Research Article

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Performance of parthenocarpic cucumber (*Cucumis sativus* L.) under polyhouse condition as influenced by organic amendments

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ABSTRACT

The study revealed that various treatment combinations of biodynamic, silica and *Dashparni* imparted significant effects on growth, yield and quality parameters of cucumber var. Nagene grown under protected cultivation. Out of various treatments, the treatment T_{10} (BD 500 @75g/ha + BD 501 @2.5g/ha+ Silica @1% + *Dashparni* @10%) was found superior for most of parameters studied *i.e.* vine length at 30 DAS (1.67 m), 60 DAS (2.67 m), final harvest (3.63 m), leaf area (509.17cm^2), days to first anthesis (26.07), days to first harvest (36.07), fruit weight (131.70 g), fruit volume (130.57 cc), fruit length (18.43 cm), fruit diameter (3.63 cm), number of branches (6.13), number of fruits per vine (31.43) yield per vine (4.20 kg), yield per square meter (10.07 kg) and yield per acre (40.30 t), whereas least performing treatment was found to be T_1 *i.e.* control.

Introduction

Cucumber (*Cucumis sativus* L.) belonging to family cucurbitaceae is a warm season vegetable, grown throughout the world under tropical and subtropical conditions. It is said to be the native of Northern India (Pursglove, 1969). It is one of the quickest maturing vine vegetables and widely grown throughout the country. The immature fruits of cucumber are said to have cooling effect, prevent constipation and indigestion. It is one of the most important vegetables and popular among polyhpouse growers due to early production and high profitability (Rajawat *et al.,* 2021). There is an urgent need to increase production of vegetable to feed millions of mouths, which seems possible only by increasing productivity. Land is limiting factor, hence boom in production can be achieved only through vertical harvesting (Ameta *et al.,* 2019). Parthenocarpic and gynoecious cucumber cultivars increase the potential to yield a high fruit load in controlled environments resulting in a high harvest index. Plants exhibiting a high harvest index will more efficiently use the limited growing area in a growth chamber (Meena *et al.,* 2017). In recent years, undoubtedly chemical fertilizers have played a critical role in providing nutrients for intensive crop production which heralded green revolution in the country and have changed India from a region of food scarcity to food sufficiency. But increased use of chemical fertilizers in an unbalanced manner has

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created problem of nutrient deficiencies, diminishing soil fertility and unsustainable crop yields (Dhakar *et al.,* 2023). These problems can be overcome by the use of organic amendments like biodynamic, silicon and *Dashparni* should be added to enrich fertility, improve soil structure, help to combat both abiotic and biotic stresses and work as natural insecticides. Among biodynamic preparations, uses of BD 500 and BD 501 have shown significant effect on crop growth, yield and disease minimization. BD 500 stimulates microorganisms and increases the availability of nutrients including trace elements. BD 501 complements BD 500 but works in atmosphere by enhancing photosynthetic uptake and increasing assimilation of nutrients.

Silicon (Si) beneficial effects on growth have been reported in a wide variety of crops, including horticultural crops (Cai and Qian, 1995). Si helps to combat both abiotic and biotic stresses, further excess of Si has no toxic reports so far (Ma and Yamaji, 2006). In cucumber, it was reported that addition of silicon of Si (100 mg/l) could increase the chlorophyll content, RuBP carboxylase activity (ribulose-bis-phosphate), root fresh weight and dry weight in cucumber plants grown in recirculating nutrient solution (Adatia and Besford, 1986). *Dashparni* ark is one of natural pesticide which used to control pest and diseases and improve richness of soil. Moreover, it acts as an enriched for greenery of the plants which is used for all kinds of agricultural crops (Ganvir, 2022).

Material and Methods

The experiment under polyhouse was conducted at Hi-Tech Unit, Rajasthan College of Agriculture, Udaipur (24°35'N latitude 74°42' longitude at 585.5 meters above mean sea level) during July-October, 2023 in *Kharif* season on cucumber var. Nagene. The trial was laid out in Completely Randomized Design with three replications. The polyhouse was covered with aluminate sheet and ultra violet stabilized low density polyethylene sheet having 200-micron thickness with provision of foggers. The experiment was comprised of ten treatments T_1 (Control), T_2 (BD 500 @75g/ha), T_3 (BD 501 @2.5g/ha), T_4 (BD 500 @75g/ha) + BD 501 @2.5g/ha), T_5 (Silica @1%), T_6 (*Dashparni* @10%), T_7 (BD 500 @75g/ha + Silica @1% + *Dashparni* @10%), T_8 (BD 501 @2.5g/ha + Silica @1% + *Dashparni* @10%), T_{10} (BD 500 @75g/ha + BD 501 @2.5g/ha + Silica @1% + *Dashparni* @10%) for polyhouse cultivation of cucumber, the seeds were sown in raised beds of 1 meter width and 45 cm above from ground level along with length of polyhouse were prepared. Basal dose of FYM was applied and mixed in the soil one week before sowing. Spray of BD 501 in soil was done before 1 day of sowing in morning hours. Seeds were sown at approximately 2 cm depth. All the cultural practices including irrigation and hoeing were carried out as per the standard commercial procedures. Plants were vertically trained with nylon ropes. Observation regarding vine length at 30 DAS, 60 DAS, final harvest (m), leaf area (cm^2), days to first anthesis, days to first harvest, fruit weight (g), fruit volume (cc), fruit length (cm), fruit diameter (cm), number of branches (at final harvest), number of fruits per vine, yield per vine (kg), yield per square meter (kg) and yield per acre (t) were recorded on selected five tagged plants of each treatment and further analysed.

The length of vine was measured at 30, 60 days after sowing and at final harvest from the base of stem to the highest tip of the plant with the help of measuring tape and mean value was expressed in meter. Leaf area was measured at full maturity stage with the help of leaf area meter and then mean value was expressed in cm^2. The number of days taken for anthesis and number of days taken to first picking from the date of sowing in each tagged plant and average value was expressed in days. Total number of branches of the individual plants was counted at the time of final harvest. Fruits were harvested when they attend horticulture maturity. Number of marketable fruits were counted at each picking and summed for all the picking. Five marketable fruits were randomly selected from each replication during the picking and weight of individual fruit was measured in grams with the help of digital balance and average was computed. Fruit length was measured with the help of meter scale, fruit diameter was measured with the help of vernier caliper from the center of each fruit and average value was expressed in cm. Fruit volume was measured by water displacement method and measured in cubic centimeter. Total yield per plant was derived by multiplying average number of fruits per plants by average weight of fruit and expressed in gram. Total yield per square meter area was derived from yield per plant and respective crop geometry. The yield per acre was calculated by multiplying yield per square meter with 4000 and expressed in ton. In polyhouses approx. 40 per cent area is used in path, hence calculation was done including this area not only for effective area of planting *i.e.* approx. 60 per cent. The recorded observations were analysed statistically as per the procedure advocated by Panse and Sukhatme (1985) for drawing inferences.

Results and Discussion

The results (Tables 1 and 2) of the study revealed significant differences in the response of various growth and yield parameters to different treatments. In general, different

treatments increased growth and yield in cucumber over control. The results showed that higher vine length at 30 DAS(1.67 m), at 60 DAS (2.67 m), at final harvest (3.63 m), leaf area (509.17 cm^2), number of branches (6.13), number of fruits per vine (31.43), fruit weight (134.70 g), fruit volume (130.57 cc), fruit length (18.43 cm), fruit diameter (3.63 cm), yield per vine (4.20 kg) and yield per square meter (10.07 kg), yield per acre (40.30 t) and minimum days to first anthesis (26.07) were reported for treatment T_{10} (BD 500 @7 5g/ha + BD 501 @2.5g/ha + Silica @1% + *Dashparni* @10%), whereas treatment T_8 (BD 500 @75g/ ha + Silica @1% + *Dashparni* @ 10%) and T_9 (BD 501 @ 2.5g/ ha + Silica @ 1% + *Dashparni* @10%) were found best for earliness as both these treatments took least equal days for first harvest (35.63). Best performance shown by treatment T_{10}, might be due to presence of biodynamic preparations, silica and *Dashparni* as constituents of this treatment combination as BD 500 causes significant internal changes in the soil, the principal changes are a significant drop in pH, an increase in aerobic status and production of nitrate causing more vine length, similarly BD 501, enhances the photosynthesis, and as such compliment the activity of the preparation BD 500, which works mostly in the root zone of the plant. Findings of Sharma *et al.* (2012) was in conformity with this study as significantly higher plant height has been recorded in cumin. Increased vine length in cucumber is also associated due to presence of silica as silicon deposited in the walls of epidermal cells after absorption by plants, contributes considerably to stem strength (Savant *et al.*, 1999). The increase in growth parameter due to the stimulation of growth by silicon could be either indirect, owing to the protective effects of silicon against pathogens or direct as it impacts both morphological changes and physiological processes in plants as it is involved directly or indirectly in cell metabolism. Present results are in conformity with the findings of Gowda *et al.* (2015).

BD-500 and BD-501 as bio-enhancers are rich source of microbial consortia, macro and micro nutrient and plant growth promoting substance including immunity enhancers. Results of the study are in conformity with findings of Aarya *et al.* (2023). *Dashaparni* extract also boosted overall growth of plants indirectly through imparting disease resistance as reported by Chavan *et al.* (2023), further, *Dashparni* also having cow dung and cow urine as its constituents, that might be a reason for luxurious growth of crop plants. Increased fruit weight, fruit length, fruit diameter and fruit volume in treatment T_{10} might be due cumulative effects of various components of treatment *i.e.* Biodynamic, *Dashparni* and silica. Findings of Diwan *et al.* (2019) was in close proximity with present results. Similarly, Patel *et al.* (2021) observed beneficial effect of foliar application of *Dashparni*. Highest yield due to application of BD 500 and BD 501 has been reported by Sharma *et al.* (2012) while working with cumin, similarly highest yield due to application of silica has been reported by Abbas *et al.* (2015) while working with okra.

Table 1: Effect of organic amendments on growth and flowering attributes of cucumber as influenced by various organic amendments.

Treatment	Treatment details	Vine length (cm)			Leaf area (cm^2)	Days to first anthesis	Number of branches
		30 DAS	60 DAS	at final harvest			
T_1	Control	1.07	2.10	3.10	413.73	29.13	4.67
T_2	BD 500 (75g/ha)	1.20	2.20	3.23	434.93	27.90	5.10
T_3	BD 501 (2.5g/ha)	1.23	2.23	3.30	439.77	29.20	5.13
T_4	BD 500 (75g/ha) +BD 501 (2.5g/ha)	1.37	2.43	3.47	450.13	27.60	5.57
T_5	Silica (1%)	1.23	2.27	3.20	440.77	29.83	5.27
T_6	*Dashparni* (10 %)	1.27	2.27	3.20	437.20	28.40	5.30
T_7	Silica (1%) + *Dashparni* (10 %)	1.37	2.47	3.43	456.13	27.90	5.60
T_8	BD 500(75g/ ha) +Silica (1%) +*Dashparni* (10 %)	1.63	2.57	3.53	491.87	26.73	5.87
T_9	BD 501(2.5g/ha) +Silica (1%) +*Dashparni* (10 %)	1.60	2.60	3.60	493.63	26.10	5.93
T_{10}	BD 500 (75g/ha) +BD 501 (2.5g/ha) +Silica (1%) +*Dashparni* (10 %)	1.67	2.67	3.63	509.17	26.07	6.13
	C.D. (P=0.05)	NS	NS	NS	7.491	2.304	0.396
	SE(m) ±	0.204	0.157	0.149	2.522	0.776	0.133

NS= non-significant

Table 2: Effect of organic amendments on fruit and yield traits of cucumber as influenced by various organic amendments.

Treatment	Treatment details	Days to first harvest	Number of fruits / vine	Fruit weight (g)	Fruit volume (cc)	Fruit length (cm)	Fruit diameter (cm)	Yield/vine (kg)	Yield/m^2 (kg)	Yield/acre (t)
T_1	Control	39.63	26.97	121.27	116.40	12.80	2.50	3.27	7.83	31.33
T_2	BD 500 (75g/ha)	38.67	27.37	124.00	120.90	14.73	2.70	3.40	8.13	32.57
T_3	BD 501 (2.5g/ha)	39.40	29.60	125.10	121.27	15.17	2.87	3.67	8.90	35.60
T_4	BD 500 (75g/ha) +BD 501 (2.5g/ha)	37.07	29.00	128.13	124.50	16.60	2.97	3.70	8.90	35.67
T_5	Silica (1%)	38.43	28.50	124.40	120.40	15.37	2.57	3.53	8.53	34.03
T_6	*Dashparni* (10 %)	37.60	28.13	123.73	118.83	14.60	2.70	3.47	8.37	33.40
T_7	Silica (1%) + *Dashparni* (10 %)	36.50	29.20	128.43	124.43	16.73	2.90	3.73	9.00	36.00
T_8	BD 500(75g/ ha) +Silica (1%) +*Dashparni* (10 %)	36.07	30.17	130.77	126.53	17.60	3.53	3.93	9.50	37.90
T_9	BD 501(2.5g/ha) +Silica (1%) +*Dashparni* (10 %)	36.07	30.10	131.03	128.60	17.57	3.40	3.93	9.47	37.87
T_{10}	BD 500 (75g/ha) +BD 501 (2.5g/ha) +Silica (1%) +*Dashparni* (10 %)	35.63	31.43	134.70	130.57	18.43	3.63	4.20	10.07	40.30
	C.D. (P=0.05)	2.294	2.396	3.486	4.962	1.652	0.371	0.340	0.824	3.269
	SE(m) ±	0.772	0.807	1.174	1.670	0.556	0.125	0.115	0.277	1.100

Conclusion

On the basis of results obtained in present investigation it is concluded that among the different treatments used, treatment T_{10} (BD 500 @75g/ha + BD 501 @2.5g/ha + Silica @1% + *Dashparni* @ 10%) proved the most beneficial for most of parameters studied *viz.,* leaf area, days to first anthesis, days to first harvest number of branches per plant, fruit weight, fruit length, fruit diameter, number of fruits per plant, fruit volume, yield per vine, yield per square meter and yield per acre of cucumber grown under polyhouse condition.

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