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INFLUENCE OF INTEGRATED NUTRIENT MANAGEMENT ON THE YIELD, NUTRIENT STATUS AND QUALITY OF CUCUMBER (*CUCUMIS SATIVUS* L.)

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Summary

Field experiment was conducted to evaluate the effect of different organic manures and their combinations with bio-fertilizers and inorganic fertilizers in comparison with recommended dose of fertilizer (RDF) @ 100:50:50 kg NPK on the cucumber production and quality. The results indicated that application of FYM (10 t) or vermicompost (2t) + Bio-fertilizers + ½ recommended dose of fertilizer (RDF) ha^{-1} resulted significantly higher yield of 111q and 106 q ha^{-1} respectively compared to the application of RDF (84 q ha^{-1}) and on par yields with other treatments except with the application of green leaf manure 5t ha^{-1} + Bio-fertilizers (68 q ha^{-1}). Higher benefit cost ratio of 1: 2.1 was observed with the application of FYM 10 t ha^{-1} + Bio-fertilizers (N & P sources) + ½ RDF. The quality parameters indicated that the Vit. 'C', total carotenes and β – carotenes were high in the cucumber fruits produced with integrated nutrient management compared to the treatments where organic manures or RDF (Recommended dose of fertilizer) alone were applied as individual treatments. The nitrogen, phosphorus and potassium contents in fruit and leaf were high comparatively in the treatments where the integrated nutrient management component was involved than that of the treatments where the organic manures and RDF alone were applied

सारांश

खीरा की उपज तथा गुणवत्ता पर कार्बनिक खाद, जैविक खाद तथा अकार्बनिक खाद के प्रभाव का अध्ययन किया गयां 10 टन गोबर की खाद, 2 टन वर्मी कम्पोस्ट तथा संस्तुति रासायनिक खाद की आधी मात्रा देने पर सबसे अधिक उपज क्षमता पायी गयी। फलों में विटामिन सी तथा केरोटीन की मात्रा कार्बनिक खाद देने पर अधिक पाया गया।

Introduction

Currently India is second in fruit and vegetable production in the world. Organic and biological routes of improving soil health and fertility for optimum crop production form the vital component of integrated plant nutrient supply system. The yields obtained with the use of fertilizers in combination with organic manures are higher than the use of inorganic fertilizers alone (Sharma and Dua, 1995). Yield of cucumber is influenced by several factors including optimum nutrition of the crop. Farmers are attracted towards the organic farming in developed countries in order to reduce the harmful chemical residues, but it has not yet taken up roots in majority of developing countries, including India. Hence, this trial was undertaken to find out the effect of integrated nutrient management on cucumber production which is being a very commonly used as salad vegetable.

Materials and Methods

The experiment was carried out during *rabi* 2003-04 to 2005-06 at Vegetable Breeding Station, Agricultural Research Institute, ANGRAU, Rajendranagar, Hyderabad – 30. The soil of the experimental plot was clay loam in texture having pH - 8.0, low in organic carbon (0.38%), available nitrogen (240 kg ha^{-1}), phosphorus (27 kg ha^{-1}) and medium in potash (325 kg ha^{-1}) contents. Nine treatments were evaluated in Randomized Block Design with three replications. The treatments consisted of T_1 –Farm Yard Manure (FYM) @ 20 t ha^{-1}; T_2 -Vermicompost (VC) @ 4 t ha^{-1}; T_3 - FYM @ 10 t ha^{-1} + Vermicompost @ 2 t ha^{-1}; T_4 - Legume green leaf manure @ 5t ha^{-1} + Biofertilizers (N, P sources) ; T_5- FYM @ 10 t ha^{-1} + Biofertilizers (N,P sources) ; T_6 – T_5 + ½ RDF (50:40:50 kg ha^{-1}); T_7 - Legume green leaf manure @ 2.5 t ha^{-1} + Biofertilizers + ½ RDF ; T_8 - Vermicompost @ 2 t ha^{-1} + Biofertilizers + ½ RDF; T_9 - RDF (100:50:50 kg ha^{-1}). The organic manures and biofertilizers were incorporated well in advance of 15 days soil before sowing of the crop.

Cucumber crop (var. Poinsette) was sown adopting a spacing of 50 cm between hills in channels spaced at 2.5 m under irrigated conditions. All the recommended cultural operations were carried out to maintain a healthy crop. The data was analysed by the method advocated by Panse and Sukhatme (1978).

Results and Discussion

The data of experimentation revealed that application of FYM / VC + biofertilizers + ½ RDF (INM- Integrated Nutrient Management) significantly influenced the yield and yield components of cucumber. The vine length, no. of branches and fruit girth though they were not significantly influenced by the treatments, there were marked differences between INM and other treatments (Table 1). The no. of fruits /vine, fruit length and fruit yield were significantly high with the application of the combinations of organic manures + biofertilizers + ½ RDF (INM- Treatments) compared to RDF (Recommended dose of fertilizer) and the performance of all other treatments and RDF were comparable in all the aspects of this investigation.

Further, application of FYM or vermicompost + biofertilizers + ½ RDF and combined application of FYM (10 t) + VC (2 t) produced significantly higher cucumber fruit yield of 111 and 106 q ha^{-1} respectively compared to RDF and application of legume green leaf manure @ 5t ha^{-1} (Table 1). Significantly very low yields (68 q ha^{-1}) were observed with the application of legume green leaf manure @ 5 t ha^{-1} compared to all other treatments.

The favourable nutritional environment in the root zone thus created by addition of organic manures and biofertilizers resulted in increased absorption of these nutrients from soil solution and uptake of these nutrients which was responsible for increased fruit growth and yield attributing characters of cucumber. Similar findings have been reported by earlier researchers Mondal and Roy (2001) in potato; in onion by Jyotishi and Panday (1969) and in carrot by Luzzati *et al.,* (1980).

The quality parameters indicated that the Vit. 'C', total carotenes and â – carotenes were high in the cucumber fruits produced with integrated nutrient management compared to the treatments where only organic manures and RDF (Recommended dose of fertilizer) were added individually (Table 2). However, the difference in total soluble solids and moisture per cent was not significant among the treatments.

Table 2: Quality parameters in cucumber as influenced by INM

Treatment	Moisture %	Total Carotenes (µg/ 100g)	β-carotenes (µg/ 100g)	Vit. C mg/ 100g	Total Sol. Solids (^{0}Brix)
T_1	95.8	327.9	37.0	17.6	3.2
T_2	95.8	418.8	30.8	12.9	2.6
T_3	95.7	367.4	36.1	12.9	3.0
T_4	96.3	313.4	27.2	14.9	2.5
T_5	96.0	331.6	33.1	13.7	2.6
T_6	95.8	545.6	51.9	17.6	2.6
T_7	96.0	529.7	48.8	16.5	2.9
T_8	96.2	520.0	37.6	14.9	2.9
T_9	95.6	454.8	47.6	12.6	3.0
Mean	95.9	423.2	38.9	14.8	2.8
SD	0.2	93.1	8.6	2.0	0.2

The total nitrogen, phosphorus, potassium and calcium contents were high in fruit compared to leaf where as the magnesium content was comparable between leaf and fruit in all the treatments (Table 3&4). The nitrogen, phosphorus and potassium contents in fruit and leaf were relatively high in the treatments where the integrated nutrient management component was involved than that of the treatments where the organic manures and RDF alone were applied.

Table 1 : Yield components of cucumber as influenced by the Integrated Nutrient management

Treatment	Vine length (cm)	No. of branches/ plant	No.of fruits/ vine	Fruit girth (cm)	Fruit Length (cm)	Yield (q/ ha)	BC ratio
FYM @ 20 t/ha	1.36	4.5	3.9	15.7	19.9	92	1.52
Vermi compost (VC) @ 4t/ha	1.23	4.5	3.9	16.1	20.4	94	1.56
FYM @ 10 t + (VC) @ 2 t/ha	1.19	4.4	4.2	15.9	20.3	103	1.74
Green leaf manure @5t/ha + BF (N + P) fixi	1.13	4.3	3.0	14.4	18.3	68	1.32
FYM @ 10 t + BF(N + P fixing)	1.09	4.5	4.1	15.6	19.8	105	1.91
FYM @ 10 t + BF(N + P fixing) + 1/2 RDF	1.32	4.5	4.3	17.6	21.5	111	2.10
GLM@ 2.5 t + BF(N + P fixing) + 1/2 RDF	1.21	4.3	3.9	16.3	20.2	90	1.75
VC @ 2t/ha + BF(N + P fixing) + 1/2 RDF	1.30	4.3	4.3	16.6	22.2	109	2.03
RDF(50-40-50 kg N,P_2O_5,K_2O ha^{-1})	1.18	4.4	3.8	16.1	19.8	84	1.68
SEm ±	0.12	0.15	0.2	0.7	0.5	7	--
CD at 5% level	NS	NS	0.5	NS	1.6	19	--
CV (%)	17.6	6.0	7.5	7.7	4.5	--	--

Table : 3. Effect of Integrated Nutrient Management on the Nitrogen, Phosphorus and Potassium, Calcium and Magnesium content of the leaf of cucumber

Treatments	Leaf Nutrient content				
	%N	%P	%K	%Ca	%Mg
T_1	2.38	0.22	1.90	1.10	0.47
T_2	2.29	0.24	1.93	1.07	0.39
T_3	2.33	0.24	1.95	1.13	0.42
T_4	2.42	0.24	2.12	1.08	0.36
T_5	2.19	0.24	2.07	1.02	0.35
T_6	2.12	0.27	2.12	1.11	0.41
T_7	2.29	0.25	2.05	1.00	0.41
T_8	2.24	0.24	1.93	1.14	0.38
T_9	2.29	0.25	1.98	1.08	0.41
Mean	2.28	0.24	2.01	1.08	0.40

Table 5: Effect of Integrated Nutrient Management on the Nitrogen, Phosphorus and Potassium content of the soil

Treatments	N	P_2O_5	K_20
FYM @ 20 t/ha	235	38	304
Vermi compost(VC) @ 4t/ha	258	40	302
FYM @ 10 t + (VC) @ 2 t/ha	257	39	298
Green leaf manure @5t/ha + BF(N+P fixing)	247	37	294
FYM @ 10 t + BF(N+P fixing)	243	40	303
FYM @ 10 t + BF(N+P fixing) + 1/2 RDF	256	43	312
GLM@ 2.5 t + BF (N+P fixing) + 1/2 RDF	267	40	306
VC @ 2t/ha + BF(N+P fixing) + 1/2	266	42	311
RDF(50-40-50 kg N,P_2O_5, K_2O ha^{-1})	252	37	307
Mean	253	39	304
SD	10	2	6

Table 4. Effect of Integrated Nutrient Management on the Nitrogen, Phosphorus and Potassium and other macro and micro nutrient content of the fruit of cucumber.

Treatments	Fruit Nutrient content								
	%N	%P	%K	%Ca	%Mg	Zn ppm	Cu ppm	Fe ppm	Mn ppm
T_1	2.74	0.31	2.87	1.05	0.35	21.5	3.4	75.8	77.8
T_2	2.86	0.33	2.77	1.11	0.37	18.2	4.6	96.2	67.5
T_3	2.68	0.31	2.81	1.15	0.38	17.5	3.8	102.4	82.5
T_4	2.80	0.35	2.75	1.07	0.36	15.7	4.1	114.1	76.5
T_5	2.78	0.32	2.83	1.10	0.37	19.6	3.9	119.5	92.5
T_6	2.81	0.34	2.95	1.15	0.38	24.6	4.4	121.2	89.4
T_7	2.79	0.38	2.75	1.15	0.36	23.4	3.8	113.4	91.2
T_8	2.77	0.36	2.86	1.18	0.34	20.6	4.2	115.6	86.5
T_9	2.80	0.33	2.90	1.12	0.37	24.5	3.9	110.4	82.1
Mean	2.78	0.33	2.83	1.11	0.36	20.6	4.0	107.6	82.9
SD	0.056	0.02	0.08	0.04	0.01	3.1	0.4	14.3	8.1

In soil, the available nitrogen content was more with INM and RDF treatments. However, the available phosphorus content was high in all the treatments compared RDF application which can be attributed to the increased activity of micro organisms because of the application of organic manures (Rajbir singh and Ram Asrey, (2005) and also had solubilizing effect on fixed and unavailable form of nutrients in the soil (Kumaran *et al,* 1998). Distinctive variation in the available potassium content was not observed (Table 5).

From the results it can be concluded that maximum yields could not be realized with organic farming alone particularly in high productive crops like vegetables. Judicious application of N which built soil N reserves by the addition of organic manures as primary sources of N and split application of fertilizer N to supplement organic N is suggested for higher yields in cucumber. Integrated nutrient management has not only improved the yields but also the quality, nutrient status in cucumber and also of the soil.

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