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Assessment of resource use efficiency and instability in Ber cultivation in Jammu district

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Abstract
The present investigation was conducted in Jammu district of Jammu and Kashmir state during the year 2008. Two blocks were selected from Jammu district having the highest area under the ber fruit. Cobb-Douglus function was used to study the relationship between output and various inputs. The inputs involved in the production of ber cultivation varied significantly at different age groups. The regression coefficient values of selected inputs mainly human labour, manures + fertilizers, plant protection and pruning + training varied significantly at the six age groups of five years from 5th to 28th year. The coefficient of variation was highest in case of area, whereas it was low in case of yield and net returns.

Keywords: Resource use efficiency, instability, Ber

Introduction
Globalization of economics and liberalisation of trade has led an urgent need for prioritizing the potential areas for investment in order to earn handsome amount of money. Diversification to horticultural crops has been found to be the best option as they make profit, generate additional income and employment opportunities for rural masses and conserve natural resources. India is the world's second largest producer of fruits (57.73 million tonnes) and vegetables (129.15 million tonnes) and contributes 13.3 and 10 percent of vegetables and fruits, respectively, in the world (Economic survey, 2007-08). Horticulture crops cover only 18.98 million hectares i.e. 13.27 percent of total cultivated area (7.2 million hectare under vegetables, 0.15 million hectare under loose flowers, 3.2 million hectare under plantation crops, 2.4 million hectare under spices and 5.51 million hectare under fruits) but contribute 28 percent of the gross domestic product in agriculture (Mittal, 2007) [4]. The state of Jammu and Kashmir is bestowed with the temperate zone of Kashmir valley where apple, pear, walnut, cherry, almond etc. can be grown, cold arid zone of Ladakh where seabuck thorn and apricot can be grown and sub-tropical zone of Jammu where mango, ber, citrus, guava, litchi etc can be cultivated. Raising of horticultural crops has proved to be a vital economic activity contributing significantly to the agricultural GDP. The fruit industry alone in Jammu and Kashmir generates over 1,500 crore rupees annually and besides, it provides direct and indirect employment to over 25 lakh people and about 4.5 lakh families are engaged directly or indirectly with horticulture activities. The total export and imports from Jammu and Kashmir is 6.93 and 2.97 lakh tonnes of fruits, respectively (Anonymous, 2007) [1]. Ber, one of the ancient and common fruits of India is often called poor man's fruit. Being hardy it can grow successfully even under unfavorable climatic and conditions of salinity, drought and water logging, where most other fruit trees fail to grow and is thus known as king of arid fruits. Among the various fruit crops, growing of ber has vast potential in Jammu district of J&K state as it compromises large chunk of area under its cultivation (4552 hectare), whereas its production has been realized to 6078 metric tonnes (Anonymous, 2007) [1]. But it is unfortunate that its average productivity per hectare in the state is much below the national average. Thus apart from the increasing productivity through various technological interventions, it became necessary to evaluate and quantify how much efficiently the resources are utilized besides the risks involved in its cultivation.

Methodology
The present study was conducted in Jammu district of Jammu and Kashmir state. The data was collected on various aspects 60 growers of four villages namely, Ambara, Jud, Pati and Ranjili from Akhnoor and Khoud blocks having the highest area in the district.

Resource efficiency

The age of the orchards were grouped into six groups viz. 5th to 9th year, 10th to 14th year, 15th to 19th year, 20th to 24th year, 24th to 28th year and overall group which included the whole age of the orchard as was done by Wani *et al.* 1993. First to 4th year was not taken as these were the non-bearing years.

In order to study the relationship between output and various inputs used, Cobb-Douglas production function was used as was done by Naikwadi *et al.* 2004 [5]. This function is used extensively in agricultural production function analysis. The functional form applied is given as under:

$$Y_t = \beta_0 \left(\prod_{i=1}^{n} x_i^{\beta_i} \right) u_t \quad (i= 1, 2, 3\ldots n)$$

Where Y and Xi (i = 1, 2, 3… n) are the output and levels of inputs. The constant β_o and β_i's (i = 1, 2, 3… n) represent the efficiency parameters and the production elasticties of the respective input variables for the given population at a particular period, t.

The fitted Cobb-Douglas production may be written for the present case with five input variables as:

$$Y = a_o x_1^{b1} x_2^{b2} x_3^{b3} \ldots . x_5^{b5}$$

On log transformation, the above function can be transformed to a linear form as:

$$\text{Log } y = \log a_o + b_1 \log x_1 + b_2 \log x_2 + \ldots . + B_5 \log x_5$$

$$\text{Or } \log y = \log a_o + \sum_{i=1}^{5} b_i \log x_i$$

Where

Y = Output of ber in quintals as dependent variables

X_1 = Human labour in man days

X_2 = Manure and fertilizers (Rs)

X_3 = Expenditure on plant protection (Rs)

X_4 = Expenditure on irrigation (Rs)

X_5 = Expenditure on training and pruning (Rs)

A_o = Constant

B's = Elasticities of production of respective resource categories

To examine the productivity of different inputs used in production of studied fruits, marginal value productivities of inputs were estimated at geometric mean levels of inputs. To calculate Marginal Value Productivity (MVP) of resource x_i the following formula was used.

$$MVP = b_i \frac{GM(Y)}{GM(x_i)}$$

Where,

MVP (x_i) = marginal value productivity of ith resource

B_i = regression coefficient. (Estimated)

GM (Y) = geometric mean of output

GM (x_i) = geometric mean of inputs.

Instability

The instability in cropped area, yield and net returns was studied by calculating coefficient of variation, as was done by Jhagrawat and Vargheese (2008) [3].

$$C.V = \frac{\sigma}{\bar{X}} \times 100$$

Where

C.V = Coefficient of variation

σ = Standard deviation

$\bar{X}$ = arithmetic mean

Results and Discussion

Production Efficiency

In the age group of 5-9 years the regression coefficients of ber (Table 1) for human labour with positive sign indicated that with one percent increase in the use of this input keeping all the other inputs constant, could increase the return of the crop to 1.14 percent. The regression coefficients of manures + fertilizers and pruning + training were however negative. It could be seen from the Table 6 that marginal value productivity of human labour was positive and showed that additional one rupee spent on human labour, keeping all other inputs constant, could add to gross returns by Rs. 16.23 per acre and hence there still existed a scope to invest more on human labour. In the age group of 10- 14 years the regression coefficients of ber (Table 2) for human labour with positive sign indicated that with one percent increase in the use of this input keeping all the other inputs constant, could increase the return of the crop to 1.15 percent. The regression coefficients of manures + fertilizers and pruning + training were however negative. In the age group of 15-19 years the regression coefficients of ber (Table 3) for human labour with positive sign indicated that with one percent increase in the use of this input keeping all the other inputs constant, could increase the return of the crop to 1.12 percent. The regression coefficients of manures + fertilizers was however negative. The marginal value productivity of human labour was positive and showed that additional one rupee spent on human labour, keeping all other inputs constant, could add to gross returns by Rs. 41.53 while that of manures + fertilizers indicated that additional one rupee spent on it, keeping all other inputs constant, could reduce the gross returns by Rs. 18.42 and hence there still existed a scope to invest more on human labour while that on manures + fertilizers should be checked. These findings were supported by Rohile *et al.* (2006) [6]. The results of regression coefficient of ber in the age group of 20- 24 years (Table 4) showed that the regression coefficient of human labour and pruning + training with positive sign indicated that with one percent increase in these inputs, keeping all other inputs constant, could increase the returns by 0.33 percent in case of human labour and 0.70 percent in case of pruning + training. The results of regression coefficient of ber in the age group of 25-28 years (Table 5) showed that the regression coefficient of human labour and pruning + training with positive sign indicated that with one percent increase in these inputs, keeping all other inputs constant, could increase the returns by 0.33 percent in case of human labour and 0.70 percent in case of pruning + training. The MVP of manures and fertilizers indicated that an additional one rupee spent on human labour and pruning + training could add to the gross return by Rs. 8.69 rupees and 580.49 rupees respectively, hence there was scope in investing in these inputs. The result of regression coefficient of overall group of ber (Table 6) indicated that regression coefficient of human labour with positive sign indicated that one percent increase in the use of human labour, keeping the other inputs constant, could increase the

return by 1.12 percent. The regression coefficient of manures and fertilizers was negative and non-significant whereas that of pruning + training was positive but non-significant. The MVP as shown in table 7 indicated that an additional rupee spent on human labour, could add to gross returns by Rs. 18.59, hence there was scope of investing more on human labour.

Table 1: Estimated regression coefficients of various factors, their standard errors and MVP of ber production (5^{th}-9^{th} year)

Variables	Regression coefficients	Standard error	MVP
Constant	0.834*	0.036	
Human labour (X_1)	1.143*	0.020	16.230
Manures and Fertilizers (X_2)	(-) 0.003	0.006	-3.477
Pruning and training (X_5)	(-) 0.027	0.018	-0.923
F value	80.725		
Coefficient of determination (R^2)	0.916		

Note * Significant at 1% level of significance

Table 2: Estimated regression coefficients of various factors, their standard errors and MVP of ber production (10^{th}-14^{th} year)

Variables	Regression coefficients	Standard error	MVP
Constant	0.978*	0.026	
Human labour (X_1)	1.149*	0.017	22.591
Manures and Fertilizers (X_2)	(-) 0.004	0.006	(-) 4.891
Pruning and training (X_5)	(-) 0.008	0.016	(-) 0.439
F value	46.111		
Coefficient of determination (R^2)	0.935		

Note * Significant at 1% level of significance

Table 3: Estimated regression coefficients of various factors, their standard errors and MVP of ber production (15^{th}-19^{th} year)

Variables	Regression coefficients	Standard error	MVP
Constant	0.841*	0.037	
Human labour (X_1)	1.122*	0.022	41.532
Manures and Fertilizers (X_2)	(-) 0.021**	0.008	(-)18.420
Pruning and training (X_5)	0.015	0.020	0.218
F value	92.000		
Coefficient of determination (R^2)	0.928		

Note* Significant at 1% level of significance
** Significant at 5% level of significance

Table 4: Estimated regression coefficients of various factors, their standard errors and MVP of ber production (20^{th}-24^{th} year)

Variables	Regression coefficients	Standard error	MVP
Constant	1.488*	0.199	
Human labour(X_1)	0.333*	0.081	12.100
Manures and Fertilizers(X_2)	0.012	0.050	10.290
Pruning and training(X_5)	0.699*	0.075	18.381
F value	0.419		
Coefficient of determination (R^2)	0.884		

Note * Significant at 1% level of significance

Table 5: Estimated regression coefficients of various factors, their standard errors and MVP of ber production (25^{th}-28^{th} year)

Variables	Regression coefficients	Standard error	MVP
Constant	1.487*	0.196	
Human labour(X_1)	0.333*	0.081	8.692
Manures and Fertilizers(X_2)	0.012	0.050	0.434
Pruning and training(X_5)	0.700*	0.075	580.490
F value	0.373		
Coefficient of determination (R^2)	0.884		

Note * Significant at 1% level of significance

Table 6: Estimated regression coefficients of various factors, their standard errors and MVP of ber production (overall)

Variables	Regression coefficients	Standard error	MVP
Constant	0.806*	0.040	
Human labour(X_1)	1.119*	0.019	18.594
Manures and Fertilizers(X_1)	(-) 0.013	0.006	- 0.579
Pruning and training(X_1)	0.004	0.016	7.1812
F value	75.774		
Coefficient of determination (R^2)	0.905		

Note * Significant at 1% level of significance

Table 7: Instability using coefficient of variation (percent) of cropped area, yield and net returns for ber

Age group	Area	Yield	Net returns
5th to 9th year	83.82	25.45	29.81
10th to 14th year	83.52	21.17	21.58
15th to 19th year	83.52	20.42	21.39
20th to 24th year	83.52	20.44	21.63
24th to 28th year	83.52	20.44	21.63
Overall	83.82	30.71	31.07

Instability

The results of instability in ber orchards (Table 7) indicated that instability in area, yield and net returns were higher for ber. The overall coefficient of variation for cropped area, yield and net returns was 83.82, 30.71 and 31.07 percent. Among the different age groups the coefficient of variation for area was 83.52 percent in all the groups except 5th to 9th year group where it was 83.82 percent. The instability in ber was mainly due to the dependence of the yield on the rains. The coefficient of variation for area was found comparatively higher than that of yield and net returns. These results were similar to those of Umesh *et al.* (1991) [7].

Conclusion

The production function analysis indicated that in ber orchards human labour was positive and statistically significant in all the age groups, manures and fertilizers was significant and negative in 15-19th year group. Pruning and training were positive and significant and positive in 20-24th year group and 25-28th group. The instability for area was more than 100 percent in all the age groups except 10-14th year where it was slightly less than 100 percent. The instability in yield and net returns was 83.03 and 83.02 percent.

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