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NOTES

RESOURCE PRODUCTIVITY AND ALLOCATION EFFICIENCY ON SEED POTATO FARMS IN HIMACHAL PRADESH

Himachal Pradesh is the major supplier of seed potato to many States of India. This is so because it has agro-climatic conditions favourable for the cultivation of this crop. This is a major cash crop of the State, therefore, its expansion along with certain horticultural crops may be a worthwhile proposition for the State in order to increase its revenues and thereby stimulating the development of the region. Seed potato is generally grown in areas at an elevation of 6,000 feet above sea level. Its major competing crop grown in the area is maize. This paper seeks to measure the productivity of various agricultural resources on the seed potato farms and examine the possibilities of increasing returns by reallocation of the existing resources within seed potato and maize crops.

SAMPLE DESIGN AND METHODOLOGY

The data for this study were collected from the farmers of Mahasu district of Himachal Pradesh which accounts for the major portion of seed potato production area in the State. Theog tehsil of Mahasu district has the maximum area under this crop and is one of the most suitable tehsils for the cultivation of seed potato. Theog tehsil was, therefore, selected for detailed investigations. Three villages were randomly selected from this tehsil. From each village ten farmers were selected at random from the list of all farmers growing seed potato, thus making a sample of 30 observations in all. In view of very small variation in the size of farms no stratification according to size was considered essential. Information on input-output of seed potato and maize crops was collected by personal interview method with the help of pre-tested and specifically prepared questionnaires for the purpose. The data so collected pertained to the *kharif* season of 1967-68.

Production function analysis was used as an analytical tool for analysis. Two types of production functions, namely, Cobb-Douglas and Quadratic were used to express the relation between output and the various inputs for each crop. However, before doing so the zero-order correlation matrices were worked out and the correlation coefficients were examined for multicollinearity. For economic and statistical considerations only Cobb-Douglas type functions could be selected for further economic analysis.

The variables used in the equation were as follows :

$$Y = f(X_1, X_2, X_3, X_4, X_5)$$

Where Y = Total output in quintals of seed potato or maize.
X_1 = Land area in hectares.
X_2 = Human labour days (man-equivalent days).
X_3 = Bullock labour days.
X_4 = Seed quantity used in quintals of seed potato or in kilograms of maize.
X_5 = Expenses on manures and fertilizers in rupees.

The functions obtained along with adjusted values of R^2 are given below. These are the final run functions in which only those variables were retained which were significant at least at 10 per cent level of significance.

$$\text{Seed potato}: Y = 22.64754\ X_1^{0.50233***}\ X_2^{0.40569**}$$
$$(0.10769) \qquad (0.14895)$$

$$n = 30 \qquad R^2 = 0.8523$$

$$\text{Maize}: Y = 27.61904\ X_1^{0.78848***}\ X_2^{-0.27134*}\ X_5^{0.22757***}$$
$$(0.09126) \qquad (0.17409) \qquad (0.05648)$$

$$n = 30 \qquad R^2 = 0.8537$$

*** Significant at 1 per cent level of significance.
** Significant at 5 per cent level of significance.
* Significant at 10 per cent level of significance.

FINDINGS

Returns to Scale

The returns to scale imply the behaviour of the change of total returns when all the inputs are changed simultaneously in the same proportion and is indicated by the sum of the individual elasticities of various factors included in a Cobb-Douglas function. The sums of elasticities were noted to be 0.90802 and 0.74471 in the case of seed potato and maize respectively. The t-test was used to determine whether the returns to scale were diminishing, it was observed that 0.90802 was not significantly different from unity and thus indicated constant returns to scale in the case of seed potato. In the case of maize, 0.74471 being significantly lower than unity at 5 per cent level of significance, suggested diminishing returns to scale in this crop.

Marginal Productivities of Inputs

The marginal value products of agricultural inputs in each crop equation were worked out at their respective geometric mean levels. These values were expressed in rupees corresponding to a rupee investment and are presented in Table I.

TABLE I—MARGINAL VALUE PRODUCT OF AGRICULTURAL RESOURCES AT THE GEOMETRIC MEAN LEVELS EXPRESSED IN RUPEES PER RUPEE OF INVESTMENT

Crop	Land	Human labour	Manures and fertilizers
Seed potato	2.7028	2.6927	—
Maize	1.6172	—0.6114	1.2505

The marginal value products of land and human labour were higher in the case of seed potato as compared to the maize crop explaining the reason as to why seed potato is the more popular crop of the area under study. This is due partly to the better adaptability of seed potato to the agro-climatic conditions and partly due to the better land preparation for seed potato, which is a very important cash crop. The human labour showed a negative marginal value product in the case of maize crop indicating excessive use of the input.

In the light of Table I, it would appear that scope exists for farmers to shift land and labour from maize to seed potato. This could, however, not be confirmed because inter-crop optimum allocation of resources was not attempted in this study.

Allocation Efficiency of Agricultural Resources

In order to test the allocation efficiency of agricultural resources on the seed potato farms within each crop, three alternative techniques are followed.

(*a*) Comparison of Marginal Value Products of Agricultural Resources with Their Prices

The marginal value product of each resource, as worked out at the geometric mean level, was compared with its corresponding price and the difference was tested statistically for significance with the help of t-test. It was observed that the marginal value product of land was significantly higher (at 1 per cent level) than its price, taken as an average of imputed value of the crop share on the one hand and the contract value on the other, in the case of both the crops. The marginal value product of human labour was observed to be significantly lower (at 1 per cent level) than its price in the case of maize crop, indicating thereby the excess use of this input. Apart from this, the marginal value products of other inputs in both the crops were not significantly different from their respective prices. Land being a fixed resource, it cannot be increased by the farmers as dictated by the marginal value products at the same time under both the crops. For all other resources, except human labour in maize, present allocation seems to be nearly optimal.

(*b*) Intra-Crop Comparison of Marginal Value Products of Agricultural Resources

In order to test whether existing capital outlay within each crop was optimally allocated or not, the marginal value products of various agricultural resources were compared within each crop and the differences were statistically tested. The results showed that the marginal value product of human labour was significantly lower than that of manures and fertilizers in the case of maize crop (at 1 per cent level), suggesting thereby an increase in the crop returns by shifting funds from human labour to manures and fertilizers. This conclusion is valid only under the assumption when the capital available to the farmers is unlimited. This need not to be in conformity with the inferences when the capital funds were limited. In all other cases, however, no difference was significant indicating in general, that the resources were optimally or nearly optimally allocated within each crop.

(*c*) Economic Optimum Levels of Inputs and Their Comparison with Their Existing Levels at Geometric Mean Levels

Profit maximizing, *i.e.*, optimal levels of various resources were worked out by allocating the limited funds optimally among various inputs[1] within each crop. An examination of the differences between the economic optimal level and

1. The wage rate used to determine the optimum level of human labour is Rs. 3 per human labour day.

the existing level of each resource in both the crops revealed that there were no significant differences between these values. The resources were nearly optimally allocated on the farms. Table II gives the economic optimum and existing levels of various inputs.

TABLE II—OPTIMAL AND EXISTING LEVELS OF AGRICULTURAL RESOURCES

Resource	Seed potato		Maize	
	Optimal level	Existing level	Optimal level	Existing level
Land (hectares)	0.6800	0.6788	0.7918	0.7430
Human labour (days)	213.4954	213.9377	—	—
Manures and fertilizers (Rs.)	—	—	180.7082	219.3025

While allocating the limited available capital among different inputs within each crop, human labour could not be included for analysis due to its negative coefficient in the case of maize crop.[2] Except the labour input on maize crop it seems plausible to believe that the agricultural resources on seed potato farms in Himachal Pradesh are optimally or nearly optimally allocated at the present stage of technology.

SUMMARY AND CONCLUSIONS

The results of this study on the seed potato farms of Himachal Pradesh suggested that at the present level of technology the farm resources within each crop are optimally or nearly optimally allocated. There seems, therefore, no possibility of increasing the farm returns through the reallocation of the limited available capital among various input uses in seed potato. In the case of maize crop, however, there appeared a possibility of increasing returns by diverting funds from human labour to manures and fertilizers, because the marginal value product of the former was significantly lower than the latter. This may probably be achieved by developing cottage industries in the area, so as to absorb the excess labour force presently engaged in agriculture due to lack of adequate alternative non-farm occupations, and then using the labour earnings for the purchase of fertilizers.

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2. It may, however, be inferred from the negative coefficient that use of labour is excessive on maize. Labour, therefore, could be diverted to other enterprises to increase the farmers' income and then using these earnings for the purchase of fertilizers.

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