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Economics and resource use efficiency of Bottle gourd production in Navsari District of Gujarat State

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Abstract

Bottle gourd is important vegetable crop provide a considerable amount of income to farm families in Navsari district. The present investigation was done to study the input use, cost, return and resource use efficiency in cultivation of bottle gourd in Navsari district. For this purpose primary data collected from 120 respondent from 12 villages of two talukas of navsari district and categorized according to size of holding as marginal, small, medium and large farms. To arrive at conclusion the data analysed with cost concepts, different income measures and Cobb-Douglas production function. The average per hectare cost of cultivation, gross income and net income of bottle gourd was Rs.137509.13, Rs. 282118.98 and Rs. 144609.85, respectively. The value of different farm income measures indicated that the cultivation of bottle gourd in study region was profitable. The regression coefficient derived from the analysis of Cobb- Douglas production function was positive for the inputs i.e. human labours, machine labours, fertilizers and FYM. The MVP price ratio in bottle gourd cultivation was worked out to more than one for all the factors of production indicated that these resources were underutilized in study area.

Key words: Cost of cultivation, Economics, Production, Bottle gourd, Resource use efficiency

Introduction

Bottle gourd is an important vegetable crop in India and available in the market from February to November. Bottle gourd locally known as *"Lauki"* (Hindi) or *"Dudhu"* (Gujarati). This vegetable having a great medicinal value. Ayurveda highly recommends this food for diabetic patients and young children and also recommends the juice of this gourd in the treatment of acidity, indigestion and ulcers as it serves as an alkaline mixture (Kumbhar *et al*., 2017). The area and production of bottle gourd in India during the year 2017-18 was 1.57 lakh hectare and 26.83 lakh tonnes, respectively. The major bottle gourd producing states are Gujarat, Andhra Pradesh, Uttar Pradesh, Madhya Pradesh and Bihar.

Gujarat is one of the major vegetable producing state in the India. Among the different vegetable produced in the state, cucurbits accounts 11 percent of its share in total production of vegetable. The area under cucurbits in Gujarat state was 0.88 lakh ha. and production was 14.14 lakh tones during 2017-18. Navsari district ranks first in the Gujarat state in terms of area and production of cucurbits. Bottle gourd is one of the important cucurbit grown on wide area. In Gujarat, major bottle gourd producing districts are Navsari, Surat, Ahmadabad, Anand, Vadodara and Sabarkantha. Generally bottle gourd is commercially grown in *kharif* and summer season. It was observed that a considerable amount of income is generated by bottle gourd cultivation to the farm families. The knowledge regarding cost, return and profitability of bottle gourd cultivation useful to the farmers in making different production related decisions. The findings of the study will help to increase the area under bottle gourd by knowing the profitability of crop. Considering the importance of cultivation of bottle gourd, the present investigation was done to study the input use, cost, return and resource use efficiency in cultivation of bottle gourd in Navsari district.

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Methodology

Present investigation is based on the primary data which was collected from respondent farmers selected by multistage random sampling method. On the basis of highest area and production of bottle gourd, Navsari district was selected purposively for study. Among the five talukas of Navsari district two talukas viz. Chikhali and Vansda were selected. From each taluka six villages and from each village ten respondent farmers were selected randomly. Thus, total 120 farmers selected for study purpose, which categorised on the basis of land holdings as marginal (< 1 ha), small (1 to 2 ha), medium (2 to 4 ha) and large (> 4 ha). The data was collected by survey method through a schedule specially designed for the purpose, by making personal visit to the sample farmer. The data tabulated and analysed to work out cost and return in bottle gourd production. To work out cost of cultivation and cost of production standard cost concept given by CACP viz. Cost A_1, Cost A_2, Cost B_1, Cost B_2, Cost C_1, and Cost C_2 were used. To see the profitability of bottle gourd, different income measures were estimated.

The resource use efficiency was studied by fitting the Cobb-Douglas production function (monetary values) to the farm data.

$$Y = a X_1^{b1} X_2^{b2} X_3^{b3} X_4^{b4} X_5^{b5} X_6^{b6} X_7^{b7} e^{u} \quad \ldots\ldots\ldots\ldots (1)$$

In logarithmic form, it assumed a log-linear equation as under:

$$\text{Log } Y = \text{Log } a + b1 \log x1 + b2 \log x2 + b3 \log x3 + b4 \log x4 + b5 \log x5 + b6 \log x6 + b7 \log x7 + u \log e \quad \ldots\ldots\ldots\ldots\ldots\ldots (2)$$

Where,

Y=Per hectare gross income of bottle gourd

X_1=Value of human (Rs./ha)

X_2=Tractor charges (Rs./ha)

X_3=Cost on chemical fertilizers (Rs./ha)

X_4=Cost of irrigation (¹ /ha)

X_5=Value of seed (Rs./ha)

X_6=Cost on farm yard manure (FYM) (Rs./ha)

X_7=Cost of supporting material (Rs./ha)

a = Constant/intercept term

u = Random variable

b1 to b7 represented production elasticity of respective inputs.

The regression co-efficient (b_i) were tested for the significance using 't' test and the coefficient of multiple determinations (R^2) was also worked out to test the goodness of fit of the model.

Results and Discussion

Cost of cultivation of bottle gourd:

The item-wise and group-wise per hectare cost of cultivation of bottle gourd were workout and presented in Table 1. It was observed from the table that, total per hectare cost of cultivation (cost C_2) of

Table 1: Per hectare cost of cultivation of bottle gourd (Rs./hectare)

SN	Particulars	Size of farm				
		Marginal (< 1ha)	Small (1-2 ha)	Medium (2-4 ha)	Large (> 4 ha)	Overall
1	Total human labours	23164.70 (18.07)	26091.00 (19.27)	27475.96 (19.64)	29081.10 (19.85)	26453.19 (19.24)
	a) Family	15860.35 (12.30)	15914.58 (11.75)	11437.98 (8.18)	3683.40 (6.61)	13224.08 (9.62)
	b) Hired	7304.35 (5.70)	10176.42 (7.52)	16037.98 (11.46)	19397.70 (13.24)	13229.11 (9.62)
2	Seeds	3078.26 (2.40)	3331.48 (2.46)	3166.85 (2.26)	3003.86 (2.05)	3145.11 (2.29)
3	FYM	7947.83 (6.20)	8653.67 (6.39)	8583.97 (6.14)	9667.95 (6.60)	8713.36 (6.34)
4	Chemical fertilizers	5464.38 (4.26)	5113.09 (3.78)	5257.51 (3.76)	5383.75 (3.67)	5304.68 (3.86)
5	Bullock labours	2226.09 (1.74)	1652.74 (1.22)	1492.87 (1.07)	988.42 (0.67)	1590.03 (1.16)
6	Machine charges	4904.35 (3.83)	5548.75 (4.10)	6092.21 (4.36)	6671.81 (4.55)	5804.28 (4.22)
7	Plant protection chemicals	8895.65 (6.94)	9271.12 (6.85)	9689.90 (6.93)	10405.39 (7.10)	9565.52 (6.96)
8	Irrigation charges	5241.74 (4.09)	5532.03 (4.09)	5586.83 (3.99)	5410.04 (3.69)	5442.66 (3.96)
9	Amortized cost	12446.38 (9.71)	13461.78 (9.94)	13043.36 (9.32)	13716.86 (9.36)	13167.10 (9.58)
10	Miscellaneous	2516.52 (1.96)	2371.87 (1.75)	2266.74 (1.62)	1948.26 (1.33)	2275.85 (1.66)
11	Depreciation	2956.52 (2.31)	3323.58 (2.45)	3536.77 (2.53)	3733.59 (2.55)	3387.62 (2.46)
12	Interest on working capital	3149.10 (2.46)	3421.82 (2.53)	3737.72 (2.67)	4016.38 (2.74)	3581.26 (2.60)
	Total Variable cost	66131.17 (51.58)	71858.35 (53.08)	78492.71 (56.11)	84344.03 (57.55)	75206.57 (54.69)
13	Rental value of owned land	42755.20 (33.35)	43851.30 (32.39)	45846.45 (32.77)	48103.36 (32.82)	45139.08 (32.83)
14	Interest on fixed capital	3464.01 (2.70)	3763.98 (2.78)	4111.49 (2.94)	4418.01 (3.01)	3939.37 (2.86)
15	Total cost	128210.80 (100.00)	135388.20 (100.00)	139888.70 (100.00)	146548.80 (100.00)	137509.13 (100.00)

Note: Figure in parenthesis indicate percentage to total cost

Source: Field Survey

bottle gourd was worked out to Rs. 128210.80, Rs.135388.20, Rs. 139888.70 and Rs. 146548.80 while per hectare variable cost was Rs. 66131.17, Rs. 71858.35, Rs.78492.71 and Rs. 84344.03 in marginal, small, medium and large farmers, respectively. At the overall level, per hectare cost of cultivation and variable cost was worked out to be Rs.137509.13 and Rs.75206.57, respectively. Among the different cost items rental value of land was worked out to be highest for all the farm size groups. It was ranging between 32 to 33 percent of total cost of cultivation in all the farm size groups. Rental value of land was followed by family human labours in marginal (12.30 per cent) and small (11.75 per cent) farm size and by hired human labours in medium (11.46 per cent) and large (13.24 per cent) farm size. At overall level total human labour cost was estimated to 19.24 per cent of cost of cultivation implied that cultivation of bottle gourd required higher labour in study area.

The cost of cultivation of bottle gourd with different cost concepts presented in Table 2. The highest Cost A_1 was recorded on large farms (Rs. 84344.03) and the lowest on marginal farms (Rs. 66131.17). The average per hectare Cost B_1, Cost B_2 and cost C_1 was Rs. 79145.94, Rs. 124285.03, Rs. 92370.02, respectively. Similar results were reported by Kumbhar *et al*. (2017) and Maurya *et al*. (2015).

Cost of production and profitability of bottle gourd:

Table 3 revealed that per hectare yield of bottle gourd was varied between 177.91 quintals and 200.93 quintals on different farm size holdings, with an average of 191.40 quintals. The per quintal cost of production was highest on small farms (Rs.737.53), followed by large farms (Rs. 729.35), medium farms (Rs. 722.86) and marginal farms (Rs. 720.65). The overall cost of production was Rs. 727.65 which was lower than medium and marginal but higher than small and large. It is evident from the table that, gross income per hectare of bottle gourd cultivation was varied between Rs. 267220.00 to Rs. 300645.00 on different farm size holdings. The gross income per hectare of bottle gourd cultivation was the highest on large farms as compared

Table 2: Per hectare cost of cultivation of bottle gourd with cost concepts (**Rs.**/hectare)

Particulars	Size of farm				
	Marginal (< 1ha)	Small (1-2 ha)	Medium (2-4 ha)	Large (> 4 ha)	Overall
Cost A_1	66131.17 (51.58)	71858.35 (53.08)	78492.71 (56.11)	84344.03 (57.55)	75206.57 (54.69)
Cost A_2	66131.17 (51.58)	71858.35 (53.08)	78492.71 (56.11)	84344.03 (57.55)	75206.57 (54.69)
Cost B_1	69595.18 (54.28)	75622.33 (55.86)	82604.20 (59.05)	88762.04 (60.57)	79145.94 (57.56)
Cost B_2	112350.40 (87.63)	119473.60 (88.25)	128450.70 (91.82)	136865.40 (93.39)	124285.03 (90.38)
Cost C_1	85455.53 (66.65)	91536.91 (67.61)	94042.18 (67.23)	98445.44 (67.18)	92370.02 (67.17)
Cost C_2	128210.80 (100.00)	135388.20 (100.00)	139888.70 (100.00)	146548.80 (100.00)	137509.13 (100.00)

Note: Figure in parenthesis indicate percentage to Cost C_2
Source: Field Survey

Table 3: Returns and profitability from bottle gourd cultivation on selected farm

Particulars	Size of farm				
	Marginal (< 1ha)	Small (1-2 ha)	Medium (2-4 ha)	Large (> 4 ha)	Overall
Average yield (q/ha)	177.91	183.57	193.52	200.93	188.98
Cost of cultivation (Rs./ha)	128210.80	135388.20	139888.70	146548.80	137509.13
Gross income (Rs./hectare)	267220.00	274070.60	286540.30	300645.00	282118.98
Net income (Rs./hectare)	139009.20	138682.40	146651.60	154096.20	144609.85
Cost of production (Rs./quintal)	720.65	737.53	722.86	729.35	727.60
Farm business income	201088.83	202212.25	208047.59	216300.97	206912.41
Family labour income	154869.60	154597.00	158089.60	163779.60	157833.95
Returns per rupee	2.08	2.02	2.05	2.05	2.05

to medium, small and marginal farms mainly because of higher productivity of large farms. Similar result was obtained by Maurya *et al*. (2015) and Kumbhar *et al*. (2017). The different income measures shows the profitability of crop cultivation. In case of bottle gourd cultivation, on an average per hectare net income, farm business income, family labour income and return per rupee was worked out to Rs.144609.85, Rs.206912.41, Rs.157833.95 and 2.05, indicated that cultivation of bottle gourd is profitable in study area. The results are in conformity with Mathew *et.al*. (2019), Kumbhar *et al*. (2017) and Patel (2017).

Resource use efficiency in production of bottle gourd

Table 4 showed the relationship between per farm inputs in production of bottle gourd by employing Cobb-Douglas production function. From the table it was observed that the regression coefficient was negative and statistically significant for input human labour (-0.491) on the marginal farm implied that human labour negatively affect the bottle gourd production on these farms. The regression coefficient was positive and significant for the input FYM (0.500) on marginal farm, for input machine labour (0.402) and seeds (0.369) on small farms, for inputs human labour (0.262) and machine labour (0.312) on medium farms and for human labour (0.466), machine labour (0.474) and fertilizers (0.624) on large farms, this implied that these inputs positively affecting on bottle gourd production in Navsari district. The sum of elasticity coefficient was more than one in case of small, medium and large farm size indicated the increasing return to scale. The positive and statistically significant relationship between per farm inputs in production of bottle gourd indicated that an increase in the application of these inputs would lead to increase in the output of bottle gourd. The marginal farm reported the sum of elasticity coefficient less than one implied the decreasing return to scale in bottle gourd production. On an average the coefficient of determination (R^2) was estimated to be 0.86 this indicated that, 86.00 per cent of variation in the bottle gourd production explained by identified input variable included in the function. Similar results were reported by Lokapur *et al*. (2014) and Khatri *et. al.* (2011).

Table 5 showed the resource use efficiency which was studied with the help of MVP to factor price ratio (Px) to see whether the input resources employed in the production of bottle gourd have used efficiently or otherwise. From the table depicted that all the factors of production in bottle gourd cultivation having the value of MVP to factor price ratio more than one on all the selected farm size and overall level indicated that these resources were underutilized in study area. More and less similar result was obtained by Mathew *et. al*. (2019), Patel (2017), Kshrisagar *et al*. (2016) and Godambe *et al*. (2015).

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Table 4: Relationship between per farm input in production of bottle gourd

SN	Particulars	Size of farm				
		Marginal (< 1ha)	Small(1-2 ha)	Medium (2-4 ha)	Large (> 4 ha)	Overall
1	Human labour(Rs. /ha) X 1	-0.491* (0.242)	0.132 (0.112)	0.262* (0.133)	0.466* (0.192)	0.048 (0.079)
2	Machine labour(Rs./ha) X 2	0.053 (0.132)	0.402* (0.134)	0.312** (0.077)	0.474** (0.126)	0.224** (0.063)
3	Fertilizer (Rs./ha) X 3	0.336 (0.254)	0.195 (0.166)	0.135 (0.100)	0.624* (0.212)	0.219* (0.086)
4	Irrigation (Rs./ha) X 4	0.046 (0.141)	0.080 (0.139)	0.169 (0.114)	0.106 (0.149)	0.061 (0.071)
5	Seed (Rs./ha) X 5	-0.024 (0.181)	0.369** (0.084)	0.019 (0.113)	0.246 (0.124)	0.301** (0.057)
6	FYM (Rs./ha) X 6	0.500** (0.174)	-0.070 (0.146)	0.025 (0.099)	0.160 (0.190)	0.085 (0.079)
7	Supporting material (Rs./ha) X7	0.351* (0.159)	0.272* (0.133)	0.303* (0.120)	-0.495 (0.371)	0.146 (0.085)
8	Intercept	2.486 (0.615)	0.402 (0.402)	0.634 (0.407)	-0.444 (1.055)	1.404 (0.151)
9	Returns to scale	0.772	1.379	1.225	1.581	1.083
10	R2	0.77	0.85	0.84	0.87	0.86

(Figures in parenthesis indicate Standard Error of regression coefficient)

Note:* and ** denotes of significance at 5 per cent and 1 per cent level, respectively

Table 5: Resource use efficiency in bottle gourd production

Input variable	Size of farm	MVP	Factor price (Px)	MVP/Factor Price Ratio	Level of resources used
Human labour(Rs./ha)X1	Marginal	1.00	1.00	1.00	Optimum utilization
	Small	1.48	1.00	1.48	Under utilization
	Medium	1.05	1.00	1.05	Under utilization
	Large	1.08	1.00	1.08	Under utilization
	Overall	1.09	1.00	1.09	Under utilization
Machine (Rs./ha)X 2	Marginal	1.23	1.00	1.23	Under utilization
	Small	1.78	1.00	1.78	Under utilization
	Medium	1.25	1.00	1.25	Under utilization
	Large	6.46	1.00	6.46	Under utilization
	Overall	1.32	1.00	1.32	Under utilization
Fertilizer(Rs./ha)X 3	Marginal	1.20	1.00	1.20	Under utilization
	Small	1.80	1.00	1.80	Under utilization
	Medium	1.27	1.00	1.27	Under utilization
	Large	5.23	1.00	5.23	Under utilization
	Overall	1.33	1.00	1.33	Under utilization
Irrigation (Rs./ha)X 4	Marginal	1.23	1.00	1.23	Under utilization
	Small	1.78	1.00	1.78	Under utilization
	Medium	1.26	1.00	1.26	Under utilization
	Large	4.42	1.00	4.42	Under utilization
	Overall	1.32	1.00	1.32	Under utilization
Seed (Rs./ha)X 5	Marginal	1.32	1.00	1.32	Under utilization
	Small	1.96	1.00	1.96	Under utilization
	Medium	1.35	1.00	1.35	Under utilization
	Large	4.32	1.00	4.32	Under utilization
	Overall	1.44	1.00	1.44	Under utilization
FYM (Rs./ha)X 6	Marginal	1.16	1.00	1.16	Under utilization
	Small	1.69	1.00	1.69	Under utilization
	Medium	1.19	1.00	1.19	Under utilization
	Large	4.30	1.00	4.30	Under utilization
	Overall	1.25	1.00	1.25	Under utilization
Supporting material (Rs/ha)X7	Marginal	1.09	1.00	1.09	Under utilization
	Small	1.60	1.00	1.60	Under utilization
	Medium	1.14	1.00	1.14	Under utilization
	Large	3.99	1.00	3.99	Under utilization
	Overall	1.19	1.00	1.19	Under utilization

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