttar Pradesh and West Bengal. Overall, less casual labour use was in all crops for Rajasthan and Madhya Pradesh; this might be due to the low labour/land ratio and less commercialization of agriculture in these two states. The share of casual labour in sugarcane cultivation in Uttar Pradesh was only 42.7 as against 75.3 per cent in Andhra Pradesh; for paddy cultivation, it ranged from 40.9 per cent in Madhya Pradesh to 65 per cent in Bihar; for cotton, it ranged from 10.9 per cent in Rajasthan to 68.3 per cent in Karnataka; for maize ranged from 13.6 per cent in Rajasthan to 61.6 per cent in Karnataka; for chickpea ranged from 10.5 per cent in Rajasthan to 74.8 per cent in chickpea; for wheat ranged from 16.6 per cent in Rajasthan to 47.4 per cent in Bihar.

Overall at the aggregate level, the growth rate in casual labourer was almost stagnant, but there was significant variation across the states and crops. For example highest positive growth reported in chickpea (11.42 per cent) followed by maize (2.14 per cent) and cotton (1.25 per cent). There is negative growth for wheat, paddy and sugarcane. Highest positive growth in casual labourer was observed for chickpea in Bihar, Uttar Pradesh and Haryana; for maize in Rajasthan; for cotton in Haryana and for paddy in Madhya Pradesh. The highest negative growth was observed for cotton and sugarcane in Rajasthan; for paddy in Andhra Pradesh, Uttar Pradesh and Bihar; for wheat in Gujarat, Rajasthan, Punjab and Madhya Pradesh. Haryana, Madhya Pradesh, West Bengal and Punjab recorded positive growth in most of the crops, while Karnataka, Maharashtra, Andhra Pradesh and Rajasthan recorded negative growth for most of the crops.

#### *Family Labour Use*

There is higher degree of variation across the states in the share of family labour in total human labour use (Table 9). For example, the highest share was observed in Rajasthan in all four major crops (88.6 per cent in chickpea, 83.3 per cent in maize, 80.8 per cent in cotton and 80.7 per cent in wheat) with an average of 82.5 per cent, while the lowest was observed in Andhra Pradesh with an average of 26.7 per cent (with maize 36.5 per cent, cotton 28.4 per cent, paddy 31.6 per cent and sugarcane 22.5 per cent). Overall, the share of family labour was higher in wheat (61.4 per

cent), chickpea (59.8 per cent), maize (55.5 per cent), cotton (46.5 per cent), paddy (45.3 per cent) and sugarcane (29.1 per cent).

TABLE 9. SHARE OF FAMILY LABOUR USE IN HUMAN LABOUR BY STATE (TE 2010)

State (1)	<i>(per cent)</i>						
	Sugarcane (2)	Chickpea (3)	Wheat (4)	Paddy (5)	Cotton (6)	Maize (7)	Total (8)
Andhra Pradesh	22.5 (2.85)			31.6 (-18.37)	28.4 (-14.34)	36.5 (-4.19)	26.7 (-6.25)
Bihar		24.7 (-6.24)	52.3 (0.48)	34.1 (-1.67)		42.3 (-4.29)	38.5 (-2.44)
Gujarat			52.2 (-4.65)		44.4 (-0.07)		46.5 (-1.45)
Haryana	18 (-2.89)	80 (-5.87)	67.2 (-0.62)	40.3 (1.13)	61.4 (-3.32)		41.4 (-2.1)
Karnataka	32.2 (-1.91)				30.8 (-0.1)	37.2 (-1.68)	32.8 (-1.48)
Maharashtra	34.3 (0.46)				35.4 (4.63)		34.6 (1.67)
Madhya Pradesh		60.5 (-0.68)	61.8 (-2.29)	58.1 (-3.16)	57.4 (-15.01)	65.7 (-7.75)	60.3 (-7.52)
Orissa				46.5 (-1.89)			46.5 (-1.89)
Punjab			42.1 (0.94)	34.3 (-3.88)	32.9 (-10.8)		34.6 (-6.95)
Rajasthan		88.6 (1.89)	80.7 (-1.18)		80.8 (3.54)	83.3 (-1.74)	82.5 (0.59)
Tamil Nadu	21.3 (2.50)				51.3 (5.76)		31.0 (4.39)
Uttar Pradesh	54.1 (0.05)	64.5 (1.01)		56.5 (-0.11)		69.2 (-2.24)	59.3 (-0.48)
West Bengal				50 (-1.2)			50.0 (-1.2)
Total	29.1 (0.18)	59.8 (-1.01)	61.4 (-1.45)	45.3 (-2.56)	46.5 (-2.65)	55.5 (-3.43)	42.7 (-1.87)

Note: Figures in parenthesis are ACGR (per cent) family labour from 1997 to 2010.

Growth rate in family labour use is negative for most of the crops and states. Highest negative growth was observed in case of maize (-3.43 per cent) and cotton (-2.65 per cent) even paddy (-2.56 per cent). For cotton, family labour use significantly reduced in Andhra Pradesh, Punjab and Madhya Pradesh, while increased in Tamil Nadu, Maharashtra and Rajasthan. Below -5 per cent growth rates were observed for cotton in Tamil Nadu, Andhra Pradesh, Punjab and Madhya Pradesh; for maize in Madhya Pradesh; for paddy in Andhra Pradesh; for chickpea in Haryana and Bihar.

IV

CONCLUSION

The paper has analysed the trends in cost of cultivation, profitability, labour use (casual labour and family labour), machine use for five major crops paddy, wheat, cotton, sugarcane and chickpea across the major states. The paper test the hypothesis that there is significant changes in the labour use and farm mechanisation across the states and crops by using the data collected from comprehensive costs of cultivation scheme for the period 1997 to 2010. The farm mechanisation is speeded up replacing both human and bullock capital. This transformation started in Punjab and Haryana and spread to other states. It increased labour productivity significantly when compared to land productivity. There is also a process of casualisation of agricultural labour as reflected in increased share of casual labourer in states like Andhra Pradesh, Karnataka, Tamil Nadu, Bihar, Maharashtra, Punjab, Gujarat and Haryana. However, in most of the crops in Orissa, West Bengal and in some crops in Uttar Pradesh, Madhya Pradesh and Rajasthan still the share of family labour is high with low level

of farm mechanisation and less labour productivity which reflects the prevalence of subsistence agriculture. The positive association among farm mechanisation, displacement of family labour and increased casualisation of labour is observed across many states and crops. Some less developed states are catching up in the process. In this process, there is a steep increase in the labour productivity in agriculture, but the growth rates in wage rates are not commensurate with labour productivity growth. There is huge labour productivity gap exists across the states with Punjab and Haryana at the top with Madhya Pradesh and Orissa at the lower level.

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