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International Journal of Agricultural Extension

ISSN: 2311-6110 (Online), 2311-8547 (Print)

<http://www.escijournals.net/IJAE>

INPUT USE, COSTS STRUCTURE, RETURN AND RESOURCE USE EFFICIENCY ANALYSIS OF WHEAT CROP IN SOUTH GUJARAT, INDIA

^aAsodiya P. Sureshkumar* ^aKashinath S. Patel, ^bParth S. Asodiya, ^aVinay K. Parmar

^a Department of Agricultural Economics, N.M.C.A, Navsari Agricultural University, Gujarat, India.

^b National Institute of Pharmaceutical Education and Research (NIPER), India.

ABSTRACT

Present study was designed to measure input use, cost structure, return and resource use efficiency in wheat production of South Gujarat division of Gujarat, India. In present investigation The sample of 240 Wheat farmers were selected from study area which input-output data collected based on rabi cropping season with a view to examine the input use, cost structure and returns in production and marketing of wheat and the resource use efficiency of wheat growers in year 2013-14. We used the log linear type Cobb-Douglas production function. The results of study revealed that the average total cost of cultivation of wheat was ` 45784.31. It was the highest on large farms followed by 45720.79 on medium farms, and 39016.69 on small farms. Higher costs on large farms are associated with intensive use of Human labour, bullock labour, manures & fertilizers and irrigation charges. The average overall farm harvest price received by the wheat growers was ` 1552.79 per quintal. It varied from ` 1500.43 on small farms to ` 1597.43 on large farms. The average net profit per hectare over (Cost-C₂) was ` 20017.55 and it increased with the increase in size of farms. The overall input-output ratio was 1:1.44 on the basis of total cost of cultivation. It was the highest (1: 1.48) on large farms, followed by medium farms (1:1.43), and small farms (1:1.35). The average cost of production per quintal of wheat was about ` 1285.86 which was lower than the market price of wheat ranging from ` 1600 to ` 1950 per quintal. Functional analysis of wheat crop revealed that seed, N fertilizer, irrigation, human labour, No. of weeding, P fertilizer F.Y.M, bullock labors, and No. of spray *i.e.* 0.511, 0.371, 0.288, 0.188, 0.171, 0.148, 0.059, 0.029, and 0.020 respectively. This is positive and statistically significant, indicated which indicated that if expenses made on these resources, then it will be gives profitable returns.

Keywords: Input use, cost structure, returns, production, marketing and market price, Resource use efficiency, log linear production function.

INTRODUCTION

Wheat (*Triticum aestivum* L.) is the world most widely cultivated as a cash crop because it produces a good yield per unit area, grows well in a temperate climate even with a moderately short growing season. The center of origin for wheat was in the Mid-east, near the cross point of national boundaries for USSR, Turkey, Iraq, and Iran. Wheat is a staple food and also one of the most important staple food grains of human race. India produces about 70 million tonnes of wheat per year or about 12 per cent of world production. It is now the second largest producer of wheat in world. Being the

second largest in population, it is also the second largest in wheat consumption after China, with a huge and growing wheat demand (Ansari *et al.*, 2009).

The wheat is cultivated in about 120 countries of the world. The major wheat producing countries are China, India, USA, Russian Federation, Canada, Australia, etc. The China has emerged as the largest producer of wheat and accounted for 15.7 per cent share followed by India, the productivity of wheat in China, was appreciably higher at 3830 kgs compared to 2696 kgs per hectare in India.

India harvested record wheat of about 94.9 million tonnes in 2011-12 from an area of 29.9 million ha. But in year 2012-13, the production of wheat may remain 3 per cent lower to about 92.3 million tonnes with 4.31 million

*Corresponding Author:

Email: kashinath.patel@yahoo.in

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ha decline in area and slightly lower yield due to less availability of irrigation, comparing last year (Chayulu and Prahadeeswaran, 2012).

In Gujarat during year 2011-12, wheat production was 4.72 million tones and productivity was 3015 kg/ha while the area under wheat crop was 13,50,600 ha.

MATERIALS AND METHODS

Data: A South Gujarat was selected purposively as the district has fertile land with good irrigation facility. Moreover, this district is well connected by road with other parts of the state and the country. In south Gujarat four districts were selected i.e Bharuch, Narmada, Surat and Tapi, from each district two talukas were selected on the basis of highest area under wheat cultivation from last 5 years average.

In order to select the villages, taluka development officer was contacted and lists of the wheat growing villages were prepared. From the prepared list of two villages were selected randomly from the each selected taluka. Thus, total 16 villages were selected for the study. From each villages 15 farmers were selected on the base of proportionate of population, total 240 respondents were selected for study. Lists of all wheat growing farmers of the selected villages were obtained from the village Talathi kum mantri. The wheat growing farmers in the sample villages were divided in three standard size groups on the basis of the size of their operational land holdings. These size groups are small (0-2 hectares), medium (2-4 hectares) and large (above 4 hectares). A sample of two hundred forty farmers was selected adopting the multistage stratified random sampling technique.

Data Analysis

A. Benefit Cost Ratio (BCR): The benefit cost ratio (BCR) was worked out by using following formula (Kuthe, 2012):

$$B:C \text{ ratio} = \frac{\text{Discounted cash inflows}}{\text{Discounted cash outflows}}$$

B. Cost of cultivation: The data pertaining to the cost of cultivation of wheat crop are those which are generally adopted in the farm management studies. The various cost concepts are determined by agricultural economists being used while analyzing the data as (Kuthe, 2012).

Cost A1: It includes

1. Value of hired human labour.
2. Value of hired and owned bullock labour.

3. Value of hired and owned machine labour.
4. Value of seed (both farm seed and purchased).
5. Value of manures (owned and purchased).
6. Cost of fertilizers.
7. Plant protection charges (insecticide/pesticide).
8. Irrigation charges.
9. Land revenue.
10. Interest on working capital.
11. Miscellaneous expenses.
12. Depreciation.

Family labours were charged at the rate of hired labour charges prevailing in the region. Owned bullock labour is taken on the basis of hire rate prevailing in the village.

- a. Cost A2: Cost A1 + rent paid for leased in land.
- b. Cost B1: Cost A1 + interest on fixed capital (excluding land).
- c. Cost B2: Cost B1 + rental value of owned land + rent for leased in land.
- d. Cost C1: Cost B1 + imputed value of family labour.
- e. Cost C2: Cost B2 + imputed value of family labour.
- f. Cost C3: Cost C2 + 10 percent of cost C2 as management cost.

C. Cost of production:

$$\text{Cost of production/ qtl} = \frac{\text{Cost of cultivation}}{\text{Quality of product}}$$

D. Income measures: Following income measure and were used:

1. Gross income:

It is the total value of main product as well as of by product:

$$GI = (Q_m \times P_m) + (Q_b \times P_b)$$

Where:

- GI = Gross income
- Q_m = Quantity of main product
- P_m = Price of main product
- Q_b = Quantity of by product
- P_b = Price of by product

2. Returns over variable cost (RVC):

$$RVC = \text{Gross income} - \text{Cost A1}$$

3. Farm business income (FBI):

$$FBI = \text{Gross income} - \text{Cost A2}$$

4. Family labour income (FLI) and management:

$$FLI = \text{Gross income} - \text{Cost B2}$$

5. Net income (NI): NI = Gross income – Cost C2

6. Returns to Mgt: GI – Cost C3

7. Returns per rupee (RPR):

$$RPR = \frac{\text{Gross income}}{\text{Cost C2}}$$

C. Resource use efficiency of wheat growers:

The use of different inputs in production of wheat crop on sample farm was studied, to analyse the resource use efficiency in wheat crop. The different variables used in the production function are as under (Patil and Khobarkar, 2013).

The general form of function is

$$Y = a X_1^{b_1} X_2^{b_2} X_3^{b_3} X_4^{b_4} X_5^{b_5} X_6^{b_6} X_7^{b_7} X_8^{b_8} \dots X_n^{b_n}$$

Where:

Y = Output in quintals per ha.

a = Intercept

b = parameter regression coefficient

X₁ = Quantity of seed (Kg) per ha.

X₂ = Quantity of FYM cartload (in quintal) per ha.

X₃ = Quantity of Nitrogen (in Kg) per ha.

X₄ = Quantity of Phosphorus (in Kg) per ha.

X₅ = Hired labour (man days) used per ha.

X₆ = Number of sprays per ha.

X₇ = Number of weeding per ha.

X₈ = Number of irrigation per ha.

X₉ = Fuel consumption (liter / operation)

X₁₀ = Bullock labour (in days) used per ha.

X₁₁ = Farm size of respondents

Where Xi is the variable resources measure, Y is the output, a is constant and bi estimates give extent of relationship between X and Y and when X is at different magnitudes. The b coefficient also represents the elasticity of production.

The log linear function of Cobb-Douglass used for present study, because it has given rationale value of R² and adjusted R² than other functions like Non-linear function and Quadratic function.

RESULTS AND DISCUSSION

The decision and choice of crops to be grown on a farm and the area to be allocated under a crop depends to a large extent on the prices of output, productivity level, technology available and the level and prices of inputs used in their production. The knowledge of input use, cost structure and returns from the cultivation of crops helps in formulating the policies at macro and micro levels. Such knowledge is more useful for crops taken mainly for the market purpose w.r.t the cash crops, spices crops, fruits, vegetables and other high value crops. Therefore this study have been undertaken to find out input use, cost structure and profitability of wheat crop.

Input Pattern Use in Cultivation of Wheat Crop:

Wheat is one of the major cereal crops occupying a prominent place in the economy of cultivators and use as

staple food in India. Therefore, cost of wheat cultivation has paramount importance in determining the net income from it. The details of per hectare component wise costs for wheat cultivation on different size of farms are studied and results are furnished in Table - 1. It could be inferred from the Table 1 that that per hectare total cost was found highest (₹48288.01) on large farms and lowest (₹41140.42) on small farms with an overall total cost of ₹45784.31. Relatively more utilization of human labours, fertilizer, manure and irrigation charges might have inflated the higher total cost on large farms as compared to other farm size groups. Among the different items of cash expenditure, the rental value of owned land ranked first with 23.01 per cent of the total cost due to the cultivation of wheat because now a days increasing trend in value of land in Gujarat.. Another the major cost of wheat cultivation was human labour with 14.99 per cent of the total cost because of wheat requires more number of labours for harvesting, weeding and application of irrigation.

The other per hectare expenditure were irrigation cost (13.40 per cent), fertilizer charges (11.79 per cent), managerial costs (10.00 per cent), tractor/ machine charges (6.38 per cent), seed cost (6.20 per cent), Bullock labour charges (4.80 per cent), interest on working capital (2.34 per cent), depreciation (2.00 per cent), manures and cakes (1.97 per cent), weedicide charges (1.47 per cent), interest on fixed capital (1.00 per cent), miscellaneous cost (0.96 per cent) and insecticides/pesticide cost (0.37 per cent).

Cost Structure and Returns from Wheat Cultivation

a- Estimates of different costs: Estimates of different costs such as cost A, Cost B, Cost C₁ and Cost C₂ are presented in Table – 2.1. It could be inferred from the table 2 that overall per hectare Cost-A came to ₹28750.98. The highest per hectare Cost-A was ₹30878.35 on large farms and lowest was ₹24414.38 on small farms. The study also shows that Cost-B and Cost-C₁ accounted for about 86.90 and 90.00 per cent of the total cost C₂. On an average, Cost-C₂ came to ₹45784.31 per hectare which was highest on large farms (₹48288.01 per hectare) and lowest on small farms (₹41140.42 per hectare). Higher costs on large farms are associated with intensive use of human labours, seed, manures and fertilizer charges, irrigation miscellaneous. As per table no particular trend was observed in different cost concepts on various categories of wheat cultivators in study.

Table 1. Input use Pattern of Wheat Crop (₹ /hectare).

Sr.	Item	Category of Farm			
		Small	Medium	Large	All Farms
1	Human Labour	7978.16 (19.39)	7127.63 (15.65)	6630.63 (13.73)	6864.37 (14.99)
	(a) Family	3716.64 (9.03)	2000.50 (4.39)	1098.72 (2.28)	1835.47 (4.01)
	(b) Hired	4261.52 (10.36)	5127.13 (11.26)	5431.91 (11.25)	5088.44 (11.11)
2	Bullock labour	3417.25 (8.31)	2207.91 (4.85)	1648.48 (3.41)	2199.86 (4.80)
3	Tractor/machine charges	1372.72 (3.34)	2870.17 (6.30)	3654.07 (7.57)	2922.51 (6.38)
4	Manures and cakes	582.36 (1.42)	886.13 (1.95)	1055.90 (2.19)	901.75 (1.97)
5	Seed	2463.80 (5.99)	2737.48 (6.01)	3076.31 (6.37)	2837.93 (6.20)
6	Irrigation charges	5710.34 (13.88)	6014.51 (13.21)	6411.52 (13.28)	6135.64 (13.40)
7	Fertilizer	4347.25 (10.57)	5384.03 (11.82)	5877.71 (12.17)	5396.61 (11.79)
8	Insecticides/Pesticides	64.73 (0.16)	150.70 (0.33)	233.74 (0.48)	171.38 (0.37)
9	Weedicides	322.92 (0.78)	681.57 (1.50)	820.68 (1.70)	671.50 (1.47)
10	Miscellaneous	242.52 (0.59)	424.24 (0.93)	536.22 (1.11)	438.42 (0.96)
11	Depreciation	717.54 (1.74)	949.74 (2.09)	982.02 (2.03)	916.37 (2.00)
12	Interest on working capital	911.42 (2.22)	1059.35 (2.33)	1149.79 (2.38)	1070.56 (2.34)
13	Interest on fixed capital	358.77 (0.87)	474.87 (1.04)	491.01 (1.00)	458.19 (1.00)
14	Rental value of owned land	8910.59 (21.66)	10427.59 (22.90)	11430.11 (23.67)	10577.46 (23.10)
15	Managerial cost	3740.04 (10.00)	4139.59 (10.00)	4389.82 (10.00)	4162.21 (10.00)
16	Total Cost	41140.42 (100.00)	45535.51 (100.00)	48288.01 (100.00)	45784.31 (100.00)

Note : Figures in parentheses indicate percentage to total. Source: Field Survey.

b- Yield, price, gross income and net gains: Yield, farm harvest price and value of gross output from wheat production on different farm size groups are presented in Table - 2.2. It revealed that the the average yield of wheat was 35.61 quintals per hectare. It ranged from 36.36 quintals on large farms to 33.74 quintals on small farms. Higher yield level on large farms may be due

optimum level of inputs utilized by them along with timely weeding operations, proper selection of varieties of wheat, as compared to other farms. Also the variation in the yield might be due to the different time of sowing, types of land.

The results (table 2.2) indicate that that per quintal average farm harvest price received by the wheat

growers was 1285.86. The large size growers realized higher prices per quintal (1328.15) followed by medium (1273.68) and small sized farms (1218.86). Generally, large farm growers sell their produce at higher prices compared to medium farms, which was mainly due to time of sale and agencies to which the produce was sold (Wholesaler cum processor). The average gross returns per hectare on wheat farms amounted to ` 66109.11. It varied from ` 55691.21 on small farms and ` 71438.20 on large farms. The gross income was high on large farms followed by medium and small farms. This might be due to sale of wheat by large farmers through the channel IV i.e. directly sale to retailers and cost of production of per quintal of wheat is less than other categories because of optimal use of input resources. They sold their byproduct to Maharashtra industries for fuel purpose so, they got good rate of it than other categories.

c- Per hectare net returns: A perusal of above Table – Table 2a. Estimation of Different Cost.

2.3 shows that the per hectare net returns over operational cost (Cost-A) was the highest (40561.70) on large farms and the lowest (` 31288.31) on small farms with on an average of ` 37360.52 on sample farms. Net returns from wheat farms on the basis of Cost B, Cost C₁ and cost C₂ was ` 26324.88, ` 24478.01 and ` 20314.90 per hectare, respectively. It is apparent from the table that per hectare net returns on wheat farms over Cost C₂ ranged from ` 23152.22 on large farms to ` 14563.41 on small farms with an average of ` 20314.90. As per table no particular trend was observed in different cost concepts on various categories of wheat cultivators.

d- Per hectare FBI, FLI and FII and net profit: The overall per hectare farm business income, family labour income and farm investment income in Table – 2.4 were ` 37360.52, ` 26324.88, and ` 24478.01 respectively. The data further revealed that the net profit per hectare (over Cost-C₂) was ` 20314.90 for all farm groups.

Category of Farm	Different costs (per hectare)			
	Cost-A	Cost-B	Cost-C ₁	Cost-C ₂
Small	24414.38 (59.34)	33872.71 (81.88)	37589.35 (90.00)	41348.28 (100.00)
Medium	28492.96 (62.57)	39200.44 (86.52)	41200.94 (90.00)	45321.03 (100.00)
Large	30878.35 (63.95)	42727.70 (88.63)	43826.43 (90.00)	48209.07 (100.00)
Overall	28750.98 (62.80)	39728.89 (86.90)	41564.36 (90.00)	45720.79 (100.00)

Figure in parenthesis indicate percentages to Cost-C₂.

Source: Field Survey.

Table 2b. Yield Level, Farm Harvest Price and Gross Income per hectare.

Category of Farm	Yield (quintal)	Harvest price (quintal)	By product Yield	Value of gross output
Small	33.74	1500.43	5053.47	56872.21
Medium	35.75	1578.50	9241.08	63953.80
Large	36.36	1597.43	13339.60	70989.66
All Farms	35.61	1552.79	10273.33	65748.24

Source: Field Survey.

Table 2c. Net Gains over Different Costs per hectare.

Category of Farm	Net gains over different costs			
	Cost-A	Cost-B	Cost-C ₁	Cost-C ₂
Small	31288.31	22018.94	18302.30	14563.41
Medium	36679.46	25777.00	23776.51	19636.91
Large	40561.70	28640.58	27541.85	23152.22
Overall	37360.52	26324.88	24478.01	20314.90

Source: Field Survey.

Table 2d. Farm Business Income, Family Labour Income, Farm Investment income and Net Profit over Cost-C₂ (₹ /hectare).

Category of Farm	Small	Medium	Large	All Farms
Farm business income	31288.31	36679.46	40561.70	37360.52
Family labour income	22018.94	25777.00	28640.58	26324.88
Farm investment income	18302.30	23776.51	27541.85	24478.01
Net profit	14563.41	19636.91	23152.22	20314.90

Source: Field Survey.

e- Input-Output Ratio: The input - output ratio reflects the criteria for economic viability of the crop based on return per rupee invested. The input - output ratios were worked out on the basis of different cost concepts and the same are presented in Table – 2.5. The overall input output ratio was 1: 1.44 on the basis of cost- C₂. It indicates that an investment worth 1 on all the inputs used in the cultivation of wheat yielded an output worth 1.44. The input output ratio was the lowest (1: 1.35) on small farms and the highest (1: 1.48) on large farms. Further, it was observed that the input output ratio on the basis of cost- A i.e. paid out cost, was highest (1: 2.31) on large farms followed by medium farms (1: 2.29) and small farms (1: 2.28). It was lowest (1: 2.28) on small farms because higher cost of input than other categories.

f- Costs per quintal: It is the cost-price relationship (the cost-price ratio) that generally decides the economic Table 2e. Input-Output Ratio.

prosperity and the degree of commercialization on these farms. Given the price, offered by the market mechanism to a unit of output, the farmers prosperity depend upon his capacity to produce his output at a lesser cost than the market price.

The overall paid out cost (cost- A) per quintal was ₹ 807.23, which was 62.80 per cent of the total cost. The overall cost- B came to ₹ 1117.10 per quintal which was 86.90 per cent of total cost. The overall total cost of production (cost- C₂) per quintal of wheat was about 1285.86. Cost of production per quintal is highest on large farms (1328.15), followed by medium farms (₹ 1273.68) and small farms (₹ 1218.86).

Here, there is an increasing cost according to size. The market price of wheat for producer ranged from ₹ 1400 to ₹ 1599 per quintal. Therefore, it can be concluded that the wheat cultivation was quite remunerative even if the lowest market price is considered.

Category of Farm	Cost-A	Cost-B	Cost-C ₁	Cost-C ₂
Small	1 : 2.28	1 : 1.65	1 : 1.49	1 : 1.35
Medium	1 : 2.29	1 : 1.65	1 : 1.57	1 : 1.43
Large	1 : 2.31	1 : 1.67	1 : 1.63	1 : 1.48
All Farms	1 : 2.30	1 : 1.66	1 : 1.59	1 : 1.44

Source: Field Survey.

Table 2f. Cost of Production per Quintal on the Basis of Different Cost Concepts.

Category of Farm	Different costs (₹ per quintal)			
	Cost A	Cost B	Cost C ₁	Cost C ₂
Small	723.20 (59.54)	997.91 (81.92)	1108.06 (90.00)	1218.86 (100.00)
Medium	796.98 (62.57)	1101.93 (86.50)	1157.89 (90.00)	1273.68 (100.00)
Large	849.29 (63.95)	1177.19 (88.63)	1207.41 (90.00)	1328.15 (100.00)
Overall	807.23 (62.80)	1117.10 (86.90)	1168.96 (90.00)	1285.86 (100.00)

Note: Figures in parentheses indicate the percentages to Cost-C₂

Source: Field Survey.

Estimation of Resource use efficiency: Resource Use Efficiency means how efficiently the farmer can use his resources in production process. It is very important because our resource is very limited. For calculating resource use efficiency we considered eleven factors namely hired human labour, seed rate, manures and cakes, fertilizer, insecticide and pesticide's spray, irrigation, No. of weeding, bullock labour, fuel, farm size etc. The data collected from the respondents were used to run regression analysis so as to determine the relationship between inputs and the output of wheat crop. The results obtained are shown in the table 3.

The results showed that all inputs (except fuel consumption) were positively related to the output of wheat. The R² of 0.66 implied that 66 % of total variation in the output of wheat is explained by the inputs specified in the Cobb-Douglas production function. The regression co-efficient of all the variables are positive, indicating that a unit increase in any of the variable holding others constant will lead to a unit increase in the gross output. Furthermore, number of weeding, No. of spray, and bullock labour, are significantly affect the output of turmeric at 5% and remained at 1% level of significance. The variable fuel is non significance because use of harvester increases the waste of grain during the cutting process.

The regression equation is

$$Y = - 3.436 + 0.511 X_1 + 0.059 X_2 + 0.371 X_3 + 0.148 X_4 + 0.188 X_5 + 0.020 X_6 + 0.171 X_7 + 0.288 X_8 - 0.010 X_9 + 0.029 X_{10}$$

It must be noted that Intercept = ln A = - 3.436

Therefore, A = e^{-3.44} = 0.0322

Thus, the estimated equation in its multiplicative form is:

$$Y = (0.0322) X_1^{0.551} X_2^{0.059} X_3^{0.371} X_4^{0.148} X_5^{0.188} X_6^{0.02} X_7^{0.171} X_8^{0.288} X_9^{-0.010} X_{10}^{0.029}$$

Table 3: Resource use efficiency of wheat growers in south Gujarat

Variables	Regression coefficient	Standard Error	Calculated 't'
Constant	-3.436	0.819	-4.195
Seed (X ₁)	0.551	0.166	3.308**
F.Y.M (X ₂)	0.059	0.020	2.968**
N (X ₃)	0.371	0.051	7.165**
P (X ₄)	0.148	0.046	3.206**
Human labour (X ₅)	0.188	0.050	3.754**
No. of spray (X ₆)	0.020	0.010	2.085*
No.of weeding (X ₇)	0.171	0.047	3.663*
Irrigation (X ₈)	0.288	0.094	3.054**
Machine hours (X ₉)	-0.010	0.009	-1.116
Bullock labour (X ₁₀)	0.029	0.013	2.151*
R ²		66 %	
Calculated F		45.25**	

* Significant at 5 % level of significance. ** Highly significant at 1 % level of significance

The regression co-efficient of seed rate (Kg.) were significant at 1 percent level which indicated that holding other factors constant one percent increase in seed (Kg.) would increase the gross return by 0.511, while for variable Nitrogen of wheat growers was 0.371 which was significant at 1 percent level of confidence. In the case of Co-efficiency of irrigation were significant at 1 percent level which indicated that holding other factors constant one percent increase in irrigation rate would increase the gross return by 0.288. While, in the case of human labour, No. of weeding, P fertilizer, F.Y.M, Bullock labours , and No. of spray *i.e* 0.188, 0.171, 0.148, 0.059, 0.029, and 0.020 respectively which is positive and statistically significant, indicated that increase in these inputs will significantly effect on wheat yield. If expenses made on these resources, then it will be gives profitable returns.

The elasticity of production (E_p) of all the variables summed up to 0.66 meaning decreasing return to scale, implying that, if these resources are increase by 1%, the output would increases by less than 1% except in case of fuel variable. The F - values of the equation derived for farmer 45.25 which were highly significant at 1 percent level implying that all the explanatory variables were important for explaining the variations in gross returns of the operators or wheat growers.

CONCLUSION

The average total cost of cultivation of wheat was ` 45784.31. The expenditure on plant protection chemicals was very low though the attack of disease affected the production of wheat to a greater extent. Higher costs on small farms are associated with intensive use of family labour, bullock labour, manures and irrigation charges. The average overall yield of wheat was 35.61 quintals per hectare. It was highest (36.36 quintals) on large size farms and lowest (33.74 quintals) on small size farms. On an average net return per hectare from wheat farms on the basis of Cost A, B, C₁ and Cost C₂ were ` ` 37360.52, ` 26324.88, and ` 24478.01 and ` 20314.90, respectively. The average net profit per hectare over (Cost-C₂) was ` 20314.90 and it increased with the increase in size of farms. The overall input-output ratio was 1:1.44 on the basis of cost- C₂. Thus, it shows the increasing trend with an increase in the farm size. The average cost of production per quintal of wheat was about ` 1285.86 which was lower than the market price of wheat ranging from ` 1600 to ` 1950 per quintal. Therefore, it can be concluded that the wheat cultivation was quite remunerative even if the lowest market price is considered. The results showed that all inputs (except fuel consumption) were positively related to the output of wheat. The R² is 66 % of total variation in the output of wheat is explained by the inputs specified in the Cobb-Douglas production function. The regression co-efficient of all the variables are positive, indicating that a unit increase in any of the variable holding others constant will lead to a unit increase in the gross output. Furthermore, number of weeding, No. of

spray, and bullock labour, are significantly affect the output of turmeric at 5% and remained at 1% level of significance. The variable machine hour is non-significant because use of harvester increases the waste of grain during the cutting process. The elasticity of production (E_p) of all the variables summed up to 0.66 meaning decreasing return to scale, implying that, if these resources are increased by 1%, the output would increase by less than 1%. The F - values of the equation derived for farmer 45.25 which were highly significant at 1 percent level implying that all the explanatory variables were important for explaining the variations in gross returns of the cultivators.

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