Plant Archives Vol. 17 No. 2, 2017 pp. 924-928 *ISSN 0972-5210*

AN ECONOMICS OF RESOURCES USE EFFICIENCY IN PRODUCTION OF ONION CROP IN HARYANA

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Abstract

India is the second largest producers of vegetable in the world next to China. The cauliflower, potato, onion, tomato and radish are the major vegetable crops of Haryana. The present investigation was carried out to study the resource use efficiency of onion. The study was conducted inAmbaladistrict. From selected district one tehsil and two villages from tehsil were selected on the bases of highest area. Samples of 15 farmers from each selected village were selected thereby making a sample of 30 vegetable growers.The cost of cultivation of onion was higher on large farms as compared to medium & small farms. The gross returnwas found higher in medium farms as compared to large and small farms. The cost of production per quintal was lower on medium farms and highest on large and small farms indicating that the medium farms are having economies of scale in production. The net income was higher on medium farms as compared to small and large.

Key words: Onion crop, Balanced diet, Agricultural economy, Marginal physical product.

Introdution

Our country has achieved self-sufficiency and a good degree of stability in food production. This has created an urgent need for providing health security to our population by supplying nutrition through balanced diet. Vegetables form the most important component of a balanced diet. We can grow a variety of vegetables around the year. India is the world's second largest producer of vegetables next only to China. India can claim to grow the largest number of vegetable crops compared to any other country of the world and as many as 61 annual and 4 perennial vegetable crops belonging to different groups, namely, solanaceous, cucurbitaceous, leguminous, cruciferous (Cole crops), root crops and leafy vegetables are grown in India in tropical, sub-tropical and temperate regions. Important vegetable crops grown in the country are potato, onion, tomato, brinjal, cabbage, cauliflower, okra and peas.

Vegetable cultivation occupies an important place in the agricultural economy of the country. The agricultural economy of our country has the characteristics of preponderance of small and marginal land holdings and family labor for which vegetable cultivation is more suitable. Though, vegetable crops hold a great promise for fostering the economic growth and improving the diet of the people, yet they received limited attention in marketing research programmes in India. The vegetables industry can be expected to have good growth provided the producers are assured better marketing facilities and reasonable prices for their produce.

In Haryana, area under vegetable crops in 2013-14 was 373.2 thousand hectares and production was 5565.9 thousand metric tonnes with productivity of 14.9 MT/ ha.Onion is mainly grown in the districts of Mewat, Yamunanagar, Rohtak, Karnal and Ambala, and tomato is mainly grown in the districts of Karnal, Mewat, Yamunanagar, Gurgaon and Sonipat.

Materials and Methods

Selection of Crops

The vegetable crop for the study was being selected on the basis of area and production of the crop grown in Haryana state.The onion crop was selected from Ambala district as it was having highest area and production. On the basis of highest area, Naraingarhtehsil from the district was selected for the study.Accordingly on the basis of highest area, two *i.e.* Jatwar and Panjetovillage from the tehsil were selected purposively. For the selection of

farmers, a complete list of all the vegetable growers of selected villages were prepared and arranged in ascending order on the basis of area under the selected crop. The farmers were categorized as small, medium and large by cumulative total method on the basis of area under selected vegetable crop. Farmers on the top of the list representing 1/3rd of total cultivated area were categorized as small farmers, next representing 1/3rd of total cultivated area as medium farmers and the remaining were categorized as large farmers.The category and size wise classificationof the selected farmers are given in table 1.

Table 1: Classification of the farmers in different categories.

Vegetable Crop	Villages	Categories	Size of holdings (ha)	Average area (ha)
Onion	Jatwar	Small	<0.74	0.46
		Medium	0.74-1.00	0.96
		Large	>1.00	1.18
	Panjeto	Small	<0.56	0.32
		Medium	0.56-0.80	0.64
		Large	>0.80	1.02

The small farmers of Jatwar village had up to 0.74 hectares land under onion crop. The average sizes of small, medium and large onion farmers were 0.46, 0.96 and 1.18 hectares and in Panjeto village the values were 0.32, 0.64 and 1.02 hectares, respectively. Thereafter, a sample of 15 farmers from each selected village was selected by probability proportion in each size group holding; thereby making a sample of 30 vegetable growers.The distribution of selected farmers in different size groupsgrowig onion are presented in tables 2.

Table 2: Selected number of onion growing farmers in different size groups.

Size of holdings	Villages		Total no. of selected farmers
	Jatwar	Panjeto	
Small	8	9	17
Medium	5	4	9
Large	2	2	4
Total	15	15	300

Collection of data: Primary as well as secondary data were used for the present study. Information regarding cost of cultivation, returns and inputs used in production of vegetables were collected from selected vegetable farmers on pre-structured and pre-tested schedules through personal interview method for the year 2014-15.

Analysis of data: The data were analyzed using various statistical techniques to achieve the objectives as specified below:

Resource use efficiency: The use of different inputs in production of selected vegetable crops on sample farms was studied. To analyse the resource use efficiency in vegetable crop, Cobb-Douglas production functions was fitted to analyse elasticity of production, marginal physical products and marginal value productivity. The production function used is given as under:

$$Y = a.X_1^{b1}.X_2^{b2}.X_3^{b3}.\ldots\ldots\ldots\ldots X_n^{bn}.U_i$$

Different variables used in the production function were as under:

Where,

Y = Output in quintals per hectare

X_1 = Quantity of seed (kgs) per hectare

X_2 = Quantity of F.Y.M. (in quintals) per hectare.

X_3 = Quantity of Nitrogen (in kgs) per hectare

X_4 =Quantity of Phosphorus (in kgs) per hectare

X_5 = Human labour (man-days) used per hectare

X_6 = Animal labour (in days) per hectare

X_7 = Machine labour in hrs per hectare

X_8 = Number of irrigations per hectare

X_9 = Number of sprays per hectare

X_{10} = Number of weedings per hectare

a = Constant

$b_1, b_2 \ldots\ldots\ldots b_9$ = Regression coefficients / elasticities of production

U_i= Error term.

The regression coefficients, their significance, standard errors and co-efficient of multiple determination (R^2) were worked out. Marginal physical product and marginal physical productivity were worked out for each significant input.

Marginal Physical Product (MPP) and Marginal Value Productivity (MVP):

The marginal physical product of the input used in each vegetable crop was worked out with the help of following equation

$$MPP = bi \frac{\bar{x}}{\bar{y}}.$$

The MVP was worked out as follows:

MVP = MPP × Price/qtl.

Where,

MPP = marginal physical product

MVP = marginal value productivity

bi = elasticity of production of i^{th} input

$\bar{x}$ = Geometric mean of output per hectare

$\bar{y}$ = Geometric mean of input per hectare

Results and Discussion

Resource use pattern, cost and returns on different cost concepts basis and efficiency of resource use

Resource use pattern

Resource use pattern depends on the availability of inputs with the farmers. This significantly determines the cost of production of any crops. The use of inputs and various cultural practices used in the cultivation of onion crop on the sample farms in the study area have been presented in this section. Generally, onion is grown in the months of October-November. In Ambala district, the input use pattern and cultural practices followed in cultivation of onion crop across the land size categories are presented in the table 3.

Table 3: Resource use pattern for onion cultivation on different land size holding.

Sr. No.	Inputs	Units	Size of holdings			Average
			Small	Medium	Large	
1.	Seed rates	kg/ha	12.57	13.35	14.40	13.44
2.	FYM	tonnes/ha	43.60	45.30	48.11	45.67
3.	Fertilizers					
	Nitrogen	kg/ha	121.22	123.73	127.90	124.28
	Phosphorus	kg/ha	46.80	48.95	53.12	49.62
	Potassium	kg/ha	23.88	25.55	28.70	26.04
	Zinc sulphate	kg/ha	13.15	13.80	14.96	13.97
4.	Insecticide / Pesticides sprays	no.	2.02	2.20	2.37	2.20
5.	Hoeing and weedings	no.	4.10	4.21	4.40	4.24
6.	Irrigations	no.	13.20	14.20	16.10	14.50

The average quantity of seed, FYM and fertilizers used were 13.44 kg, 45.67 tonnes and 213.91 kg per hectare, respectively. While average numbers of insecticides/pesticides sprays and irrigation used were 2.20 and 14.50 per hectare by the sample farms, respectively. Our results were accordance with Goni*et al.* (2013). Who found that that if additional units of seed, pesticide and land were available and accessible, it would lead to an increase in vegetable yield by 114.58, 322.64 and 568.72kg per hectare among the farmers, respectively.

The total labours used, in all operations were 138.7, 58.5 and 33.7 man-days per hectare of family labour by the small, medium and large farmers, respectively, 86.6 and 136.6 man-days per hectare of casually hired labour were used by the small, medium and large farmers, respectively and 20.2, 22.2 and 24.5 hours per hectare of machine labour were used by the small, medium and large farmers, respectively.

Table 5 shows breakup of the cost incurred by different size groups. On an average, Rs. 186134 was spent on onion per hectare. Cost of cultivation of large farm category was highest (Rs. 200139), followed by medium farms (Rs. 183736) and small farms (Rs. 174527). Among the different components of cost of cultivation, rental value of land (36.00 per cent) accounted for the largest portion followed by human labour (25.40 per cent), seed (11.07 per cent) and FYM (7.92 per cent). The other major components were machinery (5.99 per cent), fertilizers (3.23 per cent), irrigation charges (2.89 per cent) and plant protection chemicals (2.28 per cent). Similar findings were also found by Lokapur and Kulkarni (2014).

Productivity and profitability of onion

The productivity and gross returns on sample farms for onion cultivation are given in table 6.

The overall gross return was Rs. 358400 per hectare. The table reveals that on an overall basis, productivity of onion was 320 quintals per hectare. The yield was highest (328 quintals) on medium farms, followed by large farms (322 quintals) and small farms (310 quintals). The overall gross return was Rs. 358400 per hectare. Similar results were also found by Sidhu*et al.* (2010).

Income measures

A comparison of various income measures from onion cultivation in Haryana are given in table 7.

The table 7 reveals that returns over variable cost varied between Rs. 239621 to Rs. 281983. The overall returns over variable cost decreased with increase in the size of land holding. Farm business income which represents returns over cost A_2 were same as returns over variable cost as there were no difference between cost A_1 and A_2 because the leasing in land for vegetable production were not in practice in the study area. Net income, implies profit per hectare after deducting cost C_2 from gross income. The overall net income from onion cultivation was Rs. 172266 per hectare. Among different size groups, it varied between Rs. 160501 per hectare to Rs. 172673 per hectare on different land size holdings. The overall returns to management

Table 4: Operation - wise labour use pattern on selected farm size holdings for onion .

Operations	Small			Medium			Large			Average		
	FL	CHL	ML	FL	CHL	ML	FL	CHL	ML	FL	CHL	ML
Preparatory tillage	2.2	0.0	8.2	3.0	0.0	8.5	1.0	2.7	9.0	2.1	0.9	8.6
Nursery raising	2.2	0.0	0.0	1.1	1.9	0.0	0.0	3.5	0.0	1.1	1.8	0.0
Transplanting/ Sowing	17.3	0.0	0.0	5.2	13.3	0.0	5.0	15.0	0.0	9.2	9.4	0.0
FYM applications	2.4	0.0	10.0	2.8	0.0	11.2	0.0	3.5	13.0	1.7	1.2	11.4
Irrigations	13.2	0.0	0.0	7.0	8.0	0.0	8.4	10.0	0.0	9.5	6.0	0.0
Fertilizers application	1.5	0.0	0.0	0.0	2.0	0.0	0.0	3.0	0.0	0.5	1.7	0.0
Hoeing and weeding	35.6	0.0	0.0	22.4	14.9	0.0	7.8	35.4	0.0	21.9	16.8	0.0
Insecticides/ Pesticides application	3.0	0.0	0.0	0.0	4.0	0.0	0.0	5.0	0.0	1.0	3.0	0.0
Harvesting and cutting	38.8	0.0	0.0	10.0	30.9	0.0	8.5	40.5	0.0	19.1	23.8	0.0
Grading	12.5	0.0	0.0	6.0	8.6	0.0	2.0	14.0	0.0	6.8	7.5	0.0
Transportation	10.0	0.0	2.0	1.0	3.0	2.5	1.0	4.0	2.5	4.0	2.3	2.3
Total	**138.7**	**0.0**	**20.2**	**58.5**	**86.6**	**22.2**	**33.7**	**136.6**	**24.5**	**77.0**	**74.4**	**22.3**

FL = Family labour (man-days), CHL = Casually hired labour (man-days), ML = Machine labour (hours)

Table 5: Item-wise break up of cost of cultivation/ha in onion crop.

Sr. No.	Items	Size groups						Average	
		Small		Medium		Large			
		Value (Rs.)	%	Value (Rs.)	%	Value (Rs.)	%	Value (Rs.)	%
1.	Human labour								
	a. Family	41610	23.84	17550	9.55	10110	5.05	23090	12.41
	b. Hired	0	0.00	28145	15.32	44395	22.18	24180	12.99
2.	Seeds	19135	10.96	20100	10.94	22584	11.28	20606	11.07
3.	FYM	14485	8.30	14675	7.99	15082	7.54	14747	7.92
4.	Fertilizers	5569	3.19	5956	3.24	6525	3.26	6017	3.23
5.	Machinery	10100	5.79	11100	6.04	12250	6.12	11150	5.99
6.	PP chemical	3920	2.25	4155	2.26	4670	2.33	4248	2.28
7.	Weedicides	750	0.43	885	0.48	900	0.45	845	0.45
8.	Irrigation charges	5286	3.03	5350	2.91	5525	2.76	5387	2.89
9.	Land revenue	150	0.09	150	0.08	150	0.07	150	0.08
10.	Depreciation	1654	0.95	1690	0.92	1787	0.89	1710	0.92
11.	Miscellaneous	1360	0.78	1580	0.86	1940	0.97	1627	0.87
12.	Interest on working capital @ 4.5%	2808	1.61	4220	2.30	5211	2.60	4080	2.19
	Total variable cost	65217	37.37	98006	53.34	121019	60.47	94748	50.90
13.	Interest on fixed capital	700	0.40	1180	0.64	2010	1.00	1297	0.70
14.	Rental value of land	67000	38.39	67000	36.47	67000	33.48	67000	36.00
	Total cost	**174527**	**100.00**	**183736**	**100.00**	**200139**	**100.00**	**186134**	**100.00**

on cost C_3 basis from onion cultivation were Rs. 153652 per hectare. Among different land size groups, it varied between Rs. 140487 to Rs. 165250.

Resourse use efficiency

Linear and Cobb-Douglas production functions were used for the purpose of finding out elasticites of different inputs used on the farms. Cobb-Douglas function was found to be the best fit because of high R^2 value. The value of R^2 (coefficient of multiple determination) shows that 94 per cent of the variation in the yield of onion was explained by variables included in the model. However, only nitrogen variable was found significantly positive,

Table 6: Gross income per hectare from onion cultivation on different size holdings.

Size holdings	Yield (q/ha)	Gross income (Rs./ha)
Small	310	347200
Medium	328	367360
Large	322	360640
Average	**320**	**358400**

Table 7: Return from cultivation of onion crop on sample farms per hectare (Rs./ha)

Particulars	Size holdings			Average
	Small	Medium	Large	
Returns over variable cost	281983	269354	239621	263652
Farm business income	281983	269354	239621	263652
Family labour income	214283	201174	170611	195356
Net income	172673	183624	160501	172266
Return to management	155220	165250	140487	153652
Return per rupee	1.99	2.00	1.80	1.93

Table 8: Regression coefficients of different production variables and their significance in cultivation of onion.

Input variables	Regression coefficients	Standard errors	T-value variables	R^2
Seeds	0.2257	0.1455	1.5513	
FYM	-0.1641	0.2404	-0.6828	
Nitrogen	2.0709*	0.8649	2.3944	
Phosphorus	-0.0473	0.1510	-0.3130	
Human labour	-0.0573	0.1084	-0.5287	**0.94**
Machine labour	0.0274	0.1230	0.2227	
Irrigations	0.0073	0.1484	0.0490	
Sprays	0.0414	0.0303	1.3660	
Weedings	-0.1810**	0.0502	-3.6062	

*and ** Significant at 5 per cent and 1 per cent level of significance, respectively

Table 9: G.M., MPP and MVP of different inputs for onion.

Input variable expenditure	G.M.	MPPxi (quintals)	MVPxi (Rs.)	MPPxi /Pxi
Yield (quintals)	319.46			
Nitrogen (kg)	124.27	5.3236478	5962.486	596.2486
Weedings (no.)	4.15	-13.93307	-15605	-19.5063

G.M. = Geometric mean, MPP = Marginal physical product and MVP = Marginal value product

whereas weedings is negatively significant. Similar finding were also found by Ram A. Jat *et al.* (2011).

The value of R^2 (coefficient of multiple determination) shows that 94 per cent of the variation in the yield of onion was explained by variables included in the model. However, only nitrogen variable was found significantly positive, whereas weedings is negatively significant.

Marginal physical product and Marginal value product

The basic criterion of an efficient resource use is that as long as MVPxi>Pxi, the farmer can increase input use till MVPxi = Pxi. Hence, for evaluating the efficiency of resource use, the marginal value products of different factors and the factor prices were compared. Additional rupee invested in nitrogen brings additional rupee of Rs. 596.25. This indicate that this resource can be used further till their MVPxi=Pxi, whereas weedings has to be decreased.

Additional rupee invested in nitrogen brings additional rupee of Rs. 596.25. This indicate that this resource can be used further till their MVPxi=Pxi, whereas weedings has to be decreased. Dastagiri*et al.*(2013)and Baba *et al.* (2010) also found the similar results.

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