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Planting date and nutrients level affecting flowering, yield and quality of gynoecious cucumber under nethouse condition

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Abstract

An experiment was conducted to assess the effect of different date of plantings *viz*., 15th August, 1st September and 15th September and nutrients level *viz*., 15:7:16, 20:12:21, 25:17:26 and 30:22:31 kg NPK ha^{-1} in factorial randomized block design with three replications under nethouse. Among date of planting, 15th September exhibited significantly early female flowering (20.75 days) on lower node of 1.55, and it also reported highest for fruit length (13.32 cm), fruit diameter (3.25 cm), fruit weight (124.28 g), fruits per plant (15.12), yield per plant (1888.8 g), yield per 1000 m^2 (125.93 q), nitrogen (50.08 mg/100g), phosphorus (22.50 mg/100g), potassium (138.75 mg/100g), calcium (8.53 mg/100g), iron (0.19 mg/100g), zinc (0.19 mg/100g) and manganese (0.12 mg/100g) content of the fruit. Similarly, fruit length (13.51 cm), fruits per plant (15.13), fruit weight (129.28 g), fruits per plant (15.13), yield per plant (1960.6 g), yield per 1000 m^2 (130.71 q), nitrogen (54.67 mg/100g), phosphorus (24.89 mg/100g), potassium (144.89 mg/100g), calcium (10.58 mg/100g), iron (0.21 mg/100g), zinc (0.20 mg/100g) and manganese (0.13 mg/100g) were recorded highest by application of 30:22:31 kg NPK ha^{-1}. Among treatment combinations, 15th September planting with 30:22:31 kg NPK ha^{-1} of fertilizer application resulted in better performance for all yield and quality parameters and observed as the most promising treatment for cucumber production under nethouse condition.

Keywords: *Cucumis sativus,* gynoecious, nutrients, date of planting, parthenocarpic

Introduction

Cucumber (*Cucumis sativus* L.) is one of the most important vegetable crop of the family Cucurbitaceae, cultivated as cooking vegetable and as salad crop, which quenches thirst and adds the nutrients content to a human diet (Chadha and Lal 1993). Fruits are good for people suffering from jaundice, constipation and indigestion. The global production of cucumber is 71.36 million tonnes (FAOSTAT 2014) and in India, it is grown in 43 thousand hectares with an annual production of 678.00 thousand tonnes (NHB 2014-15). Recent days cucumber production gaining importance due to higher yield and income in short period of time and popularity under protected cultivation. Popularity of cucumber cultivation under protected cultivation due its indeterminate vine growth, response to training and pruning and development of gynoecious parthenocarpic hybrids which set fruits parthenocarpically under protected cultivation. For cucumber mere providing of specified climate is not sufficient because other factors like planting time and nutrient composition especially nitrogen are also known to have a decisive role in a successful production with enhanced productivity via affecting sex expression. So specifying a date of planting and amount of fertilizer to be applied is important for its successful cultivation. Recently Indian Agricultural Research Institute (IARI) New Delhi released extra early (40-45 days for first fruit harvest) improved variety of parthenocarpic gynoecious cucumber suitable for cultivation in protected condition (Anonymous 2015). However, very few reports are available on cucumber production under a nethouse condition in India. Hence present investigation was under taken to find the proper planting time and fertilizer level for the cultivar Pusa Seedless cucumber-6 under nethouse condition.

Materials and Methods

The experiment was conducted in insect-proof nethouse at the Centre for Protected Cultivation Technology (CPCT), Indian Agricultural Research Institute (IARI), New Delhi during August 2015 to January 2016. The experiment was laid out in a factorial randomized block design with 3 replications. The treatments were formulated with three dates of planting *viz*.,15th August (P_1), 1st September (P_2) and 15th September (P_3) with 4

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different doses of fertilizers *viz*.,15:7:16 kg ha^{-1} (D_1), 20:12:21 kg ha^{-1} (D_2), 25:17:26 kg ha^{-1} (D_3) and 30:22:31 kg ha^{-1} (D_4). The cucumber var. Pusa Seedless Cucumber-6 planting was done at a spacing of 50x30 cm under insect-proof net house of size 500m^2. Plant nutrients are supplied by use of water-soluble fertilizers like urea (46:0:0), urea phosphate (17:44:0) and potassium sulphate (0:0:50). Oven dried fruits were crushed into powder form to determine the fruit nutrient content viz., nitrogen (N), phosphorus (P), potassium (K), iron (Fe), zinc (Zn), calcium (Ca) and manganese (Mn). For nitrogen estimation, samples were digested according to the method of Chapaman and Pratt (1961) and total nitrogen content was determined using Kjeldahl method. Phosphorus content was determined by using the method of Jackson (1962). Knudsen et al. (1982) method were used determine potassium content by flame photometer. For trace elements analysis, the method by Edward (1999) was applied using atomic absorption spectrophotometer (AAS).

Results and Discussion

Effect on flowering: The date of planting exhibited marked influence on flowering characters of cucumber (Table 1). In the present study, 15th September planting exhibited significantly early female flower (20.75 days) on the lower node of 1.55. This might be due to the coincidence of flowering with the low temperature (20-25 ^{0}C) in 15th Sept; this revealed that low temperature had a correlation with earliness in parthenocarpic cucumber (Narayanankutty et al. 2013). The fertigation levels did not show any significant effect on flowering (Table 2). This might due to non-coincidence of first fertilizer application with flower bud differentiation, which generally takes place at 2-3 leaf stage (Arora et al. 1989). However, application of 30:22:31 kg NPKha^{-1}plants produced early female flower (22.53 days) on the lower node of 1.93.

Effect on yield and yield attributing characters: In the present study, date of planting exhibited marked influence on yield and yield components of cucumber (Table 1). Among date of plantings, 15th Sept planting exhibited significantly higher values for fruit length (13.32 cm), fruit diameter (3.25 cm), fruit weight (124.28 g), fruits per plant (15.12), yield per plant (1888.8 g) and yield per 1000m^2 (125.93 q). This might be due to cool climate during fruiting which reduced the physiological processes like transpiration and respiration results in increased accumulation of photosynthates. Whereas, the lowest yield was noticed in 1st Sept planting (99.14 q/1000m^2). Fertilizer levels showed significant influence over the yield and yield attributes of cucumber (Table 2). The maximum value for fruit length (13.51 cm), fruits per plant (15.13), fruit weight (129.28 g), yield per plant (1960.6 g) and yield per 1000m^2 (130.71 q) was recorded by application of 30:22:31 kg NPK ha^{-1}. The reason might be that higher fertigation has affected in the production of the higher number of flowers per plant, higher per-cent of fruit set and retention of set fruits resulting in the significantly

Table 1: Influence of planting dates on flowering, yield and nutrients accumulation in fruit of cucumber under nethouse

Planting dates	Days to opening of first female flower	Node at first female flower appearance	Fruit length (cm)	Fruit diameter (cm)	Number of fruits/ plant	Fruit weight (g)	Total fruit yield/ plant (g)	Yield /1000 m^2 (q)	N (mg 100 g^{-1})	P (mg 100 g^{-1})	K (mg 100 g^{-1})	Ca (mg 100 g^{-1})	Fe (mg 100 g^{-1})	Zn (mg 100 g^{-1})
15th August	24.13	2.23	12.78	3.22	13.72	118.73	1641.3	109.43	48.00	19.67	135.33	8.12	0.16	0.17
1st September	23.13	1.73	12.79	3.25	12.92	114.57	1487.0	99.14	49.17	21.25	137.83	8.31	0.17	0.18
15th September	20.75	1.55	13.32	3.25	15.12	124.28	1888.8	125.93	50.08	22.50	138.75	8.53	0.19	0.19
CD (5%)	0.77	0.17	0.15	0.00	0.37	1.48	46.37	3.10	0.77	0.50	0.69	0.02	0.01	0.00
SE(m)	0.26	0.06	0.05	0.00	0.13	0.50	15.70	1.05	0.26	0.17	0.23	0.01	0.00	0.00

Table 2: Influence of nutrient levels on flowering, yield and nutrients accumulation in fruit of cucumber under nethouse

Nutrient levels (N:P:K Kg/ha)	Days to opening of first female flower	Node at first female flower appearance	Fruit length (cm)	Fruit diameter (cm)	Number of fruits/ plant	Fruit weight (g)	Total fruit yield/ plant (g)	Yield /1000m^2 (q)	N (mg100 g^{-1})	P (mg100 g^{-1})	K (mg100 g^{-1})	Ca (mg100 g^{-1})	Fe (mg100 g^{-1})	Zn (mg100 g^{-1})
15:7:16	22.71	1.82	12.37	3.08	12.29	105.70	1299.6	86.64	42.56	17.22	127.78	6.37	0.13	0.15
20:12:21	22.71	1.80	12.73	3.20	13.53	116.15	1576.5	105.11	48.00	19.89	135.78	7.72	0.16	0.17
25:17:26	22.73	1.80	13.42	3.34	14.71	125.64	1852.9	123.53	51.11	22.56	140.78	8.61	0.19	0.19
30:22: 31	22.53	1.93	13.51	3.25	15.13	129.28	1960.6	130.71	54.67	24.89	144.89	10.58	0.21	0.20
CD (5%)	NS	NS	0.18	0.00	0.43	1.71	53.53	3.57	0.89	0.58	0.79	0.02	0.01	0.01
SE(m)	0.30	0.07	0.06	0.00	0.14	0.58	18.13	1.21	0.30	0.20	0.27	0.01	0.00	0.00

Table 3: Interaction effect of date of planting and nutrient level on flowering, yield and nutrients accumulation in cucumber under nethouse

Interactions	Days to opening of first female flower	Node at first female flower appearance	Fruit length (cm)	Fruit diameter (cm)	Number of fruits/ plant	Fruit weight (g)	Total fruit yield/ plant (g)	Yield /1000m^2 (q)	N (mg100 g^{-1})	P (mg100 g^{-1})	K (mg100 g^{-1})	Ca (mg100 g^{-1})	Fe (mg100 g^{-1})	Zn (mg100 g^{-1})
P_1+D_1	23.80	2.20	12.05	3.15	11.47	107.16	1228.5	81.90	41.67	15.67	126.00	6.28	0.12	0.15
P_1+D_2	24.27	2.20	12.55	3.18	13.27	114.62	1520.5	101.37	47.67	18.67	134.33	7.51	0.14	0.17
P_1+D_3	24.40	2.13	13.24	3.32	14.53	124.10	1803.6	120.24	49.67	21.00	138.33	8.37	0.17	0.18
P_1+D_4	24.07	2.40	13.28	3.24	15.60	129.03	2012.8	134.19	53.00	23.33	142.67	10.30	0.20	0.19
P_2+D_1	23.27	1.80	12.29	3.2	11.80	102.09	1205.6	80.38	42.33	17.67	128.33	6.35	0.13	0.16
P_2+D_2	23.33	1.53	12.44	3.19	12.47	111.74	1394.2	92.95	48.00	19.67	136.33	7.82	0.16	0.18
P_2+D_3	22.93	1.73	13.49	3.37	13.73	119.68	1643.5	109.57	51.67	22.67	141.67	8.54	0.18	0.19
P_2+D_4	23.00	1.87	13.51	3.26	13.67	124.77	1704.7	113.65	54.67	25.00	145.00	10.55	0.21	0.20
P_3+D_1	21.07	1.47	12.79	2.91	13.60	107.85	1464.7	97.65	43.67	18.33	129.00	6.47	0.13	0.16
P_3+D_2	20.53	1.67	13.21	3.21	14.87	122.08	1814.9	120.99	48.33	21.33	136.67	7.83	0.18	0.18
P_3+D_3	20.87	1.53	13.55	3.37	15.87	133.13	2111.6	140.78	52.00	24.00	142.33	8.92	0.21	0.20
P_3+D_4	20.53	1.53	13.75	3.26	16.13	134.05	2164.2	144.28	56.33	26.33	147.00	10.89	0.23	0.22
CD (5%)	NS	NS	NS	0.00	0.74	2.96	92.72	6.18	NS	NS	NS	0.04	NS	NS
SE(m)	0.52	0.11	0.00	0.00	0.25	1.00	31.41	2.09	0.52	0.34	0.47	0.01	0.01	0.00

P_1:15th August, P_2: 1st September, P_3: 15th September; D_1: 15:7:16 N: P: K Kg/ha, D_2: 20:12:21 N: P: K Kg/ha, D_3: 25:17:26 N: P: K Kg/ha, D_4: 30:22: 31 N: P: K Kg/ha
NS: Non-significant

higher number of fruits per plant. Similar results were reported by Sharma et al. (2009). However, the lowest value for these parameters was recorded with the application of 15:7:16 kg NPK ha^{-1}. In the present study, variation due to the interaction of planting date and different level of nutrients showed a significant result for yield and yield attributing characters. Among the combinations, 15th Sept planting with 30:22:31 kg NPKha^{-1} recorded highest for the number of fruits per plant (16.13), fruit weight (134.05 g), yield per plant (2164.2 g) and yield per 1000m^2 (144.28 q). Whereas, the lowest value for these parameters was found in 1st Sept planting with 15:7:16 kgha^{-1} of fertilizer application (Table 3).

Effect on nutrients accumulation in fruit: The present study showed that delayed planting leads to increased accumulation of nutrients of cucumber fruit so that, the highest accumulation was noticed in 15th September planting for nitrogen (50.08 mg/100g), phosphorus (22.50 mg/100g), potassium (138.75 mg/ 100g), calcium (8.53 mg/100g), iron (0.19 mg/100g), zinc (0.19 mg/100g) and manganese (0.12 mg/100g) (Table 1). On other hands by increasing fertigation level from 15:7:16 kg NPKha^{-1} to 30:22:31 kg NPKha^{-1}, the nutrient content of fruit was increased (Table 2). Application of 30:22:31 kg NPKha^{-1} resulted fruits with highest amount of nitrogen (54.67 mg/100g), phosphorus (24.89 mg/100g), potassium (144.89 mg/ 100g), calcium (10.58 mg/100g), iron (0.21 mg/100g), zinc (0.20 mg/100g) and manganese (0.13 mg/100g). The present results are corroborated with the findings of Mostafa et al. (2012) who reported that increasing nitrogen fertigation from 75 to 225 kg/ha has increased N (53.265%), P (77.61%), K (25.85%), Ca (14.28%), Zn (16.58%) and Mn (24.75%) uptake in bitter gourd fruit. Among the combinations, the highest interaction effect was noticed in 15th Sept planting with application of 30:22:31 kg NPKha^{-1} for nitrogen (56.33 mg/100g), phosphorus (26.33 mg/100g), potassium (147.00 mg/ 100g), calcium (10.89 mg/100g), iron (0.23 mg/100g), zinc (0.22 mg/100g) and manganese (0.14 mg/100g) content of fruit (Table 3). Whereas, the lowest value for these parameters was found in 15th planting with 15:7:16 kg NPKha^{-1} of fertilizer application. On the basis of a present investigation it is concluded that cucumber variety Pusa Seedless Cucumber-6 responded well in terms of growth, yield and quality characters with the different date of planting and nutrient level under insect proof nethouse condition. The results indicated that cucumber sown in 15th September with 30:22:31 kg NPKha^{-1} of fertilizer found better performance for all yield and quality parameters and observed as the most promising treatment for cucumber cultivation under nethouse.

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जायांगी खीरे को जालीदार–गृह में विभिन्न रोपण दिनों के प्रभाव को ज्ञात करने के लिए 5 अगस्त, 1 सितम्बर एवं 15 सितम्बर को लगाकर एक प्रयोग किया गया जिनमें पोषक तत्वों के स्तर जैसे– 15:7:16: 20:12:2; 25:17:26 व 30:22:31 किलोग्राम/हे. नत्रजन, फास्फोरस तथा पोटाश का प्रयोग यादृच्छिक प्रखण्ड रूपरेखा में तीन बार प्रतिकृति कर किया गया। विभिन्न रोपण दिनांक 15 सितम्बर की

लगी फसल में अगेती मादा पुष्पन (20.75 दिन) नीचले गांठ (1.55) पर सार्थक पाये गये तथा यह भी स्पष्ट हुआ कि इस समय की फसल में फल की लम्बाई (13.32 सेमी.), फल व्यास (3.25 सेमी.), फल भार (124.28 ग्राम), प्रति पौध फल (15.12), उपज प्रति पौध (188.8 ग्राम), उपज प्रति 1000 वर्ग मीटर (125.93 कुन्तल), नत्रजन (50.08. मिग्रा./100 ग्राम), फास्फोरस (25.50 मिग्रा./100 ग्राम), पोटैशियम (138.75 मिग्रा./100 ग्राम), कैल्शियम (8.53 मिग्रा./100 ग्राम), आयरन (0.19 मिग्रा./100 ग्राम), जिंक (0.19 मिग्रा./100 ग्राम) तथा मैग्नीज (0.12 मिग्रा./100 ग्राम) फल में पाया गया। इसी प्रकार सबसे सार्थक फल लम्बाई (13.51 सेमी.), फल प्रति पोध (15.13), फल भार (129.28 ग्राम), फल प्रति पौध (15.13), उपज प्रति पौध (1960.6 ग्राम), उपज प्रति 1000 वर्गमीटर (130.71 कुन्तल), नत्रजन (54.67 मिग्रा./100 ग्राम), फास्फोरस (24.89 मिग्रा./100 ग्राम), पोटैशियम (144.89 मिग्रा./100 ग्राम), कैल्शियम (10.58 मिग्रा./100 ग्राम), आयरन (0.21 मिग्रा./100 ग्राम), जिंक (0.20 मिग्रा./100 ग्राम) एवं मैग्नीज (0.13 मिग्रा./100 ग्राम); 30:22:31 किलोग्राम नत्रजन, फास्फोरस व पोटाश प्रति हेक्टेयर प्रयोग से पाया गया। उपचार संयोजनों के मध्य सितम्बर की पौध रोपण 30:22:31 किलोग्राम नत्रजन, फास्फोरस व पोटाश प्रति हेक्टेयर के प्रयोग से उपज व सभी गुणवत्ता घटकों में अच्छा परिणाम देखा गया एवं यह उपचार खीरा के जायांगी प्रभेद के जालीदार–गृह दशा में उत्पादन हेतु उत्तम है।

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