Research Article

TO EXAMINE THE LABOUR ABSORPTION IN CROP PRODUCTION FOR PRINCIPAL CROPS IN TRANSITIONAL PLAIN REGION OF RAJASTHAN

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Abstract: The present investigation was undertaken with a view to study the labour absorption (both family and hired labour) in principal crops in transitional plain regions of Rajasthan. The primary data were collected from the 200 households of 10 villages during year of the 2018-2019. To study the labour absorption in crop production for principal crops the model suggested by Singh, 1996 was used. The labour absorption in crop production for the transitional plain region varied from 53.47 man-days per hectare (marginal farms) to 45.55 man-days per hectare (large farms) in different farm size groups. The absorption of machine labour was the highest on large farms (44.72 hours per hectare) and lowest on marginal farms (24.71 hours per hectare) indicating that machine labour replaced human labour with the increase in size of the farm.

Keywords: Labour absorption, Region, Family labour, Crop production

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Introduction

In India, agriculture is the vertical backbone of the country and is regarded as the largest sector of the country's economic activity. In agriculture production of goods and services requires the use of factors of production. Since economic growth consists in expansion in total production, the supply and productivity of the factors are vital to the process of economic growth. Labour is the most significant and important factor of production both from the social and economic point of view. Agricultural workers are generally classified in two categories *viz.* cultivators and Agricultural labours. Agricultural workers constitute the most neglected class in India's rural structure. The decline in cultivators and rise in agricultural labourers is mainly attributed to the falling size of land holdings. Labour is an important input in agricultural production process. Labour requirement will vary from farm operation to operation with in a crop. Some operations both on grounds of tradition and some criteria of efficiently are performed by male or female workers.

A realistic assessment of the structure and size of the labour force and prospects for non-agricultural employment expansion suggests that agricultural development should not only increase out but should also increase labour absorption. In agriculture, farm power is one of the important inputs used in agriculture to carry out various operations. Seasonal fluctuations in wage and employment opportunities also have serious effects on their welfare.

Material and Methods

For estimation of labour absorption in crop production, the model suggested by Singh, (1996) was used [1]. The labour absorption in crop production was analyzed for principal crops according to marginal, small, semi-medium, medium, and large farm size groups in transitional plain regions in Rajasthan state. The labour absorption estimates were worked out separately for the principal crops on the sample farms.

Farm size group wise labour absorption estimates for selected crops was estimated on per hectare gross cropped area. For the purpose of crop operation wise labour absorption estimates, all crop operations will be grouped under various heads such as ploughing, sowing/transplanting, intercultural operation, fertilizer application and manuring, plant protection measures, irrigation, harvesting, threshing, marketing operations and other miscellaneous work like purchase of inputs etc. Therefore, estimation of labour requirement for these activities were made on the basis of information from sample household for transitional plain regions agro-climatic regions. Region wise per hectare labour absorption for selected principal crops which were grown on the sample farms, for irrigated and unirrigated conditions were used for total labour absorption. For arrive at region level labour absorption, firstly summed over all crops in the given district to arrive to zonal estimates and summed over all zones to arrive at the region level estimates and after that over all summed of all crops give the state level estimates of total labour time actually utilized in the crop production. The weighted average technique was used for aggregation at each level of district, zone, region and state as a whole [2]. Precisely, estimation procedure of labour time requirement in crop production in r[th] region can be expressed as follows; Per hectare labour use in the district /region/state was calculated as-

$$L_R = \sum_{i=1}^{n} W_i L_i$$

Where,
LR = Per hectare labour absorption in the district/region
Wi = Proportion of cultivated area in i[th] district/region to the total cultivated area in the district
Li = Per hectare labour use in the district
n = Number of districts/zones/regions

Result and Discussion
Labour absorption in Transitional plain region
In this section the labour absorption, human labour and machine labour, in transitional plain region of Rajasthan has been studied for marginal, small, semi medium, medium and large categories of farm size for *kharif* as well as *rabi* crops for the year 2018-2019. The absorption of human labour as well as machine labour vary from crop to crop and size of farms. In this region principal crops that covered more than 75 percent gross cropped area in this region were selected. The labour absorption was estimated in all selected principal crops *viz*., pearl millet, cluster bean, groundnut, moth bean and green gram of *kharif* season and wheat, rapeseed & mustard, cumin and taramira of *rabi* season according to different size groups in this region.

Labour absorption in Transitional plain region on marginal farms
The labour absorption (human labour and machine labour) in Transitional plain region in selected principal crops on marginal farms are presented in [Table-1]. The principal crops included were pearl millet, cluster bean, groundnut and green gram of *kharif* season and rapeseed & mustard and cumin of *rabi* season. The annual average human labour absorption was 53.47 man-days per hectare out of which family labour absorption was 50.94 man-days per hectare and hired labour absorption was 2.53 man-days per hectare. The reason for less absorption of hired labour on marginal farms was small size of land holding, due to which available family labour was fully utilized or under-utilized on their marginal farms and therefore, no requirement of hired labour was observed. Another reason for less utilization of hired labour on marginal size farms was short duration employment opportunity. Therefore, hired labour preferred large size farms, where they get more wages with more working days. The average human labour absorption in *kharif* and *rabi* season was 52.78 man-days per hectare and 56.21 man-days per hectare, respectively. In this region the average human labour absorption was more in *rabi* season than *kharif* season. The probable reason may be that during *kharif* season the human labour (family and hired) get off farm work along with higher wages with more working days. Due to which average human labour absorption in *kharif* season was less than *rabi* season. In *kharif* season the average family labour absorption and average hired labour absorption was estimated to be 51.76 man-days per hectare and 1.01 man-days per hectare, respectively. In *kharif* season the total human labour absorption was the highest in groundnut (58.59 man-days per ha) followed by pearl millet (56.49 man-days per ha) while the lowest in green gram (43.12 man-days per ha). This was due to the fact that groundnut and pearl millet required more human labour in inter-culture and harvesting operation than the cluster bean and green gram. In *kharif* season family labour absorption was the highest in groundnut (58.59 man-days/ha) and the lowest in cluster bean (40.63 man-days/ha) while hired labour absorption was the highest in cluster bean (3.91 man-days/ha). There was no use of hired labour in green gram and groundnut crop on marginal farms. In *rabi* season the average family labour absorption and average hired labour absorption was estimated to be 47.72 man-days per hectare and 8.49 man-days per hectare, respectively. The total human labour absorption in cumin and rapeseed & mustard was 61.88 man-days per hectare and 50.47 man-days per hectare, respectively. In this region cumin was a more labour-intensive crop than rapeseed & mustard. Due to which more human labour used in cumin than rapeseed & mustard. In *rabi* season average family labour absorption in cumin and rapeseed & mustard was 55.00 man-days per hectare and 40.35 man-days per hectare, respectively while hired labour absorption in rapeseed & mustard and cumin was 10.13 man-days per hectare and 6.88 man-days per hectare, respectively.

The annual average machine labour absorption was 24.71 hr/ha. In *kharif* season the average machine labour absorption was 13.04 hr/ha while in *rabi* season it was more than five times of *kharif* season i.e. 70.50 hr/ha. The reason for more absorption of machine labour (mainly in tube wells) in *rabi* season was due to irrigation whereas *kharif* season crops were mainly cultivated in rainfed conditions. It was observed that in *kharif* season the total machine labour was the highest in groundnut (50.00 hr/ha) and the lowest in cluster bean (8.13 hr/ha). The groundnut was a more mechanized crop than cluster bean. The crop operations *viz*., preparatory tillage, sowing, irrigation, harvesting and threshing was performed by machine labour. Due to which total machine labour was the highest in groundnut compared to other crops in *kharif* season. Whereas in *rabi* season total use of machine labour was 72.38 hr/ha and 68.61 hr/ha in cumin and rapeseed & mustard, respectively. In this region over all annual average wage rate for hired man, woman and machine labour were ₹36.93/hr, ₹32.16/hr and ₹822.40/hr, respectively. Thus, it can be concluded that the absorption of both human labour and machine labour was found more in *rabi* season than *kharif* season. The average hired labour absorption was also more (8.49 man-days per ha) in *rabi* season than in *kharif* season (1.01 man-days per ha). On marginal farms the major requirement of human labour in all the crops was being fulfilled by family labour itself. The annual absorption of human labour was 53.47 man-days per hectare and absorption of machine labour was 24.71 hr/ha. These results were in conformity with Singh (1996), Devi *et al*. (2013) [3] and Raju *et al*. (2015) [4]. The absorption of women labour (both family and hired) in *kharif* as well as in *rabi* season was more than the men labour. The similar results were reported by Das (2015) [5], Kispotta *et al*. (2016) [6] and Singariya *et al*. (2016) [7]. The average wage rate for machine labour varied from ₹720.34/hr to ₹923.08/hr.

Labour absorption in Transitional plain region on small farms
The labour absorption of human and machine labour in Transitional plain region in selected principal crops on small farms is depicted in [Table-2]. The principal crops included were pearl millet, cluster bean, groundnut, moth bean and green gram of *kharif* season and wheat and cumin of *rabi* season. The annual average human labour absorption was 52.70 man-days per hectare out of which average family labour absorption was 48.63 man-days per hectare and average hired labour absorption was 4.07 man-days per hectare. The average human labour absorption in *kharif* and *rabi* season was 51.28 man-days per hectare and 62.58 man-days per hectare, respectively. The same results were found on marginal farms also. In *kharif* season average family labour absorption was 47.78 man-days per hectare whereas hired labour absorption was 3.51 man-days per hectare. It was observed that in *kharif* season the total human labour absorption was the highest in groundnut (56.81 man-days/ha) while the lowest in moth bean (41.02 man-days/ha). This may be due to the fact that groundnut crop required two times inter-culture and harvesting operation. In *kharif* season family labour absorption was the highest in peal millet (52.33 man-days/ha) and the lowest in moth bean (37.89 man-days/ha) while hired labour absorption was the highest in groundnut (8.00 man-days/ha) and the lowest in green gram (1.48 man-days/ha). In *rabi* season the average family labour absorption and hired labour absorption was estimated to be 54.58 man-days per hectare and 8.00 man-days per hectare, respectively. The total human labour absorption in wheat and cumin was 65.21 man-days per hectare and 60.83 man-days per hectare, respectively. In this region per hectare total human labour was more used in wheat than cumin due to irrigation and guarding & supervision operation. In *rabi* season family labour absorption was more in wheat (58.54 man-days/ha) than cumin (51.94 man-days/ha) while hired labour absorption was opposite to family labour *i.e*., more in cumin (8.89 man-days/ha) than wheat (6.67 man-days/ha).

The annual average machine labour absorption was 26.84 hr/ha. In *kharif* season the average machine labour absorption was 17.59 hr/ha and in *rabi* season it was 91.50 hr/ha. It was found that the absorption of machine labour was more in *rabi* season than the *kharif* season. The same type of result also found on marginal farms. It was observed that in *kharif* season the total machine labour absorption was the highest in groundnut (52.90 hr/ha) and lowest in moth bean (8.13 hr/ha) whereas in *rabi* season total use of machine labour was 117.92 hr/ha and 73.89 hr/ha in wheat and cumin, respectively. Due to irrigation activity which was performed more in wheat than cumin, the total machine labour was more in wheat than cumin. The annual average wage rate for hired man, woman and machine labour were 39.06 ₹/hr, 35.11 ₹/hr and 794.39 ₹/hr respectively.

Thus, it can be concluded that the absorption of both human labour and machine labour was found more in *rabi* season than *kharif* season similar to marginal farms. The average hired labour absorption was more (8.00 man-days/ha) in *rabi* season than *kharif* season (3.51 man-days per ha). On small farms per hectare annual average human labour absorption was 52.70 man-days and the machine labour absorption was 26.84 hours.

Table-1 *Labour absorption in Transitional plain region on Marginal farms for the year 2018-2019*

SN	Crop	Human labour (Man-days/ha)							Machine labour (hr./ha)			Wage rate (Rs./hr)		
		Family			Hired			Total human labour	Owned	Hired	Total machine labour	Human labour		Machine
		M	W	Total	M	W	Total					M	W	
1	*Kharif* season													
	Pearl millet	25.73	29.23	54.97	0.19	1.33	1.52	56.49	0.00	8.81	8.81	35.71	31.25	816.94
	Cluster bean	15.63	25.00	40.63	0.00	3.91	3.91	44.53	0.00	8.13	8.13	0.00	36.80	923.08
	Groundnut	28.13	30.47	58.59	0.00	0.00	0.00	58.59	37.50	12.50	50.00	0.00	0.00	887.50
	Green Gram	19.08	24.04	43.12	0.00	0.00	0.00	43.12	0.00	8.88	8.88	0.00	0.00	866.67
	Kharif Average	23.92	27.84	51.76	0.11	0.90	1.01	52.78	3.85	9.19	13.04	35.71	31.87	842.20
2	*Rabi* season													
	Rapeseed & Mustard	18.67	21.68	40.35	0.00	10.13	10.13	50.47	53.16	15.44	68.61	0.00	31.25	778.69
	Cumin	20.78	34.22	55.00	1.88	5.00	6.88	61.88	65.00	7.38	72.38	37.50	34.38	720.34
	Rabi Average	19.73	27.99	47.72	0.94	7.55	8.49	56.21	59.12	11.38	70.50	37.50	32.29	759.67
	Annual Average	23.07	27.87	50.94	0.28	2.25	2.53	53.47	15.07	9.64	24.71	36.93	32.16	822.40

Table-2 *Labour absorption in Transitional plain region on Small farms for the year 2018-2019*

SN	Crop	Human labour (Mandays/ha)							Machine labour (hr./ha)			Wage rate (Rs./hr)		
		Family			Hired			Total human labour	Owned	Hired	Total machine labour	Human labour		Machine
		M	W	Total	M	W	Total					M	W	
1	*Kharif* season													
	Pearl millet	20.43	31.90	52.33	0.00	3.03	3.03	55.36	0.00	9.20	9.20	0.00	33.04	781.18
	Cluster bean	15.63	23.44	39.06	0.00	4.69	4.69	43.75	0.00	8.75	8.75	0.00	31.33	585.71
	Groundnut	21.44	27.38	48.81	2.00	6.00	8.00	56.81	40.00	12.90	52.90	39.06	37.50	852.71
	Moth bean	14.06	23.83	37.89	0.00	3.13	3.13	41.02	0.00	8.13	8.13	0.00	32.00	673.08
	Green Gram	19.32	22.97	42.29	0.00	1.48	1.48	43.77	5.92	3.55	9.47	0.00	35.63	833.33
	Kharif Average	20.00	27.78	47.78	0.38	3.13	3.51	51.28	9.54	8.04	17.59	39.06	35.00	803.91
2	*Rabi* season													
	Wheat	25.00	33.54	58.54	0.00	6.67	6.67	65.21	100.00	17.92	117.92	0.00	31.25	800.00
	Cumin	22.78	29.17	51.94	0.00	8.89	8.89	60.83	66.67	7.22	73.89	0.00	37.50	661.54
	Rabi Average	23.67	30.92	54.58	0.00	8.00	8.00	62.58	80.00	11.50	91.50	0.00	35.42	747.83
	Annual average	20.46	28.17	48.63	0.33	3.74	4.07	52.70	18.36	8.48	26.84	39.06	35.11	794.39

Table-3 *Labour absorption in Transitional plain region on Semi medium farms for the year 2018-2019*

SN	Crop	Human labour (Mandays/ha)							Machine labour (hr./ha)			Wage rate (Rs./hr)		
		Family			Hired			Total human labour	Owned	Hired	Total machine labour	Human labour		Machine
		M	W	Total	M	W	Total					M	W	
1	*Kharif* season													
	Pearl millet	23.18	24.96	48.14	1.12	6.56	7.68	55.82	2.90	8.02	10.92	31.25	29.91	684.84
	Cluster bean	13.14	19.35	32.49	1.96	5.99	7.95	40.43	5.38	4.28	9.66	34.38	32.65	857.14
	Moth bean	12.28	22.32	34.60	0.89	4.69	5.58	40.18	2.32	6.16	8.48	31.25	29.76	634.06
	Green Gram	18.92	21.28	40.20	0.00	2.74	2.74	42.95	3.72	6.01	9.73	0.00	32.31	726.12
	Kharif Average	19.32	22.81	42.13	1.11	5.64	6.75	48.88	3.60	6.66	10.25	32.57	30.80	714.73
2	*Rabi* season													
	Wheat	24.11	29.19	53.31	0.00	8.47	8.47	61.78	111.19	11.31	122.49	0.00	37.50	707.65
	Taramira	9.15	15.24	24.39	0.00	2.44	2.44	26.83	0.00	7.68	7.68	0.00	25.00	666.67
	Rapeseed & Mustard	13.85	21.14	34.99	0.00	13.70	13.70	48.69	67.64	7.58	75.22	0.00	35.77	767.31
	Rabi Average	17.52	23.77	41.28	0.00	10.28	10.28	51.56	77.78	9.12	86.90	0.00	36.06	727.34
	Annual average	18.79	23.09	41.88	0.78	7.01	7.80	49.68	25.59	7.39	32.97	32.57	33.09	719.34

These results were in conformity with Singh (1996), Devi *et al*. (2013) and Raju *et al*. (2015). The average wage rate for machine labour varied from ₹661.54/hr to ₹852.71/hr. The participation of women labour (family and hired) in both the seasons *i.e.*, *kharif* and *rabi* was more than the men labour. The similar results were reported by Das (2015), Kispotta *et al*. (2016) and Singariya *et al*. (2016).

Labour absorption in Transitional plain region on semi-medium farms
Labour absorption *i.e.*, human labour and machine labour in Transitional plain region in selected principal crops on semi medium farms are depicted in [Table-3]. The principal crops included were pearl millet, cluster bean, moth bean and green gram of *kharif* season and wheat, taramira and rapeseed & mustard of *rabi* season. The annual average human labour absorption was 49.68 man-days per hectare out of which average family labour absorption was 41.88 man-days per hectare and average hired labour absorption was 7.80 man-days per hectare. The average human labour absorption in *kharif* and *rabi* season was 48.88 man-days per hectare and 51.56 man-days per hectare, respectively. The same results were found on marginal and small farms also. In *kharif* season average family labour absorption and hired labour absorption was 42.13 man-days per hectare and 6.75 man-days per hectare, respectively.
In *kharif* season the total human labour absorption was the highest in pearl millet (55.82 man-days/ha) while the lowest in moth bean (40.18 man-days/ha). The

reason for more absorption of human labour in pearl millet was due to laborious crop operations like inter-culture, harvesting and threshing then the other crops. While moth bean is low labour-intensive crop which require less human labour. In *kharif* season family labour absorption was the highest in pearl millet (48.14 man-days/ha) and the lowest in cluster bean (32.49 man-days/ha) while hired labour absorption was the highest in cluster bean (7.95 man-days/ha) and the lowest in green gram (2.74 man-days/ha). In *rabi* season average family labour absorption was 41.28 man-days per hectare and average hired labour absorption was 10.28 man-days per hectare. The total human labour absorption was the maximum in wheat (61.78 man-days/ha) while minimum in taramira (26.83 man-days per ha). The reason for high human labour absorption in wheat was due to more labour-intensive nature of the crop. The more human labour-intensive activities in wheat were irrigation and harvesting which required more human labour than the taramira as well as rapeseed & mustard.
The family labour absorption in *rabi* season was the highest in wheat (53.31 man-days per ha) while the lowest in taramira (24.39 man-days per ha) and the hired labour absorption was the highest in rapeseed & mustard (13.70 man-days per ha) while the lowest in taramira (2.44 man-days per ha). The annual average machine labour absorption was 32.97 hr/ha. In *kharif* season the machine labour absorption was 10.25 hr/ha while in *rabi* season it was more than eight times of *kharif* season *i.e.*, 86.90 hr/ha.

Table-4 *Labour absorption in Transitional plain region on medium farms for the year 2018-2019*

SN	Crop	Human labour (Mandays/ha)						Total human labour	Machine labour (hr./ha)			Wage rate (Rs./hr)		
		Family			Hired				Owned	Hired	Total machine labour	Human labour		Machine
		M	W	Total	M	W	Total					M	W	
1	*Kharif* season													
	Pearl millet	17.94	20.00	37.94	0.00	15.43	15.43	53.37	4.88	6.21	11.10	0.00	31.47	679.45
	Cluster bean	11.72	13.28	25.00	1.25	10.00	11.25	36.25	2.81	7.66	10.47	32.81	32.11	851.02
	Groundnut	18.23	19.17	37.40	0.94	18.75	19.69	57.08	70.83	10.75	81.58	37.22	35.56	709.30
	Moth bean	11.26	19.16	30.43	1.20	6.74	7.93	38.36	4.94	6.14	11.08	31.25	31.25	631.71
	Green Gram	15.23	17.52	32.76	0.00	8.50	8.50	41.26	3.42	6.88	10.30	0.00	32.97	712.64
	Kharif Average	15.12	17.73	32.85	0.53	11.97	12.50	45.35	9.99	7.08	17.08	33.07	32.36	728.90
2	*Rabi* season													
	Wheat	22.20	25.38	47.58	0.00	12.12	12.12	59.70	125.76	6.21	131.97	0.00	37.50	692.68
	Rapeseed & Mustard	11.67	17.32	28.99	3.40	13.13	16.54	45.53	67.70	12.45	80.16	32.14	30.56	562.50
	Cumin	20.61	21.97	42.58	5.86	9.77	15.63	58.20	62.50	11.72	74.22	37.50	35.00	520.00
	Taramira	7.94	10.91	18.85	0.00	6.35	6.35	25.20	1.43	6.59	8.02	0.00	25.00	903.61
	Rabi Average	15.45	19.55	35.00	2.28	11.66	13.93	48.93	76.94	9.82	86.76	33.75	32.81	607.61
	Annual average	15.21	18.26	33.47	1.04	11.88	12.92	46.39	29.40	7.88	37.28	33.50	32.49	685.07

Table-5 *Labour absorption in Transitional plain region on large farms for the year 2018-2019*

SN	Crop	Human labour (Mandays/ha)						Total human labour	Machine labour (hr./ha)			Wage rate (Rs./hr)		
		Family			Hired				Owned	Hired	Total machine labour	Human labour		Machine
		M	W	Total	M	W	Total					M	W	
1	*Kharif* season													
	Pearl millet	17.80	17.94	35.74	1.12	15.80	16.92	52.66	13.82	2.07	15.90	37.50	32.81	634.92
	Cluster bean	7.59	10.62	18.21	2.53	13.89	16.42	34.63	11.67	2.63	14.30	33.33	32.02	800.86
	Groundnut	6.90	15.92	22.82	9.45	14.24	23.69	46.51	86.48	4.13	90.61	34.62	33.16	690.14
	Moth bean	11.28	14.82	26.10	2.58	6.44	9.02	35.12	14.18	2.89	17.06	31.25	30.00	718.75
	Green Gram	14.06	15.51	29.58	0.00	8.65	8.65	38.23	6.88	4.35	11.23	0.00	33.71	602.30
	Kharif Average	13.19	15.32	28.51	1.98	12.66	14.64	43.15	17.75	2.99	20.74	34.45	32.67	668.69
2	*Rabi* season													
	Wheat	20.33	22.28	42.62	0.00	15.88	15.88	58.50	135.10	3.15	138.25	0.00	36.18	681.42
	Rapeseed & Mustard	10.09	16.03	26.11	4.68	15.88	20.57	46.68	66.92	19.72	86.64	39.54	35.44	416.87
	Cumin	16.56	20.01	36.57	6.16	11.03	17.19	53.75	71.08	5.51	76.59	38.56	36.39	473.33
	Taramira	4.85	9.70	14.55	0.00	8.62	8.62	23.17	0.86	7.76	8.62	0.00	0.00	994.44
	Rabi Average	13.66	18.06	31.72	4.25	13.83	18.07	49.80	75.57	11.62	87.19	39.04	34.74	456.37
	Annual average	13.36	16.31	29.67	2.80	13.08	15.88	45.55	38.61	6.10	44.72	36.97	33.46	522.83

The reason behind this was due to irrigation operation which required more frequently in *rabi* season as compared to *kharif* season. The same type of results was also found on marginal and small farms.

It was also observed that in *kharif* season the total machine labour absorption was the highest in pearl millet (10.92 hr/ha) and the lowest in moth bean (8.48 hr/ha) while in *rabi* season it was 122.49 hr/ha and 7.68 hr/ha in wheat and taramira, respectively. The reason for high machine labour used in wheat was mechanized nature of many operations. The crop activities *viz.*, preparatory tillage, sowing, irrigation and threshing were performed through machine so wheat crop required more machine labour than other crops on semi-medium farms. It was found that the absorption of total human labour as well as total machine labour was the highest in wheat among both the seasons. The major reason for high human labour absorption in wheat was discussed earlier while the reason for high machine labour absorption was irrigation activity which contributed maximum hours. In this region the irrigation activity in wheat was done up to six times. Due to which absorption of human labour as well as machine labour was maximum in wheat than the rapeseed & mustard and taramira. It was observed that in this region the total human labour absorption as well as total machine labour absorption was the lowest in taramira between both the season *i.e., kharif* and *rabi*, because taramira is a low labour-intensive crop together with less mechanization. The annual average wage rates for hired man, woman and machine labour were ₹32.57/hr, ₹33.09/hr and ₹719.34/hr, respectively.

Thus, it can be concluded that the absorption of both human labour and machine labour was found more in *rabi* season than *kharif* season. The same type of results was also found on marginal and small farms. The average absorption of hired labour was more (10.28 man-days/ha) in *rabi* season than *kharif* season (6.75 man-days/ha). The annual average human labour absorption was 49.68 man-days per hectare and the machine labour absorption was 32.97 hr/ha. These results were in conformity with Singh (1996), Alam (2005) [8], Devi *et al.* (2013) and Raju *et al.* (2015). The absorption of women labour (both family and hired) in *kharif* as well as in *rabi* season was more than the men labour. The similar results were reported by Das (2015), Kispotta *et al.* (2016) and Singariya *et al.* (2016). The average wage rate for machine labour varied from ₹634.06/hr to ₹857.14/hr.

Labour absorption in Transitional plain region on medium farms
[Table-4] revealed the labour absorption in Transitional plain region in selected principal crops on medium farms. The principal crops included were pearl millet, cluster bean, groundnut, moth bean and green gram of *kharif* season and wheat, rapeseed & mustard, cumin and taramira of *rabi* season. It was found that the annual average human labour absorption was 46.39 man-days per hectare out of which family labour absorption was 33.47 man-days per hectare and hired labour absorption was 12.92 man-days per hectare. The average human labour absorption in *kharif* season was 45.35 man-days per hectare out of which average family labour absorption and hired labour absorption was 32.85 man-days per hectare and 12.50 man-days per hectare, respectively. It was observed that in *kharif* season the total human labour absorption was the highest in groundnut (57.08 man-days/ha) followed by pearl millet (53.37 man-days per ha) while the lowest in cluster bean (25.20 man-days/ha).

In this region groundnut and pearl millet were a labour-intensive crops because of various crop operations *viz.*, inter-culture, harvesting and threshing which required more human labour than crop operations in the cluster bean, moth bean and green gram. In *kharif* season family labour absorption was the highest in pearl millet (37.94 man-days/ha) and the lowest in cluster bean (25.00 man-days/ha) while hired labour absorption was the highest in groundnut (19.69 man-days/ha) and the lowest in moth bean (7.93 man-days/ha). In *rabi* season the average human labour absorption was 48.93 man-days per hectare out of which family labour absorption was 35.00 man-days per hectare and hired labour absorption was 13.93 man-days per hectare. It was observed from the analysis that the total human labour absorption in *rabi* season was the highest in wheat (59.70 man-days/ha) followed by cumin (58.20 man-days per ha) and the lowest in taramira (25.20 man-days per ha). In this region it was noticed that the total human labour absorption was more in wheat and cumin than taramira.

Because in wheat some crop operations *viz*., irrigation, harvesting and guarding & supervision required more human labour than taramira. In *rabi* season family labour absorption was the highest in wheat (47.58 man-days/ha) and the lowest in taramira (18.85 man-days/ha) while hired labour absorption was the highest in rapeseed & mustard (16.54 man-days/ha) and the lowest in taramira (6.35 man-days/ha). The annual average machine labour absorption was 37.28 hr/ha. In *kharif* season the machine labour absorption was 17.08 hr/ha and in *rabi* season it was 86.76 hr/ha. The same type of trend was also found on marginal, small and semi medium farms of this region. It was observed that in *kharif* season the total machine labour was the highest in groundnut (81.58 hr/ha) and the lowest in green gram (10.30 hr/ha). The crop operations *viz*., preparatory tillage, sowing, harvesting and threshing performed through mechanized techniques in groundnut whereas green gram required less machinery use in cultivation. Due to more use of owned tube well for irrigation the owned machine labour use was the highest in groundnut. In *rabi* season the absorption of total machine labour was the highest in wheat (131.97 hr/ha) and the lowest in taramira (8.02 hr/ha). Because in wheat, irrigation operation was performed around six times, due to which machine labour was more in wheat than taramira. In this region the annual average wage rate for hired man, woman and machine labour were ₹33.50/hr, ₹32.49/hr and ₹685.07/hr, respectively. Thus, it can be concluded that the absorption of both human labour and machine labour was found more in *rabi* season than *kharif* season. The average hired labour absorption was more (13.93 man-days/ha) used in *rabi* season than *kharif* season (12.50 man-days/ha). These results were in conformity with Singh (1996), Alam (2005), Devi *et al*. (2013) and Raju *et al*. (2015). The female labour absorption (family and hired) was more in both the seasons *i.e*., *kharif* and *rabi* than the male labour. The similar results were reported by Das (2015), Kispotta *et al*. (2016) and Singariya *et al*. (2016). The use of total human labour as well as total machine labour was lowest in taramira. The average wage rate for machine labour varied from ₹520.00/hr to ₹903.61/hr.

Labour absorption in Transitional plain region on large farms
Labour absorption of human labour and machine labour in Transitional plain region in selected principal crops on large farms are presented in [Table-5]. The principal crops included were pearl millet, cluster bean, groundnut, moth bean and green gram of *kharif* season and wheat, rapeseed & mustard, cumin and taramira of *rabi* season. The annual per hectare average human labour absorption was 45.55 man-days out of which per hectare family labour absorption was 29.67 man-days and per hectare hired labour absorption was 15.88 man-days. The average human labour absorption in *kharif* season was 43.15 man-days per hectare out of which family labour absorption and hired labour absorption was 28.51 man-days per hectare and 14.64 man-days per hectare, respectively. The same pattern of results was found on marginal, small, semi-medium and medium farms also. In *kharif* season the total human labour absorption was the highest in pearl millet (52.66 man-days/ha) followed by groundnut (46.51 man-day/ha) while the lowest in cluster bean (34.63 man-days/ha). In *kharif* season family labour absorption was the highest in pearl millet (35.74 man-days/ha) and the lowest in cluster bean (18.21 man-days/ha) while hired labour absorption was the highest in groundnut (23.69 man-days/ha) and the lowest in green gram (8.65 man-days/ha). The average per hectare human labour absorption in *rabi* season was 49.80 man-days out of which per hectare family labour absorption and hired labour absorption was 31.72 man-days and 18.07 man-days, respectively. It was observed that the per hectare total human labour absorption was the highest in wheat (58.50 man-days) while per hectare the lowest in taramira (23.17 man-days). In *rabi* season family labour absorption was the highest in wheat (42.62 man-days/ha) and the lowest in taramira (14.55 man-days/ha) while in hired labour absorption it was the highest in rapeseed & mustard (20.57 man-days/ha) and the lowest in taramira (8.62 man-days/ha). The annual average machine labour absorption was 44.72 hr/ha. In *kharif* season the average machine labour absorption was 20.74 hr/ha and in *rabi* season it was 87.19 hr/ha. It was observed that in *kharif* season the total machine labour use was the highest in groundnut (90.61 hr/ha) and the lowest in green gram (11.23 hr/ha) while in *rabi* season it was the highest in wheat (138.25 hr/ha) and the lowest in taramira (8.62 hr/ha). The annual average wage rates for hired man, woman and machine labour were ₹36.97/hr, ₹33.46/hr and ₹522.83/hr,

respectively. Thus, it can be concluded that the absorption of both human labour and machine labour was found more in *rabi* season than *kharif* season. The same type of trend of results were found on marginal, small, semi-medium and medium farms also. The average hired labour absorption was more (18.07 man-days/ha) in *rabi* season than *kharif* season (14.64 man-days/ha). These results were in conformity with Singh (1996), Devi *et al*. (2013), Alam (2005) and Raju *et al*. (2015). The absorption of female labour (family and hired) was more in both the seasons *i.e*., *kharif* and *rabi* seasons than the male labour. The similar results were reported by Das (2015), Kispotta *et al*. (2016) and Singariya *et al*. (2016). The total human labour as well as total machine labour was lowest in taramira as same as on semi-medium and medium farms also. The average wage rate for machine labour varied from ₹473.33/hr to ₹994.44/hr. The annual average human labour and machine labour use was almost equal on large farms.
From the ongoing discussion it can be concluded that the utilization of machine labour as well as human labour was maximum in wheat among all selected principal crops *i.e*., pearl millet, cluster bean, groundnut, moth bean, green gram, wheat, rapeseed & mustard, cumin and taramira. The hired men were no used in green gram on all farm size groups. In this region taramira was a less mechanized and low labour-intensive crop among all the selected principal crops. The absorption of average human labour was more in *rabi* season than *kharif* season on all farm size groups.bThe absorption of human labour was the highest on marginal farms and lowest on large farms. The absorption of machine labour was the highest on large farms and lowest on marginal farms indicating that machine labour replaced human labour with the increase in size of the farm [9-15].

Conclusion
1. labour use varies extensively from crop to crop. The main reasons are the individual characteristics of each crop, intra-regional differences in farming systems and the levels of development.
2. Hired labour is used more extensively in crops which use more labour in their crop operations. There is a backward bending labour supply curve among landowners, which permits hired hands to obtain more jobs.
3. Labour use in agriculture is contingent upon modernization of agriculture, labour promoting and displacing technologies, natural endowments, wage rates and the locally prevalent farming systems. Labour use depends upon both technologies and market characteristics.
4. Labour absorption per hectare in terms of total, family and hired, gender and size groups vary prominently across crops and region.
5. The labour absorption in crop production for the transitional plain region (Region-II) varied from 53.47 man-days per hectare (marginal farms) to 45.55 man-days per hectare (large farms) in different farm size groups.
6. In region-II, the average human labour absorption was 47.45 man-days per hectare in all selected principal crops *viz*., pearl millet, cluster bean, groundnut, moth bean, green gram, wheat, rapeseed & mustard, cumin and taramira.
7. In transitional plain region, out of total human labour absorption, the participation of family and hired labour absorption was 35.35 man-days per hectare and 12.10 man-days per hectare, respectively.
8. In region -II, it was observed that the utilization of human labour as well as machine labour was maximum in wheat crop among all selected principal crops. This was due to irrigation, harvesting and threshing operations which was required relatively more human labour as well as machine labour (in irrigation).
9. Taramira crop was found less mechanized and low labour-intensive crop in transitional plain region.
10. The absorption of machine labour was the highest on large farms (44.72 hours per hectare) and lowest on marginal farms (24.71 hours per hectare) indicating that machine labour replaced human labour with the increase in size of the farm.

Policy implication
1. Steps should be taken to integrate MGNREGA with agriculture. The public works included under MGNREGA programme now, must be undertaken during the lean months of agricultural operations, *i.e*., in the months of February, March, April and September, while the MGNREGA registered labourers must be engaged in farm related labour in the remaining months.

This may check the migration of labourers as well as prevent the MGNREGA programme hindering agriculture.

2. The seasonal unemployment of agricultural labourers has negative impact on their income, consumption expenditure and savings. So there is need to create additional income sources for agricultural labourers. This can be done through imparting entrepreneurship training to labourers and providing credit at cheaper rates of interest for carrying out the self-enterprises such as dairy farming, poultry, goat rearing, food processing and other petty business. It will help them in generating employment and engaging themselves gainfully.

3. The low absorption of hired labour in slack periods, leads to arise the problems of surplus labour and under employment. The government should come up with the determination of establishing small scale industries in the rural areas which can provide subsidiary occupation to the surplus agricultural labour during slack periods.

The difference in the extent or intensity of labour use per acre among different areas and the changes occurring there in overtime are predominantly the result of differences in irrigation facilities, nature of crop-mix cultivated and the labour requirements of different crops. If the objective of the policy is to increase the employment of labour in crop production, the cropping pattern, would need to be diverted, towards such labour-intensive craps as paddy, vegetables etc. to push up yields and labour absorption by encouraging the increased use of intermediate inputs, especially fertilisers and HYVs by improving agricultural infrastructure, especially irrigation. Therefore, first priority should be given to irrigation facilities, as it allows double-cropping.

Application of research: The application of this research to analysis labour absorption and reasons behind the migration of farmers towards cities.

Research Category: Labour Utilization in agriculture

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