Vol XXXII
No. 1

ISSN 0019-5014

JANUARY-
MARCH
1977

INDIAN JOURNAL OF AGRICULTURAL ECONOMICS

INDIAN SOCIETY OF
AGRICULTURAL ECONOMICS,
BOMBAY

SOME METHODOLOGICAL ISSUES IN USING LINEAR PROGRAMMING TECHNIQUE IN AGRICULTURE

INTRODUCTION

Prior to the recent technological breakthrough in Indian agriculture, farming was, by and large, of subsistence type. This means that the farmers used mostly inputs which were raised on the farm and production was largely consumption oriented. As a result, the concept of gross returns used by some research workers in programming analysis was not altogether unrealistic.

The situation has, however, changed with the adoption of new technology in agriculture in the mid-'sixties. Farm productivity and profitability increased with the introduction of HVY of seeds and guaranteed prices for major farm products. This encouraged the farmers to make sizable farm investments. Today, agriculture requires lot of capital investment and needs to be considered as a business proposition for better returns.

Once the proportion of farm inputs purchased by the farmers starts increasing, the concept of gross returns becomes less relevant for developing farm plans. In other words, the concept of returns to fixed farm resources assumes greater relevance for making relative comparisons among different enterprises. This means that while considering the combination of farm enterprises, the farmers are not only concerned with gross returns, but also with the rising variable costs associated with different enterprises. More importantly, if the concept of gross returns were used in deciding the combination of various enterprises, it would ignore the concept of relative profitability from different activities, which is one of the important factors governing the choice of different products.

This paper is an attempt to examine the implications of the various concepts used in linear programming by way of results obtained from them. Some of the important concepts and procedures that have been tested in this paper are (1) Returns to the fixed factors *versus* gross returns; (2) Allocation of cost of casual labour; and (3) Allocation of cost of borrowed capital.

Review

Randhawa and Heady[1] used inter-regional programming model to determine an optimal allocation of acreage among different crops and regions of India. They used gross returns to develop optimal production pattern but recognized that it would be better if net returns were used in the analyses. Furthermore, they pointed out that cash costs in their study formed a small proportion of the total cost. Now that the situation has changed and the

1. N. S. Randhawa and E. O. Heady, "Spatial Programming of Production for Agricultural Development in India," *Indian Journal of Agricultural Economics*, Vol. XXI, No. 3, July-September, 1966.

proportion of variable cost to the total cost has increased, the concept of gross returns seems to have lost its relevance.

Sankhayan and Sidhu[2] used the concept of gross returns to develop optimal plans but they admitted the point that the net returns concept should give better results.

Kapur and Kahlon[3] used the concept of returns to the fixed factors to determine optimal cropping pattern for Upper-Dhaia region of Ludhiana. Again, Johl and Kahlon[4] also used the concept of return to the fixed farm resources to develop optimal solutions. But in these studies, the allocation of cost of casual labour was put against capital resource and capital plus interest was put as capital cost in the objective function with negative sign.

Sirohi and Gangwar[5] used the concept of returns to the fixed farm resources to develop an optimal solution, but they did not specify how the cost of borrowed funds or casual labour were incorporated in the model. Singh, *et. al*[6] used the concept of returns to the fixed factors to determine an optimal solution but the authors did not indicate how the cost of capital borrowed and casual labour were treated in the model.

MATERIAL AND METHODS

The survey method was used to collect the data through personal interview. The size of the sample was 15 holdings and the data were collected from three villages of Ludhiana district of the Punjab and the data pertained to 1974-75. A synthetic farm situation was developed to discuss the appropriate concepts.

Selection of Activities

In order to determine an optimal production programme, it was essential to incorporate such enterprises which were acceptable to the cultivators. Crop activities could not be classified according to their sequence in crop rotation for want of experimental data on complementary, supplementary and competitive relationship among crops.

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2. P. L. Sankhayan and D. S. Sidhu, "Regional Specialisation in the Cultivation of Commercial Crops vis-a-vis Regional Self-Sufficiency in Foodgrain Production—A Case of Punjab," *Indian Journal of Agricultural Economics*, Vol. XXIX, No. 3, July-September, 1974.

3. T. R. Kapur and A. S. Kahlon, "Optimal Cropping Patterns for Upper-Dhaia Region of I. A. D. P. District, Ludhiana," *Indian Journal of Agricultural Economics*, Vol. XXII, No. 2, April-June, 1967.

4. S. S. Johl and A. S. Kahlon "Note on Application of Programming Techniques to Indian Farming Conditions," *Indian Journal of Agricultural Economics*, Vol. XXIII, No.1, January-March, 1968.

5. A. S. Sirohi and A. C. Gangwar, "Economic Optima in Resource Allocation for the Cultivators of Kanjhawala Block," *Indian Journal of Agricultural Economics*, Vol. XXIII, No. 3, July-September, 1968.

6. R. D. Singh, K. K. Verma and L. R. Singh, "Production Possibilities and Resource Use Pattern on Small Farms: A Comparative Study in Three Regions of Uttar Pradesh," *Indian Journal of Agricultural Economics*, Vol. XXVII, No. 4, October-December, 1972.

Resource Constraints

Land and capital were the most limiting resources in farm production but there were certain periods in the year when family labour could not cope with farm operations. Therefore, the supply of family labour during the critical periods was also treated as a restriction and labour hiring activity was introduced for each labour peak period.

Capital Constraint

Total working capital of a farmer in a season comprised of the portion of sale proceeds of previous crops, which were reserved to meet the needs of farm business during the coming season, plus borrowed funds that can be availed of during the season. The constraint was released by allowing the capital to be borrowed at 10 per cent interest rate per annum in the analysis.

Returns to Fixed Factors

The yield of various products was multiplied with their respective prices to calculate the gross returns from each activity. The operational cost was deducted from the gross returns to obtain the net returns to the fixed farm factors from different farm activities.

The following linear programming model was used:—

$$\text{Max } Z = \sum_{j=1}^{n} R_j X_j$$

Subject to

$$B_1 \geqslant a_{11} x_1 + a_{12} x_2 + \ldots\ldots\ldots\ldots + a_{1n} x_n$$

$$B_2 \geqslant a_{21} x_1 + a_{22} x_2 + \ldots\ldots\ldots\ldots + a_{2n} x_n$$

$$\vdots$$

$$B_m \geqslant a_{m1} x_1 + a_{m2} x_2 + \qquad\qquad + a_{mn} x_n$$

$$X_j \geqslant 0$$

where

Z is the total return to fixed factors from $X_1 \ldots, X_n$ activities. $a_{11} \ldots a_{1n} \ldots a_{m1} \ldots a_{mn}$ are input coefficients of $X_1 \ldots, X_n$ activities, $B_1 \ldots, B_m$ are resource availabilities.

To obtain the returns to the fixed factors, where the gross return was used as selection criterion in the objective function, the following procedure was adopted so that results could be compared.

Total gross returns $= \sum_{j=1}^{n} R_j X_j$; X_j are the activities

R_j gross returns from an activity.
$X_j = 1, \ldots\ldots, n$
$R_j = 1, \ldots\ldots, n$

Total variable costs $= \sum_{j=1}^{n} C_j X_j$; C_j is the variable cost of jth activity.

Total returns to the fixed factors $= \sum_{j=1}^{n} R_j X_j - \sum_{j=1}^{n} C_j X_j$

For comparative analysis, both the criteria were used to solve the problem; the objective functions were mathematically specified and the results were supported by solving a practical problem.

1. Max $Z = \sum_{j=1}^{n} R_j X_j$, $j=1,\ldots,n$ (Plan II)

2. Max $Z = \Sigma R_j X_j - \Sigma C_j X_j$, $J=1,\ldots, n$ (Plan I)

where R_j referred to the gross returns from jth activity and C_j referred to the costs associated with jth activity.

The two criterion functions (hereafter called as Plan II and Plan I respectively) were maximized subject to certain constraints. Alternative specification of Plan II can be written as under:

$$\text{Max } Z = \sum_{j=1}^{n} R_j^* X_j + \sum_{j=1}^{n} C_j X_j$$

where R_j^* refers to the returns to the fixed factors plus C_j which is variable cost.

Maximization of Z would imply maximization of $\Sigma R_j^* X_j$ as well as maximization of $\Sigma C_j X_j$ because X_j, C_j and R_j are supposed to be $\geqslant 0$. Contrasted with this, if the criterion function specified in Plan I,

$$(\text{Max } Z = \Sigma R_j X_j - \Sigma C_j X_j)$$

were used, the process of maximization would imply maximizing the difference between $\Sigma R_j X_j$ and $\Sigma C_j X_j$.

The difference in the two approaches lies in the value of the coefficients used in the objective function, assuming a common framework of constraints. Only in such cases, where the coefficient vector attached to the criterion func-

tion changed in such a way that the ordering of the elements of this vector was changed, one might expect a completely different solution vector resulting in different values of the objective function. For instance, the gross returns from activity A may be much higher than activity B, but the associated costs with the former activity might make this activity less profitable than the latter. As such, the coefficient vector in Plan II will be different in order compared with Plan I. These different criteria were verified by solving practical problems.

RESULTS AND DISCUSSIONS

In Plan I, R vector gives the returns to the fixed farm factors, whereas in Plan II, it shows gross returns from the activities. The results of the two plans are compared in Table I.

TABLE I—INCOME

(*Rs.*)

Item	Plan I	Plan II
1. Value obtained from the objective function ..	34,150.62	55,981.14
2. Capital borrowed	5,010.36	5,398.16
3. Total variable costs	—	22,175.78
4. Returns to fixed farm factors	34,150.62	28,407.20

Table I shows that the returns to the fixed farm factors were higher in Plan I than in Plan II. This means that the concept of returns to the fixed farm resources from each activity is a better concept than using the concept of gross returns. This is because the use of a particular concept changes the slope of price or profit line which resulted in varied income in both the cases. So, the two concepts, theoretically, do not generate the same results under all the situations. However, they may yield the same results if the slope of the profit line did not change much.

Impact on Production Patterns

The production plans using the two concepts are given in Table II.

TABLE II—OPTIMAL CROPPING PATTERNS

Production activities	Plan I	Plan II
1. Paddy-wheat (acre)	1.12	0
2. Sugarcane (acre)	0	1.12
3. Maize-potato-wheat-green gram (acre) ..	5.78	5.78
4. Dairy buffaloes (number)	7	7

Table II indicates that the two concepts generated varying cropping plans. Paddy-wheat rotation, which was the most paying rotation in Plan I, was eliminated by sugarcane activity in Plan II. This could be attributed to the higher variable cost of sugarcane compared to paddy-wheat rotation,[7] which changed the slope of the profit line in favour of sugarcane. The entry of sugarcane in the production Plan II in place of paddy-wheat rotation is not a practical proposition, because the area under sugarcane was declining in the Punjab, whereas the area under paddy-wheat rotation was on the increase. Thus, again the concept of return to the fixed factors yielded more practicable result than those obtained from the concept of gross returns. Furthermore, in the use of gross returns concept, cost does not play any role in the determination of optimal cropping pattern, whereas in reality, it is one of the crucial factors in combining different activities to optimize the objective function.

Impact of These Concepts on Borrowed and Hired Resources

The effect of using the two concepts on borrowing and hiring of farm resources is examined in Table III.

TABLE III—DEMAND FOR ADDITIONAL RESOURCES

Item	Plan I	Plan II
A. Labour period (hour)		
(*i*) 13th April to end May	228.73	176.092
(*ii*) 1st June to end July	114.52	79.80
(*iii*) 1st October to end November	99.83	66.23
B. Capital (Rs.)		
(*i*) *Kharif* cash	100.90	139.26
(*ii*) *Rabi* Cash	4,909.46	5,258.90

It will be seen from Table III that more labour was hired when the concept of returns to the fixed factors was used in Plan I. However, more capital was borrowed when the gross return was used in the objective function. This was logical because the use of gross returns concept gave a more capital intensive production plan. Recognizing that capital was more scarce in India than labour, the plan which used cheaper labour resource than dear capital

7. Statistical Abstract of Punjab, 1973, The Economic and Statistical Advisor to the Government of Punjab, Chandigarh.

resource should be preferred, consistent with the endowment of resources in the developing countries. However, this finding is specific to the sample and cannot be generalised. So, it would be logical to use the concept of returns to the fixed farm resources in future work to allocate the resources for optimizing the objective function.

Impact on the Productivity of Resources

The marginal value productivity (MVP) derived from the two formulations differs although the direction of bias is known. The effect of the two concepts on the productivity of the scarce factors is analysed in Table IV. It is noted from Table IV that the MVP of scarce factors differed substantially in Plans I and II.

TABLE IV—PRODUCTIVITY OF SCARCE RESOURCES

Items	Plan I*	Plan II*
A. Land (acre)		
(*i*) Maize and cotton land	1,419.63	2,540.25
(*ii*) Paddy land	1,108.03	3,204.05
B. Farmyard manure (ton)	493.60	254.93
C. Labour (hour)		
(*i*) 13th April to end May	0.050	0.050
(*ii*) 1st June to end July	0.037	0.037
(*iii*) 1st October to end November	0.037	0.037
D. Capital (Rs.)		
(*i*) *Kharif* cash	0.05	0.05
(*ii*) *Rabi* cash	0.05	0.05

* In Plan I, R vector gives returns to fixed factors, whereas in Plan II, R vector indicates gross returns.

Table IV shows that the MVP of resources was higher when the gross return was used in the objective function. This is because variable costs were not deducted and the gross returns concept (R) was used in the objective function in Plan II. Since the MVP of a resource indicates how much one unit of a resource will add to the income or indirectly, it indicates the price at which the resource should be augmented. Thus it would be logical to use the concept of returns to the fixed resources to find the appropriate value of MVPs.

Allocation of Hired Labour Cost in the Model

The hired labour cost was allocated in different ways in the model by different economists.[8] To determine a rational procedure for allocating the casual labour cost, the following model was used.

$$\text{Maximize } Z = R_1X_1 + R_kX_k + R_LX_L + \ldots\ldots\ldots + R_nX_n$$

Subject to

$$B_1 \geqslant a_{11}x_1 + a_{12}x_2 \ldots\ldots\ldots + a_{1L}x_L + a_{1k}x_k + \ldots\ldots + a_{1n}x_n$$

$$B_2 \geqslant a_{21}x_1 + a_{22}x_2 \ldots\ldots\ldots + a_{2L}x_L + a_{2k}x_k + \ldots\ldots + a_{2n}x_n$$

$$\vdots$$

$$B_L \geqslant a_{L1}x_1 + a_{L2}x_2 \ldots\ldots\ldots + a_{LL}x_L + a_{Lk}x_k + \ldots\ldots + a_{Ln}x_n$$

$$\vdots$$

$$B_k \geqslant a_{k1}x_1 + a_{k2}x_2 \ldots\ldots\ldots + a_{kL}x_L + a_{kk}x_k + \ldots\ldots + a_{kn}x_n$$

$$\vdots$$

$$B_m \geqslant a_{m1}x_1 + a_{m2}x_2 \ldots\ldots\ldots + a_{mL}x_L + a_{mk}x_k + \ldots\ldots + a_{mn}x_n$$

$$x_j \geqslant 0$$

Z is the total return to the fixed factors and R indicates the returns to the fixed farm resources from jth activity, except, R_L and R_k which indicated the cost of hiring one unit of labour and capital resources respectively. X_L and X_k indicate labour hiring and capital borrowing activities respectively. $a_{11} \ldots a_{1n} \ldots a_{m1} \ldots a_{mn}$ are input coefficients for different activities, where B_L and B_k are labour and capital resources respectively.

In this model, some researchers have allocated casual labour cost[9] in the objective function (R_L) and zero cost against capital resources (B_k), whereas others have allocated labour cost against capital resource, B_k, and in the objective function, they have put zero cost (R_L = Zero).

The pertinent question to be answered is which procedure of allocating the cost of casual labour is correct. Both the methods of introducing casual labour cost were tried and the results generated by the two methods are discussed. Income and production pattern derived by using the two methods are given in Table V.

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8 Theodor Heidhues, "A Recursive Programming Model of Farm Growth in Northern Germany," *Journal of Farm Economics*, Vol. 48, No. 3, Part I, August, 1966, p. 673.

In the following analysis, the return to the fixed factors was used to develop the optimal plans.

9. (*i*) K. C. Dhawan and S. S. Johl, "Economics of Dairy Buffaloes in Suburban Areas of the Punjab," *Journal of Research*, Vol. II, No. 4, December, 1965.

(*ii*) K. C. Dhawan and A. S. Kahlon, "Impact of Yield Increasing Foodgrain Technology on the Cultivation of Commercial Crops," *Indian Journal of Agricultural Economics*, Vol. XXIX, No. 3, July-September, 1974.

TABLE V—INCOME AND PRODUCTION PATTERN

Item	Plan I*	Plan II
1. Paddy-wheat rotation (acre)	1.12	1.12
2. Mash-wheat rotation (acre)	0.21	—
3. Dairy buffaloes (number)	6	7
4. Maize-potato-wheat-green gram (acre)	5.79	5.79
5. Income* (Rs.)	29,151.59	29,096.88

Note:—* In Plan I labour cost was allocated against capital resource, whereas in Plan II labour cost was put in the objective function.

Table V shows that the income was higher when the cost of casual labour was allocated against capital resource. This was natural, because in the objective function, the cost of hired labour was zero. The procedure of allocating the labour cost against capital resource seems to have inflated the income of the farm because logically, hired labour cost should come out of income, being an item of variable cost.

A better solution would be to provide for casual labour cost directly in the matrix. Restrictions can be included in the matrix according to the number of peak work load periods with availability of casual labour at zero and the hours of casual labour required for each activity restrictions could be fed through casual labour hiring activities. In this way, labour will be hired upto a point where its MVP is equal to the wage rate. This procedure will also prevent the MVP of labour from falling to zero.

Some workers have included the casual labour cost in the enterprise budget and zero cost of casual labour in the matrix to estimate how much extra labour was needed to implement the new plan. This procedure suffers from the drawback that it allows labour to be hired to a point where its MVP falls to zero. This is not a rational decision because logically, labour is hired upto a point where the MVP is equal to its wage rate and not equal to zero.

Again, some workers have introduced labour hiring and capital borrowing activities simultaneously in the matrix and the cost of casual labour is met from capital resource (Appendix I). In such a situation, casual labour is hired upto a point where its MVP is allowed to fall to the level of rate of interest. Theoretically, labour should be hired upto a point, where its MVP is equal to the wage rate.

Implication of Allocating Cost of Borrowed Funds

The effect of allocating the cost of funds by different methods on income, cropping pattern and resources use pattern was worked out and is shown in

Table VI.[10] It is evident from Table VI that the income derived from Plan II was higher than that of Plan I. This is because in Plan I, the cost of borrowing was capital plus interest, whereas in Plan II, only interest was used as cost of borrowing. So the capital (cash), which is used to meet the variable cost, was deducted twice in Plan I because it was first deducted from the gross returns to arrive at the returns to the fixed factors and again when the cost of borrowing in the matrix was charged as capital plus interest. Therefore, when borrowed funds were added to the income generated by solutions in Plan I, the returns to the fixed farm resources were exactly the same in both the plans.

TABLE VI—INCOME, PRODUCTION PATTERN AND RESOURCE USE PATTERN

Item		Plan I*	Plan II
A.	(*i*) Income (Rs.)	29,096.86	33,777.81
	(*ii*) Funds borrowed (Rs.)	4,680.72	—
	(*iii*) Returns to fixed farm resources (Rs.) ..	33,777.58	33,777.81
B.	Production plan		
	(*i*) Paddy-wheat rotation (acre)	1.12	1.12
	(*ii*) Maize-potato-wheat (acre)	5.79	5.79
	(*iii*) Dairy buffaloes (number)	7	7
C.	Demand for additional resources (hour)		
	(*i*) 13th April to end May period	228.73	228.73
	(*ii*) 1st June to end July period	114.52	114.52
	(*iii*) 1st October to end November period ..	99.83	99.85
D.	Capital (Rs.)		
	(*i*) *Kharif* season	46,800.72	46,800.72
	(*ii*) *Rabi* season	—	—

*In Plan I, capital plus interest was used as cost of borrowed money in the objective functions, whereas in Plan II, only interest was used as cost of borrowed capital.

A further examination of Table VI showed that the production pattern and demand for additional resources were also the same in both the plans. Thus it could be concluded that both the approaches of allocating the cost of borrowed funds yielded the same results and even the higher cost of capital (Plan I) made little change in the results. This can be attributed to a high MVP of capital factor (more than Rs. 1.05 per rupee), *i.e.*, even at higher cost, it was profitable to borrow the same amount of funds. However, it cannot be generalised from the information provided by this analysis that the two ways of allocating the capital cost will always generate the same results. The implications of allocating the capital cost in both ways on the productivity of the scarce factors is analysed in Table VII.

10. The plans were derived by using the concept of returns to the fixed farm resources.

TABLE VII—EFFECT OF ALLOCATING CAPITAL COST IN DIFFERENT WAYS ON THE PRODUCTIVITY OF SCARE RESOURCES

Item	Plan I (Capital + interest)	Plan II (interest)
A. Land (acre)		
(*i*) Maize, cotton and sorghum land	582.18	1,111.85
(*ii*) Paddy land	1,663.16	1,866.50
B. Labour periods (hour)		
(*i*) From 13th April to end May	1.00	1.00
(*ii*) 1st June to end July	0.75	0.75
(*iii*) 1st October to end November	0.75	0.75
C. Capital (Rs.)		
(*i*) *Kharif* cash	0	0
(*ii*) *Rabi* cash	1.05	0.05
D. Farmyard manure	395.21	599.36

It will be seen from Table VII that when the cost of borrowed capital was treated as interest in the objective function, the MVPs of scarce factors such as land and farmyard manure increased considerably compared to the MVPs of the same factors when the cost of borrowed capital was incorporated as the amount borrowed plus interest. It was theoretically right because when interest alone was put as cost of capital, it became a cheaper resource relative to other resources, which means its supply could be enhanced. But this procedure resulted in land and farmyard manure becoming relatively scarce in relation to capital and thus their productivity increased. The figures of MVPs of resources, generated by using capital plus interest as the cost of capital borrowed, cannot be used as a guiding principle for supplementing additional resources because the amount of resources would be augmented less than optimally needed.

To conclude this section, it would be advisable to take into account the amount of capital plus interest as a capital cost in the objective function, when the gross returns concept is used in the objective function. Also, interest should not be included in the enterprise budget as is usually done when the crop plan is prepared by using budgeting technique. A final form of the matrix, based on the results of this study, is suggested in Appendix 1 which may preferably be used by the researchers in their future application of linear programming technique to the situations of Indian agriculture.

CONCLUSIONS AND SUGGESTIONS

The analysis of production patterns, developed by using the two concepts of returns to the fixed factors of production and gross returns indi-

cated that the former concept gave more relevant and consistent results than the latter. It generated more income, provided a practical production plan, used those resources which were relatively in abundance and yielded MVPs of scarce factors which were more meaningful.

The analysis further indicated that the cost of casual labour may be shown in the objective function with negative sign and cash requirements against capital resources and it should not be included in the enterprise budget, because by doing so it gets counted twice.

It was found that when labour cost was paid from capital resources and capital was allowed to be borrowed in the model simultaneously, the MVP of labour came down to the rate of interest which was lower than the wage rate. This seems to be illogical because the MVP of labour, theoretically, should not be allowed to fall below its wage rate. It could, therefore, be concluded that the cost of casual labour should be allocated in the objective function if hiring of casual labour is also incorporated in the model.

Again, the MVPs of scarce resources were higher when only interest was used as capital cost. So, it is suggested that the cost of borrowed funds should be used as interest and not interest plus capital. This is because the capital required by an individual enterprise gets deducted from the gross returns indirectly when the variable costs were deducted from the gross returns to arrive at the returns to the fixed factors of production.

To sum up, the concept of returns to the fixed factors gave better results than that of gross returns. The cost of casual labour and borrowed funds should be directly included in the models and not counted in the enterprise budgets. Otherwise, these costs will be counted twice. Only interest should be used as costs of borrowed funds and not interest plus capital.

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APPENDIX 1

An Illustration of Final Matrix

	R			Returns to the fixed factors from real activities				Cost of borrowing capital (interest) with negative sign		Wage rate with negative sign		
	↓	Resource constraints	Resource availa-bilities	Real activities				Capital borrowing activities		Labour hiring activities		
		Activities	↓	AK_1	AK_2	AR_1	AR_2	RK	KK	L—1	L—2	L—3
1.	0	*Kharif land*	=	1	1	0	0	0	0	0	0	0
2.	0	*Rabi* land	=	0	0	1	1	0	0	0	0	0
3.	0	*Permanent labour* Labour period (L—1)	=	Requirement of permanent labour activitywise				0	0	0	0	0
4.	0	Labour period (L—2)	=	,,	,,	,,	,,	0	0	0	0	0
5.	0	Labour period (L—3)	=	,,	,,	,,	,,	0	0	0	0	0
6.	0	*Casual labour* Labour period (CL—1)	=	0 Requirement of casual labour activitywise				0	0	—1	0	0
7.	0	Labour period (CL—2)	=	0 ,,	,,	,,	,,	0	0	0	—1	0
8.	0	Labour period (CL—3)	=	0 ,,	,,	,,	,,	0	0	0	0	—1
9.	0	*Capital* *Rabi* capital	=	0	0	Capital requirement activitywise		—1	0	Cash requirement	0	0
10.	0	*Kharif* capital	=	Capital requirement activitywise		0	0	0	—1	0	Cash re-quirement	Cash re-quirement

A means activity, K = *kharif* season, R = *rabi* season. Returns to the fixed farm factors also include the cost of borrowed funds and of casual labour.