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Growth, yield and quality attributes of cucumber (Cv. Hassan local) as influenced by integrated nutrient management grown under protected condition

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Abstract : An experiment was carried out at during two seasons i.e., summer 2005 and rabi 2006 to study the effect of integrated nutrient management on growth, yield and quality attributes of cucumber (cv. Hassan Local) grown under protected condition. The results revealed that application of 75% RDF + 75% FYM + Azotobacter + Phosphobacteria + Trichoderma (T_2) was significantly superior for growth parameters like maximum vine length (250.33; 255.16cm), number of leaves (93.26; 96.50) and number of branches per plant (7.23; 7.78) and yield parameters like number of fruits per vine (9.60; 11.66), maximum fruit weight (270.20; 349.97g), fruit yield per vine (2.42; 2.45kg) and fruit yield (62.76; 63.68 t ha^{-1}) and quality parameters like ascorbic acid content (6.5; 5.91 mg/100g), TSS (3.00; 3.16 ^{0}Brix), moisture content (95.50; 96.06%) and shelf life (7.18; 7.86 days) during summer and rabi season respectively.

Keywords: Growth, Yield, Cucumber, INM

Introduction

Cucumber (*Cucumis sativus* L.) is 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. Application of heavy doses of chemical fertilizers without organic manures or bio-fertilizers causes deterioration of soil health in terms of physical and chemical, properties of soil, declining of soil microbial activities, reduction in soil humus, increased pollution of soil, water and air. Hence, integrated nutrient management is the need of the hour. 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 to standardize the integrated nutrient management practices for cucumber growing under low cost greenhouses to increase productivity under Indian conditions.

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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 growth yield and also quality parameters were recorded and analysed.

Results and Discussion

The growth parameters differed significantly with the influence of integrated nutrient management. The plants provided with 75% RDF + 75% FYM + Azotobacter + PSB + Trichoderma (T_2) recorded maximum vine length (250.33; 255.16 cm) which was on par with T_6 – 75% RDF + 50% FYM + VC + Azotobacter + PSB + Trichoderma, in both seasons summer 2005 and rabi 2006 (Table 1). The maximum number of branches per vine (7.23; 7.78) was registered in the plants receiving 75% RDF + 75% FYM + Azotobacter + PSB + Trichoderma (T_2) (Table 1) which was on par with T_6, T_4, T_1 and T_7 respectively during both the years. This could be attributed to the prevailing favourable microclimate inside the greenhouse which helped the plants in better utilization of solar radiation, nutrients and water for the synthesis of photosynthates and also the prevailing higher temperature inside the greenhouse might have helped in faster multiplication of cells and cellular elongation resulting in better growth of roots and shoots which helped better vegetative growth including plant height, plant spread, number of primary and secondary branches. The results obtained are in agreement with Nagalakshmi *et al.* (2001), Krishnamanohar (2002) and Srivastava *et al.* (1993).

The maximum number of fruits per vine (9.60 ; 11.66) was recorded with 75% RDF + 75% FYM + AZT + PSB + TD (T_2) which was *on par* with T_6 - 75% RDF + 50% FYM + VC + AZT + PSB + TD (9.03 ; 11.03), T_4 - 75% RDF + VC + AZT+ PSB +TD (8.73 ; 9.91) and T_1 - 100% RDF + 100% FYM (7.60 ; 9.66). While, minimum number of fruits (6.63; 8.11) was noticed in plants provided with 100% FYM + AZT + PSB + TD (T_{12}) during summer 2005 and rabi 2006 respectively (Table 2).

Maximum fruit weight (270.20 ; 349.97g) was recorded in plants fertilized with 75% RDF + 75% FYM + AZT + PSB + TD (T_2) which was *on par* with T_6 (256.98 ; 333.22g), T_4 (254.07 ; 315.47g) and T_1 (245.59 ; 280.49g), while, lowest fruit weight (176.72 ; 177.26g) was observed in plants fertilized with 100% FYM + AZT + PSB + TD (T_{12}) during summer 2005 and rabi 2006 respectively. The maximum fruit yield per vine (2.42; 2.45kg vine^{-1}) was recorded in plants fertilized with 75% RDF + 75% FYM + AZT + PSB + TD (T_2) during summer 2005 and rabi 2006 respectively. Application of 75% RDF + 75% FYM + AZT + PSB + TD (T_2) recorded maxim um fruit yield per hectare (62.76 ; 63.68t ha^{-1}) which was followed by T_6 - 75% RDF + 50% FYM + VC + AZT + PSB + TD (62.73 ; 62.47 t ha^{-1}), T_4 - 75% RDF + VC + AZT+ PSB +TD

Table 1. Effect of integrated nutrient management on vine length, plant height and number of branches per plant at 90 Days After Sowing (DAS) in cucumber grown under open condition

Treatments	90 Days after sowing (DAS)					
	Number of leaves vine^{-1}		Plant height (cm)		Number of branches plant^{-1}	
	Summer, 2005	*Rabi*, 2006	Summer, 2005	*Rabi*, 2006	Summer, 2005	*Rabi*, 2006
T_1	88.00	94.65	205.00	217.50	6.15	7.30
T_2	93.26	96.50	250.33	255.16	7.23	7.78
T_3	84.50	85.50	195.33	201.16	5.13	5.78
T_4	89.76	95.00	208.33	220.33	6.20	7.60
T_5	48.53	86.83	194.16	203.43	5.23	6.11
T_6	91.10	96.50	247.83	253.76	6.76	7.61
T_7	86.50	89.41	203.83	209.33	6.06	7.28
T_8	86.16	88.66	203.00	207.33	5.46	6.95
T_9	82.93	84.66	190.33	197.50	5.06	5.63
T_{10}	85.50	87.83	195.83	205.16	5.30	6.48
T_{11}	82.83	84.16	178.00	184.16	4.53	5.41
T_{12}	81.83	83.33	169.66	172.16	4.50	5.11
SEm ±	4.89	8.29	11.53	6.03	0.47	0.31
CD at 5%	NS	NS	33.82	17.68	1.40	0.93
CV (%)	9.80	16.07	9.82	4.90	14.69	8.35

NS: Non significant

Table 2. Effect of integrated nutrient management on number of fruits per vine and fruit yield of cucumber grown under protected condition

Treatments	Number of fruits vine^{-1}		Fruit weight (g)		Fruit weight (kg vine^{-1})		Fruit yield (t ha^{-1})	
	Summer, 2005	Rabi, 2006	Summer, 2005	Rabi, 2006	Summer, 2005	Rabi, 2006	Summer, 2005	Rabi, 2006
T_1	7.60	9.66	245.69	280.49	2.09	2.17	54.33	56.34
T_2	9.60	11.66	270.20	349.97	2.42	2.45	62.76	63.68
T_3	6.83	8.81	214.24	223.65	1.83	2.03	47.52	52.28
T_4	8.73	9.91	254.07	315.47	2.27	2.19	59.02	57.86
T_5	6.88	8.91	221.22	266.40	1.83	2.06	50.11	52.46
T_6	9.03	11.03	256.98	333.22	2.41	2.41	62.73	62.47
T_7	6.95	9.53	239.18	274.92	1.94	2.10	50.85	54.52
T_8	6.93	9.20	231.08	272.71	1.93	2.10	50.55	54.45
T_9	6.73	8.46	210.79	221.58	1.83	2.01	42.27	52.13
T_{10}	6.91	9.08	228.07	267.56	1.86	2.08	50.11	54.01
T_{11}	6.68	8.30	209.23	206.02	1.70	1.96	44.07	50.55
T_{12}	6.63	8.11	176.72	177.26	1.52	1.95	38.62	50.41
SEm ±	0.85	0.86	15.62	17.16	0.24	0.26	4.31	4.86
CD at 5%	2.51	2.52	45.83	50.35	0.72	NS	12.66	12.80
CV (%)	19.92	15.86	11.77	11.18	21.73	21.48	14.56	13.72

NS: Non significant

(59.02 ; 57.86 t ha^{-1}) and T_1 - 100% RDF + 100% FYM (54.33 ; 56.34 t ha^{-1}) in both the seasons (Table 2).

The increased number of fruits vine^{-1}, fruit weight, fruit yield vine^{-1} and total fruit yield could be attributed to better photosynthesis activity and accumulation of carbohydrates which helps in better growth of fruits. It was also related to the maximum uptake of NPK nutrients due to the influence of biofertilizers which provide favourable conditions around the root rhizosphere resulted in better absorption of nutrients. These results are on agreement with the findings of Amarananjundeshwara (2002) in greenhouse grown tomato and Gayathri (2003) in greenhouse grown capsicum. These results were also agreement with the findings of Mohomedin *et al.* (1991), Jeevansab (2000) in cucumber, Srivatsava *et al.* (1993) in capsicum.

Higher yield of cucumber in the present study is also related to the influence of combined effect of organic, inorganic and bio-fertilizers which enhanced the synthesis of photosynthates and production of hormone

Table 3. Effect of integrated nutrient management on ascorbic acid content, TSS, moisture content and shelf life and physiological loss in weight in cucumber grown under protected condition.

Treatments	Ascorbic acid (mg/100g)		TSS (^{0} Brix)		Moisture content (%)		Shelf life (Days)		Physiological loss in weight (%)	
	Summer, 2005	Rabi, 2006	Summer, 2005	Rabi, 2006	Summer, 2005	Rabi, 2006	Summer, 2005	Rabi, 2006	Summer, 2005	Rabi, 2006
T_1	6.13	5.58	2.90	2.56	95.00	95.60	6.81	6.96	22.58	21.01
T_2	6.50	5.91	3.00	3.16	95.50	96.06	7.18	7.86	22.25	20.58
T_3	5.76	5.25	2.63	2.23	94.50	94.50	7.02	7.37	21.71	20.21
T_4	6.36	5.70	2.93	2.60	95.06	95.66	7.30	7.87	22.46	20.66
T_5	5.76	5.35	2.76	2.33	94.66	95.00	7.03	7.58	22.00	20.30
T_6	6.40	5.75	2.96	3.00	95.16	96.00	7.37	8.00	21.80	20.58
T_7	6.06	5.50	2.86	2.43	94.90	95.33	7.51	8.01	20.66	20.00
T_8	6.06	5.41	2.86	2.40	94.83	95.33	7.11	7.60	22.50	20.93
T_9	5.53	5.12	2.60	2.20	94.40	94.50	6.87	7.25	21.68	20.20
T_{10}	5.93	5.40	2.80	2.36	94.66	95.16	7.03	7.57	22.25	20.25
T_{11}	5.43	4.91	2.56	2.20	94.33	94.33	6.83	7.18	22.16	20.28
T_{12}	5.33	4.85	2.36	2.13	94.16	91.83	7.95	8.08	19.83	19.91
SEm ±	0.23	0.22	0.08	0.12	3.14	3.17	0.27	0.31	0.53	0.73
CD at 5%	0.68	0.64	0.25	0.36	NS	NS	0.80	0.91	1.57	NS
CV (%)	6.76	7.09	5.41	8.81	5.74	5.79	6.58	7.06	4.25	6.24

NS: Non significant

like substances IAA, GA, amino acids and vitamins resulted in better growth and yield. More number of fruits per plant and fruit yield per plant ultimately contributed to more fruit yield per hectare. Similar findings were also reported by Pant *et al.* (2001), Mohomedin *et al.* (1991), in cucumber. The results obtained are also in line with Streeck *et al.* (1996) and Singh *et al.,* (2002) in cucumber under greenhouse as compared to that of open field condition.

Plants supplied with 75% RDF + 75% FYM + AZT + PSB + TD (T_2) (Table 3) recorded maximum ascorbic acid content (6.50 mg/100 g and 5.91 mg/100 g) and TSS (3.0 ^{0}Brix and 3.16 ^{0}Brix) content which was *on par* with the treatments of T_6, T_4, T_1 and T_5, respectively during both the years. Increased in ascorbic acid and TSS content of fruit in these treatments could be attributed to combined application of organic, inorganic fertilizers along with the bio-fertilizers (Azotobacter and PSB) which helped in better uptake of NPK nutrients including micronutrients which inturn influence the quality traits in cucumber. The results are in conformity with the findings of Grimstand (1990), Koodzeij and Kostecka (1994) and Asano (1994) in cucumber.

The shelf-life and physiological loss in weight is mostly influenced by the storage condition, but also the quality of harvested fruits, in different treatment combination in field level. Among the treatments plants supplied with T_{12} - 100% FYM + AZT + PSB + TD recorded the higher shelf-life (19.83 and 19.91%) during both the seasons. The increased shelf-life of fruits in T_{12} may be attributed to effect of the growth substances which are stimulated by the use of biofertilizers and organic manures which slow down the physiological process like respiration of fruits leading to better retention of moisture and increased their shelf-life.

सारांश

2005 के गर्मियों एवं 2006 के रबी के दो मौसम के दौरान ककड़ी (सी.वी. हसन स्थानीय) के विकास हेतु उसके उपज, गुणवत्ता, एकीकृत पोषक तत्व प्रबंधन के प्रभाव का अध्ययन एक प्रयोग द्वारा किया गया। गर्मियों एवं रबी के मौसम के दौरान 75% आर.डी.एफ. + 75% एफ.वाई.एम. + एजोवैक्टर फास्फोवैक्टेरीया + ट्राईकोडर्मा (टी–2) के अनुप्रयोग के परिणामों से पता चला की अधिकतम वेन की लम्बाई (250.33, 255.16 सेमी), पत्तियों की संख्या (93.26, 96.50), पौधें में कुल शाखायें (7.23, 7.78), विकास मापदण्डों के लिये काफी उपयुक्त था। उपज के मापदण्ड जैसे फल प्रति वेन (2.42, 2.45 किलो ग्राम), फल उपज (62.76, 63.68 टन हे$^{-1}$) और गुणवत्ता मानक जैसे एस्कार्विक एसिड सामग्री (6.5, 5.91 मीली ग्राम / 100 ग्राम), टी.एस.एस. (3.00, 3.16^0 ब्रिक्स), नमी सामग्री (95. 50, 96.06%) शेल्फ जीवन (7.18, 7.86 दिन) के लिए उपयुक्त था।

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