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Effect of foliar spray of brassinosteroids, salicylic acid and gibberellic acid on the fruit yield and yield traits of cucumber (*Cucumis sativus* L) cv. Arpit.

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Abstract

The Vegetable Research Farm, Department of Horticulture, Sam Higginbottom University of Agriculture, Technology & Science, Prayagraj, (U.P.) - 211007 conducted an investigation titled "Effect of foliar spray of Brassinosteroids, Salicylic acid, and Gibberellic acid on the fruit yield and yield traits of Cucumber (*Cucumis sativus* L) cv. Arpit." The experiment used a Randomized Block Design with 15 treatments and three replications, each of which was reproduced three times. Source of variables were Brassinosteroids (BR) 0.05 PPM, Brassinosteroids (BR) 0.10 PPM, Brassinosteroids (BR) 0.5 PPM, Brassinosteroids (BR) 1.0 PPM, Brassinosteroids (BR) 2.0 PPM, Salicylic acid (SA) 0.05 mM, Salicylic acid (SA) 0.10mM, Salicylic acid (SA) 0.2mM, Salicylic acid (SA) 0.5mM, Salicylic acid (SA) 1.0mM, Gibberellic acid (GA3) 25 PPM, Gibberellic acid (GA3) 50 PPM, Gibberellic acid(GA3) 100 PPM, Gibberellic acid (GA3) 150 PPM and combination of them with control treatment taken as 15 treatments. The treatment with T₅ (Brassinosteroid 2.0 ppm) has recorded the minimum days taken to first fruit picking (49.55 days and 48.39 days) and the maximum number of fruit per plant (9.17 and 9.79), yield per plant (1.79 kg and 2.15 kg) and fruit yield (49.72 t/ha. and 56.74 t/ha.) and whereas the treatment T₁₀ (Salicylic acid 1.0mM) recorded the maximum diameter of fruits (4.56cm and 6.81cm), Length of fruits (21.10cm and 20.19cm), Weight of fruits (203.84 g and 223.84 g) were recorded in successive both years and minimum yield and yield traits were observed in T₀ (control).

Keywords: Cucumber, yield and yield traits, brassinosteroids, salicylic acid, gibberellic acid

Introduction

Cucumber (*Cucumis sativus* L.) is a cross pollinated and popular vegetable crop in the Cucurbitaceae family with chromosomal number 2n=14. It's a monoecious, annual, trailing or climbing vine with hirsute or scabrous stems and triangular ovate leaves with shallow and sharp sinuses (Bailey, 1969) [7]. Cucumber growth and development are aided by temperatures between 20 and 30 degrees Celsius. It has an area of 41 million ha in India, produces 641 MT, and has a productivity of 15.63 t/ha. (Handbook of Horticulture Statistics 2021-22) [12]. The fruit is an elongated, round triangular fake berry or pepo. Its size, shape, and colour differ according on the cultivar. Fruits are beneficial to persons who have jaundice, constipation, or indigestion. The fruit pulp is used to make mash cakes. Flowering is a critical stage in the development of cucurbits since it determines fruiting and yield. Cucumber is a monoecious plant, which means that the first flowers that develop near the base of a cucumber plant are male. Cucumbers have a high water content while being low in calories, fat, cholesterol, and salt. Plant growth regulators are also used to control cucumber plant vegetative development, boosting plant population per unit area in terms of production (Latimer, 1991) [21].

Brassinosteroids (BRs) are a class of steroid hormones that are vital for plant development and growth. BR signalling promotes cell proliferation and division, as well as etiolation and reproduction (Zicong Li and Yuehui He, 2020) [35]. Brassinosteroids are present in a broad variety of species, from lower plants to higher ones. They are steroidal plant hormones involved in the stimulation of plant growth and development. BR may suggest a strong interest in the role of horticulture crops. It was demonstrated by a decrease in the quantity of male flowers in the early stages of growth and a promotion of female flower initiation in the main stalk. Another cucumber research found that BS has a key function in early fruit development (Fu *et al.*, 2008) [9]. Salicylic Acid (SA) was recently added to the family of phytohormones for appropriate plant growth development and induction of tolerance to both biotic and abiotic

stimuli. SA is a phenolic endogenous growth regulator that regulates various physiological processes in agricultural plants, including stomatal closure, ion uptake, ethylene biosynthesis inhibition, and transpiration (Khan *et al.*, 2003 and Shakirova *et al.*, 2003) [14, 27]. Gibberellic acid is important for seed germination, endosperm mobilisation, stem elongation, leaf expansion, shortening maturation time, and boosting flower and fruit set and composition (Roy & Nasiruddin 2011) [23]. GA₃ slows senescence, promotes chloroplast growth and development, and increases photosynthetic efficiency, perhaps leading to enhanced production (Yuan & Xu 2001) [33].

Materials and Methods

The experiment entitled “effect of foliar spray of Brassinosteroids (BR), Salicylic acid (SA) and Gibberellic acid (GA₃) on growth, yield and quality of Cucumber (*Cucumis sativus* L) Arpit” was carried out during the summer season of the year 2018-2019 and 2019-20. The experiment was laid out in a Randomized Block Design with 15 treatments and 3 replications and each replicated thrice. Department of Horticulture, Naini Agricultural Institute, Sam Higginbottom University of Agriculture Technology and Sciences, Prayagraj, provided all of the necessary equipment for the experiment. It reaching a height of 98 meters above the sea level and is located at 25°8'N latitude and 81°50' E longitude. Prayagraj district is situated in Uttar Pradesh's subtropical zone, which has extreme heat summers and mild winters. The area's peak temperature is 46°C–48°C, and it seldom goes below 4°C–5°C. The relative humidity level varies between 20 and 94 percent. The annual average rainfall in this area is 1013.4 mm. Source of variable were T₀ (Control), T₁ Brassinosteroids 0.05 PPM, T₂ Brassinosteroids 0.10PPM, T₃ Brassinosteroids 0.5 PPM, T₄ Brassinosteroids 1.0 PPM, T₅ Brassinosteroids 2.0PPM, T₆ Salicylic acid 0.05 mM, T₇ Salicylic acid 0.10 mM, T₈ Salicylic acid 0.2 mM, T₉ Salicylic acid 0.5 mM, T₁₀ Salicylic acid 1.0mM, T₁₁ Gibberellic acid 25 PPM, T₁₂ Gibberellic acid 50 PPM, T₁₃ Gibberellic acid 100 PPM, T₁₄ Gibberellic acid 150 PPM. The observations were recorded on Days taken to first fruit picking, Number of fruit per plant, Yield per plant, Fruit yield, Length of fruits, Weight of fruits, Diameter of fruits were studied in the investigation.

Result and Discussion

The data on various observations recorded during experimentation were subjected to statistical analysis in Randomized Block Design in order to find out the significance of different treatments by using the analysis of variance. The results have been integrated along with the corresponding tables. In terms of yield and yield traits, it was found that days taken to first fruit picking, number of fruit per plant, yield per plant, fruit yield, Length of fruits, Weight of fruits, diameter of fruits were significantly increased during the both year by different treatments of plant growth regulators at all successive stages.

It is clear from the table 1 that the Minimum Days taken to first fruit picking (49.55days; 48.39days and 48.97days in 2018-19, 2019-20 and pooled, respectively) were recorded in T₅ (Brassinosteroids (BR) 2.0 PPM) In melon, foliar application of EBL enhanced the yield by 10–20% Khatoon *et al.*, (2021) [19] in strawberry. Fruit setting is an important

factor determining the productivity of a crop. Similarly, also observed an increased yield by 20% in response to the foliar spray of EBL (0.01 mg/L) close conformity with Khan *et al.*, (2006) [15] in cucumber. Brassinosteroids stimulate cell division and cell elongation, increase resistance to stresses, and inhibit root growth. Similarly findings Gosai *et al.*, (2020) [11], Kadi *et al.*, (2018) [1] in cucumber. maximum days taken to first fruit picking (57.39days, 58.72days, 58.06days) in 2018-19, 2019-20 and pooled respectively were found with T₀ (Control).

Maximum Number of fruits per plant (9.17; 9.79 and 9.48 in 2018-19, 2019-20 and pooled, respectively) similarly findings Irfan *et al.*, (2017) [13] in tomato, Abdul *et al.*, (2018) [2], Vardhini rao *et al.*, (2011) [31]. The maximum yield per plant (1.79 kg; 2.15 kg and 1.97 kg in 2018-19, 2019-20 and pooled, respectively) close conformity with Kumar *et al.*, (2019) [17], Karuppiah *et al.*, (2019) [20] and Ghosh *et al.*, (2020) [10] Ramani *et al.*, (2016) [25] in mango. The highest yield (t/ha.) (49.72 t/ha; 56.74 t/ha. and 53.23 t/ha. in 2018-19, 2019-20 and pooled, respectively) were recorded with treatment T₅ (Brassinosteroids (BR) 2.0 PPM) similar findings Sondarva *et al.*, (2016) [28] in ridge gourd, Vardhini rao *et al.*, (2011) [31] in tomato, Khatoon *et al.*, (2020) [18] in strawberry, Upreti *et al.*, (2004) [16] in pea and Sanoussi *et al.*, (2019) [4] in cucumber.

The highest Fruit length was recorded (21.10cm; 20.19cm and 20.65cm in 2018-19, 2019-20 and pooled, respectively) close conformity with Vishnu Ritti *et al.*, (2019) [32] in cucumber, Ayaz *et al.*, (2019) [3] in bitter gourd, Challab *et al.*, (2016) [8] and Ram *et al.*, (2016) [24]. The maximum diameter of fruits (cm) was recorded (4.56cm; 6.81cm and 5.69cm in 2018-19, 2019-20 and pooled, respectively) similar findings reported by Rangel *et al.*, (2019) [26] in cucumber, Ibrahim *et al.*, (2019) [5] in sweet pepper, Tawseef *et al.*, (2017) [30] in strawberry and Mohammad *et al.*, (2018) [22]. The maximum weight of fruit (g) (203.84 g; 223.84 g and 213.84 g in 2018-19, 2019-20 and pooled, respectively) were recorded maximum with treatment T₁₀ (Salicylic acid (SA) 1.0mM) close conformity with Acharya *et al.*, (2020) [6] in cucurbits, Thapliyal *et al.*, (2016) [29] in pear.

While minimum number of fruit per plant was observed (7.50, 8.37 and 7.94) in 2018-19, 2019-20 and pooled respectively, Fruit length(cm) were found (14.24cm, 13.61 cm and 13.93cm) in 2018-19,2019-20 and pooled respectively, Diameter of fruits(cm) (3.00cm, 3.80cm and 3.40cm) in 2018-19, 2019-20 and pooled respectively, Weight of fruit(g) (117.64 g, 125.31 g and 121.48 g) in 2018-19, 2019-20 and pooled respectively, yield per plant (0.88 kg, 1.05 kg and 0.97 kg) in 2018-19, 2019-20 and pooled respectively, Fruit yield (t/ha) (24.50 t/ha, 27.74 t/ha and 26.12 t/ha) in 2018-19, 2019-20 and pooled respectively were recorded in treatment T₀ (Control).

It is concluded that on the basis of present investigation in both successive year 2018-19 and 2019-20, it is concluded that the treatment T₅ (Brassinosteroids (BR) 2.0 PPM) was found best in terms of yield parameters like Days to first fruit picking, No. of fruit per plant, yield/plant and yield t/ha. the treatment T₁₀ (Salicylic acid 1.0 mM) was found best in terms of Fruit length, fruit diameter and weight of fruit. So application of those Plant growth regulator combination can be recommended to growers after few more conjunctive trials.

Table 1: Effect of foliar spray of Brassinosteroids (BR), Salicylic acid (SA) and Gibberellic acid (GA₃) on yield parameters of Cucumber cv. Arpit.

Treatment	Days to first fruit picking			Number of fruit per plant.			Diameter of fruits (cm)			Length of fruits (cm)			Weight of fruits (g)		
	2018-19	2019-20	Pooled	2018-19	2019-20	Pooled	2018-19	2019-20	Pooled	2018-19	2019-20	Pooled	2018-19	2019-20	Pooled
T0	57.39	58.72	58.06	7.50	8.37	7.94	3.00	3.80	3.40	14.24	13.61	13.93	117.64	125.31	121.48
T1	56.27	55.16	55.72	8.42	9.04	8.73	4.10	4.91	4.51	16.37	17.62	17.00	157.06	190.71	173.89
T2	56.15	55.02	55.59	8.43	9.05	8.74	4.13	5.01	4.57	17.73	18.73	18.23	158.50	193.18	175.84
T3	54.72	53.72	54.22	8.72	9.35	9.04	4.23	6.36	5.30	18.87	19.47	19.17	178.70	197.94	188.32
T4	54.41	53.34	53.88	8.92	9.57	9.25	4.36	6.61	5.49	19.20	19.87	19.54	191.27	208.04	199.66
T5	49.55	48.39	48.97	9.17	9.79	9.48	4.43	6.81	5.62	19.86	20.10	19.98	195.24	219.11	207.18
T6	56.51	55.48	56.00	8.06	8.39	8.23	3.96	4.60	4.28	16.12	17.37	16.75	150.50	180.40	165.45
T7	56.50	55.30	55.90	8.37	8.83	8.60	4.06	4.88	4.47	16.21	17.37	16.79	151.68	188.34	170.01
T8	55.88	54.38	55.13	8.68	9.10	8.89	4.16	5.73	4.95	17.77	19.33	18.55	163.34	193.80	178.57
T9	54.80	53.80	54.30	8.71	9.25	8.98	4.26	6.56	5.41	19.14	19.77	19.46	179.11	205.24	192.18
T10	54.71	53.41	54.06	8.73	9.38	9.06	4.56	6.81	5.69	21.10	20.19	20.65	203.84	223.84	213.84
T11	56.02	54.66	55.34	8.65	9.09	8.87	3.96	4.46	4.21	16.03	16.88	16.46	130.71	165.17	147.94
T12	55.38	54.27	54.83	8.71	9.25	8.98	3.96	4.53	4.25	16.09	17.12	16.61	136.52	166.68	151.60
T13	54.67	53.38	54.03	8.93	9.39	9.16	4.20	5.90	5.05	18.40	19.40	18.90	167.38	193.84	180.61
T14	52.75	51.42	52.09	9.13	9.65	9.39	4.23	6.27	5.25	18.66	19.44	19.05	173.80	194.04	183.92
CD value	2.46	2.42	2.44	0.38	0.41	0.40	0.18	0.25	0.22	0.79	0.82	0.80	7.31	8.46	7.88
S.Ed (±)	1.20	1.18	1.19	0.19	0.20	0.19	0.09	0.12	0.11	0.39	0.40	0.39	3.57	4.13	3.85

Table 2: Effect of foliar spray of Brassinosteroids (BR), Salicylic acid (SA) and Gibberellic acid (GA₃) on yield parameters of Cucumber cv. Arpit.

Treatment	Yield per plant (kg)			Fruit Yield (t/ha.)		
	2018-19	2019-20	Pooled	2018-19	2019-20	Pooled
T0	0.88	1.05	0.97	24.50	27.74	26.12
T1	1.32	1.72	1.52	36.73	45.60	41.16
T2	1.34	1.75	1.54	37.11	46.24	41.67
T3	1.56	1.85	1.70	43.28	48.95	46.11
T4	1.71	1.99	1.85	46.38	52.66	49.52
T5	1.79	2.15	1.97	49.72	56.74	53.23
T6	1.21	1.51	1.36	33.69	40.03	36.86
T7	1.27	1.66	1.47	35.26	43.99	39.62
T8	1.42	1.76	1.59	39.37	46.64	43.01
T9	1.56	1.90	1.73	43.32	50.21	46.77
T10	1.78	2.10	1.94	47.42	55.03	50.48
T11	1.13	1.50	1.32	31.40	39.71	35.55
T12	1.19	1.54	1.37	33.02	40.78	36.90
T13	1.49	1.82	1.66	41.51	48.14	44.83
T14	1.59	1.87	1.73	44.07	49.53	46.80
CD value	0.06	0.08	0.07	1.76	2.06	1.91
S.Ed (±)	0.03	0.04	0.03	0.86	1.01	0.93

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