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Pramod Kumar

Zonal Research Station, Birsa
Agricultural University, Chianki,
Palamau, Jharkhand, India

Abdul Majid Ansari

Zonal Research Station, Birsa
Agricultural University, Chianki,
Palamau, Jharkhand, India

Swapnil

Department of Plant Breeding &
Genetics, Bihar Agricultural
University, Sabour, Bhagalpur,
Bihar, India

Anuradha Sinha

Department of Horticulture
(Veg. and Flori.), Bihar
Agricultural University, Sabour,
Bhagalpur, Bihar, India

Effect of fertigation on growth and fruit yield of cucumber (*Cucumis sativus* L.) grown under naturally ventilated polyhouse condition

Pramod Kumar, Abdul Majid Ansari, Swapnil and Anuradha Sinha

Abstract

The experiment was conducted during two consecutive years, *rabi*- 2019-20 and *rabi*-2020-2021 in polyhouse condition at Zonal Research Station, Chianki, Palamau, Jharkhand, sub-zone – V to study the effect of different levels of fertigation on growth and yield of cucumber (*Cucumis sativus* L.). The experiment was laid out in randomized block design in four replications with six fertigation treatments *viz.* T1 - 120% RDF, T2 - 110% RDF, T3 - 100% RDF, T4 - 90% RDF, T5 - 80% RDF and T6 - Control. The treatments were replicated four times. Among all the treatments, minimum days to first flowering, minimum days to first picking, maximum number of primary branches and harvest duration were recorded with application of T₃- 100% RDF for both the years. The yield attributes *viz.* maximum average fruit weight, number of fruits per plant, fruit diameter, fruit length, fruit yield per plant and fruit yield per hectare were recorded highest with the application of 100% RDF. Therefore, drip irrigation lead to improvement in cucumber plant growth and yield, especially with the application of 100% RDF compared to others.

Keywords: Fertigation, fruit, naturally ventilated, *Cucumis sativus* L.

Introduction

Cucumber (*Cucumis sativus* L.) is one of the potential greenhouse vegetables and a versatile crop because of wide range of uses from salads to pickles and digestive aids to beauty products. Protected cultivation is an important agricultural sector showing constant growth and rapid expansion worldwide (Orgaz *et al.*, 2005) [6]. Greenhouse cucumbers supplied with correct quantity of fertilizers not only increases the yield but also improve the quality. Application of major nutrients in proper ratio and required quantity can help growers to get the maximum out of these inputs (Kavitha *et al.*, 2007) [4]. Cucumbers are useful for people suffering from jaundice, constipation, and indigestion. Cucumber is grown on an area of 2144 thousand hectares with a production of 80616 thousand metric tonnes and productivity of 37.600 metric tonnes per hectare in the world (Anonymous, 2017a) [1]. In India, it is grown on an area of 74 thousand hectares with a production of 1142 thousand million tonnes and productivity of 15.02 tonnes per hectare (Anonymous, 2017b) [2]. Fertigation has emerged as an excellent method to improve the sustainability of greenhouse production by enabling better control over water and nutrient supply to the plants. Hence, drip irrigation under greenhouse cultivation is concentrated to supply irrigation water and fertilizers to rhizosphere through various phases of nutrient demand of a crop (Mostafa *et al.*, 2014) [5]. Therefore, keeping in view all the perspectives of protected cultivation and fertigation, the present investigation was framed to study the performance of greenhouse cucumber in varying levels of fertilizer doses.

Materials and Methods

An experiment was conducted in two years, *rabi*- 2019-20 and *rabi*-2020-2021 in polyhouse condition at Zonal Research Station, Chianki, Palamau, Jharkhand, sub-zone – V to study the effect of different levels of fertigation on growth, yield and fruit quality of cucumber (*Cucumis sativus* L.). The experiment was laid out in randomized block design with six fertigation treatments *viz.* T1 - 120% RDF, T2 - 110% RDF, T3 - 100% RDF, T4 - 90% RDF, T5 - 80% RDF and T6 - Control. The treatments were replicated four times. Raised bed method of planting was adopted (Bed size- 90 cm * 40 cm). The soil texture of experimental site was having sandy loam with pH (6.69). It was moderately fertile, with available nitrogen (234.74 kg /ha), available phosphorus (39.08 kg / ha), available potassium (145.26 kg/ ha) and electrical conductivity (1.36 dS/ m). The parthenocarpic cucumber hybrid variety Fadia F1 was transplanted at a spacing of 120 cm×50cm. The recommended dose of fertilizers for cucumber are 100, 50, 50 kg of N, P₂O₅ and K₂O per ha, respectively. The experimental site was kept

Corresponding Author:**Swapnil**

Department of Plant Breeding &
Genetics, Bihar Agricultural
University, Sabour, Bhagalpur,
Bihar, India

free from weeds by manual weeding and hoeing. Plant protection measures and irrigation whenever required were provided in same manner for all the treatments. Manual harvesting was done when fruits reached at maturity stage. After that fruits of different treatments were collected separately. Yield attributes were recorded at every harvesting of crop. Thus, fruit yield of each plant was recorded as kg per plant and then converted into tones per ha. Statistical data was analysed by standard procedure.

Result and Discussion

The present study conducted in 2 years, *rabi*- 2019-20 and *rabi*- 2020-2021, revealed that growth parameters viz. plant height (m), days to first flowering (days), days to first picking (days), number of primary branches and harvest duration (days) were significantly influenced by varying fertigation levels. This has been displayed in Table-1(a) and Table 1(b). Among all the treatments, minimum days to first flowering (30.20) and (28.20) were recorded with application of T₃- 100% RDF for *rabi*- 2019-20 and *rabi*- 2020-2021, respectively; followed by application of T₂- 110% RDF. The minimum days to first picking (46.02) and (43.01) were recorded with application of T₃- 100% RDF for *rabi*- 2019-20 and *rabi*- 2020-2021, respectively; which was followed by T₂- 110% RDF. In *rabi*- 2019-20, the maximum number of primary branches (17.32) and harvest duration (49.75) were recorded with application of T₃- 100% RDF, followed by application of T₂- 110% RDF and T₁- 120% RDF. Furthermore, the maximum number of primary branches (15.27) and harvest duration (48.20) were recorded with application of T₃- 100% RDF, followed by application of T₂- 110% RDF and T₁- 120% RDF in *rabi*- 2020-2021. From the above observations it can be concluded that application of 100% RDF gave best results in terms of growth parameters which may be due to better nutritional environment in the root

zone of for growth and development of plants as N, P and K are the major nutrients required for growth and development of plants. Fertigation plays an important role in metabolism of plants as they provide diverse types of metabolically active compounds like nucleic acids, amino acids, proteins, prophytins, co-enzymes, etc which promotes early flowering and hence less days to flowering. In contrast, higher dose of NPK promotes vegetative growth and delays flower initiation. However, application of 100% RDF might have provided balanced nutrition, better growth and development and hence early picking (Shree *et al.*, 2018) [7]. Increase in number of primary branches may be due to increased application of fertilizers directly in the nearby areas of root zone which provides better availability and uptake of nutrients which in turn promotes healthy and vigorous plant growth. The maximum harvest duration might be due to better uptake and utilization of nutrients and good water- air relationship with more oxygen concentration in the root zone. The yield attributing traits are resultant of overall development of plants. The traits have been depicted in Table-2 (a & b) which revealed significant differences among various treatments. In *rabi*- 2019-20, the maximum average fruit weight (170.35 g), number of fruits per plant (28.17), fruit diameter (12.59 cm), fruit length (19.09 cm), fruit yield per plant (4.80 Kg) and fruit yield per hectare (720.00 q) were recorded with the application of 100% RDF in *rabi*- 2020-2021. However, the maximum average fruit weight (165.32g), number of fruits per plant (27.32), fruit diameter (12.02cm), fruit length (18.02 cm), fruit yield per plant (4.20 Kg) and fruit yield per hectare (704.25 q) were recorded with the application of 100% RDF in *rabi*- 2020-2021. These may be due to enhanced nutrient supply through fertigation in the vicinity of the plant roots throughout crop development. These findings are in accordance with (Janapriya *et al.*, 2010) [3].

Table 1(a): Effect of different levels of fertigation on growth attributes of cucumber in *rabi*-2019-20.

Treatments	Plant height (m)	Days to first flowering (days)	Days to first picking (days)	No. of primary branches	Harvest duration (days)
T1	4.15	33.28	50.30	16.10	44.87
T2	4.21	32.52	48.25	16.39	47.23
T3	4.32	30.20	46.02	17.32	49.75
T4	3.36	34.00	51.87	15.21	42.73
T5	3.29	35.20	57.23	14.38	41.20
T6 (control)	2.75	39.23	53.46	13.28	38.23
CD (0.05)	0.29	1.10	1.55	1.00	2.01

Table 1(b): Effect of different levels of fertigation on growth attributes of cucumber in *rabi*-2020-21.

Treatments	Plant height (m)	Days to first flowering (days)	Days to first picking (days)	No. of primary branches	Harvest duration (days)
T1	4.02	32.28	48.21	13.2	43.25
T2	4.09	31.43	47.02	13.47	46.73
T3	4.18	28.2	43.01	15.27	48.2
T4	3.2	33	49.32	12.2	41.27
T5	3.29	38.22	53.46	11.75	40.1
T6 (control)	2.75	41	51.47	11.1	36.25
CD (0.05)	0.34	1.2	1.52	1.1	1.99

Table 2(a): Effect of different levels of fertigation on yield attributes of cucumber in *rabi*-2019-20.

Treatments	Average fruit weight (g)	No. of fruits per plant	Fruit diameter (cm)	Fruit length (cm)	Fruit yield per plant (Kg)	Fruit yield per hectare (q)
T1	161.93	24.70	12.28	17.21	4.0	600.25
T2	165.23	26.01	12.32	18.36	4.3	645.50
T3	170.35	28.17	12.59	19.09	4.8	720.00
T4	158.27	24.64	11.01	16.77	3.9	585.00
T5	155.03	23.22	10.93	15.00	3.6	540.75
T6(control)	133.25	21.01	9.57	15.01	2.8	420.75
CD(0.05)	4.0	1.75	1.22	1.7	0.31	58.00

Table 2(b): Effect of different levels of fertigation on yield attributes of cucumber in rabi-2020-21.

Treatments	Average fruit weight (g)	No. of fruits per plant	Fruit diameter (cm)	Fruit length (cm)	Fruit yield per plant (Kg)	Fruit yield per hectare (q)
T1	155.23	24.32	11.57	17.42	3.41	613.75
T2	160.1	26	11.88	17.6	3.6	653.25
T3	165.32	27.32	12.02	18.02	4.2	704.25
T4	150.21	23.98	11.32	17.02	3.2	560.25
T5	148.32	23.54	10.87	16.7	3	535.25
T6(control)	130.26	20.87	9.32	14.6	2.5	386.5
CD(0.05)	3.88	1.65	1.48	1.51	0.25	60.8

Conclusion

Among the different treatments evaluated, application of T₃-100% RDF gave best results with respect to growth and yield attributing traits for both the years. Fertigation has improved the growth of cucumber plant and fruit yield, particularly the Treatment 3- 100% RDF. Thus it can be recommended for enhancing growth, yield in cucumber under polyhouse conditions.

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