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Economic Analysis of Cost of Cultivation and Benefit Cost Ratio of Cauliflower in Response to Solid and Liquid Organic Mannure

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Abstract**—** *This study evaluates the economic impact of using solid and liquid organic manures on the cultivation of cauliflower, focusing on the cost of cultivation and the benefit-cost (B:C) ratio. The experiment was conducted at technology park CTAE, MPUAT, Udaipur during Rabi season 2021-22 under controlled conditions, where different treatments involving sole and combined application of organic manures (FYM and vermicompost) and four levels of panchagavya were evaluated on cauliflower crop with three replications under factorial RBD design. The analysis involved calculating the total cost of cultivation, including inputs, labour, and other variable costs, and comparing these costs with the net returns obtained from the crop yield. The B ratio was then determined to assess the profitability of each treatment. Result showed that among organic manures application of OM_3 treatment (50% RDN through FYM and 50% RDN through vermicompost) as soil application was found recorded maximum net return of Rs. 174791.08. Among different levels of panchagavya, application at 5% concentration as foliar spray gave maximum net return of Rs. 164587.74. The interactive effect of organic manures and panchagavya on net return showed that the combined application of OM3 + PG2 (50 per cent FYM + 50 per cent RDN through Vermicompost + 5 per cent Panchagavya) gave maximum net return of Rs. 206075.16 from cauliflower crop and The combined effect of organic manures and panchagavya on B:C ratio showed that the combined application of OM0 + PG2 (control + 5 per cent Panchagavya) gave maximum B:C ratio of 2.90.*

Keywords**— Cauliflower, Vermicompost, FYM, Panchagavya, Benefit to cost ratio.**

I. INTRODUCTION

Cauliflower (*Brassica oleracea var. botrytis*) is a widely cultivated vegetable crop known for its high nutritional value and strong market demand. The profitability of cauliflower farming is significantly influenced by the costs associated with cultivation and the economic returns obtained. In recent years, there has been an increasing shift towards organic farming practices, driven by the need for sustainable agriculture and the growing consumer demand for organic produce. Organic farming primarily relies on natural inputs, such as solid and liquid organic manures, which are believed to enhance soil health, improve crop productivity, and support long-term sustainability (Patil *et a*l., 2019).

Conducting an economic analysis of agricultural practices, particularly by evaluating the cost of cultivation and the Benefit-Cost (B:C) ratio, is crucial for understanding their financial viability. The B:C ratio, which compares the benefits (returns) to the costs of cultivation, serves as a key indicator of economic efficiency. A higher B ratio signifies a more profitable and economically efficient farming practice (Kumar *et al*., 2020).

Solid and liquid organic manures, including traditional preparations like panchagavya, are known to positively impact crop growth and yield by improving soil structure, enhancing nutrient availability, and promoting beneficial microbial activity (Ramesh *et al*., 2021). However, the economic implications of using these organic inputs, particularly regarding cost savings, net returns, and overall profitability, require thorough investigation.

Vermicomposting is a technology for decomposing various kinds of organic waste (both domestic or industrial) into useful material. Vermicomposting is mostly done with the earthworm Eisenia fetida. Vermicomposting can provide easily available nutrients, growth-promoting compounds and a variety of helpful microorganisms such as nitrogen-fixing, phosphorus solubilizing and cellulose decomposing organisms (Suthar 2012).

This study aims to perform an in-depth economic analysis of cauliflower cultivation using various organic manure treatments. By examining the cost of cultivation, net returns, and B:C ratio under different conditions involving solid and liquid organic manures, this research seeks to provide valuable insights into the economic feasibility of organic farming practices. The results will contribute to the understanding of sustainable agriculture and support farmers in making informed decisions about adopting organic farming methods.

II. MATERIAL AND METHOD

The field experiment was conducted at the Technology Park, CTAE, MPUAT, Udaipur, Rajasthan, during the Rabi season of 2021-22. The cauliflower variety 'Pusa Snowball K-1' was sown in a nursery in October. Four-week-old seedlings were transplanted at a spacing of 45 × 30 cm. Full doses of FYM, vermicompost, and their combination were applied before transplanting, according to the treatment plan. Sixteen treatments were evaluated using a Factorial RBD design with three replications.

The details of used two treatment factor respectively organic manures and panchagavya are given under:

Factor A

Organic Manures

OM0: Control

OM_1: 100 % RDN through FYM

OM_2: 100 % RDN through Vermicompost

OM_3: 50 % RDN through FYM + 50% RDN through Vermicompost

Factor B

Panchagavya

PG_0: 0 % (water spray) at 30 and 45 DAT

PG_1: 3% Panchagavya spray at 30 and 45 DAT

PG_2: 5 % Panchagavya spray at 30 and 45 DAT

PG_3: 10 % Panchagavya spray at 30 and 45 DAT

Statistical analysis of data

Factorial Randomized Block Design (RBD) was used to analyse the individual data of the numerous characters evaluated in the experiment, as suggested by Panse and Sukhatme (1985).

III. RESULT AND DISCUSSION

Effect of organic manure

Economic appraisal is the ultimate basis for evaluating the results of any study. In present study the maximum net return of Rs. 174791.08 was found with the application of with OM3 (50 per cent FYM + 50 per cent RDN through Vermicompost). This might be due to the fact that under these treatments the cost of treatments was low as compared to output added, therefore, higher curd yields resulted in higher net returns. However, the minimum net return of Rs. 92897.77 and B:C (0.73) was found with OM1 i.e. 100 per cent RDN through FYM which was significantly lower than the net return (Rs. 150978.36) and B:C (2.74) under control (no organic manure). This might be due to the fact that under control treatments the cost of treatments was nil due to no use of organic manures therefore, the output (yield) increased the B:C ratio. The above findings are also in conformity with the findings of Yadav and Luthra, (2005) in vegetable pea, Kalalbandi *et al.* (2007) in cabbage and Sharma and Bhalla (1995) and Bairwa *et al.* (2009) in Okra.

Effect of panchagavya (PG)

In present study the maximum net return of Rs. 164587.74 was found with PG3 (10 per cent Panchagavya). The increased net return could be explained on the basis of increased curd yield under the 10 per cent panchagavya which was higher than rest of the treatments. The lower net return was obtained under water spray (Rs. 107639.90). Similar finding was recorded through use of organic manures by Bhandari *et al*. (2019) on okra crop.

Interaction effect of organic manures and panchagavya (OMxPG)

The data related to interactive effect of organic manures and panchagavya on net return showed that the combined application of OM3 + PG2 (50 per cent FYM + 50 per cent RDN through Vermicompost + 5 per cent Panchagavya) gave maximum net return of Rs. 206075.16 from cauliflower crop. The next best treatment (100 per cent RDN through vermicompost + 10 per cent Panchagavya)

generated a net return of Rs. 190784.64. The minimum net return of Rs.58993.01 was recorded with OM1 + PG0 (100 per cent RDN through FYM + water spray). The data related to combined effect of organic manures and panchagavya on B:C ratio showed that the combined application of OM0 + PG2 (control + 5 per cent Panchagavya) gave maximum B:C ratio of 2.90. The next best treatment (control + 10 per cent Panchagavya) generated a B:C ratio of 2.78. The minimum B:C ratio of 0.47 was recorded with OM1PG0 (100 per cent RDN through FYM + water spray). Similar results are found by Mandloi *et al*. (2008), Chattoo *et al.* (2010) in onion and Negi *et al*. (2017) in broccoli.

Table 1 Effect of organic manures and panchagavya on net return and B:C ratio of cauliflower

Treatments	**Net return (Rs.)**	**B:C ratio**
A. Organic manure		
OM_0	150978.36	2.7
OM_1	92897.77	0.7
OM_2	143801.23	1.2
OM_3	174791.08	1.4
B. *Panchagavya*		
PG_0	107639.90	1.2
PG_1	128191.81	1.4
PG_2	162048.98	1.7
PG_3	164587.74	1.7
Interaction	**Net return (Rs.)**	**B:C ratio**
OM_0PG_0	136203.69	2.58
OM_0PG_1	147206.05	2.71
OM_0PG_2	160102.60	2.90
OM_0PG_3	160401.09	2.78
OM_1PG_0	58993.01	0.47
OM_1PG_1	88696.11	0.70
OM_1PG_2	106797.02	0.84
OM_1PG_3	117104.95	0.90
OM_2PG_0	103159.31	0.91
OM_2PG_1	106039.81	0.93
OM_2PG_2	175221.15	1.52
OM_2PG_3	190784.64	1.62
OM_3PG_0	132203.59	1.11
OM_3PG_1	170825.29	1.42
OM_3PG_2	206075.16	1.70
OM_3PG_3	190060.29	1.54

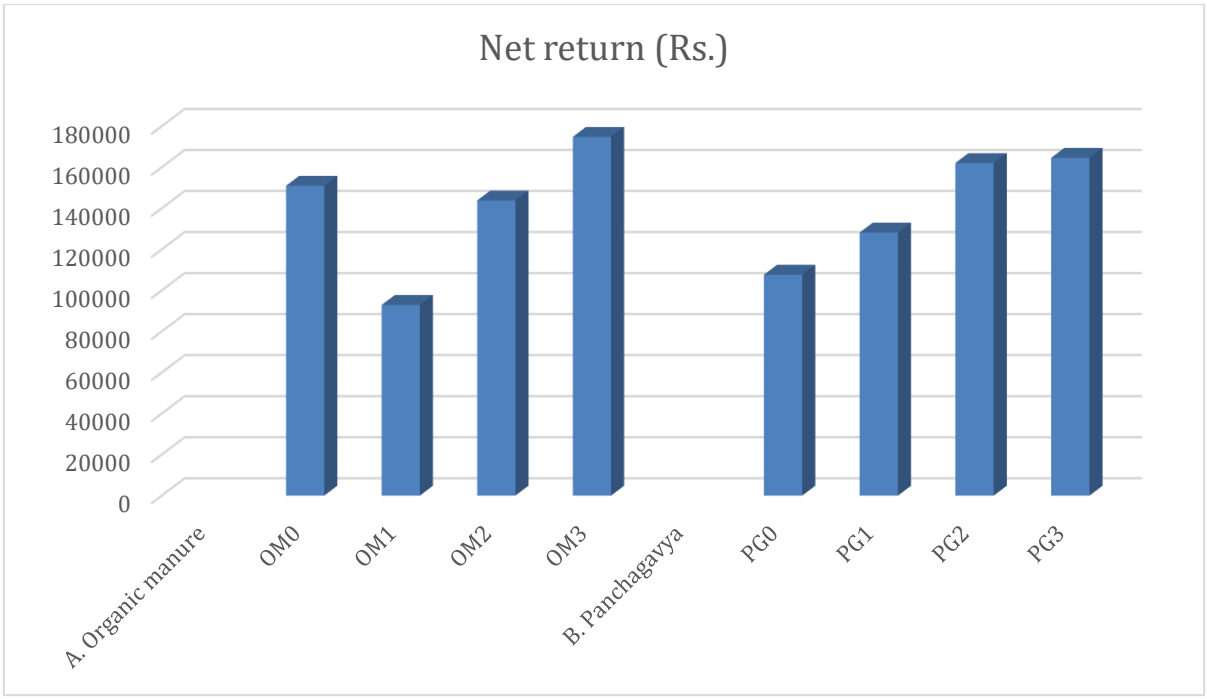

Fig. 1: Effect of organic manures and panchagavya on net returns (ha^{-1}) of cauliflower

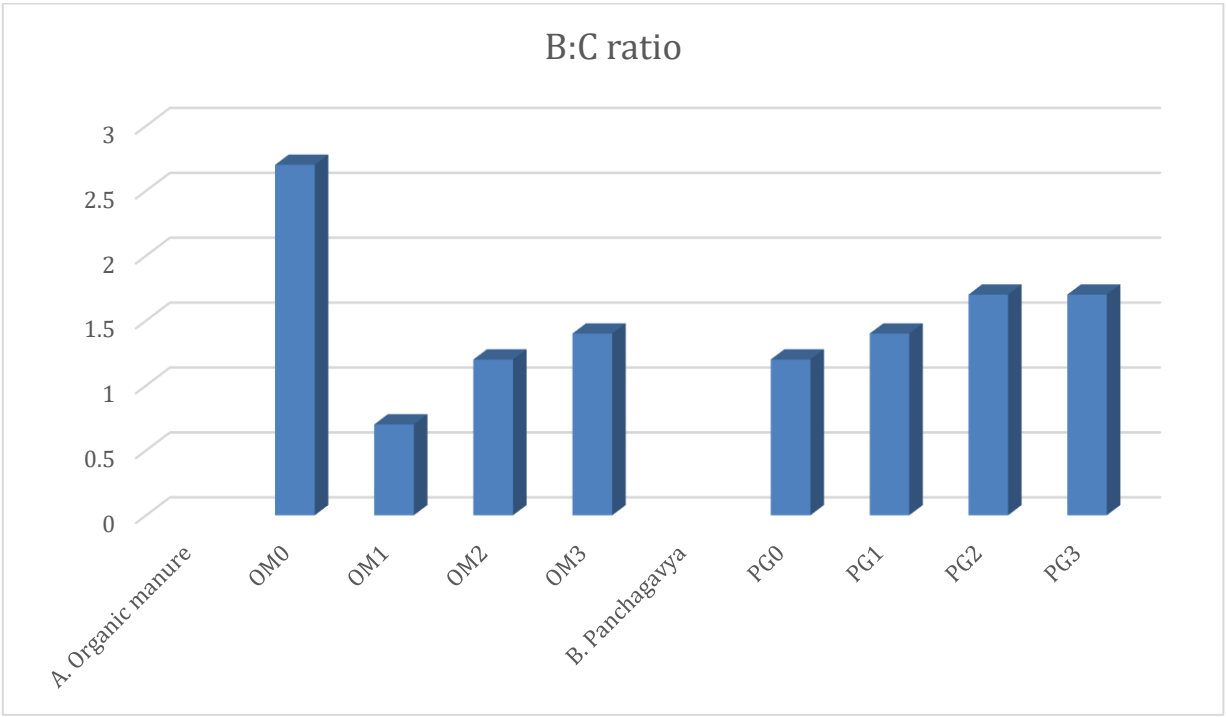

Fig. 2: Effect of organic manures and panchagavya on B:C ratio of cauliflower

General cost of cultivation (Rs/hectare) (Excluding the cost of treatment inputs).

S.No.	Particulars	Units	Cost per unit (Rs.)	Amount (Rs.)
A.	**VARIABLES**			
a)	Labour cost			
I.	**Nursery**			

i.	Nursery preparation and sowing	3 mandays	@ 300	900.00
ii.	Nursery management (2 hours for 30 days)	10 mandays	@ 300	3000.00
II.	**Main field**			
i.	Layout (bed preparation)	16 man days	@ 300	4800.00
ii.	Transplanting	10 man days	@ 300	3000.00
iii	Irrigation	10 man days	@ 300	3000.00
iv.	Manuring and fertilization	5 man days	@ 300	1500.00
v.	Intercultural operations (Hoeing, weeding, earthing up and)	35 man days	@ 300	10500.00
vi.	Spraying	8 man days	@ 300	2400.00
vii.	Picking and harvesting (2 hours for 90 days)	15 man days	@ 300	4500.00
	Total	112 man days	@ 300	**33600.00**
B.	**FIXED COST**			
i.	Land rent and interest on invested money and	15000 + 3000.00	For one crop	18000.00
C.	**MATERIALS INPUT**			
i.	Seeds	400	Rs. 3 per g	1200.00
ii				
	Total cost = (A + B + C)			**54540**

Treatment cost per hectare area of cauliflower

S.No.	Treatment	Treatment Cost (` ha)	Common Cost (` per ha)	Total Cost (` per ha)	Yield (kg/ha)	Gross Return (` per ha)	Net Return (` per ha)	B:C Ratio
1.	OM_0PG_0	0	52800	**52800**	17600.00	**176000**	**123200**	3.333333
2.	OM_0PG_1	1500	52800	**54300**	18600.00	**186000**	**131700**	3.425414
3.	OM_0PG_2	2500	52800	**55300**	19266.67	**192666.7**	**137367**	3.484027
4.	OM_0PG_3	5000	52800	**57800**	20933.33	**209333.3**	**151533**	3.621684
5.	OM_1PG_0	72000	52800	**124800**	41600.00	**416000**	**291200**	3.333333
6.	OM_1PG_1	73500	52800	**126300**	42600.00	**426000**	**299700**	3.372922
7.	OM_1PG_2	74500	52800	**127300**	43266.67	**432666.7**	**305367**	3.398795
8.	OM_1PG_3	77000	52800	**129800**	44933.33	**449333.3**	**319533**	3.461736
9.	OM_2PG_0	60000	52800	**112800**	37600.00	**376000**	**263200**	3.333333
10.	OM_2PG_1	61500	52800	**114300**	38600.00	**386000**	**271700**	3.377078
11.	OM_2PG_2	62500	52800	**115300**	39266.67	**392666.7**	**277367**	3.405609
12.	OM_2PG_3	65000	52800	**117800**	40933.33	**409333.3**	**291533**	3.474816
13.	OM_3PG_0	66000	52800	**118800**	39600.00	**396000**	**277200**	3.333333
14.	OM_3PG_1	67500	52800	**120300**	40600.00	**406000**	**285700**	3.374896
15	OM_3PG_2	68500	52800	**121300**	41266.67	**412666.7**	**291367**	3.402034
16	OM_3PG_3	71000	52800	**123800**	42933.33	**429333.3**	**305533**	3.467959

*Retail sale price of cauliflower @ Rs. 10 per kg

Treatment cost

S. No.	Treatment	Treatment details	Total quantity of input	Rate/kg	Amount (Rs.)
i.	OM_0	Control	0	0 Rs.	0
ii.	OM_1	100% RDN through FYM	24000 kg	3 Rs.	72000
iii.	OM_2	100% RDN through vermicompost	10000 kg	6 Rs.	60000
iv.	OM_3	50% RDN through FYM + 50% RDN through vermicompost	12000 + 5000 kg	3 Rs.+ 6 Rs.	66000
v.	PG_0	Control	0	0 Rs.	0
vi	PG_1	3% *Panchagavya*	15 lit.	100 Rs.	1500
vii	PG_2	5% *Panchagavya*	25 lit.	100 Rs.	2500
Viii	PG_3	10% *Panchagavya*	50 lit.	100 Rs.	5000

IV. CONCLUSION

Conclud that The treatment OM3 (50 per cent RDN through FYM + 50 per cent RDN through Vermicompost) and PG2 (5 per cent Panchagavya) spray at 30 and 45 DAT may be recommended for cauliflower crop to obtain maximum net return of Rs. 174791.08. Among different levels of panchagavya, application at 5% concentration as foliar spray gave maximum net return of Rs. 164587.74. The combined application of OM3 + PG2 (50 per cent FYM + 50 per cent RDN through Vermicompost + 5 per cent Panchagavya) gave maximum net return of Rs. 206075.16 from cauliflower crop and The combined effect of organic manures and panchagavya on B:C ratio showed that the combined application of OM0 + PG2 (control + 5 per cent Panchagavya) gave maximum B:C ratio of 2.90.

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