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Short Communication

Response of Integrated Nutrient Management on Growth and Yield of Cucumber (*Cucumis Sativus* L.) cv. Pusa Sanyog

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Abstract

Cucumber (Cucumis sativus L.) is one of the early maturing most popular vine vegetable of Cucurbitaceae family. Cucumber responds well to various nutrients, including macronutrients and micronutrients. Excessive application of chemical fertilizer alone has adverse impact on the environment as it causes deterioration of soil health, and the consumption of these inorganic products may jeopardize our health. Biofertilizers are the substances containing the living cells of beneficial microorganisms which have the potential to convert the unavailable form of nutrient to the available form in the soil.The present investigation was carried out at the CRC Farm, ITM University, Gwalior (M.P.) to investigate the response of farmyard manure (FYM) or vermicompost and biofertilizers on growth and yield of cucumber. The result concluded that the different organic manures (viz., vermicompost and FYM) and biofertilizers (viz., Azotobacter and PSB) treatments were significantly influenced the different yieldparameters of cucumber when applied with 75 % of recommended dose of fertilizers (RDF). It was noted that treatment T_7 (75 % RDF + vermicompost + Azotobacter + PSB) was found the best among all the treatments and it gave higher vine growth, early flowering and fruiting, greater fruit yield and good economic benefits in terms of gross and net return in cucumber.Thus, integration of organic manure and biofertilizers with 75 % of RDF improved growth and the production potential of cucumber and enhance the net return.

Keywords: *Bio fertilizers, Cucumber, Growth, Integrated nutrient management, Vermicompost, Yield.*

Introduction

Cucumber (*Cucumis sativus* L.) is one of the early maturing most popular vine vegetable of Cucurbitaceae family. Cucurbits are extremely cross-pollinated group of vegetable crops, and the nature of pollination is entomophilous. Cucumber is a popular summer vegetable of North and South India and lower as well as high hills in India. Cucumber seeds have several Ayurvedic uses. The cucumber is a warm season crop, and its seeds start giving satisfactory germination at 18°C and the speed of germination increases with the increase in temperature between 18°C and 24°C.Cucumber responds well to various nutrients, including macronutrients and micronutrients.

The vegetable crops grow and produce a good quality crop after application of calcium, magnesium, sulphur, zinc, copper and boron as these are important minerals for various metabolic activities in the plants. Application of these nutrients through different sources is the primary need of crop production. INM (integrated nutrient management) is a sustainable approach, which aims at maintaining the soil fertility and plant nutrient supply, by incorporating all the possible sources of nutrients like organic manures, inorganic fertilizer and the biological components in an integrated and judicious manner to get higher crop yield without in anyway hampering the soil health and the environment

Amongst biofertilizers, *Azotobacter*, PSB, Rhizobium strains play an important role in harvesting the atmospheric nitrogen through its fixation in the roots. Organic manures including farmyard manure, panchagavya, neemcake or vermicompost are bulky in nature and have less analytical value due to its low nutrient content. There always runs a risk of low yield associated with organic manures which will not fulfil the food requirement of densely populated country like India as they are slow nutrient releasing fertilizer if they are applied without integration with inorganic source.

Biofertilizers are the substances containing the living cells of beneficial microorganisms which have the potential to convert the unavailable form of nutrient to the available form in the soil. Several authors have worked on the economics of vegetable cultivation under different cropping model with integrated approach of nutrient management through organic sources as well as biofertilizers. Providing nutrients through different sources and inclusion of drip irrigation practices have also been reported to enhance the nutrient use efficiency as drip irrigation makes the fertigation feasible which ensures proper availability of nutrients to plants , organic sources are responsible for ensuring slow and long-term release of nutrients, biofertilizers ensure the mobilization of nutrients from soil complex and availability of growth promoting factors. Thus ensure the improvement in soil and plant nutrient status for high productivity, quality and economical vegetable production.

Considering all these aspects, a research study was carried out to study the effect of integrated application of vermicompost and biofertilizer with various proportion of recommended dose of fertilizers on growth, yield and economics of cucumber (*Cucumis sativus* L.) cv. Pusa Sanyog.

Materials and Methodology

A field experiment was conducted at the CRC Farm of the Division of Horticulture, ITM University Gwalior (M.P.). The climate of this place is bestowed with hot and dry early summers followed by hot and humid monsoon season and cold and dry winters. The soil of the experimental field was sandy clay loam in texture, slightly alkaline (pH 7.73) in reaction, low in organic carbon (4.3 g/kg) and available nitrogen (196.6 kg/ha) but medium in available phosphorus (15.85 kg/ha) and potassium (229.6 kg/ha) with electrical conductivity in the safer range.

The experiment was laid out in the Randomized Block Design with three replications. Each replication was comprised of ten treatments (T_1 – 100 % RDF, T_2 – 75 % RDF + *Azotobacter*, T_3 – 75 % RDF + PSB, T_4 – 75 % RDF + *Azotobacter* + PSB, T_5 – 75 % RDF + Vermicompost + *Azotobacter*, T_6 – 75 % RDF + Vermicompost + PSB, T_7 – 75 % RDF + Vermicompost + *Azotobacter* + PSB, T_8 – 75 % RDF + FYM + *Azotobacter*, T_9 – 75 % RDF + FYM + PSB and T_{10} – 75 % RDF + FYM + *Azotobacter* + PSB) were applied in cucumber cv. Pusa Sanyog. Biofertilizers (*Azotobactor* and PSB) @ 30g sqm^{-1} were inoculated and applied in soil at the time of sowing. FYM was thoroughly mixed in the soil one week prior to sowing and basal dose of vermicompost was incorporated in soil one week before sowing.

The observation on growth parameters like vine length (cm), number of leaves per plant, number of primary branches per vine; flowering and fruiting

attributes like days to first flowering, days to 50 % flowering; yield and related attributes like fruit length (cm), fruit girth (cm), average fruit weight (g), number of fruits per vine, fruit yield per plant (g), fruit yield per hectare (q); and economic analysis was carried out and analysis of variance was performed to determine the effect of FYM and biofertilizers on growth and productivity of cucumber. The interpretation of treatments effects was made based on critical difference at 5 % probability level.

Result and Discussion

Plant growth attributes of cucumber

The results clearly indicated that the different organic manures (*viz.*, vermicompost and FYM) and biofertilizers (*viz.*, *Azotobacter* and PSB) treatments were significantly influenced the different growth parameters of cucumber (Table-1). The maximum vine length, maximum number of branches and leaves per vine at 45 and 90 days after sowing (DAS) was recorded in T_7 (75 % RDF + Vermicompost + *Azotobacter* + PSB). It may be due to increased availability of nitrogen and other nutrients through inorganic fertilizers which promoted the plant growth by ensuring higher number of green leaves with increased photosynthesis and forming longer and stronger roots to absorb sufficient water and nutrients. Use of vermicompost would have facilitated better aeration, adequate drainage and created a favourable soil environment for deeper penetration of roots and higher nutrient extraction from soils and it increase the vine length, leaves and branches in cucumber (Rohith *et al.*, 2022). This may be due to increased availability of organic manures, biofertilizers like *Azotobacter* and PSB that produce phytohormone which stimulate root growth and changes in root morphology which in turn affect the assimilation of nutrients and PSB would help in the conversion of unavailable form of phosphorus to available form, especially in early crop growth phase and promoted the growth of leaves and branches in cucumber vine[1].

Flowering attributes of cucumber

The result revealed that the application of organic manures and biofertilizers treatment combination affected the days to flowering and 50% flowering in cucumber (Figure-1). The minimum days to flowering and 50% flowering were noted in treatment T_7 (75 % RDF + Vermicompost + *Azotobacter* + PSB) and it was found the best treatment combination among all the treatments. The application of organic manure and biofertilizers provide better soil physico-chemical properties, growth and productivity of plants because of its higher nutrient content, as it contains a greater number of N_2 fixing, phosphate solubilising bacteria and other beneficial microbes, antibiotics, vitamins, hormones, enzymes, which have better effect on early flowering in cucumbe[2].

Yield and related attributes

The result revealed that the treatment T_7 (75 % RDF + vermicompost + *Azotobacter* + PSB) was found the best treatment combination of different organic manures and biofertilizers for influencing the different yield parameters of cucumber and it gave the maximum fruit length, girth and weight, whereas the minimum fruit length, girth and weight was recorded in treatment T_3 (75 % RDF + PSB) (Table-2). The increase in yield parameters of cucumber could be attributed to higher

metabolic activities due to optimum nitrogen supplies and also production of phytohormones which were manifested in the form of enhanced growth and higher carbohydrate production which resulted increase in fruit size, weight and length[3].

It was recorded that the maximum number of fruits per vine was in T_7 (75 % RDF + vermicompost + *Azotobacter* + PSB) and it was found the best treatment combination of different organic manures and biofertilizers among all the treatments. It is because of different organic manures and biofertilizers resulted in increase in number of fruits per vine as they were found effective in nitrogen fixation, synthesis of plant growth promoting hormones and enzyme activation. Increase in average weight of fruit is due to application of organic manures and biofertilizers which might be due to favourable action of the microorganisms and positive effect of the manures which might have enhanced the micronutrient availability in the soil.

It was obtained from the result that T_7 (75 % RDF + Vermicompost + *Azotobacter* + PSB) was found the best treatment combination for influencing the different yield parameters of cucumber and it gave the maximum yield per vine, per plot and per hectare which may be associated with better utilization of nutrients in presence of biofertilizers and organic manures, which enhanced biological nitrogen fixation, better development of root system and active synthesis of plant growth hormones.

Economics of cucumber cultivation

The economics of cucumber cultivation after application of different treatments confirms that the maximum gross returns and net returns was found in treatment T_7 (75 % RDF + Vermicompost + *Azotobacter* + PSB) while the maximum B:C ratio was recorded in treatment T_1 (100 % RDF), whereas the minimum gross returns, net returns, and B:C ratio was noted in treatment T_3 (75 % RDF + PSB) (Table-3). Similar results for various economic parameters were also reported by Thongney *et al.* (2020)[5].

Table 1 Growth attributes of cucumber after application of vermicompost and biofertilizers with RDF

Treatments	Vine length (cm)		Number of branchesvine^{-1}		Number of leavesvine^{-1}	
	45 DAS	90 DAS	45 DAS	90 DAS	45 DAS	90 DAS
T_1	167.77	208.40	8.30	11.02	82.80	143.04
T_2	143.60	191.66	6.85	8.71	72.99	132.21
T_3	138.12	189.06	6.40	8.49	70.07	130.41
T_4	147.62	192.93	6.99	9.10	74.69	133.57
T_5	158.66	203.43	8.04	10.74	80.23	141.35
T_6	151.64	195.62	7.45	10.15	78.23	138.62
T_7	170.11	210.13	8.42	11.10	84.11	144.16
T_8	155.37	199.59	7.76	10.46	79.41	140.35
T_9	149.64	194.35	7.12	9.85	77.08	136.18
T_{10}	164.68	206.52	8.21	10.91	81.20	142.48
SEm ±	0.747	0.327	0.047	0.315	0.356	0.437
CD at 5%	2.218	0.972	0.139	0.936	1.058	1.299

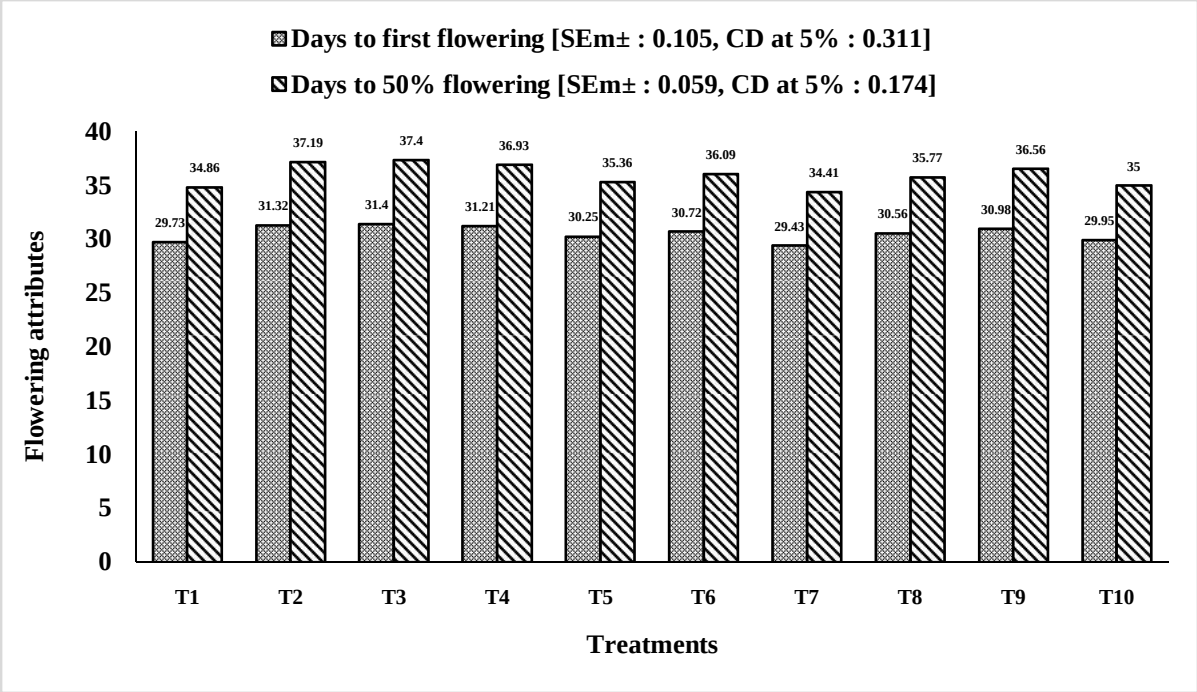

Figure 1 Flowering attributes of cucumber after application of vermicompost and biofertilizers with RDF

Table 2 Yield and related attributes of cucumber after application of vermicompost and biofertilizers with RDF

Treatments	Fruit length (cm)	Fruit girth (cm)	Fruit weight (g)	Number of fruits per vine	Yield per vine (kg)	Yield per hectare (q)
T_1	13.94	11.02	168.63	17.00	5.74	689.01
T_2	12.33	9.29	140.35	13.78	4.38	526.08
T_3	12.14	9.10	137.14	13.00	4.17	500.01
T_4	12.55	9.61	144.04	14.32	4.57	548.78
T_5	13.54	10.52	161.47	16.03	5.35	641.71
T_6	12.89	9.99	153.69	15.27	5.00	599.42
T_7	14.11	11.12	170.18	17.41	5.87	704.41
T_8	13.10	10.12	157.53	15.85	5.21	625.23
T_9	12.75	9.81	150.53	14.79	4.82	578.77
T_{10}	13.77	10.85	164.47	16.63	5.55	666.28
SEm ±	0.050	0.049	0.698	0.073	0.029	3.434
CD at 5%	0.147	0.146	2.075	0.216	0.085	10.205

Table 3 Economics of cucumber cultivation after application of vermicompost and biofertilizers with RDF

Treatments	Cost of cultivation (Rs. ha^{-1})	Gross returns (Rs. ha^{-1})	Net returns (Rs. ha^{-1})	B:C ratio
T_1	93600	413408	319808	4.41
T_2	93500	315649	222149	3.37
T_3	93700	300004	206304	3.20
T_4	94500	329266	234766	3.48
T_5	108500	385029	276529	3.55
T_6	108700	359655	250955	3.31
T_7	109500	422647	313147	3.86
T_8	101500	375140	273640	3.70
T_9	101700	347264	245564	3.41
T_{10}	102500	399771	297271	3.90

Conclusion

The application of different organic manures (*viz.*,vermicompost and FYM) and biofertilizers (*viz., Azotobacter* and PSB) treatments were significantly influenced the different attributes of cucumber. It was noted that treatment T_7 (75 % RDF + vermicompost + *Azotobacter* + PSB) was found the best among all treatment and it gave higher vine growth, early flowering and fruiting, greater fruit yield and good economic benefits in terms of gross and net return in cucumber.

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