Original Research Article

Effect of Integrated Nutrient Management (INM) Practices on Growth, Yield, Economics and Soil Properties of Sweet Pepper Under Open Condition at Mid Hill of Himachal Pradesh,India

ABSTRACT

The present investigation entitled **"Effect Of Integrated Nutrient Management (INM) Practices On Growth, Yield And Economics Of Sweet Pepper Under Open Condition At Mid Hill Of Himachal Pradesh"** was carried out at the Research farm of the School of Agriculture, Abhilashi University, Mandi (H.P.) during *Kharif* season 2022.The experiment was laid out in a randomized block design with three replications. The experiment consisted of two Bulky organic manures (FYM and vermicompost) and three nutrients *i.e.* nitrogen, phosphorus and potassium.The result revealed that maximum plant height (30.33 cm, 42.47 cm and 55.03 cm at 30, 45 and 60 DAT respectively), number of branches per plant (3.10, 3.43 and 4.03 at 30, 45 and 60 DAT respectively), number of leaves per plant (31.50, 32.60 and 35.03 at 30, 45 and 60 DAT respectively), plant spread (27.60 and 34.50 cm), minimum number of days taken to 50 per cent flowering (36.01), fruit length (8.03 cm), fruit diameter (6.73 cm), average fruit weight (72.07 g), maximum number of fruits per plant (13.13), maximum number of flowers per plant (14.47), number of pickings (4.33), yield per plant (1.01 kg), and fruits yield per hectare (350.34 q/ha) were recorded with the conjoint use of 50% RDF through inorganic fertilizer + 25% through FYM + 25% through vermicompost in treatment T_7.This treatment also showed higher nutrient availability in the soil with the residual nutrient status of nitrogen (269.97 kg/ha), phosphorus (40.03 kg/ha) and potassium (292.33 kg/ha). Maximum gross return (₹ 595578/ha), net return (₹ 485173/ha) and maximum B: C ratio (1:5.39) was obtained in T_7.Thus, application of 50% RDF through inorganic fertilizer + 25% through FYM + 25% through vermicompost was found highly beneficial for plant growth and yield of sweet pepper.

Keywords: Integrated Nutrient Management (INM), sweet pepper, B: C ratio and yield.

1.INTRODUCTION

"Sweet pepper (*Capsicum annum* L.)is an important crop belongs to the family Solanaceae.It is an annual, day neutral plant grown extensively in sub- temperate climate throughout the world. British colonists introduced sweet pepper to India in the 19th century and the first successful large scale cultivation was done in the Shimla hills area, that is why named as "*Shimla Mirch*".It is second most consumed vegetable crop worldwide. In India, sweet pepper occupies an area of 37 thousand hectares with a production of 586 thousand metric tonnes" [1]. In Himachal Pradesh, sweet pepper is being cultivated as cash crop in the sub-temperate areas and covers an area of 2.85 thousand hectare with production of 48.86 metric tonnes [1]. Himachal Pradesh is the top producer of fresh sweet pepper fruits during the summer and rainy seasons which provides large returns to small and marginal hill farmers.

"Sweet pepper is cultivated as summer crop in the hilly areas where as autumn-winter crop in the plains of India.It can be grown in well-drained, loamy soils rich in organic matter.It is susceptible to frost and temperatures between 26- 28 ºC during the day and 16- 18 ºC in night is ideal for its growth and development. Extreme temperatures, such as those below 15 ºC and above 30 ºC, greatly hinder growth and fruit set. High relative humidity is good for growth, development, fruit set, and yield, but it also encourages the spread of foliar and fruit diseases" [2].

In India especially in Himachal Pradesh, in spite of its great potential the yield per unit area is quite poor when compared to the developed countries. This is mostly because there are no adequate production technologies, particularly for the nutrient management. Only one or two nutrients are supplied to the crop when chemical fertilisers are used without the use of organic manure. On the other hand, organic manures are known to have beneficial effect on soil health but its low nutritional

content and limited supply makes it difficult to use on a larger scale. So combined application of organic and inorganic fertilizers is considered ideal for obtaining the sustainable crop production. Keeping this in view, the present experiment was proposed to find out the effect of Integrated Nutrient Management (INM) Practices on The Growth, Yield and Economics of Sweet Pepper under Open Condition At Mid Hill of Himachal Pradesh.

2. METHODOLOGY

2.1 Experimental site

The present investigation was conducted during the *Kharif* season 2022 at Research farm of the School of Agriculture, Abhilashi University, Mandi (H.P). The experimental farm situated at 31º33'32''N latitude and 77º00'47''E longitudes with the elevation of 1404 m above mean sea level. Soil of the experimental site was sandy clay loam, neutral in reaction, low in available nitrogen(269.97 kg/ha), medium in available potassium(292.33 kg/ha) and high in available phosphorus(40.03 kg/ha).

2.2 Treatment and crop culture

The experiment was laid out in Randomized Block Design (RBD) Factorial with three replications comprising of seven treatment combination of manure and liquid manure, the details of treatment combination is given in Table 1. Seeds of sweet pepper cv. 'Royal Wonder' were sown in the nursery in raised beds under polyhouse condition in 1.5 x 1 x 0.15 m seed beds at Research Farm of Abhilashi University on 1st April, 2022 and transplanting was done on 12th May, 2022. The plot size was 3 × 1.8 m^2 and a spacing of 60 cm × 45 cm was followed. After 20 days of transplanting, five plants were tagged randomly of each plot for taking observation. FYM and vermicompost were applied before sweet pepper was sown. N, P_2O_5 and K_2O were applied through urea, single super phosphate (SSP) and muriate of potash (MOP) respectively according to the treatment plan. The half dose of N and full doses of P_2O_5 and K_2O in the form of chemical fertilizer were applied at the transplanting time in each plot in accordance with the different treatments.

Table1: Details of treatments

Symbols	Treatment combinations
T_1	Control (without fertilizers)
T_2	100% RDF through inorganic fertilizers
T_3	100% Recommended dose of FYM
T_4	100% Recommended dose of vermicompost
T_5	75% RDF through inorganic fertilizer + 25% through FYM
T_6	75% RDF through inorganic fertilizer + 25% through vermicompost//
T_7	50% RDF through inorganic fertilizer + 25% through FYM + 25% through vermicompost

*****RDF: Recommended Dose of Fertilizer (100:75:55kg N:P_2O_5: K_2O/ha
** FYM: Farm Yard Manure

Table 2: Application of NPK

Dose	Fertilizer applied per plot (5.4m^2)					
	Urea		SSP		MOP	
	kg/ha	g/plot	kg/ha	g/plot	kg/ha	g/plot
(50%)	81	44	187	101	41	22
(75%)	122	66	281	152	62	34

Table 3: Application of FYM, vermicompost

Nutrients source	Per ha	Per plot (5.4 $m^{2)}$
FYM	100 q	16.2 kg
Vermicompost	50 q	8.1 kg

2.3 Soil Analysis

Before and after the experiment, five random locations within each plot were chosen to collect soil samples from a depth of 0 to 15 cm. After properly combining the soil samples, composite samples were obtained. The soil samples were crushed, sieved through a 2-mm mesh, and then air dried.Soil samples were analyzed for pH with 1:2.5 soil water suspension glass electrode pH method Jackson [3], available nitrogen content was analyzed with alkaline permanganate method Subbiah and Asija [4], available phosphorus content was determined with Olsen method of extraction with 0.5 $NaHCO_3$ (pH 8.5) Olsen et al. [5], and available potassium content was estimated with Ammonium acetate extraction method of Jackson [3].

2.4 Statistical Analysis

The statistical analysis of data carried out by using the statistical package OPSTAT as per suggested by Gomez and Gomez [6]. Economical analysis was carried out by calculating the amount of material needed for one hectare, calculating annual cost of production by considering present market rate. The results have been interpreted on the basis of 'F' test value and critical difference (CD) was calculated at 5 % level of significance. The analysis of variance was calculated as follows:

Table 4: Analysis of variance

Source of variation	**Degree of freedom**	**Sum of squares**	**Mean sum of square**	**Variance ratio ("F" Value)**
Replication (R)	(r-1)=2	Sr	RSS/(r-1) = Mr	Mr/Me
Treatments (t)	(t-1)=6	St	TrSS/(t-1) = Mt	Mt/Me
Error	(r-1)(t-1)=12	Se	Err.SS/(r-1)(t-1) = Me	

Where,

r = Number of replications
t = Number of treatments
Me = Mean sum of square due to error
df = Degree of freedom

The standard error of mean (SEm) and critical difference (CD) for comparing the mean of any two treatments were computed as follows:

SEm = $\left(Me/r\right)^{1}/_{2}$

SE (d) = $\left(2\,Me/r\right)^{1}/_{2}$

CD = SE (d) "t" value at error degree of freedom.

3. RESULTS AND DISCUSSION

3.1 Chemical properties of soil

Integrated use of inorganic and organic sources of nutrients had significant effect on soil pH, available N, P and K content (kg/ha) in soil as mentioned in Table-3.

3.1.1 Soil pH

Soil reaction (pH) is the primary element which affects the availability of nutrients in soil. The pH range of 5.5-6.5 is optimum for availability of most of the nutrient elements for pepper crop. Maximum pH value (6.13) was observed in T_5 (75% RDF through inorganic fertilizer + 25% through FYM) while minimum in T_2 (100% RDF through inorganic fertilizers) *i.e.* 5.68. The pH in the plots treated with a combination of organic and inorganic nutrients moved slightly towards neutrality, indicating that the application of organic amendments had a positive impact on soil health Nandi et al. [7]. Similar findings were obtained by Jamir et al. [8].

3.1.2 Available Nitrogen (kg/ha)

Maximum available nitrogen (269.97 kg/ha) was recorded in plots supplied with (50% RDF through inorganic fertilizer + 25% through FYM + 25% through vermicompost) treatment T_7 which might be due to the release of additional nitrogenous compounds into the soil due to the presence of vermicompost, which may have enhanced the soil's capacity for retaining nutrients Vijaya and Seethalakshmi [9]. Also these results are in close conformity with Atal [10] and Jamir et al. [8].

3.1.3 Available Phosphorus (kg/ha)

As far as available phosphorus is concerned maximum available phosphorus (40.03 kg/ha) was recorded in T_7 (50% RDF through inorganic fertilizer + 25% through FYM + 25% through vermicompost). The availability of phosphate was improved by combining inorganic fertiliser with organic manure, such as vermicompost and farm yard manure, which was also observed by Vimeraet al.[11]. Raturi et al. [12] and Sharma et al.[13] expressed the similar views.

3.1.4 Available Potassium (kg/ha)

The data pertaining to available potassium content (292.33 kg/ha) was maximum in treatment T_7 (50% RDF through inorganic fertilizer + 25% through FYM + 25% through vermicompost). The increase in potassium content might be due to application of organic manures such as vermicompost in bulk quantity and their subsequently slow mineralization process Chetriet al. [14].Another possible reason might be due to increase in potassium availability caused by a change in the equilibrium in the soil from relatively exchangeable potassium to soluble potassium Prativa and Bhattarai [15]. The above findings are in accordance with Atal[10].

Table 5:Effect of integrated Nutrient Management (INM) practices on chemical properties of soil

Treatments	Soil pH	Available N (kg/ha)	Available P (kg/ha)	Available K (kg/ha)
T_1: Control (without fertilizers)	6.06	217.18	16.07	123.88
T_2: 100% RDF through inorganic fertilizers	5.68	261.13	38.20	245.93
T_3: 100% Recommended dose of FYM	5.71	234.13	27.13	145.07
T_4: 100% Recommended dose of vermicompost	6.10	252.13	31.07	257.53
T_5: 75% RDF through inorganic fertilizer + 25% through FYM	6.13	249.07	24.03	190.87
T_6: 75% RDF through inorganic fertilizer + 25% through vermicompost	5.86	259.27	34.07	179.93
T_7: 50% RDF through inorganic fertilizer + 25% through FYM + 25% through vermicompost.	5.94	269.97	40.03	292.33
SE(m)±	8.68	3.10	3.09	2.60
CD at 5%	N/A	9.65	9.62	8.09

3.2 Plant growth attributes

Improvement in growth characters is considered to be pre-requisite to increased yield as showed in Table-3.

3.2.1 Plant height (cm)

Height of the plant is one of the key variables impacting yield and harvest duration particularly for plants with an indeterminate growth habit. Among the treatments, treatment T_7 (50% RDF through inorganic fertilizer + 25% through FYM + 25% through vermicompost) recorded a maximum plant height of 42.47 cm and 55.03 at 45 and 60 DAT respectively and 31.53 cm at 30 DAT of treatment T_2 (100% RDF through inorganic fertilizers). The increase in plant height may be attained due to the release of the fixed nitrogen, hence increasing the concentration and availability of nitrogen in the root zone. Plant growth and its development was also obtained byFawzy et al. [16],–Malik et al. [17], Lal and Kanaujia [18], Jamiret al. [8] and Shilpa et al. [19].

3.2.2 Number of branches per plant

Branching in sweet pepper is a natural phenomenon but if allowed that usually induce more fruit production at the expense of size *i.e.* more fruits with more number of branches. The maximum number of branches per plant (3.10, 3.43 and 4.03) was produced at 30, 45 and 60 DAT respectively from T_7 (50% RDF through inorganic fertilizer + 25% through FYM + 25% through vermicompost).While minimum number of branches per plant (1.67, 1.80 and 2.27) was produced at 30, 45 and 60 DAT respectively from T_1 (Control) treatment.The reason for the enhancement of branches production might be due to the direct effect of higher amount of inorganic nitrogen, which is a component of protein and chlorophyll molecules which might have increased the foliage of the plants and thus improved photosynthesisKumar and Dhar [20].Alike results was observed by Malik et al. [17], Shilpa et al. [19].

3.2.3 Number of leaves per plant

Among the treatments, treatment T_7 (50% RDF through inorganic fertilizer + 25% through FYM + 25% through vermicompost) recorded a maximum number of leaves *i.e.* 31.50, 32.60 and 35.03 at 30, 45 and 60 DAT respectively and was found significantly superior to all other treatments. Maximum number of leaves might be due to fact that application of NPK and vermicompost provided adequate Nitrogen which is associated with high photo synthetic activity and vigorous vegetative growth Pariari and Khan [21]. The results of present investigation in terms of vegetative growth are also in concordance with the findings reported earlier by Lal and Kanaujia [18] and Jamir et al. [8].

Table 6: Effect of Integrated Nutrient Management (INM) practices in growth parameters of sweet peppers

Treatments	Plant height (cm)			Number of branches			Number of leaves			Plant spread (cm)		Days to 50% flowering
	30 DAT	45 DAT	60 DAT	30 DAT	45 DAT	60 DAT	30 DAT	45 DAT	60 DAT	45 DAT	60 DAT	
T_1: Control (without fertilizers)	25.27	37.43	48.17	1.67	1.80	2.27	22.40	25.77	26.70	22.47	29.70	45.01
T_2: 100% RDF through inorganic fertilizers	31.53	41.53	54.53	2.97	3.27	3.87	29.83	31.40	33.17	27.57	33.97	38.67
T_3: 100% Recommended Dose of FYM	27.10	37.98	52.30	1.77	2.27	3.23	24.03	26.90	27.50	23.87	32.23	43.97
T_4: 100% Recommended Dose of vermicompost	28.50	40.53	49.20	2.53	2.97	2.80	23.73	27.70	28.60	26.43	30.90	41.03
T_5: 75% RDF through inorganic fertilizer + 25% through FYM	27.53	39.50	54.01	2.40	2.83	3.30	28.93	30.30	31.40	27.20	33.07	40.33
T_6: 75% RDF through inorganic fertilizer + 25% through vermicompost	28.77	41.07	54.07	2.70	3.00	3.37	27.50	30.80	32.01	27.50	33.67	38.96
T_7: 50% RDF through inorganic fertilizer + 25% through FYM + 25% through vermicompost	30.33	42.47	55.03	3.10	3.43	4.03	31.50	32.60	35.03	27.60	34.50	36.01
SE(m)±	0.45	0.54	0.69	0.04	0.04	0.04	2.00	1.40	1.59	1.14	0.92	1.53
CD at 5%	1.42	1.69	2.15	0.14	0.13	0.13	6.24	4.36	4.95	3.54	2.85	4.76

3.2.4 Plant spread (cm)

Plant spread is an important growth parameter which consequently affect yield per plant.Among the treatments, treatment T_7 (50% RDF through inorganic fertilizer + 25% through FYM + 25% through vermicompost) recorded maximum plant spread (27.60 and 34.50 cm) at 45 and 60 DAT respectively. The increase in plant spread was attributed due to increase in fertilizer and organic manure application,which may increase amount of nutrients like nitrogen, phosphorus and potassium in plants, increasing the formation of plant metabolites that supported the development of plant tissues Malik et al.[17]. Similar result was also obtained by Raturi et al.[12].

3.2.5 Days to 50 per cent flowering

Early flowering results in early fruit development, which benefits in timing the crop. The number of days for inducing flowering varied from 36 to 45 days. The minimum day (36.01) for appearance of 50 per cent flowering was observed in treatment T_7 (50% RDF through inorganic fertilizer + 25% through FYM + 25% through vermicompost). It seems that with increase in the levels of nutrient application the number of days taken for 50 per cent flowering showed decreasing trend. Anotheraspect that could contribute to nutritional integration that results in earlier flowering is quicker photosynthesis and better translocation of photosynthates towards the flower bud initiation Naidu et al. [22] and Prativa and Bhattarai [15].

3.3 Yield attributes

Integrated application of chemical fertilizers and organic manures increased yield and yield attributing characters of sweet pepper (Table-4).

3.3.1 Fruit length (cm)

Fruit length is an important yield characteristic that influences fruit size as well as yield per hectare. The treatment T_7 (50% RDF through inorganic fertilizer + 25% through FYM + 25% through vermicompost) recorded maximum fruit length (8.03 cm) whereas the treatment T_1 (Control) recorded minimum fruit length (5.67 cm). Sufficient quantity of the fertilizers *i.e.* nitrogen, phosphorus and specially potassium, fulfilled the need of plants to attain more vigour, flowering and fruit development which produced fruits of high quality and significant size (length) Dubeyet al. [23].Similar results were obtained by Malik et al. [17], Chetriet al. [14] and Lal and Kanaujia[18].

3.3.2 Fruit diameter (cm)

Fruit diameter is an important yield character which affects fruit size and consequently yield.Analysis of the data shows that the interaction effect of integrated nutrient management practices on sweet pepper recorded maximum fruit diameter (6.73 cm) in T_7 (50% RDF through inorganic fertilizer + 25% through FYM + 25% through vermicompost). It may be due to improved soil physical, chemical and biological properties and addition of nutrients through vermicompost and chemical fertilizers which in turn enhanced growth and led to the production of blocky fruits in the sweet pepper Lal and Kanaujia[18]. Similar are the findings of Malik et al. [17], Dubeyet al. [23], Ngupok [24] and Raturi et al.[12].

3.3.3 Number of flowers per plant

Among the treatments, treatment T_7 (50% RDF through inorganic fertilizer + 25% through FYM + 25% through vermicompost) recorded a maximum number of flowers *i.e.* 14.47 and was found significantly superior to all other treatments.This may be due to translocation of nutrients to the aerial parts of the plant. Vermicompost contains (3% N), (1% P_2O_5) and (1.5%K_2O). The solubilization of plant nutrients caused by the addition of vermicompost leads to increase NPK uptake and resulted in maximum number of flowers per plant in sweet pepper Shiva et al. [25].Alike results was obtained by Bhattarai et al.[26], Chetriet al. [14]and Jamir et al. [8].

3.3.4 Number of fruits per plant

This is one of the most important characters contributing directly towards yield.The data on different levels of nutrients revealed that T_7 (50% RDF through inorganic fertilizer + 25% through FYM + 25% through vermicompost)produced maximum number of fruits per plant (13.13)and minimum number of fruits per plant (8.93) was recorded in T_1 (Control).The increase in number of fruits per plant as results of integrated application of organic and inorganic fertilizers may be due to higher organic sources, higher organic matter build up, balanced C:N ratio and availability of nutrients Malik et al. [17].Superiority of vermicompost over other organic sources could be attributed to its nutritional richness which results in better growth, more number of fruits when used in combination with organic

or inorganic sources Lal and Kanaujia[18]. Similar observations were also made by other workers like Chetriet al. [14], Ngupok [24].

3.3.5 Average fruit weight (g)

Fruit weight is an important yield parameter for obtaining maximum yield per hectare.The treatment T_7 (50% RDF through inorganic fertilizer + 25% through FYM + 25% through vermicompost) which produced highest fruit length and fruit diameter, also observed maximum fruit weight 72.07 g followed by T_6 (75% RDF through inorganic fertilizer + 25% through vermicompost) which is 69.30 g. It appears from the findings of Suthar [27], that supply of nutrients from conjoint application of organic and inorganic sources *i.e.*vermicompost and chemical fertilizer improved the partionning of photo-assimilates from source to sink (leaf to fruit) thereby increased fruit weight.Similar results have also been reported by Chetriet al. [14], Lal and Kanaujia[18] and Raturi et al.[12].

3.3.6 Fruit yield per plant (kg)

The treatment T_7 (50% RDF through inorganic fertilizer + 25% through FYM + 25% through vermicompost) which produced highest fruit yield per plant *i.e.* 1.01 kg whereas the lowest fruit yield per plant was observed in control treatment T_1 (Control) *i.e.* 0.46 kg.This might be due to continuous availability of more nutrients in higher amount and better utilization by plants Chetriet al.[14]. These results are supported by Bhattarai et al. [26] and Raturi et al. [12].

3.3.7Fruit yield per hectare (q)

The main objective of cultivation is to have maximum yield for better returns.Among the treatments, treatment T_7 (50% RDF through inorganic fertilizer + 25% through FYM + 25% through vermicompost) recorded highest fruit yield per hectare of 350.34 q/ha which was found significantly higher to other treatment combinations. While the control treatment T_1 having the lowest yield attributes had attained the lowest fruit yield of 165.21 q/ha. It is seen that the treatment having plant growth couples with yield contributing parameters like number of fruits per plant, fruit length, fruit diameter and average fruit weight had attained the highest fruit yield. Similar are the findings of Bhattarai et al. [26], Dubeyet al. [23] and Sharma et al. [13].

3.3.9 Number of pickings

The maximum number of picking was observed in treatment T_7 (50% RDF through inorganic fertilizer + 25% through FYM + 25% through vermicompost) *i.e.* 4.33which was statistically at par with treatment T_5 (75% RDF through inorganic fertilizer + 25% through FYM) which is 4.01 and T_2 (100% RDF through inorganic fertilizers) which is 4.00. While the minimum number of picking was done in treatment T_1 (Control) which is 2.33.

Table 7: Effect of integrated nutrient management practices in yield parameters of sweet pepper

Treatments	Fruit length (cm)	Fruit diameter (cm)	No. of flowers per plant	No. of fruits per plant	Average fruit weight (g)	Number of pickings	Fruit yield per plant (kg)	Fruit yield per hectare (q)
T_1: Control (without fertilizers)	5.67	5.03	9.53	8.93	49.87	2.33	0.46	165.21
T_2: 100% RDF through inorganic fertilizers	6.90	5.60	11.37	10.63	62.38	4.00	0.68	246.23
T_3: 100% Recommended Dose of FYM	6.57	5.07	10.87	9.97	51.22	2.67	0.52	189.23
T_4:100% Recommended Dose of vermicompost	6.67	5.40	11.07	10.23	55.98	3.00	0.56	213.61
T_5: 75% RDF through inorganic fertilizer + 25% through FYM	7.40	6.13	13.53	11.40	64.62	4.01	0.76	274.69
T_6: 75% RDF through inorganic fertilizer + 25% through vermicompost	7.43	6.53	12.73	11.97	69.30	3.67	0.85	308.12
T_7: 50% RDF through inorganic fertilizer + 25% through FYM + 25% through vermicompost.	8.03	6.73	14.47	13.13	72.07	4.33	1.01	350.34
SE (±)	0.36	0.36	0.59	0.56	1.40	0.43	0.03	12.15
$CD_{0.05}$	1.13	1.13	1.83	1.74	4.37	1.34	0.10	37.85

3.4 Economics

3.4.1 Cost of cultivation (₹/ha)

A perusal of data revealed that highest cost of production ₹ 143310 was incurred in treatment T_4 (100% Recommended Dose of FYM) because of the higher cost of vermicompost,whereas lowest (₹ 93310) was observed in treatment T_1 (Control).

3.4.2 Gross return (₹/ha)

The maximum gross return per hectare amounting to ₹ 595578 was obtained in treatment T_7 (50% RDF through inorganic fertilizer + 25% through FYM + 25% through vermicompost)followed by T_6 (75% RDF through inorganic fertilizer + 25% through vermicompost) which is ₹ 523804 and T_5 (75% RDF through inorganic fertilizer + 25% through FYM) which is ₹466973. On the other hand, the minimum gross return (₹ 280857) was recorded for treatment T_1 (Control).

3.4.3 Net return (₹/ha)

The highest net return (₹ 485173) was recorded in T_7 (50% RDF through inorganic fertilizer + 25% through FYM + 25% through vermicompost) followed by T_6 (75% RDF through inorganic fertilizer + 25% through vermicompost) *i.e.* ₹ 414851) and T_5 (75% RDF through inorganic fertilizer + 25% through FYM) *i.e.* ₹ 368020. Whereas, the lowest net return (₹ 187546) was observed in T_1 (Control).

3.4.4 B: C ratio

In overall, maximum B: C ratio (1:5.39) was recorded in T_7 (50% RDF through inorganic fertilizer + 25% through FYM + 25% through vermicompost) followed by B: C ratio (1.4.80) in T_6 (75% RDF through inorganic fertilizer + 25% through vermicompost) and T_5 (75% RDF through inorganic fertilizer + 25% through FYM) which is 1:4.71.Whereas minimum B: C ratio (1:3.00) was calculated in T_1 (Control), which may be due to the lower cost of production and comparable gross income in T_1 (Control). The reason for increased profit and highest Benefit: Cost ratio in treatment T_7 (50% RDF through inorganic fertilizer + 25% through FYM + 25% through vermicompost) is due to maximum fruit weight, healthy and better fruit size and higher net returns as compared to other treatments.

Table 8: Effect of integrated Nutrient Management (INM) practices on economics of sweet pepper production

Treatments	Cost of cultivation (₹ ha^{-1})	Gross Return (₹ ha^{-1})	Net Return (₹ ha^{-1})	Benefit: Cost ratio
T_1: Control (without fertilizers)	93310	280857	187546	1:3.00
T_2: 100% RDF through inorganic fertilizers	97499	418591	321091	1:4.29
T_3: 100% Recommended Dose of FYM	103310	321691	218380	1:3.11
T_4: 100% Recommended Dose of vermicompost	143310	363137	219826	1:2.53
T_5: 75% RDF through inorganic fertilizer + 25% through FYM	98952	466973	368020	1:4.71
T_6: 75% RDF through inorganic fertilizer + 25% through	108952	523804	414851	1:4.80

vermicompost				
T_7: 50% RDF through inorganic fertilizer + 25% through FYM + 25% through vermicompost.	110404	595578	485173	1:5.39

4. CONCLUSION

It can be concluded that, among different treatment, T_7 (50% RDF through inorganic fertilizer + 25% through FYM + 25% through vermicompost) recorded significantly higher values of growth characters and yield attributing characters. As well as Benefit: cost ratio, gross return, net return and also improved chemical properties of soil, treatment T_7 was found utmost.

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