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COST-EFFECTIVE ANALYSIS OF BITTER GOURD (*MOMORDICA CHARANTIA L*) CROP PRODUCTION WITH APPLICATION OF ORGANIC AND CHEMICAL FERTILIZERS

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ABSTRACT

After conducting the field experiments, based on primary data as yield obtained from present research work and with the help of questionnaire through personal interview from farmers, cost benefit analysis on out come in field experiment for Bitter Guard crop was carried out. Five treatments were taken as vermicompost (T_1) @ 2.6 t/ha, NADEP compost (T_2) @ 6.25 t/ha, pit compost (T_3) @ 6.25 t/ha, chemical fertilizers (T_4) @ 100:50:50 Kg of NPK/ha control (T_5) were applied to plot area (1 hector) with recommended dose of fertilizers. The average yield per hectare of Bitter Guard were obtained 8381 kg, 6026 kg, 4450 kg, 7698 kg and 8,361 kg in the treatment T_1, T_2, T_3, T_4 and T_5 respectively. The cost of cultivation per hectare for of Bitter Guard crop have been estimated to be Rs 1,25,709 in treatment T_1, Rs 1,17,165 in treatment T_2, Rs 1,07,972 in treatment T_3, Rs 1,08,886 in treatment T_4 and Rs 1,07,837 in treatment T_5. The profit comes out to be Rs 1,67,626 in treatment T_1, Rs 93,745 in treatment T_2, Rs 47,778 in treatment T_3, Rs 1,60,544 in treatment T_4 and Rs 1,84,798 in the treatment T_5. Gross return Rs was higher than cost of cultivation therefore profit obtained in all the treatments were positive. The input output ratios were about 2.33, 1.80, 1.44, 2.47 and 2.71 in the treatment T_1, T_2, T_3, T_4 and T_5 respectively. Control treatment (T_5) was definitely an encouraging maximum return as compared to remaining fertilizer treatments in three months.

INTRODUCTION

Bitter gourd is popular locally by the name as "Karle" (Marathi). It has been used in various herbal medicine systems of India for quite a long time because of its inherent disease preventing and health promoting compounds like dietary fibre, minerals, vitamins, flavonoids and antioxidants. Bitter Gourd is also used to reduce blood sugar levels in the treatment of diabetics, especially for type-2 diabetes. It is a good source of vitamin B3 (niacin), vitamin B5 (antithetic acid), vitamin B6 along with the minerals such as iron, zinc, potassium, manganese and magnesium.

Cost of production of any crop include all types of cost including fixed cost, variable cost and marketing cost. The production costs of Bitter Gourd were estimated sum of all cost incurred on land preparation, machinery charges, purchase of seedlings, manures, irrigation charges, land revenue cess and taxes, labour charges, depreciation cost of various assets, interest of fixed and working capital.

The studies on economics of production of bitter gourd (*Momordica charantia* L) in Raigad District (M.S.) were conducted by Rathod et. al. (2016) to estimate the pattern of resource use, cost, returns and profitability of bitter gourd cultivation. The studies revealed that, per hectare physical input utilization indicated that, the proportion of family labour days was 53.50% as compared to hired labour days 46.00% with per hectare average of 267.84 labour days. The other inputs required were Rs 5,045.00 for supporting and shading materials, and fertilizers (148.90 kg. N, 116.60 kg. P, 19.88 kg. K, 34.58 q, FYM, 637.07 kg), mulching materials, and netting materials. At the overall level per hectare cost of cultivation of bitter gourd was worked out to Rs. 1,29,582.24. The per hectare gross returns were Rs.172888 and realizing net return of Rs. 41,962.30 with benefit-cost ratio of 1.33.

To determine the economic variation of the different treatments based benefit cost ratio was used. BCR gives the ratio between present value of benefit and present value of cost (Abraham et al, 2017). According to Jain et al., (2007) BCR greater than 1.5 can be considered as acceptable for the field experiment. Organic manures have been helpful and cause positive effect on root growth by improving the root

rhizosphere conditions such as structure, humidity and thus the plant growth is encouraged by increasing the population of microorganisms in soil environment. The high demand of chemical fertilizers can meet need of nutrients for the crop whereas organic fertilizers initially form conductive environment with regard to physical parameters of soil which promotes better root growth and other vegetative growth (Meenakumari and Shekhar, 2012; Shaheen et al. 2007). Vermicompost is a nutrient rich organic amendment which increases yield of various crop. In chemical fertilizer nutrients are available to plants immediately, thus improvement rapidly occurs. The present study was conducted for studying the economic production of Bitter Guard with application of organic and chemical fertilizers in comparison with control.

MATERIALS AND METHOD

Based on primary data as yield obtained from present research work and with the help of questionnaire through personal interview from farmers, cost benefit analysis for Bitter Guard crop was carried out. The field experiment was conducted with five treatments via T_1 (vermicompost prepared from agricultural solid waste and cow dung), T_2 (NADEP compost prepared from agricultural solid waste and cow dung), T_3 (pit compost prepared from municipal solid waste), and T_4 (chemical fertilizer) and T_5 (control). Chemical fertilizer (@ 100:50:50 Kg of NPK/ha) was applied to the plots according to recommended dose of fertilizers. A common dose of organic fertilizer such as NADEP (T_2) and pit (T_3) compost were used at same rate 6.25 t/ha as per usual practice of farmers. Crop spacing 1.5 m x 1m was kept to the Bitter Guard (Krushidarshani, 2014). Drip irrigation system was used in entire study field. All plants were selected at the time of harvesting (After 90th day) from plots for the assessment of yield of Bitter guard (*Momordica Charantia L*). Fertilizer treatments were detailed bellow

Fertilizer treatment details:

- T_1: Vermicompost prepared from agricultural solid waste @ 2.6 t/ha, (Triveni et al., 2015)
- T_2: NADEP compost prepared from agricultural solid waste @ 6.25 t/ha, (Aryal and Tamrakar., 2013).
- T_3: Pit compost prepared from municipal solid waste @ 6.25 t/ha, (Aryal and Tamrakar, 2013).
- T_4: Chemical fertilizer 100:50:50 - N: P_2O_5: K_2O Kg/ ha, (Krushidarshani, 2014).
- T_5: Control

Economic parameters were calculated by using following formulae's - (Nandeshwar et al, 2013, Grema and Gashua, 2014 and Barakade et al, 2011, Mehmmood et al, 2011 and RAWE manual, 2017)

Depreciation value = (Present value assets–Junk value assets)/ Remaining life of assets

Junk value = 10 % from present value of assets

Per hector depreciation cost = Total depreciation/cropped area

Cost of cultivation = Cost A + → subsequent Cost B + → subsequent Cost C

Profit (Rs) = gross return – total cost of cultivation

Rental value of land = 1/6 of gross produce – Land revenue

BC ratio = Gross return/total cost of cultivation

RESULT AND DISCUSSION

As this was organic fertilized based field experiment no any additional measures for plant protections were used in entire the treatments. Number of male and female labours (hired and family labour), machinery charges, cost of seed, irrigation charges, land and expenses on acquisition of inputs and miscellaneous, cost on depreciation and fixed cost in rupees were used same in expanse throughout the experiment.

Table 1: Expenditure items for cultivation of Bitter Guard production

Sr. No.	Items	Expenditure (Rs)
1	Hired male labour	: 300 for 8 hours per day
2	Hired female labour	: 150 for 8 hours per day
3	Sowing through Bullock pair	: Rs. 4500/- per hector
4	Machinery charges (ploughing, clod crushing, harrowing and levelling)	: Rs. 10000/- per hector
5	Vermicompost	: Rs. 6/- per kg
6	NADEP compost	: Rs. 3/- per kg
7	Pit compost	: Rs. 3/- per kg
8	Urea	: Rs. 5.96/- per kg
9	Single super phosphate (SSP)	: Rs. 7.6/- per kg
10	Murate of potash (MOP)	: Rs. 11.3/- per kg
11	Drip irrigation set	: Rs. 1,00,000/- per hector
12	Electric motor (3 HP)	: Rs. 10,000/-
13	Electrical charges	: Rs. 1500 for three months (For 3 HP E. Motor)
14	Insecticides/Fungicides	: Not used
15	Repairs to implements and machinery	: Not repaired
16	Land revenue cess and taxes	: Rs. 110/- per hector for irrigated land.
17	Travelling cost for organic fertilizers	: Rs. 500/- per tonne
18	Farm house/farm building	: Rs. 1,00,000/-
19	Sprayer (for one NAG)	: Rs. 1,500/-

20	Weeding hook for (one NAG)	: Rs. 140/-
21	Sickle (for one NAG)	: Rs. 140/-
22	Spade (for one NAG)	: Rs. 250/-
23	Kudali (for one NAG)	: Rs. 300/-
24	Pickaxe (for one NAG)	: Rs. 500/-
25	Axe (for one NAG)	: Rs. 300/-
26	Ghameli (For one NAG)	: Rs. 220/-
27	Iron bar (For one NAG)	: Rs. 500/-
28	Junk value	: 10% from present value of assets
29	Interest on working capitals	: 6% for seasonal crop
30	Interest on fixed capitals	: 10% per year

The economic analysis given in Table 2 shows the effects of different fertilizers treatments on Bitter gourd production.

Economics of Bitter guard cultivation

Experimental study area is one hector with five treatments where T_5 was kept as control and four others treatment were T_1-Vermicompost @ 2.6 t/ha, (Triveni et al., 2015), T_2-NADEP compost @ 6.25 t/ha, (Aryal and Tamrakar, 2013), T_3-pit compost @ 6.25 t/ha, (Aryal and Tamrakar, 2013) and T_4-chemical fertilizer (100:50:50 - N: P_2O_5: K_2O kg/ha), Krushidarshani, 2014). Bitter guard plants were harvested after 90th day. The required cost of assets and materials details related to cultivation of Bitter guard plant were presented in Table 1.

Working capital also named as variable cost include cost of various assets including hired male labour (No. 5 = Rs. 1500), hired female labour (No. 40 = Rs. 6,000), machinery charges Rs 10,000, seed (250 kg/ha = Rs 3,250), irrigation charges Rs 1500 for 3 months, land revenue cess and taxes Rs 110/year for irrigated, land and expenses on acquisition of inputs. Total Rs. 2,13,000 was expenses for working capital for cultivation of Bitter guard. Fix capitals include cost of various assets including farm house (No. 1 = Rs. 1,00,000), drip unit (No. 1 = Rs. 1,00,000), electric motor 3HP (No. 1 = Rs. 10,000), weeding hook (No. 6 = Rs. 840), sickle (No. 1 = 140), spade (No. 1 = Rs. 250), kudali (No. 1 = Rs. 300), pickaxe (No. 01 = 500), axe (No. 1 = 300), ghameli (No. 01 = Rs. 220) and iron bar (No. 1 = 450). Total depreciation value Rs. 11816 was spending for cultivation of Bitter guard crop. Total Rs. 2,13,000 was capitalised for investment for cultivation of Bitter guard.

The Economics of production of Bitter Guard crop were estimated and shown in Table 2. The average yield per hectare of Bitter Guard were obtained 8,381 kg, 6,026 kg, 4,450 kg, 7,698 kg and 8,361 kg in the treatment T_1, T_2, T_3, T_4 and T_5 respectively. Average market price Rs 35/kg was taken for calculation of Economics to the all fertilizer treatments. Bitter Guard had earned per hectare gross returns of Rs 2,93,335 in treatment T_1, Rs 2,10,910 in treatment T_2, Rs 1,55,750 in treatment T_3, Rs 2,69,430 in treatment T_4 and Rs in Rs 2,92,635 in treatment T_5. The cost of cultivation per hectare for of Bitter Guard crop have been estimated to Rs 1,25,709 in treatment T_1, Rs 1,17,165 in treatment T_2, Rs 1,07,972 in treatment T_3, Rs 1,08,886 in treatment T_4 and Rs 1,07,837 in treatment T_5. The profit comes out to be Rs 1,67,626 in treatment T_1, Rs 93,745 in treatment T_2, Rs 47,778 in treatment T_3, Rs 1,60,544 in treatment T_4 and Rs 1,84,798 in the treatment T_5. Gross return Rs was higher than cost of cultivation therefore profit obtained in all the treatments were positive. The input output ratios were about 2.33, 1.80, 1.44, 2.47 and 2.71 in the treatment T_1, T_2, T_3, T_4 and T_5 respectively.

Table 2.
Economics analysis of Bitter guard production after 90th day

Sr. No	Treatments ?	T_1	T_2	T_3	T_4	T_5
	Economics Particulars ?	**Expenditure (Rs)**				
1	Hired human labours (Male)	1,500	1,500	1,500	1,500	1,500
	Hired human labours (Female)	6,000	6,000	6,000	6,000	6,000
2	Bullock labour	0	0	0	0	0
3	Machinery charges	10,000	10,000	10,000	10,000	10,000
4	Seed (125gm)	3,250	3,250	3,250	3,250	3,250
5	Fertilizers	15,600	18,750	18,750	4,639	0
6	Irrigation Charges	1,500	1,500	1,500	1,500	1,500
7	Plant protection	0	0	0	0	0
8	Repairs to implement and machinery	0	0	0	0	0
9	Land revenue cess and taxes	110	110	110	110	110
10	Expenses on acquisition of inputs and miscellaneous	1,250	3,000	3,000	100	100
	Working capital (1 to 10)	39,210	44,110	44,110	27,099	22,460

11	Depreciation on farm implements, machinery and buildings	11,816	11,816	11,816	11,816	11,816
12	Interest on working capital	2,353	2,647	2,647	1,626	1,348
	Cost A (Working capital + 11 + 12)	53,379	58,573	58,573	40,541	35,624
13	Rental value of land	48,780	35,042	25,849	44,795	48,663
14	Interest on fixed capital (Fixed cost Rs. 213000/-)	21,300	21,300	21,300	21,300	21,300
	Cost B (Cost A+13+14)	1,23,459	1,14,915	1,05,722	1,06,636	1,05,587
15	Family labours (Male/Female)	2,250	2,250	2,250	2,250	2,250
	Cost C (Cost B + 15)	1,25,709	1,17,165	1,07,972	1,08,886	1,07,837
16	Yield kg per ha.	8381	6026	4450	7698	8361
17	Selling price (Rs per kg)	35	35	35	35	35
18	Gross return	2,93,335	2,10,910	1,55,750	2,69,430	2,92,635
19	Profit	1,67,626	93,745	47,778	1,60,544	1,84,798
20	BC ratio	2.33	1.80	1.44	2.47	2.71

T_1 indicates vermicompost, T_2 indicates NADEP compost, T_3 indicates pit compost, T_4 indicates chemical fertilizers, and T_5 indicates control. Fraction rounded off to complete figures.

CONCLUSION

Under present investigation, control treatment (T_5) for cultivation of Bitter guard crop was found most economically beneficial, followed by treatments T_4, T_1, T_2, and T_3 respectively. Control treatment (T_5) was definitely an encouraging with maximum returns in terms of cost benefit ratio as compared to remaining fertilizer treatments from three months, but has less yield.

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