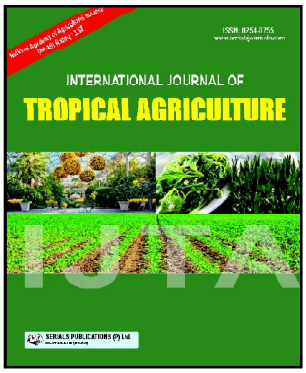

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Effect of Fertigation Scheduling and Doses of NPK on Growth, Yield and Quality of *Cucumis sativus* (L.) *cv* Kian Under Polyhouse Condition

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Abstract: An experiment was conducted to develop fertigation schedule and assess the effects different levels of NPK and drip irrigation on yield and yield attributes of parthenocarpic cucumber grown under polyhouse condition during two consecutive years 2015-16 and 2016-17. There were nine treatment combinations of recommended doses of water soluble fertilizers along with three intervals of fertigation. The experiments were laid out in completely randomized design with three replications. Observations were recorded on various vegetative and yield attributes. The results showed that most of the traits under study were significantly influenced by various fertigation schedules except specific gravity and fruit length. On the basis of pooled data, it has been observed that, among various treatment combinations, maximum yield per vine (4106.49 g), number of fruits per vine (35.37), vine length (415 cm) and yield per square meter (11.48kg) were reported for treatment T_8 (125 % RDF with fertigation at three days interval) followed by T_7 (125 % RDF with fertigation at two days interval), whereas treatment T_9 (125 % RDF with fertigation at four days interval) taken minimum days to first harvest.

Key words: Fertigation, NPK, drip irrigation, parthenocarpic cucumber and polyhouse.

INTRODUCTION

In India before independence vegetable production was less than 20 million tonnes which has now increased to 163 million tonnes from an area of 9.4 million ha in 2013-14 (Agriculture Statistics, 2014). Further, there is an urgent need to increase production of vegetable to feed millions of mouth, which seems possible only by increasing productivity. Land is limiting factor, hence boom in production can be achieved only through vertical harvesting

i.e. polyhouse cultivation of vegetable crops, by which one can produce quality vegetables even in off season with more productivity. Among the vegetables grown in polyhouse condition, cucumber is most popular crop due to its short life cycle and more biomass production. Cucumber (*Cucumis sativus* L.) is strictly warm season vegetable and an important member of family cucurbitaceae. It is said to be the native northern India (Pursglove, 1969). Cucumber is commonly a monoecious annual (one can encounter with androecious, gynoecious, hermaphrodite and andromonoecious sex types also), trailing or climbing vine (Bailey, 1969). The fruits of cucumbers possesses various medicinal properties *e.g.* cooling effect, prevents constipation, checks jaundice and indigestion (Nandkarni, 1927). Cucumber is very low calorie vegetable, provides only 15 calories per 100 g, hence, preferred by urban and peri-urban young generation.

Parthenocarpic and gynoecious cucumber cultivars increase the potential to yield a high fruit load in controlled environments resulting in a high harvest index. Yield of cucumber is influenced by several factors including optimum nutrition of the crop. Standardization of advanced and efficient methods of fertigation with meticulously designed nutrient management system is the prerequisite for better quality and increased yield under polyhouse condition, looking above facts, this trial was undertaken to assess the effects of fertigation scheduling on yield and yield attributes of polyhouse grown cucumber.

MATERIAL AND METHODS

The experiment was conducted under naturally ventilated polyhouse (NVP) at Hi-tech Horticulture Unit, Rajasthan College of Agriculture, Udaipur (Rajasthan), India during two consecutive years 2015 and 2016. The trial was laid out in Completely Randomized Design with three replications. The size of the polyhouse was 28 m × 32 m (896 sq.m) covered with aluminate sheet and ultra violet stabilized low density polyethylene sheet having 200 micron thickness with provision of foggers installed over head. There were nine treatments *viz.* T_1 : 75 per cent RDF at 2 days interval (RDF was 100 kg N, 80 kg P and 80 kg K), T_2 : 75 per cent RDF at 3 days interval, T_3 : 75 per cent RDF at 4 days interval, T_4 : 100 per cent RDF at 2 days interval, T_5 : 100 per cent RDF at 3 days interval, T_6 : 100 per cent RDF at 4 days interval, T_7 : 125 per cent RDF at 2 days interval, T_8 : 125 per cent RDF at 3 days interval and T_9 : 125 per cent RDF at 4 days interval. Seeds were sown on well prepared beds having length of 28 meter, width of 80 cm and height of 30 cm, at spacing of 45 cm between rows and 30 cm within rows in zig-zag pattern. All the cultural practices including irrigation and hoeing were carried out as per the standard commercial procedures. Spraying for pests and diseases were applied whenever it appeared necessary throughout the growing season. Plants were vertically trained with plastic ropes. Data on vegetative characteristics (vine length, number of branches, leaf area, days to first harvest, number of fruits per vine, fruit weight, fruit volume, specific gravity, fruit length, yield per vine and yield per square meter were recorded from randomly selected five tagged plants of each treatment and further analyzed. All data were subjected to analysis of variance to determine main effects and interaction effects.

RESULT AND DISCUSSION

Results showed (Table 1 and Table 2) that different combination of RDF and fertigation significantly affected during both the years except for fruit weight, fruit volume and specific gravity. On the basis pooled data it is revealed that maximum vine length (415.00 cm), number of branches per plant (11.53), leaf area (432.73 cm^2) and number of fruits (35.37) were observed for treatment T_8 *i.e.* 125 per cent RDF and three days fertigation interval, closely followed by T_7 *i.e.* 125 per cent RDF and two days fertigation interval with values of 413.67, 10.87, 429.28 and 34.63, respectively. Whereas most poorly performing

Table 1

Effect of fertigation scheduling on Vine length, No. of branches, Leaf area, Days of first harvest and no. of fruits per plant in polyhouse grown Cucumber

	Vine Length (cm)			*No. of branches*			*Leaf Area (cm^2)*			*Days to first harvest*			*No. of fruits/plant*		
	2015-16	*2016-17*	*Mean*	*2015-16*	*2016-17*	*Mean*	*2015-16*	*2016-17*	*Mean*	*2015-16*	*2016-17*	*Mean*	*2015-16*	*2016-17*	*Mean*
T_1	356.67	359.00	357.83	8.73	8.57	8.65	394.07	395.70	394.88	40.37	39.70	40.03	21.57	21.73	21.65
T_2	366.33	369.33	367.83	8.63	8.70	8.67	402.93	398.77	400.85	39.87	39.97	39.92	23.00	22.20	22.60
T_3	377.33	378.67	378.00	9.43	9.50	9.47	404.63	403.73	404.18	39.67	39.93	39.80	26.30	26.60	26.45
T_4	396.67	395.00	395.83	10.47	10.50	10.48	423.17	416.50	419.83	39.13	39.73	39.43	31.83	31.53	31.68
T_5	404.67	406.67	405.67	11.07	11.17	11.12	425.77	423.77	424.77	39.77	39.10	39.43	34.17	32.57	33.37
T_6	380.67	386.33	383.50	10.10	10.43	10.27	411.87	415.87	413.87	38.07	38.83	38.45	29.03	29.37	29.20
T_7	411.33	416.00	413.67	10.53	10.87	10.70	429.80	428.77	429.28	37.83	37.93	37.88	35.60	33.67	34.63
T_8	415.67	414.33	415.00	11.57	11.53	11.55	434.23	431.23	432.73	37.43	37.90	37.67	36.73	34.00	35.37
T_9	385.33	392.00	388.67	10.27	10.87	10.57	417.37	419.47	418.42	37.63	37.60	37.62	32.90	31.80	32.35
SEm	5.150	4.852		0.407	0.375		2.985	4.348		0.295	0.396		0.873	1.137	
CD	15.419	14.528		1.219	1.123		8.939	13.02		0.883	1.185		2.615	3.403	

Table 2

Effect of fertigation scheduling on fruit weight, fruit volume, specific gravity, fruit length, yield per plant and yield per square meter in polyhouse grown Cucumber.

	Fruit weight (g)			*Fruit volume (cc)*			*Specific gravity (g/cc)*			*Fruit length (cm)*			*Yield/plant (g)*			*Yield/m^2(kg)*		
	2015-16	*2016 17*	*Mean*	*2015-16*	*2016-17*	*Mean*	*2015-16*	*2016-17*	*Mean*	*2015-16*	*2016-17*	*Mean*	*2015-16*	*2016-17*	*Mean*	*2015-16*	*2016-17*	*Mean*
T_1	116.43	115.60	116.02	124.17	123.60	123.88	0.94	0.94	0.94	15.70	15.80	15.75	2511.16	2515.78	2513.47	6.70	6.71	6.70
T_2	116.83	115.67	116.25	124.43	123.13	123.78	0.94	0.94	0.94	16.18	16.35	16.26	2687.74	2567.05	2627.40	7.17	6.85	7.01
T_3	117.60	117.20	117.40	125.07	125.77	125.42	0.94	0.93	0.94	16.81	16.48	16.65	3092.65	3116.36	3104.51	8.25	8.31	8.28
T_4	119.07	118.47	118.77	127.20	125.97	126.58	0.94	0.94	0.94	16.84	16.66	16.75	3788.64	3736.80	3762.72	10.10	9.96	10.03
T_5	120.07	120.00	120.03	128.53	128.10	128.32	0.93	0.94	0.94	17.23	16.75	16.99	4102.75	3904.99	4003.87	10.94	10.41	10.68
T_6	118.27	117.33	117.80	126.40	125.10	125.75	0.94	0.94	0.94	16.64	16.67	16.66	3433.49	3448.42	3440.96	9.15	9.19	9.17
T_7	120.57	120.37	120.47	128.47	128.27	128.37	0.94	0.94	0.94	17.32	17.27	17.29	4291.38	4054.27	4172.83	11.44	10.81	11.13
T_8	122.63	120.67	121.65	130.77	128.90	129.83	0.94	0.94	0.94	17.42	17.55	17.48	4504.58	4106.49	4305.54	12.01	10.95	11.48
T_9	118.53	118.27	118.40	126.43	126.50	126.47	0.94	0.94	0.94	16.55	16.45	16.50	3900.60	3753.51	3827.06	10.40	10.01	10.21
SEm	0.796	1.584		0.814	1.664		0.001	0.002		0.274	0.413		103.539	143.446		0.276	0.382	
CD	2.383	N/A		2.437	N/A		0.003	N/A		0.821	N/A		310.014	429.502		0.827	1.145	

Treatment for above traits was T_1 (75 % RDF and 2 days fertigation interval) and this treatment was at par with T_2 and T_3. Treatment T_9 (125 per cent RDF and four days fertigation interval) taken minimum days (37.62) for first harvest, whereas maximum days to first harvest were taken by treatment T_1 (75 % RDF and 2 days fertigation interval). Number of fruits per plant is directly contributes yield of cucumber, it ranges between 21.65 in T_1 to 35.37 in treatment T_8 (Figure 1).

The significant response of the above parameter to increasing gradient of fertigation may be due to nutrients taken up by the plants and well utilized in cell multiplication, stimulation of cellular expansion and cell division, amino acid synthesis and energy formation and hence an increased rate of photosynthesis. This trend was in line with the findings of El-Badawi (1994) and Lawal (2000), who reported significant response of yield attributes of cucumber to applied fertilizer levels. Highest yield per plant (g) and yield per square meter (kg) were recorded for treatment T_8 *i.e.* 125 per cent RDF and three days fertigation interval with values of 4305.54 and 11.48, respectively. Treatment T_7 *i.e.* 125 per cent RDF and two days fertigation interval was closely followed to treatment T_8 with second highest yield per plant (4172.83 g) and yield per square meter (11.43kg). Minimum yield per plant (2511.16 g) and yield per square meter (6.70kg) were recorded for treatment T_1 *i.e.*75 % RDF and 2 days fertigation interval (Figure 2). Treatments T_2 and T_3 were also at par with treatment T_1 as in these treatments doses of fertilizers were kept at 75 per cent RDF. These findings are in close proximity with the results of experiment conducted at Centre for Protected Cultivation Technology (CPCT), IARI (Annual Report, 2012) in which Kian variety of cucumber produced highest yield with maximum level of fertigation *i.e.* 120 per cent RDF. Palfi (1965) opinioned that nitrogen, being the chief constituent of protein accelerates amino acids synthesis and increased and timely supply of nitrogen increased biomass production. The use of water soluble fertilizers in the above treatments makes availability of nutrient readily which results in more production per plant and per unit area as well. Arun and Kumar (2014) also reported same trend of maximum yield from cucumber with 125 per cent RDF under polyhouse grown crop.

Figures (1 to 2) Effect of fertigation scheduling on number of fruits per plant and yield per square (kg) in polyhouse grown cucumber.

CONCLUSION

On the basis of the findings of this experiment, it can be concluded that increased yield from cucumber in polyhouse condition can be achieved by application water soluble fertilizers at the rate of 125 percent RDF *i.e.* 125 kg nitrogen, 100 kg phosphorus and 100 kg potash per ha along with fertigation at three days interval, as this combination gave maximum values of vegetative as well as yield attributes.

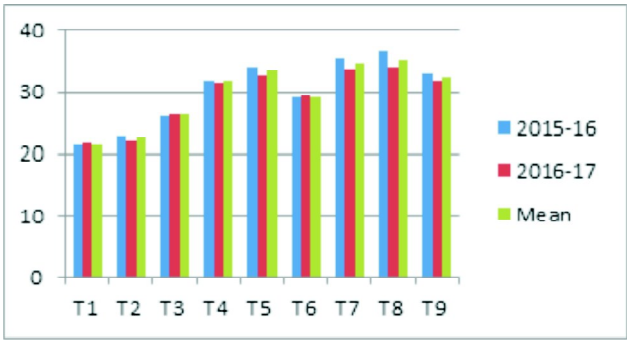

Figure 1. Number of fruits per plant

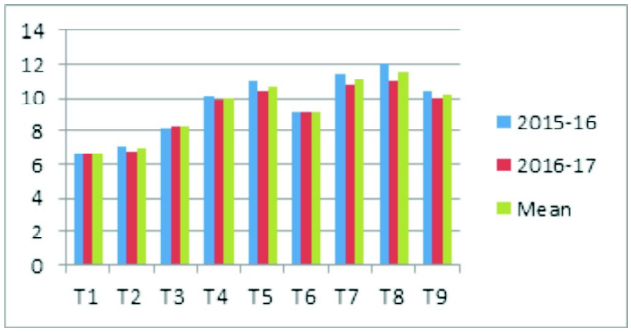

Figure 2. Yield per square meter

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