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An economical analysis of the effectiveness of vermiwash, vermicompost and NPK on growth and yield of OKRA (*Abelmoschus esculentus* L.) cv. VRO 6

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Abstract
The study was carried out to evaluate the economical effectiveness of vermiwash, vermicompost and NPK combinations on the growth, flowering and productivity of okra (Abelmoschus esculantus). The experiment was conducted with 13 treatment combinations of NPK, Vermicompost and Foliar spraying of Vermiwash in Randomized Complete Block Design with three replications. Seeds of Okra, cv. VRO.-6 were sown on plot size of 3.6m X 3.0 m. The row to row and plant to plant spacing was maintained at 60 cm and 30 cm, respectively hence each plot accommodated 60 plants. The observations were recorded treatment wise by selecting 5 random plants. The growth, yield and economics of the treatment were worked out. Vermiwash was extracted from different vermicompost which was composted from different animal agro and kitchen wastes through earthworm Eisenia foetida. It was observed that the maximum net return of Rs 38484/ha was observed in treatment T11 (Rec. NPK + Vermiwash (as soil treatment) + Vermiwash 3 sprays at 1 week interval after 30 DAS) with the maximum cost benefit ratio of 2.01. Whereas the lowest fruit yield and net return 53.55 q and Rs 25624/ha was obtained with T 6 (V C@ 5t/ha+ V W 1 spray). Application of recommended dose of NPK + Vermiwash as soil treatment with 3 foliar sprays of Vermiwash at 1week interval after 30 DAS fetched maximum net return and C:B ratio as comparison to other treatments.

Keywords: Okra, Vermiwash, Vermicompost, NPK, C: B Ratio

Introduction
Okra or Ladies finger, which is also known as 'Bhindi', is one of the important vegetable crops in India. It is grown throughout the tropical and sub -tropical regions and also in the warmer parts of the temperate regions. [1, 2] Okra has a good potential as a foreign exchanger crop and accounts for 60% of the export of fresh vegetables. The major okra producing states in India are U.P., Bihar, Orissa, West Bengal and Andhra Pradesh [5]. Vermiwash is an indispensable part of vermicompost, which is a watery extract of earthworms. It is basically a combination of secretion and wash of earthworms, present in the medium, honey brown in colour. It is a nutrient rich liquid produced by earthworms, feeding on organic waste material and plants residues. [3, 4, 6]. It is also nontoxic and eco -friendly, which arrests bacterial growth and forms as a protective layer for their survival and growth. Vermiwash contains NPK, Ca and hormones such as Auxins, Cytokinins, some other secretions and many useful microbes like heterotrophic bacteria, fungi etc. The quality of Vermiwash produced by earthworms depends on the vermicompost that is used. Vermiwash is a mixed culture containing soil bacteria mixed and an effective strain of earthworms. Earthworm has efficiency to consume all type of organic rich waste material including vegetable waste, industrial waste and other organic waste [7]. Vermicomposting refers to the production of plant nutrient excreta of worms. Cost Benefit analysis evaluates and compares all of costs and benefits of the environmental, social and economic positive and negative impacts of the adaptation approaches which are expressed in monetary term based on its general information. Crop production costs include operating cost, fixed cost and consumption of water and benefits are sales revenue and water and labor saving using the irrigation systems. In view of the above facts, our objective is to quantify the economics of different treatments in the present study of okra.

Material and Methods

The experiment was carried out during Kharif season 2011-12 and the experimental detail of treatments comprised of 13 treatments is presented in Table 1.

Table 1: Detail of treatments and check used in the study

S No.	Treatment symbol	Detail of treatments
1	T1	Rec. NPK+ Vermiwash 1 spray at 1 week interval after 30 DAS
2	T2	Rec. NPK+ Vermiwash 2 spray at 1 week interval after 30 DAS
3	T3	Rec. NPK+ Vermiwash 3 sprays at 1 week interval after 30 DAS.
4	T4	Rec. NPK+ Vermiwash 4 sprays at 1 week interval after 30 DAS.
5	T5	Rec. NPK+ Vermiwash 5 sprays at 1 week interval after 30 DAS.
6	T6	Vermicompost@5t/ha + Vermiwash 1 spray at1 week interval after 30 DAS
7	T7	Vermicompost@5t/ha + Vermiwash 2 spray at1 week interval after 30 DAS
8	T8	Vermicompost@5t/ha + Vermiwash 3 sprays at 1 week interval after 30 DAS.
9	T9	Vermicompost@5t/ha + Vermiwash 4 spray at 1 week interval after 30 DAS.
10	T10	Vermicompost@5t/ha + Vermiwash 5 sprays at 1 week interval after 30 DAS.
11	T11	Rec. NPK+ Vermiwash (Soil treatment) + 3 foliar sprays at 1 week interval after 30 DAS
12	T12	Vermicompost @5t/ha + Vermiwash (Soil treatment) + Vermiwash 3 foliar sprays
13	T13	Recommended NPK (150:80:100)

Statistical Methodology

The data obtained in respect of all the characters has been subjected to the following statistical analyses:

Mean

It was calculated by using following formula.

$$\text{Mean} = \frac{\Sigma X}{N}$$

where;

ΣX = Sum of all the observations.

N = Number of observations.

Economics of different treatments

Economics of each treatment was computed on the basis of existing market price of all inputs used and the value of produce realized. Benefit: cost ratio of each treatment was determined by using the following formula.

Benefit: cost ratio = Gross value of the produce (Rs/ha.)

Results and Discussion

The present study has been carried out with the objectives to quantify the economics of different treatments and to find out the optimum nutrient treatment combination for better growth and yield of okra. Higher money value and less cost of cultivation are desirable for getting higher returns. Hence, economics of the treatments were worked out. The data pertaining to economics of different treatments are depicted in Table 2. The data clearly indicated that the treatment number T5 (Rec. NPK+ V W 5 sprays) gave the maximum fruit yield 80.47q/ha followed by treatment T4, 78.81q/ha, treatment T11, 76.31q/ha, treatment T3 74.18q/ha, treatment T2 72.79q/ha, treatment T1 69.65q/ha, treatment T13 69.09q/ha, treatment T10 66.41q/ha, treatment T9 62.25q/ha, treatment T8 56.33q/ha, treatment T7 55.68q/ha while minimum fruit yield was observed in treatment T 53.55q/ha.[8],[9],[10]. Treatment number T5 gave the maximum gross income 80470 Rs/ha followed by treatment T4, 78810 Rs/ha, treatment T11 76310 Rs/ha, treatment T3 74180 Rs/ha, treatment T2 72790 Rs/ha, treatment T1 69650 Rs/ha, treatment T13 69090 Rs/ha, treatment T10 6641 Rs/ha, treatment T9 62250 Rs/ha, treatment T8 56330 Rs/ha, treatment T7 55680 Rs/ha where as minimum gross income was obtained by treatment T 53550 Rs/ha. [8, 11, 12]. Maximum expenditure observed in treatment T7 64152 Rs/ha followed by treatment T2 54400 Rs/ha, treatment T4 54176 Rs/ha, treatment T1 51100 Rs/ha, T12 treatment 47800 Rs/ha, treatment T9 44500 Rs/ha, treatment T5 44426 Rs/ha, treatment T10 41200 Rs/ha, treatment T3 41126 Rs/ha, treatment T11 37826 Rs/ha, treatment T13 34526 Rs/ha, treatment T8 31226 Rs/ha while minimum expenditure observed in treatment T6 27926 Rs/ha. [4, 13, 14]. Maximum Net income obtained by treatment T11 38484 Rs/ha, followed by treatment T5 36044 Rs/ha, treatment T13 34564 Rs/ha, treatment T3 33054 Rs/ha, treatment T6 25624 Rs/ha, treatment T10 25210 Rs/ha, treatment T8 25104 Rs/ha treatment, T4 24634 Rs/ha, treatment T1 18550 Rs/ha, treatment T2 18390 Rs/ha, treatment T9 18210 Rs/ha, treatment T12 14450 Rs/ha while lowest net income obtained by treatment T7 -8472 Rs/ha. C: B ratio observed maximum for the treatment T11 2.01, followed by treatment T13 2, treatment T6 1.91, treatment T5 1.81, treatment T3 1.8, treatment T8 1.8, treatment T10, treatment 1.61, treatment T4 1.45, treatment T9 1.4, treatment T1 1.36, treatment T2 1.33, treatment T12 1.3 whereas minimum C: B ratio observed for the treatment T7 0.86. [10, 15, 16].

Table 2: Economics of different treatments for okra

Treatment symbol	Treatments	Fruit Yield (q/ha)	Gross Income (Rs/ha)	Expenditure (Rs/ha)	Net Income (Rs/ha)	C:B ratio
T1	Rec. NPK+ V W 1 spray	69.65	69650	51100	18550	1.36
T2	Rec. NPK+ V W 2 sprays	72.79	72790	54400	18390	1.33
T3	Rec. NPK+ V W 3 sprays	74.18	74180	41126	33054	1.8
T4	Rec. NPK+ V W 4 sprays	78.81	78810	54176	24634	1.45
T5	Rec. NPK+ V W 5 sprays	80.47	80470	44426	36044	1.81
T6	VC@5t/ha + V W 1 spray	53.55	53550	27926	25624	1.91
T7	VC@5t/ha + V W 2 spray	55.68	55680	64152	-8472	0.86
T8	VC@5t/ha + V W 3 spray	56.33	56330	31226	25104	1.8
T9	VC@5t/ha + V W 4 spray	62.71	62710	44500	18210	1.4

T10	VC@5t/ha + V W 5 sprays	66.41	66410	41200	25210	1.61
T11	Rec. NPK+ V W (Soil treatment) + 3 foliar sprays	76.31	76310	37826	38484	2.01
T12	VC@5t/ha + V W (Soil treatment) + V W 3 foliar sprays	62.25	62250	47800	14450	1.3
T13.	Rec.NPK (150:80:100)	69.09	69090	34526	34564	2

Table 3: Cost of common expenditure for all treatments on per hectare area basis for okra

S. No.	Particulars	Rs/ha
1.	Land preparation	3000.00
2.	Cost of seed and sowing	2800.00
3.	Crop maintenance hoeing and weeding	10000.00
4.	Cost of irrigation	600.00
5.	Plant protection	1000.00
6.	Harvesting, transporting, marketing	5000.00
7.	Miscellaneous	500.00
	Total	22900.00

Table 4: Cost of variable expenditure as per treatments on per hectare area basis for okra

Treatment symbol	Treatments	Rs/ha
T1	Rec. NPK+ V W 1 spray	8326
T2	Rec. NPK+ V W 2 sprays	11626
T3	Rec. NPK+ V W 3 sprays	14926
T4	Rec. NPK+ V W 4 sprays	18226
T5	Rec. NPK+ V W 5 sprays	21526
T6	VC@5t/ha + V W 1 spray	18300
T7	VC@5t/ha + V W 2 spray	21600
T8	VC@5t/ha + V W 3 spray	24900
T9	VC@5t/ha + V W 4 spray	28200
T10	VC@5t/ha + V W 5 sprays	31500
T11	Rec. NPK+ V W (Soil treatment) + 3 foliar sprays	31276
T12	VC@5t/ha + V W (Soil treatment) + V W 3 foliar spra	41252
T13.	Rec NPK (150:80:100)	5026

Table 5: Cost of cultivation as per treatments on per hectare area basis for okra

Treatment symbol	Treatments	Expenditure (Rs/ha)		Total Rs/ha
		common	variable	
T1	Rec. NPK+ V W 1 spray	22900.00	8326	31226
T2	Rec. NPK+ V W 2 sprays	22900.00	11626	34526
T3	Rec. NPK+ V W 3 sprays	22900.00	14926	37826
T4	Rec. NPK+ V W 4 sprays	22900.00	18226	41126
T5	Rec. NPK+ V W 5 sprays	22900.00	21526	44426
T6	VC@5t/ha + V W 1 spray	22900.00	18300	41200
T7	VC@5t/ha + V W 2 spray	22900.00	21600	44500
T8	VC@5t/ha + V W 3 spray	22900.00	24900	47800
T9	VC@5t/ha + V W 4 spray	22900.00	28200	51100
T10	VC@5t/ha + V W 5 sprays	22900.00	31500	54400
T11	Rec. NPK+ V W (Soil treatment) + 3 foliar sprays	22900.00	31276	54176
T12	VC@5t/ha + V W (Soil treatment) + V W 3 foliar sprays	22900.00	41252	64152
T13.	Rec. NPK (150:80:100)	22900.00	5026	27926

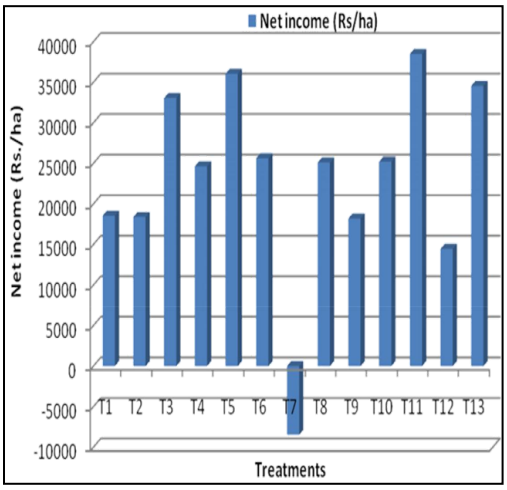

Fig 1: Net income of different treatments.

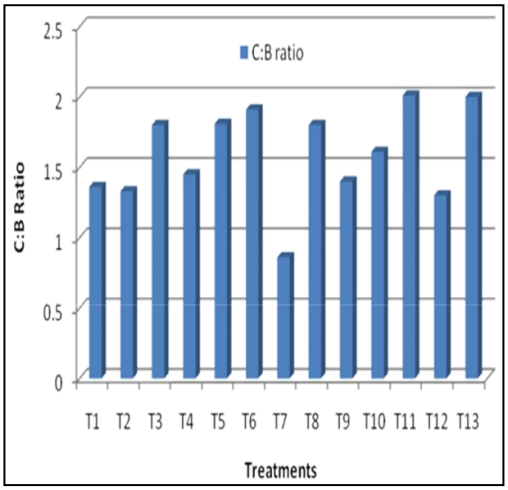

Fig 2: C: B ratio of different treatments**.**

Conclusions

On the basis of present investigation it is concluded that the okra cv. VRO-6 responded well in terms of growth, yield and net profit to Application of recommended dose of NPK + Vermiwash as soil treatment with 3 foliar sprays of Vermiwash at 1week interval after 30 DAS fetched maximum net return and C:B ratio as comparison to other treatments. It is revealed from the data obtained that a significantly maximum fruit yield of 80.47 q/ha was obtained under the treatment T5 in okra variety VRO-6. The maximum net return of Rs 38484/ha was observed in treatment T11 (Rec. NPK + Vermiwash (as soil treatment) + Vermiwash 3 sprays at 1 week interval after 30 DAS) with the maximum cost benefit ratio of 2.01. Whereas the lowest fruit yield and net 53.55 q and Rs 25624/ha was obtained with T 6 (V C@ 5t/ha+ V W 1 spray).

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