IMPACT OF FARM MECHANIZATION : ON THE FARM ECONOMY A CASE STUDY IN COASTAL ANDHRA PRADESH*

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Many agriculturally developed countries in the world like Japan, Korea, Philippines, China, America etc., have mechanized agriculture completely. They use manpower in agriculture only to an extent of 3 to 5 per cent (Sarma, 1999), whereas in India agriculture is dependent on manpower to an extent of 65 to 70 per cent.

The increasing emphasis on production per unit time necessitates greater energy use to ensure timeliness and precision in farm operations. The biological sources of energy, especially bullocks could not cope with the requirements of the changed situation. Belief that mechanization is only possible in case of large farms has been proved wrong in states like Punjab and Haryana. Mechanization of agricultural operations can be done irrespective of farm size if there is a combined effort of farmers, who are having small farm holdings.

In the Andhra Pradesh, it is a common phenomenon that surplus labour from Telangana and Rayalaseema districts, migrates to the coastal districts during the period of transplanting and harvesting of rice crop. They demand higher wages due to shortage of labour and time to carryout those operations. Sometimes farmers have to forcibly go for contract labourers and they plant seedlings at a wider spacing than the recommended in order to cover larger area in a shorter period. This has directly resulted in lower yields, as the recommended rate of seedlings per unit area could not be maintained.

Moreover it is a common knowledge that cyclones and heavy rains in the coastal area have always inflicted heavy losses through damage of ready-to-harvest crops. To illustrate further, it is worthwhile to recall that in Guntur district alone the losses were estimated at 901 kg/ha in the year 1977-78 while it was 777 kg/ha in West Godavari district in 1986-87.

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Further, it was estimated that if the harvesting is to be done by traditional method, 20 to 25 labourers per hectare per day are required to harvest. In addition, more labour is required for operations such as drying, heaping and threshing, which usually takes about 7 to 10 days of time. These manual operations would invariably lead to grain losses to the tune of 18 to 20 bags per hectare (Sarma, 1999). Such losses can be avoided in terms of time, grain and excess labour costs with mechanization.

In spite of the above-mentioned positive aspects of farm mechanization, it was not very much popularized. According to State Agriculture and Industries Development Institute (SAIDI), Hyderabad, the total number of tractors in the state are 1,35,000 for the net area sown of 84 lakh hectares, whereas in Punjab there are about 3,70,000 tractors under use for a net sown area of 42.10 lakh hectares. This possible reasons for this may be the negative views of the farmers about farm mechanization such as displacement of labour, high investment in purchase and maintenance of farm machinery etc., Keeping this in view the study was conducted to analyze the impact of farm mechanization on various aspects in coastal Andhra Pradesh.

METHODOLOGY

Three districts, West Godavari, Prakasam and Nellore, were selected, based on their first three positions in the state ranking in their stocks of farm machinery. A random sample of 240 farmers was collected from 12 villages of the three districts. Primary data were collected with the help well-structured questionnaires. Entire sample was divided into two categories viz., mechanized and non-mechanized farms. The farms on which the ploughing, transportation, irrigation (pump sets), harvesting, threshing and winnowing operations were mechanized either partially or completely were considered as mechanized and otherwise as non-mechanized. Data were analysed with simple means, frequencies and percentages; and were tabulated.

RESULTS AND DISCUSSION

1. Impact on Farm Labour Employment

Employment of labour can vary significantly even on farms of the same size located in the same area, cultivating the same crop, if the degree of mechanization is different. It is common knowledge that mechanized farms require less labour when compared to non-mechanized. However there has been a controversy of opinion i.e., whether mechanization causes absorption or displacement of labour. In order to arrive at some meaningful conclusions regarding the pattern of labour employment, an attempt was made to study the employ ment of labour operation-wise with respect to the two categories of farms.

The results presented in Table-1 and the earlier discussion indicated that the operations mechanized were ploughing, irrigation, transportation of manures, harvesting and threshing. Hence these operations were considered as important for comparison.

Ploughing

It was clear from Table 1 that there was a slight decrease in human labour employment from 4.50 to 4.38 man-days on mechanized farms. However this difference was significant at 5 per cent level of probability. The percent displacement of human labour was only 4.37 per cent. But in case of bullock labour it was 100 per cent displaced by tractor ploughing. But though there is a significant difference in casual human labour absorption, the difference was only 0.13 man days as indicated in the Table 1, while in case of bullock labour 12.80 Cattle Pair Days were completely displaced by tractor in ploughing operation. However if we consider the human labour, which works with the cattle pair in ploughing the displacement, might be about 13 man-days.

Manuring

In case of manuring only transportation was mechanized and this was also completely displaced tractor transportation. But with respect to human labour there was

no significant difference between man-days worked out on the two farms. This is conformity with the results of Johl (1973). He concluded that tractorisation did not have any significant effect on human labour employment. Thus from the above it can be suggested that mechanization did not have any affect on human labour absorption or displacement in case of manuring operation, however it had completely displaced the bullock labour transportation.

Irrigation

Mechanization of irrigation has led to assured irrigation throughout the year, thereby providing employment throughout. The results presented in Table 1 indicated that the human labour employment increased from 25.58 man-days on non-mechanized farms to 32.61 man-days on mechanized farms. This increase of about 7 man-days per hectare was found to be highly significant at 1 per cent level. This is in conformity with the results of Ahammed and Herdt (1984), Rao and Raju (1987) and ILO (1984). There was about 30 per cent increase in human labour absorption on mechanized farms than on non-mechanized. Mechanization of irrigation created employment for additional human labour through regular and increased number of irrigations, to look after and operate the pump sets etc., thus mechanization caused absorption of human labour in irrigation operation.

Harvesting

The foregoing results indicated that harvesting on mechanized farms was done in two ways. One with the use of harvest-combines and the other was by human labour. Harvesting by human labour had a positive effect on human labour absorption. There was a marginal increase in human labour absorption of 1.25 man-days. However it was not statistically significant and did not indicate any contribution from mechanization. It may be because of sample error.

But when the operation was carried out by harvest-combine, human labour was completely displaced. Since the harvesting, threshing and winnowing were carried out simultaneously by the harvest combine it has displaced the human labour used for all the three operations i.e. about 67 man-days per hectare. Thus on the farms

where the harvest combine was used, 100 per cent displacement of human labour was observed with respect to the three operations mentioned above. This is in conformity with the results indicated by Rao (1972), Balister and Singh (1983) and Lingard *et al* (1994). Out of 120 mechanized farms 85 farms used harvest combine. That means 70 per cent of them used harvest-combines for harvesting. Thus the above results indicated that on mechanized farms, there was a marginal increase in labour absorption when the harvesting was carried out by human labour, while a 100 per cent displacement of labour was observed when it was done by harvest-combines.

Threshing

As it was mentioned earlier, threshing operation was carried out in two ways. Threshing with harvest-combine had completely replaced the human labour. Mechanized farms, on which human labour was employed for harvesting adopted tractor threshing. The results indicated that when these farms compared with non-mechanized farms, tractor threshing had also displaced more than 10 man-days per hectare and the difference was statistically significant at 1 per cent level of probability. This is in conformity with the results of Thomas and Kshirsagar (1985). Hence from the above discussion it can be suggested that, tractor threshing caused displacement of human labour.

Total

The results presented in Table 1 indicated that there was a slight decrease in human labour absorption from non-mechanized (168.68 man-days) to mechanical (165.87 man-days). The difference was about 3 man-days, which was found to be highly significant at 1 per cent level. The percent change in man days from non-mechanized to mechanize indicated that a less than 2 per cent of human labour was displaced on mechanized farms when compared to non-mechanized farms. Thus, though mechanization of agricultural operations had displaced human labour but it was not considerable (< 2%), though there was some displacement on ploughing and threshing operations it was compensated by absorption in case of irrigation these results

are in conformity with the study conducted by Rao and Raju (1987) and Nandal (1988). However this is in the case, where the harvesting was done by human labour.

But when the harvest combines were used, the average man-days on a mechanized farm indicated a large decline. Displacement of nearly 58 man-days per hectare was observed due to the mechanization of three operations viz., harvesting, threshing and winnowing. When it was taken in percent terms, harvest combine on mechanized farms compared to non-mechanized farms displaced about 34 per cent of total human labour. Thus the above analysis indicated that on mechanized farms considerable labour displacement (34 %) was observed only when the harvest combines were used, otherwise the displacement of labour was only less than 2 per cent. Hence though mechanization is profitable keeping in view of the danger of labour displacement and creation of fresh unemployment, selective mechanization may be more suitable for the labour abundant economies like India. These results are in conformity with the studies conducted by Rao (1972), Basant (1987) and Pariyar *et al* (1995).

Permanent Labour Employment

The results presented in Table-1 indicate that there was a large difference of 5.19 labourers in the employment of permanent labour from mechanized (5.50) to non-mechanized farms (0.31). The permanent labour available per hectare also higher on mechanized farms by 1.49 labourers when compared to non-mechanized farms. This indicated that mechanized farms employed more number of permanent labour and suggested that there was a change in the pattern of labour employment. This might be due to the increased irrigation facilities through mechanization, which led to the intensification of crops and operations, thereby creating regular and continuous employment opportunities rather than seasonal employment. These results are in conformity with the studies conducted by ILO (1984) and NCAER (1987). From this it may be concluded that mechanization had a positive effect on permanent labour employment.

Table-1

Operation Wise Pattern of Labour Employment on Selected Farms (per ha.)

S. No	*Operation*	*Mecha-nized*	*Non-mechanized*		*Difference*		
		MDs	**MDs**	**CPDs**	**MDs**	**S.E**	**% change**
1	Ploughing	4.38	4.50	12.80	-0.13*	-0.06	-2.78
2	Sowing	2.60	2.50	0.00	0.10**	0.01	4.00
3	Manuring	4.42	4.31	12.35	0.11	0.14	2.55
4	Fertilization	8.44	7.17	0.00	1.27	1.09	17.73
5	Weeding	19.85	19.52	0.00	0.33	0.30	1.71
6	Transplanting	31.88	31.06	0.00	0.81*	0.36	2.62
7	Plant protection	6.40	6.23	0.00	0.17	0.13	2.68
8	Irrigation	32.61	25.58	0.00	7.03**	1.94	27.48
9	Harvesting	33.00	31.75	0.00	1.25	0.92	3.94
10	Threshing	6.45	16.83	0.00	-10.38**	-0.10	-61.65
11	Winnowing	15.85	19.23	0.00	-3.38**	-1.06	-17.57
12	Harvest-Combine	0.00	67.81	0.00	-67.81		100.00
13	Total without HC	165.87	168.68	0.00	-2.80**	0.11	-1.66
14	Total labour with HC		110.57			58.11	34.45
15	Permanent labour	5.50	0.31		5.19**	0.82	
	Per hectare	1.71	0.22		1.49**	0.34	

** Significant at P < 0.01 * Significant at P < 0.05

HC: Harvest combine MDs: Mandays

CPDs: Cattle Pair Days (A pair of cattle with a human labour)

2. Impact of Mechanization on the Cropping Intensity

The results presented in Table 2 indicated that there was a significant increase in cropping intensity from 105 per cent on non-mechanized farms to 180 per cent on mechanized farms. An increase of about 75 per cent was observed and it is depicted in the Fig.5.4. This increase was found to be statistically significant at 1 per cent level of significance. Thus it can be concluded that mechanization had increased the cropping intensity by 75 *a et al.* (1986) and Balister *et al.* (1993). However this increase in cropping intensity was due to the extended irrigation facilities and conserving time in carrying out various operations.

Table - 2

Impact of Mechanization on Various Aspects

S. No	Particulars	Mechanized	Non-mechanized	Difference	S.E
1	Cropping Intensity (%)	179.52	105.44	74.08**	28.20
2	Production (Q)	274.99	85.68	189.30**	18.02
3	Productivity (Q)	54.71	52.75	1.96**	0.28
4	Gross Income (Rs.)	26,675.00	24,253.13	2421.88**	349.80
5	Net Income (Rs.)	12,352.50	11,437.73	914.78**	179.36

** Significant at 1 % level (P<0.01)

3. Impact of Mechanization on the Productivity

Results presented in Table-2 indicated that there was an yield increased 196 Kg per hectare on an average on mechanized farm when compared to non-mechanized farms. This increase was found to be statistically significant at 1 $P < 0.01$. This is in conformity with the results of *Singh et al.* (1986). Important reasons for this may be the extended irrigation facilities due to mechanization use of high yielding variety seeds, etc. The average size of irrigated area on mechanized farms was about 3 hectares,

whereas in case of non-mechanized farms it was only one hectare. Since it is a known fact that productivity on irrigated land is considerably higher than the non-irrigated area. Further the use of HYV, high fertilizer and manure application on average, on a mechanized farm was higher when compared to non-mechanized farm. Thus mechanization had increased the irrigated area thereby increasing the productivity.

4. Impact of Mechanization on Production Per Farm

As it was seen earlier, increased productivity indicates increased production per farm on mechanized farms. The results presented in Table 2 indicated that production per farm on a mechanized farm (27 tones) was higher by nearly 19 tones per farm, when compared to non-mechanized farms (8 tones). This was found statistically significant. This large difference was accounted for bigger size of mechanized farms. Frequency of farmers in various farm sizes, presented in Table 2 indicated that, about 95 per cent of the non-mechanized farms had less than or equal to 2 hectares, while more than 72.50 per cent of the mechanized farms had more than 2 hectares. Thus mechanized farms being large, produced much higher output when compared to non-mechanized, thereby creating a large increase in production due to mechanization.

5. Impact of Mechanization on the Income

Gross income

The results presented in Table 2 indicated that gross income per hectare was also found to be higher on mechanized farms. It is a known fact that when there is high productivity on mechanized farms, there will definitely be high gross income. There was an increase in gross income of Rs.2,421 per hectare from non-mechanized (Rs.24,253.13) to mechanized farms (Rs.26675). This increase was found to be statistically significant at 1 per cent ($P < 0.01$). This is in conformity with the study conducted by Kahlon (1976).

Net income

Information on operational costs was collected to study the impact of mechanization on net farm income. The results are presented in Table 2. The average net income from a mechanized farm per hectare exceeded the net income from non-mechanized from by Rs.914 and it was found statistically significant at 1 per cent level of probability. This is in conformity with the study conducted by Reddy *et al.* (1984) and Balister *et al.* (1993). Compared to non-mechanized farms the per hectare cultivation expenses of mechanized farms were higher by 7.93 per cent. The additional expenditure on mechanized farms may be accounted for the extra expenditure on material inputs, more number of irrigations, human labour etc. Thus a mechanized category of farmer in spite of spending more, derived higher net income per hectare compared to a non-mechanized category of farmer. However, this may not to be attributed entirely to machine usage since the other factors such as high yielding varieties, fertilizers and irrigation have also contributed to it.

Conclusion

From the above discussion it can be concluded that the cattle labour was completely displaced by tractors on mechanized farms. However, in the case of casual labour, there was only a slight displacement unless harvester was used. The displacement of casual labour observed on threshing and ploughing operations due to tractorisation was compensated by the casual labour absorption through irrigation operation. Further mechanization had a positive affect on permanent labour employment. Mechanization had positive impact on all the aspects considered viz., cropping intensity, production, productivity and income.

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