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Effect of organic inorganic and bio fertilizers on uptake of nutrients by different vine parts of cucumber grown under protected condition

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Abstract An experiment was carried out on integrated nutrient management on uptake of nutrients by different vine parts of Cucumber (cv. Hassan Local) grown under open condition at Department of Horticulture, University of Agricultural Sciences, Bangalore during the year 2005 and 2006. The results revealed that the plants treated with 75% RDF + 75% FYM + AZT + PSB + TD (T_2) registered maximum up take of nitrogen by shoots ((58.26 ; 49.28 kg ha^{-1}), leaves (49.11 ; 43.22 kg ha^{-1}), fruits (27.43 ; 28.66 kg ha^{-1}) and by roots (10.56 ; 7.00 kg ha^{-1}) and phosphorus uptake by shoot (27.71 ; 26.76 kg ha^{-1}), leaves (19.92 ; 21.79 kg ha^{-1}), fruits (13.58 ; 14.04 kg ha^{-1}) and by roots (3.65 ; 3.93 kg ha^{-1}) and highest potassium uptake by shoot (153.69 ; 136.25 kg ha^{-1}), leafs (96.66 ; 117.29 kg ha^{-1}), fruits (82.71 ; 77.55 kg ha^{-1}), and by roots (30.27 ; 20.46 kg ha^{-1}) followed by T_6 and T_4 in all treatments. Even the same treatment also recorded maximum uptake of total nitrogen (145.36 and 128.16 kg ha^{-1}), total phosphorus (64.88 and 66.52 kg ha^{-1}) and total potassium uptake (363.33 and 351.55 kg ha^{-1}). Hence, the treatment (T_2) 75% RDF + 75% FYM + AZT + PSB + TD is considered as a best treatment for uptake of major nutrients.

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Introduction

Cucumber (*Cucumis sativus* L.) is one of the most popular vegetable belongs to the family cucurbitaceae. It is preferably grown for its edible tender fruits in almost all parts of the world. In India, cucumber is cultivated in an area of 18,000 hectares with a production of 1, 20,000 tonnes. In Karnataka cucumber is grown in an area of 6021 hectares with annual production of 87,858 tonnes (Anon, 2005). Growing of high value vegetables like cucumber under green houses has been reported to give high yield of good quality produce in developed countries. Hence there is a need know the uptake of nutrients by integrated nutrient management practices for cucumber growing under low cost greenhouses.

Materials and Methods

The experiment was carried out at Precision Farming Development Centre (PFDC) in the Division of Horticulture, Gandhi Krishi Vigana Kendra, University of Agricultural Sciences, Bangalore during summer 2005 and rabi 2006 The soil of the experimental field was sandy loam having 6.5 to 7.0 PH and the plot size of 2.25 x 1.0 m with a spacing of 60 x 45cm. The experiment was laid out in Randomized Completely Block Design with three replications involving 12 treatments *viz*,100% recommended dose of fertiliser (72 :60:96 kg NPK ha^{-1})+100% FYM (25t ha^{-1}) (T_1) ;75% RDF + 75% FYM + Azotobacter (AZT) + Phosphobacteria (PSB) + Trichoderma (TD) (T_2); 50% RDF + 50% FYM + Azotobacter + Phosphobacteria + Trichoderma(T_3) ;75% RDF + VC (1.5t ha^{-1}) + Azotobacter + Phosphobacteria + Trichoderma(T_4) ;50% RDF + VC (1.5t ha^{-1}) + Azotobacter + Phosphobacteria + Trichoderma (T_5) ;75% RDF + 50% FYM + VC (1.5t ha^{-1}) + Azotobacter + Phosphobacteria + Trichoderma (T_6) ;50% RDF + 50% FYM + VC (1.5t ha^{-1}) + Azotobacter + Phosphobacteria + Trichoderma (T_7) ;75% RDF + 50%

FYM + Azotobacter Trichoderma (T_8) ;50% RDF + 50% FYM + Azotobacter) (T_9) 75% RDF + 50% FYM + Phosphobacteria (T_{10});50% RDF + 50% FYM + Phosphobacteria (T_{11})and 100% FYM + Azotobacter + Phosphobacteria + Trichoderma (T_{12}). The recommended dose of NPK (72:60:92kg/ha) Farm yard manure (25t ha^{-1}) Vermicompost (1.5t ha^{-1}) and bio-fertilizers like Azotobacter (5kg ha^{-1}) Phosphobacteria (5kg ha^{-1}) Trichoderma(5kg ha^{-1}) were applied as per the treatments. Fifty percent of N and full dose of P and K were applied in the furrows as per treatments and were thoroughly mixed in soil. The remaining half of the nitrogen was top dressed at 30 days after planting. The cultivar used in this study was Hassan Local, it is an indigenous and most popular local variety grown mainly in Hassan district of Karnataka. The observations on uptake of nitrogen, phosphorus, potassium and total NPK uptake was recorded and analysed.

Results and Discussion

Nitrogen uptake: Data pertaining to nitrogen uptake (kg ha^{-1}) by different vine parts of cucumber as influenced by integrated nutrient management differed significantly under protected condition during summer 2005 and rabi 2006 (Table 1). Plants provided with 75% RDF + 75% FYM + AZT + PSB + TD (T_2) recorded maximum nitrogen uptake (58.26 ; 49.28 kg ha^{-1}) in shoot which was *on par* with T_6 - 75% RDF + 50% FYM + VC + AZT+ PSB +TD (57.91; 46.36 kg ha-1), while lowest nitrogen uptake (43.02 ; 28.56 kg ha^{-1}) was recorded with 100% FYM + AZT+ PSB +TD (T_{12}) during summer 2005 and rabi 2006 respectively. The maximum nitrogen uptake (49.11; 43.22 kg ha^{-1}) in leaves was recorded in plants fertilized with 75% RDF + 75% FYM + AZT + PSB + TD (T_2) which was *on par* with T_6 (48.26 ; 40.07 kg ha^{-1}), Whereas, lowest nitrogen uptake (27.32; 28.05 kg ha^{-1}) was recorded with 100% FYM + AZT+ PSB +TD (T_{12}) during summer 2005 and rabi 2006 respectively.

With regard to fruit, again T_2 recorded the maximum nitrogen uptake (27.43; 28.66 kg ha^{-1}) which was *on par* with T_6 (26.58; 28.58 kg ha^{-1}) and T_4 (25.50; 28.28 kg ha^{-1}). However, the lowest nitrogen uptake (19.61; 19.57 kg ha^{-1}) was registered with 100% FYM + AZT+ PSB +TD (T_{12}) during summer 2005 and rabi 2006 respectively.

Plants provided with 75% RDF + 75% FYM + AZT + PSB + TD (T_2) recorded maximum nitrogen uptake (10.56 ; 7.00 kg ha^{-1}) in roots which was *on par* with T_6 - 75% RDF + 50% FYM + VC + AZT+ PSB +TD (10.40; 6.96 kg ha^{-1}), while plants fertilized with 100% FYM + AZT+ PSB +TD (T_{12}) registered lowest uptake of nitrogen (5.99; 5.06 kg ha^{-1}) during both the years respectively.

Phosphorus uptake: Data pertaining to phosphorus uptake (kg ha^{-1}) by different vine parts of cucumber as influenced by integrated nutrient management differed significantly under protected condition (Table 2). During summer 2005 and rabi 2006 plants fertilized with 75% RDF + 75% FYM + AZT + PSB + TD (T_2) recorded maximum phosphorus uptake by shoot (27.71 ; 26.76 kg ha^{-1}) which was *on par* with T_6 (27.28; 24.80 kg ha^{-1}), whereas lowest phosphorus uptake (13.14; 13.74

Table 1: Effect of integrated nutrient management on Nitrogen uptake by different parts of cucumber vine at harvest grown under protected condition.

Treatments	Nitrogen uptake (kg/ha)							
	Shoot		Leaf		Fruit		Root	
	Summer, 2005	Rabi, 2006	Summer, 2005	Rabi, 2006	Summer, 2005	Rabi, 2006	Summer, 2005	Rabi, 2006
T_1	54.41	45.26	44.94	33.12	24.86	27.36	8.61	6.59
T_2	58.26	49.28	49.11	43.22	27.43	28.66	10.56	7.00
T_3	46.70	33.43	32.63	28.35	22.95	25.58	7.62	5.55
T_4	56.10	45.77	46.26	33.42	25.50	28.28	9.20	6.89
T_5	47.81	39.24	34.71	29.26	23.04	25.80	7.70	5.62
T_6	57.91	46.36	48.26	40.07	26.58	28.58	10.40	6.96
T_7	53.22	46.36	40.98	31.75	23.95	26.30	8.46	5.87
T_8	52.78	41.98	40.07	30.06	23.31	26.16	8.28	5.82
T_9	46.64	33.40	30.64	28.33	22.91	24.40	7.52	5.52
T_{10}	51.45	40.97	35.99	29.34	23.05	25.80	8.05	5.69
T_{11}	46.46	32.72	30.31	28.23	22.87	20.55	7.19	5.44
T_{12}	43.02	28.56	27.32	28.05	19.61	19.57	5.99	5.06
SEm ±	2.14	1.25	3.44	1.13	0.79	1.20	0.43	0.32
CD at 5%	6.27	3.69	10.09	3.33	2.32	3.52	1.26	0.93
CV (%)	7.23	5.44	15.50	6.16	5.76	8.14	8.99	9.23

Table 2: Effect of integrated nutrient management on Phosphorus uptake by different parts of cucumber vine at harvest grown under protected condition.

Treatments	Phosphorus uptake (kg ha^{-1})							
	Shoot		Leaf		Fruit		Root	
	Summer, 2005	Rabi, 2006	Summer, 2005	Rabi, 2006	Summer, 2005	Rabi, 2006	Summer, 2005	Rabi, 2006
T_1	21.18	22.82	15.05	16.62	11.90	12.70	2.93	3.73
T_2	27.73	26.76	19.92	21.79	13.58	14.04	3.65	3.93
T_3	15.94	17.04	13.24	14.96	9.93	11.04	2.50	2.80
T_4	23.36	23.03	15.11	18.25	12.58	13.09	3..04	3.41
T_5	19.23	19.52	13.61	15.73	10.82	11.45	2.60	3.00
T_6	27.28	24.80	15.19	18.31	12.66	13.26	3.61	3.52
T_7	19.92	22.10	14.95	16.32	11.51	12.65	2.85	3.27
T_8	19.75	21.05	14.91	16.31	11.12	12.24	2.71	3.23
T_9	14.86	15.58	13.00	14.13	9.31	10.62	2.30	2.79
T_{10}	19.32	19.55	14.11	16.28	10.82	12.23	2.71	3.00
T_{11}	14.64	14.71	12.24	14.03	8.76	8.94	2.09	2.61
T_{12}	13.14	13.74	9.17	13.95	7.95	7.68	1.97	2.52
SEm ±	2.98	0.73	1.21	0.72	0.45	0.46	0.08	0.16
CD at 5%	8.75	2.15	3.57	2.11	1.34	1.37	0.24	0.47
CV (%)	26.23	6.33	15.02	7.62	7.31	6.97	5.16	9.05

Table 3: Effect of integrated nutrient management on Potassium uptake by different parts of cucumber vine at harvest grown under protected condition.

Treatments	Potassium uptake (kg ha^{-1})							
	Shoot		Leaf		Fruit		Root	
	Summer, 2005	Rabi, 2006	Summer, 2005	Rabi, 2006	Summer, 2005	Rabi, 2006	Summer, 2005	Rabi, 2006
T_1	138.92	120.65	67.70	82.36	71.70	71.23	22.09	17.31
T_2	153.69	136.25	96.66	117.29	82.71	77.55	30.27	20.46
T_3	101.27	97.41	49.89	76.78	68.44	55.44	16.66	14.62
T_4	139.14	123.19	84.44	84.08	77.86	71.29	24.41	19.02
T_5	110.69	102.23	50.68	76.99	68.72	63.44	19.83	15.67
T_6	139.50	131.17	84.82	88.09	79.45	76.77	26.02	19.66
T_7	138.88	120.22	63.75	82.01	71.13	68.93	20.79	16.91
T_8	119.71	110.86	59.05	80.45	69.65	67.96	19.38	16.77
T_9	92.33	93.80	48.39	76.35	66.10	50.38	15.62	14.50
T_{10}	112.24	106.61	53.06	77.24	69.48	67.54	19.83	15.99
T_{11}	80.69	79.07	42.16	75.80	64.30	48.78	15.56	12.55
T_{12}	75.23	78.74	29.63	68.70	54.24	48.12	13.19	10.26
SEm ±	5.27	6.40	4.54	3.72	4.90	3.04	2.92	0.79
CD at 5%	15.48	18.77	13.34	10.93	14.37	8.93	8.56	2.13
CV (%)	7.82	10.23	12.94	7.85	12.07	8.24	25.10	7.82

kg/ha) was recorded in plants fertilized with 100% FYM + AZT + PSB + TD (T_{12}) respectively.

Plants fertilized with 75% RDF + 75% FYM + AZT + PSB + TD (T_2) recorded maximum phosphorus uptake by leaf (19.92; 21.79 kg ha^{-1}) followed by T_6 (15.19; 18.31 kg ha^{-1}). Whereas the lowest uptake of phosphorus (9.17 ; 13.95 kg ha^{-1}) was recorded with 100% FYM + AZT + PSB + TD (T_{12}) during summer 2005 and *rabi* 2006 respectively.

During summer 2005 and *rabi* 2006 the maximum phosphorus uptake by fruits (13.58; 14.04 kg ha^{-1}) was recorded with 75% RDF + 75% FYM + AZT + PSB + TD (T_2) which was *on par* with T_6 (12.66; 13.26 kg ha^{-1}), T_4 (12.58; 13.09 kg ha^{-1}). While the lowest phosphorus uptake (7.95; 7.68 kg ha^{-1}) was recorded in 100% FYM + AZT + PSB + TD (T_{12}) respectively.

Plants provided with 75% RDF + 75% FYM + AZT + PSB + TD (T_2) recorded maximum phosphorous uptake by roots (3.65 ; 3.93 kg ha^{-1}) which was *on par* with T_6 (3.61 kg ha^{-1}) and T_1 (3.73 kg ha^{-1}], While lowest phosphorus uptake (1.97 ; 2.52 kg ha^{-1}) was recorded with 100% FYM + AZT + PSB + TD (T_{12}) during summer 2005 and *rabi* 2006 respectively.

Table 4: Effect of integrated nutrient management on total nitrogen, phosphorus and potassium uptake by cucumber vine at harvest grown under protected condition.

Treatments	Nitrogen (kg ha^{-1})		Phosphorus (kg ha^{-1})		Potassium (kg ha^{-1})	
	Summer, 2005	Rabi, 2006	Summer, 2005	Rabi, 2006	Summer, 2005	Rabi, 2006
T_1	132.82	112.33	51.86	55.87	300.41	256.73
T_2	145.36	128.16	64.88	66.52	363.33	351.55
T_3	109.9	92.91	41.61	45.84	236.26	244.25
T_4	137.06	114.36	54.09	57.78	325.85	297.58
T_5	113.26	99.92	46.26	49.70	249.92	258.33
T_6	143.15	121.97	58.74	59.89	329.79	315.69
T_7	126.61	110.28	49.23	54.34	294.55	288.07
T_8	124.44	104.02	48.49	52.83	267.79	276.04
T_9	107.71	91.65	39.47	43.12	222.44	235.03
T_{10}	118.54	101.8	46.96	51.06	254.61	267.38
T_{11}	106.83	86.94	37.73	40.29	202.71	216.20
T_{12}	95.94	81.22	32.23	37.89	163.24	205.82
SEm ±	29.61	2.34	8.35	3.91	27.82	12.34
CD at 5%	NS	6.88	9.84	11.49	81.60	36.22
CV (%)	39.85	3.91	12.53	13.25	17.28	7.98

NS: Non significant

Potassium uptake: Data pertaining to potassium uptake (kg ha^{-1}) by different vine parts of cucumber as influenced by integrated nutrient management differed significantly grown under protected condition (Table 3). The maximum potassium uptake by shoot (153.69; 136.25 kg ha^{-1}) and leaf (96.66; 117.29 kg ha^{-1}) was recorded in plants fertilized with 75% RDF + 75% FYM + AZT + PSB + TD (T_2) which was *on par* with T_6, T_4. While minimum potassium uptake by shoot (75.23; 78.74 kg ha^{-1}) and leaf (29.63; 68.70 kg ha^{-1}) was registered with 100% FYM + AZT + PSB + TD (T_{12}) during summer 2005 and *rabi* 2006 respectively.

The maximum potassium uptake (82.71; 77.55 kg ha^{-1}) by fruit and (30.27 ; 20.46 kg ha^{-1}) by roots was with 75% RDF + 75% FYM + AZT + PSB + TD (T_2) which was *on par* with T_6 (79.45 ; 76.77 kg ha^{-1}), T_4 (77.86 ; 71.29 kg ha^{-1}) in fruit and T_6 (26.02 ; 24.41 kg ha^{-1}), T_4 (24.41 ; 19.02 kg ha^{-1}) in roots respectively. Whereas least potassium uptake by fruits (54.24 ; 48.12 kg ha^{-1}) and by roots (13.19 ; 10.26 kg ha^{-1}) was recorded with 100% FYM+AZT+PSB+TD (T_{12}) during summer 2005 and *rabi* 2006 respectively.

Total NPK: Data pertaining to total nitrogen, phosphorus and potassium uptake as influenced by integrated nutrient management grown under protected condition during summer 2005 and *rabi* 2006 presented in Table 4.

Uptake of total NPK nutrients by different vine parts of cucumber was significantly influenced by the integrated nutrient management practices during both the years. The plants provided with 75% RDF + 75% FYM + AZT + PSB + TD (T_2) recorded maximum uptake of nitrogen (145.36 and 128.16 kg ha^{-1}) which was followed by T_6 and T_4, respectively. Phosphorous (64.88 and 66.52 kg ha^{-1}) and potassium (363.33 and 351.55 kg ha^{-1}) this could be attributed to maximum uptake of nitrogen, phosphorous and potassium could be attributed to applications of balanced dose of NPK nutrients along with organic manure and biofertilizers (AZT, PSB) which helps in quick availability of nutrient. The increase uptake of nitrogen is also related to fixing of atmospheric nitrogen due to Azotobacter. Maximum uptake of phosphorous is due to better mobilization of phosphorous by phospho-bacteria with solubalizes the insoluble form of phosphorous into soluble form. The maximum uptake of potassium is related to synergetic effect of nitrogen and phosphorous. The increased uptake of NPK nutrients is also related to maximum dry matter production, creations of better soil conditions due to applications of organic manures and bio-fertilizers. The biofertilizers produces the bio-active substances, similar to the hormonal effect and creates better rhizophere around the root zone which helps in better uptake of NPK nutrients by the plants. These findings were in conformity with the results of Shun Fung *et al.* (2000) in cucumber, Mohandas (1990) in muskmelon.

सारांश

ककड़ी की प्रजाति 'हसन लोकल'' जिसे सुरक्षित दशा में उगाया गया तथा इस पर कार्बनिक, अकार्बनिक तथा बायोफर्टीलाइजर के प्रभाव को कृषि विज्ञान विश्वविद्यालय बंगलौर में सन् 2005 तथा 2006 में देखा गया। दो वर्षों के परिक्षणों के आधार पर यह पाया गया कि ककड़ी के जिस पौधों में 75 प्रतिशत आर.डी.एफ. + 75 प्रतिशत एफ.वाई.एम. + ए.जेड.टी. + पी.एस.बी. + टी.डी. (T_2) दिया गया, सबसे अधिक नाइट्रोजन ग्रहण सूट (58.26, 49.28 कि.ग्रा. प्रति

है.), पत्तियों (49.11, 43,22 कि.ग्रा. प्रति है.), फलो (27.43, 28.66 कि.ग्रा. प्रति है.) था। जबकि फास्फोरस का सबसे अधिक ग्रहण सूट (27.71, 26.76 कि.ग्रा./है.) पत्तियाँ (19.92, 21.79 कि.ग्रा./है.), फलों (13.58, 14.04 कि.ग्रा./है.), तथा जड़ों (3.65, 3.93 कि.ग्रा./है.) था। पोटेशियम ग्रहण सबसे अधिक सूअ (153.69, 136.25 कि.ग्रा./है.), पत्तियाँ (19.66, 117.26 कि.ग्रा./है.), फलो (82.71, 77.55 कि.ग्रा./है.) तथा जड़ों द्वारा (30.27, 20.46 कि.ग्रा./है.) था। अतः ककड़ी में पोषक तत्वों के ग्रहण की क्षमता बढ़ाने में 75 प्रतिशत आर.डी.एफ. + 75 प्रतिशत एफ.वाई.एम. + ए.जेड.टी. + पी. एस.बी. + टी.डी. सबसे उत्तम परिक्षण पाया गया था।

References

Anonymous (2005) Area and production of horticultural crops in Karnataka, Directorate of Horticulture, Lalbaugh, Bangalore

Shun Fung T, Matsumara T, Ashiwzawa M (2000) Effect of nutrition on cucumber production and yield. Proc Amer Soc Hort Sci 72: 343-352

Mohandas AK, Kumaraswamy N (1990) Effect of Azotobacter, Trichoderma along with NPK on growth, yield and quality of musk melon grown under protected condition. South Indian Hort 52 : 234-236