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ARTICLES

Factors Affecting Demand for Human Labour in Punjab Agriculture: An Econometric Analysis

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Technological change expands output by raising the efficiency of input use and raises employment by increasing the demand for labour. But the relative growth rates of output and employment depend upon the type of technological change. There is a close relationship among the level of technology, agricultural development and the pattern and extent of labour utilisation. In the Punjab State, agriculture has experienced a rapid technological change in the form of seed-irrigation-fertiliser technology with the advent of Green Revolution. These technologies along with the adoption of multiple cropping system have placed a premium on timeliness and precision of farm operations for increasing agricultural production per unit area and time which paved the way for mechanisation. The seed-irrigation-fertiliser technology is normally considered to be land and labour augmenting whereas the impact of farm mechanisation is viewed with great concern. On the one hand, it is considered as labour displacing and on the other, it is regarded as yield and production increasing in nature. Therefore, it becomes necessary to study the human labour employment pattern at different levels of technology. An analytical study also needs to be made on factors bearing on demand for human labour, namely, the farm size, extent of tractorisation, level of production, level of commercial inputs use, etc.. This paper focuses on these issues. It would enable the policy makers to examine the impact of recent changes in technology on human labour employment and its consistency with the national objective of building up employment potential.

METHODOLOGY

The study was based on the data collected for the agricultural year 1981-82 from the 'Comprehensive Scheme to Study the Cost of Cultivation of Principal Crops in Punjab' in which the State was divided into three homogeneous zones, namely, *(i)* wheat-paddy-maize zone, *(ii)* wheat-maize-groundnut zone and *(iii)* wheat-cotton-bajra zone on the basis of similarity in cropping pattern, soil type, irrigation, rainfall and productivity. With varying probability and using three-stage stratified random sampling technique, 90 operational holdings for zone I, 50 for zone II and 60 for zone III were selected. Since our objective was to examine labour use pattern at different levels of technology, these holdings were classified into bullock operated farms and tractor operated farms on the basis of main source of draft power on these farms, assuming that the level of adoption of seed-irrigation-fertiliser technology is directly related with the level of mechanisation. The operational holdings, where harvesting combine was used, were not considered for this study because it was difficult to form a separate zonewise category for them, their number being very small in the case of zones II and III. Thus a sample of 34 bullock operated and 36 tractor operated

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farms for zone I, 24 bullock operated and 23 tractor operated farms for zone II and 37 bullock operated and 21 tractor operated farms for zone III were formed for the study. The average farm size of these categories was 3.98 and 8.90 hectares for zone I, 4.20 and 8.85 hectares for zone II and 5.57 and 9.56 hectares for zone III respectively.

ECONOMETRIC MODEL

Specification of the Variables

The specification of the variables included in the study is as under:

X_1 = Gross value of agricultural production (in Rs.):
Since a large number of crops were grown on a farm, the gross value of agricultural production in value terms was taken as the variable. This variable considers the sum total of all the products plus by-products, if any.

X_2 = Farm size (in hectares):
It was estimated as the land owned plus leased in land minus leased out land.

X_3 = Total human labour use (in man-hours):
The total family labour and total hired labour used at the farm for performing various farm operations were added up to calculate the total human labour employment at the farm during the year. Labour hours of women and children were converted into man-hour equivalents by using standard conversion factors of 0.67 for women and 0.50 for children.

X_4 = Bullock pair use (in hours):
The actual bullock pair hours employed on a farm in the year were taken in this variable.

X_5 = Tractor use (in hours):
Use of tractor in hours on a farm was recorded and taken as an independent variable.

X_6 = Use of fertilisers and manures (in Rs.):
Actual use of fertilisers and manures for all the crops was summed up and taken in value terms because there were several fertilisers used which had variable N, P, K ratios and prices.

X_7 = Use of pesticides (in Rs.):
Actual use of pesticides on the farm was also taken in value terms as in the case of fertilisers due to the same reasons.

X_8 = Use of weedicides (in Rs.):
The variable was treated separately from pesticides because it reduced the labour employment in hoeing operations for different crops.

X_9 = Irrigation use (in hours):
Irrigation in the Punjab is done from many sources, *viz.*, Electric motor operated pumpsets, diesel engine operated tubewells, canal irrigation, etc. In order to bring all the farms on comparable and uniform basis with respect to irrigation factor, all the hours of irrigation done were standardised as equivalent of five horse power operated tubewell using the horse power of the electric motor/diesel engine. Similarly, canal hours were approximated into irrigation hours using the conversion factor of 3.75. The rate of water discharge in most of the canal distributories in the southern districts of Punjab, where canal is the main source of irrigation, is one cusec. The water management experts of the Punjab Agricultural University suggested that discharge of one

cusec is equivalent to 30 litres of water flow per second whereas the water discharge rate of most of the five horse power operated tubewells in those districts is equivalent to 8 litres per second. Therefore, the above-mentioned conversion factor was used.

X_{10} = Wage rate (in Rs. per man-hour)

It was calculated by dividing total wage bill (including the imputed wage bill for family labour use) by the total human labour used (in hours) on the farm.

The variables were expressed on per cultivated hectare basis.

The Model

In functional analysis, a two-simultaneous equation model was used to estimate the labour demand functions for different zones. The single equation method is appropriate where the line of causation is one way and the dependent variable is unilaterally determined by other independent variables. However, in the present case, the line of causation was not one way. For example, the level of production on the farm depends upon the use of labour on the farm, on the one hand and use of labour depends upon the level of output, on the other hand. Given the existence of two-way relationship a simultaneous equation model with two equations, *viz.*, labour employment equation and output equation, was considered to be more appropriate. Human labour employment and output equations with various combinations of variables in linear as well log-linear form were tried and the final equations were selected based upon the value of the coefficient of multiple determination (R^2), the sign and significance of the estimates which were meaningful and logically explainable. Linear equations were found to explain better the set of reduced form equations (Appendix). The mathematical formulation of the selected model was as under:

(i) Labour employment equation

$$X_3 = a_0 + a_1 x_1 + a_2 x_2 + a_4 x_4 + a_5 x_5 + a_7 x_7 + a_8 x_8 + a_9 x_9 + a_{10} x_{10}$$

(ii) Output equation

$$X_1 = b_0 + b_2 x_2 + b_3 x_3 + b_4 x_4 + b_5 x_5 + b_6 x_6 + b_7 x_7 + b_8 x_8 + b_9 x_9$$

This two-equation structural model was tested for identification by applying rank and order conditions and was found to be exactly identified. Therefore, by substituting the value of X_1 from equation (2) into equation (1) and X_3 from equation (1) into equation (2), reduced form equations were obtained as below:

$$X_3 = A_0 + A_2 X_2 + A_4 X_4 + A_5 X_5 + A_6 X_6 + A_7 X_7 + A_8 X_8 + A_9 X_9 + A_{10} X_{10}$$
$$X_1 = B_0 + B_2 X_2 + B_4 X_4 + B_5 X_5 + B_6 X_6 + B_7 X_7 + B_8 X_8 + B_9 X_9 + B_{10} X_{10}$$

where

$$A_0 = \frac{a_0 + a_1 b_0}{1 - a_1 b_3} \qquad B_0 = \frac{b_0 + a_0 b_3}{1 - a_1 b_3}$$

$$A_2 = \frac{a_2 + a_1 b_2}{1 - a_1 b_3} \qquad B_2 = \frac{b_2 + a_2 b_3}{1 - a_1 b_3}$$

$$A_4 = \frac{a_4 + a_1 b_4}{1 - a_1 b_3} \qquad B_4 = \frac{b_4 + a_4 b_3}{1 - a_1 b_3}$$

$$A_5 = \frac{a_5 + a_1 b_5}{1 - a_1 b_3} \qquad B_5 = \frac{b_5 + a_5 b_3}{1 - a_1 b_3}$$

$$A_6 = \frac{a_1 b_6}{1 - a_1 b_3} \qquad B_6 = \frac{b_6}{1 - a_1 b_3}$$

$$A_7 = \frac{a_7 + a_1 b_7}{1 - a_1 b_3} \qquad B_7 = \frac{b_7 + a_7 b_3}{1 - a_1 b_3}$$

$$A_8 = \frac{a_8 + a_1 b_8}{1 - a_1 b_3} \qquad B_8 = \frac{b_8 + a8_0 b_3}{1 - a_1 b_3}$$

$$A_9 = \frac{a_9 + a_1 b_9}{1 - a_1 b_3} \qquad B_9 = \frac{b_9 + a_9 b_3}{1 - a_1 b_3}$$

$$A_{10} = \frac{a_{10}}{1 - a_1 b_3} \qquad B_{10} = \frac{a_{10} b_3}{1 - a_1 b_3}$$

The estimates A_0, A_2, A_4, A_5, A_6, A_7, A_8, A_9 and A_{10}, and B_0, B_2, B_4, B_5, B_6, B_7, B_8, B_9 and B_{10} were the reduced form estimates of the labour employment and output equations respectively. Finally, the reduced form estimates were transformed to estimate the structural coefficients, *i.e.*, a_0, a_1, a_2, a_4, a_5, a_7, a_8, a_9 and a_{10} and b_0, b_2, b_3, b_4, b_5, b_6, b_7, b_8 and b_9. Since the estimates of the structural parameters obtained through Ordinary Least Squares method are not only biased but inconsistent also, these were transformed through the method of Indirect Least Squares as our model was exactly identified. Multicollinearity was not found to be a serious problem while estimating the equations. The impact of different variables on total human labour employment was estimated with the help of these structural coefficients. To examine the relative importance of these variables in estimating the respective labour functions, the elasticities were worked out at mean levels of different independent variables.

HUMAN LABOUR EMPLOYMENT PATTERN ON TRACTOR OPERATED VERSUS BULLOCK OPERATED FARMS

Table I depicts human labour use pattern on bullock operated and tractor operated farms. The labour use on per hectare basis was to the tune of 1,065 hours on tractor operated farms as compared to 1,228 hours on bullock operated farms in zone I and this reduction on mechanised farms was significant. The substitution of bullock labour by tractors itself accounted for the reduction in human labour use on these farms to some extent. Higher use of weedicides on tractor farms was another important factor for bringing about this decrease in human labour use. Secondly, paddy was the main *kharif* crop of this zone which was more amenable to the labour substituting effects of tractorisation because it requires lot of

TABLE I. PER HECTARE USE OF HUMAN LABOUR AND OTHER INPUTS AND LEVEL OF OUTPUT ON BULLOCK OPERATED FARMS (BOF) AND TRACTOR OPERATED FARMS (TOF), 1981-82

Input/ Output	Zone I		Zone II		Zone III		Pooled	
(1)	BOF (2)	TOF (3)	BOF (4)	TOF (5)	BOF (6)	TOF (7)	BOF (8)	TOF (9)
FL (hrs.)	627 (51.0)	349 (32.7)	653 (61.4)	414 (36.2)	713 (69.1)	539 (46.4)	673 (61.2)	420 (37.7)
PL+CL(hrs.)	601 (49.0)	716 (67.3)	411 (38.6)	730 (63.8)	319 (30.9)	623 (53.6)	426 (38.8)	694 (62.3)
TL(hrs.)	1,228 (100.0)	1,065* (100.0)	1,064 (100.0)	1,144^{NS} (100.0)	1,032 (100.0)	1,162* (100.0)	1,099 (100.0)	1,114^{NS} (100.0)
BL(hrs.)	219	20	196	53	148	50	180	38
TrU(hrs.)	2.8	30.6	2.4	21.2	2.7	29.9	2.7	27.7
F+M(Rs.)	1,258	1,339	1,086	1,340	756	956	985	1,233
Pest(Rs.)	5	20	6	25	79	97	40	43
Weed(Rs.)	52	81	32	50	14	35	30	60
Irrg(hrs.)	227.9	230.2	193.6	194.2	184.7	206.6	199.9	213.6
Output(Rs.)	7,981	8,645	7,510	8,581	7,153	8,122	7,488	8,481
			Area under Different Crops (per cent)					
Paddy	26.8	22.1	13.6	15.6	4.2	10.5	13.8	17.1
Cotton (American)	-	-	3.1	3.2	27.6	23.7	13.0	7.0
Cotton *(Desi)*	1.0	0.7	3.5	4.2	2.6	3.1	2.3	2.3
Sugarcane	3.9	5.8	5.7	4.3	0.7	1.4	2.9	4.2
Maize	5.8	6.3	10.0	7.3	0.4	1.3	4.3	5.2
Wheat	37.4	38.7	39.6	42.4	35.3	38.7	37.0	39.8
Gram	0.3	0.1	-	-	7.6	4.4	3.5	1.3
Potato	3.1	5.9	0.1	2.8	-	-	1.1	3.5
Cropping intensity(%)	188.6	186.1	172.4	173.9	166.3	177.3	174.5	180.2

FL = Family labour. PL = Permanent labour. CL = Casual labour.
TL = Total labour. BL = Bullock labour. TrU = Tractor use.
F+M = Fertilisers+Manures. Weed = Weedicides. Pest = Pesticides.
Irrg = Irrigation.
* Significantly higher/lower at 1 per cent level.
NS = Non-significant.
Figures in parentheses indicate percentages of different components of human labour to total labour used.

preparatory tillage. Labour use for paddy was 805 hours on tractor operated farms as compared to 970 hours on bullock operated farms in zone I. The positive forces promoting labour use such as higher level of production and higher use of pesticides on tractor farms as compared to bullock farms were unable to offset the negative effects on labour use.

In zones II and III, a reverse trend was, however, observed so far as labour use pattern was concerned. The per hectare human labour use was higher at 1,144 hours on tractor operated farms against 1,064 hours on bullock operated farms in zone II and 1,162 and 1,032 hours correspondingly in zone III. This increase in labour use on mechanised farms was statistically significant in zone III but not in zone II. In these zones, the increase in labour utilisation on tractor operated farms could partially be assigned to the combined effects of increase in cropping intensity, increase in area under more labour absorbing crops like paddy, cotton, potato, sugarcane, etc., and the rise in the levels of input use and output. In zone III, the significant increase in the labour use on tractor operated farms was primarily brought about by significantly higher cropping intensity on these farms as compared to bullock operated farms. Moreover, cotton was the principal *kharif* crop of this zone and keeping of

bullocks along with tractors was the common characteristic of tractor farms. The operations like sowing and hoeing of cotton were generally done with bullocks. Therefore, the crop was relatively less amenable to labour substitution effect of tractorisation and as a result, the reduction of bullock use was less on tractor operated farms in this zone as compared to zone II. On the whole, labour replacing effects of tractorisation and weedicides could not overshadow the labour increasing effects of crop mix, cropping intensity and higher input use and level of production.

For the State as a whole, tractor operated farms employed a little more labour at 1,114 hours as compared to bullock operated farms where it was 1,099 hours. The difference was, however, not significant. In spite of replacement of bullock labour by tractors and higher use of weedicides, which are labour saving in nature, the increase in cropping intensity, larger proportion of area under labour intensive crops like sugarcane, potato and paddy, increased use of fertilisers and enhanced production enabled the tractor farms to employ more human labour as compared to bullock farms.

For all the zones and the State as a whole, the proportion of hired labour (permanent+casual) to the total labour used was greater than that of family labour in the case of tractor operated farms. This happened because these farms were generally large sized farms and family labour availability for crop production on per unit area basis was smaller. It could also be due to substitution of leisure for work because of higher incomes. Therefore, tractorisation did not adversely affect the wage earning section of society, rather it increased employment opportunities for them by boosting agricultural production.

HUMAN LABOUR DEMAND FUNCTIONS

In the following section, an attempt has been made to estimate the human labour demand function with per hectare human labour used as dependent variable and farm size, use of pesticides, use of weedicides, irrigation intensity, level of production, wage rate and source of draft power, *i.e.*, tractor hours and bullock hours as independent variables by using two-simultaneous equation model. The coefficients of demand for human labour employment and their elasticities in different zones of the Punjab State and for the State as a whole are presented in Table II and III.

TABLE II. STRUCTURAL COEFFICIENTS OF HUMAN LABOUR EMPLOYMENT EQUATIONS FOR DIFFERENT ZONES AND PUNJAB, 1981-82 (Y = HUMAN LABOUR USE IN HRS./HA.)

Variable (1)	Zone I (2)	Zone II (3)	Zone III (4)	Punjab (5)
Intercept	1000.40	-177.95	466.53	672.22
Farm size (ha.)	-9.27	-10.41	-5.13	-2.61
Bullock labour (hrs.)	0.86	1.82	0.93	1.18
Tractor use (hrs.)	-2.50	11.99	3.54	3.30
Pesticides use (Rs.)	3.06	0.27	0.50	0.24
Weedicides use (Rs.)	-1.12	-2.36	-0.97	-1.90
Irrigation use (hrs.)	0.49	0.67	0.82	0.77
Production (Rs.)	0.11	0.19	0.09	0.09
Wage rate (Rs./hr.)	-638.58	-460.24	-155.23	-358.80

Structural coefficients are derived from reduced form coefficients which are given in the Appendix. Their standard errors cannot be worked out since they belong to simultaneous equation system.

TABLE III. ELASTICITY OF HUMAN LABOUR EMPLOYMENT FOR DIFFERENT ZONES AND PUNJAB, 1981-82

Variable (1)	Zone I (2)	Zone II (3)	Zone III (4)	Punjab (5)
Farm size	-0.05	-0.06	-0.03	-0.02
Bullock labour	0.06	0.16	0.08	0.10
Tractor use	-0.05	0.16	0.05	0.05
Pesticides use	0.04	0.01	0.04	0.01
Weedicides use	-0.07	-0.09	-0.02	-0.08
Irrigation use	0.10	0.12	0.15	0.14
Production	0.85	1.42	0.60	0.66
Wage rate	-0.79	-0.54	-0.22	-0.46

Farm size was found to have negative relationship with labour use in all the zones as well as the State. Considering the unit of measurement of farm size which was in hectares, the decrease, however, seems negligible. Therefore, the elasticity of labour use for farm size was worked out as -0.05, -0.06, -0.03 and -0.02 respectively for different zones and the State as a whole. Since the use of bullock labour and of human labour are complementary to each other, it was noticed that additional use of bullock labour pushed up the demand for human labour on all categories of farms. The percentage increase in labour use due to one per cent increase in bullock use was computed as 0.06 per cent, 0.16 per cent, 0.08 per cent and 0.10 per cent respectively for zones I, II, III and the Punjab State.

So far as the effect of tractor use on labour use was concerned, tractor use was not found to be labour displacing in nature in the State. However, a minor displacement of labour by 2.50 hours due to additional use of a tractor by one hour was estimated in zone I. This zone was paddy intensive zone and this crop as well as wheat crop, which is grown in rotation with paddy, was more susceptible to labour displacing effect of tractorisation as compared to other crops. Further, the zone was more tractorised as compared to other zones (Table I). The labour displacing effects of tractorisation were more than compensated by an increase in cropping intensity and shift in cropping pattern towards more labour absorbing crops brought about primarily by tractorisation. The coefficient of elasticity pointed out that one per cent increase in tractor use reduced the labour use by 0.05 per cent in zone I whereas in zone II and III and, on overall basis, the demand increased by 0.16 per cent, 0.05 per cent and 0.05 per cent respectively.

The use of pesticides was observed to be labour increasing in effect whereas the use of weedicides in place of hoeing was labour saving in nature. This is so because hoeing is one of the most labour intensive operations in crop production. It was worked out that one per cent increase in weedicides expenditure reduced the labour use by 0.07 per cent in zone I, by 0.09 per cent in zone II, by 0.02 per cent in zone III and by 0.08 per cent on overall basis.

Irrigation intensity had a perceptible positive effect on demand for human labour in all the zones. For the State as a whole, labour utilisation went up by 0.77 hour due to increase in irrigation by one hour and the percentage increase was about 0.14 per cent as a result of one per cent increase in the intensity of irrigation.

The level of production is postulated to have a direct bearing on the demand for human labour. It was found to be labour augmenting in nature in all the zones. At the State level, the increase was estimated at 90 hours per thousand rupees increase in total production. One per cent increase in the level of output led to 0.85 per cent, 1.42 per cent, 0.60 per cent and 0.66 per cent rise in labour utilisation for zones I, II, III, and the Punjab State respectively. The increase was more pronounced in zones I and II as compared to zone III because the proportion of area under paddy to the total cropped area was relatively more in these zones

and this crop needed more labour hours per unit output for harvesting and threshing operations as compared to other crops.

The differences in wage rate are not greater from one farm to another within the same region but variations do exist. Primarily due to this reason, inter-village migration of labour takes place. Migration of labour force from other States such as Uttar Pradesh, Bihar, Madhya Pradesh, Orissa, etc., to the Punjab also affects the wage rate and its influence is different in different zones and even within the same zone depending upon the influx of labour in that area/zone. The data indicated that a rise in the wage rate brought about a fall in the annual per hectare labour employment in all the zones and the State. One per cent increase in the wage rate decreased human labour employment by about 0.79 per cent in zone I, by 0.54 per cent in zone II, by 0.22 per cent in zone III and by 0.46 per cent for the whole State. Since paddy-wheat was the main crop rotation in zones I and II, which was more sensitive to the labour displacing effects of mechanisation, a greater decrease in the demand for human labour in these zones was observed due to an increase in the wage rate because farmers might have opted for mechanisation and higher use of weedicides. However, the effect of wage rate in zone III was less sharp because of the dominance of cotton crop which was relatively less amenable to mechanisation.

CONCLUSIONS AND POLICY IMPLICATIONS

In Punjab agriculture, farm mechanisation especially tractorisation has not replaced human labour uptill now. Whatever substitution that happened due to tractorisation of farm operations was compensated by labour increasing forces like increase in cropping intensity and labour intensive shifts in cropping pattern ushered primarily by tractorisation. The increase in the level of production due to higher use of commercial inputs and farm mechanisation to catch up the time schedule and farm precision also helped to increase the demand for human labour on the farms. Tractorised farms were also found to be employing more hired labour in proportionate as well as absolute terms, thereby indicating more employment opportunities for the wage earning section of the society. Farm mechanisation on the farms has been adopted more out of technical necessity rather than for reasons of substitution of labour as in the case of western agriculture, where labour is scarce.

In the initial phase of agricultural development, farm mechanisation along with seed-irrigation-fertiliser technology had been proved to be complementary to the demand for human labour. But this trend is not likely to continue in future. It is feared that Punjab agriculture has reached a stage where increased mechanisation like introduction of harvesting combines and more use of labour substituting inputs like weedicides and herbicides might start competing with labour force resulting into its displacement. On the other hand, the scope of labour use promoting forces like increase in cropping intensity as well as agricultural production is limited with the existing level of technology due to higher incremental capital-output ratios. Consequently, the demand for labour in the Punjab may not grow enough in future to absorb the growing labour force. The solution to the problem of disguised and open employment, therefore, lies in creating employment opportunities in the secondary and tertiary sectors of the economy.

APPENDIX

REDUCED FORM ESTIMATES OF LABOUR EMPLOYMENT AND OUTPUT EQUATIONS FOR DIFFERENT ZONES AND THE PUNJAB STATE AS A WHOLE, 1981-82

Variable	Zone I		Zone II		Zone III		Punjab	
	Labour	Output	Labour	Output	Labour	Output	Labour	Output
	(hrs.)	(Rs.)	(hrs.)	(Rs.)	(hrs.)	(Rs.)	(hrs.)	(Rs.)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Intercept	1235.26	2096.97	1094.44	6592.70	603.12	1820.77	972.83	2829.85
FS (ha.)	-17.04**	-69.40^{NS}	-15.54***	-26.58^{NS}	-4.99^{NS}	1.60^{NS}	-5.04^{NS}	-26.92^{NS}
BL(hrs.)	0.56***	-2.71^{NS}	1.52**	1.56^{NS}	0.88^{NS}	-0.61^{NS}	0.98*	-2.13^{NS}
TU (hrs.)	1.37^{NS}	25.72***	14.03**	10.58^{NS}	3.61**	0.80^{NS}	3.93**	6.99^{NS}
Fer (Rs.)	0.18^{NS}	1.62***	0.31***	1.63**	0.29***	3.35*	0.19***	2.08*
Pest(Rs.)	4.35*	11.51^{NS}	4.52**	22.02***	0.77***	3.13***	0.68**	4.84**
Wd (Rs.)	-0.77**	3.11^{NS}	-2.20*	0.84^{NS}	-0.87^{NS}	1.26^{NS}	-1.57*	3.70***
Irrg (hrs.)	0.82**	2.97^{NS}	1.44*	4.00**	1.15***	3.85**	1.33*	6.19*
Wg rate (Rs./hr.)	-374.7*	2355.9***	-598.7*	-717.5^{NS}	-30.07^{NS}	1455.4^{NS}	-251.6*	1186.8***
R^2	0.60*	0.43**	0.74*	0.51*	0.50*	0.59*	0.49*	0.45*

FS = Farm size. BL = Bullock labour. TU = Tractor use
Fer = Fertiliser use. Pest = Pesticides use. Wd = Weedicides use
Irrg = Irrigation hours. Wg rate = Wage rate.
* Significant at 1 per cent level. ** Significant at 5 per cent level.
*** Significant at 10 per cent level. NS = Non-significant.