

Influence of Training on Vegetative Growth Characteristics and Yield of Polyhouse Grown Cucumber (*Cucumis sativus* L.)

ABSTRACT

Aims: To study the influence of various training techniques on vegetative growth characteristics and yield of cucumber grown under protected cultivation.

Study design: Randomized Block Design with three replications.

Place and Duration of Study: Research farm, Department of Vegetable Science and Floriculture, CSK HPKV, Palampur during spring summer season 2016.

Methodology: The experiment consists of seven different training methods. The observations were recorded viz., days to 50 per cent flowering, days to first harvest, fruit weight (g), number of fruits/plant, fruit yield/plant (kg), harvest duration (days), inter-nodal length (cm) and vine length (m). Observations were recorded from 5 plants chosen at random in each replication and then average was worked out for each parameter.

Results: Treatment comprised of single stem (T_1) recorded minimum days to 50 per cent flowering (23.67), minimum days to first picking (35.00 days), maximum fruit weight (136.23 g), harvest duration (56.00 days), vine length (2.26 m) and minimum inter nodal length (9.34 cm) which was statistically at par with treatment comprising of single stem with side shoot training after 3 leaves (T_2) to all these characters respectively. Whereas the treatment comprised of three stems with side shoot training after 3 leaves (T_6) obtained maximum number of fruits/plant (28.23) which was significantly superior to all other treatments and maximum fruit yield/m² area (8.27 kg) which was statistically at par with treatment comprising of three stems (T_5).

Conclusion It was concluded that plants trained to single stem had better vegetative characters but plants trained to three stems with side shoot training after three leaves had higher yield/m² area.

Keywords: cucumber, growth, protected environment, training, yield

1. INTRODUCTION

Cucumber (*Cucumis sativus* L.) is a member of the gourd family cucurbitaceae, which comprises of 117 genera and 282 species in warmer parts of the world. It is a warm season crop and has little or no tolerance to frost. Growth and development are favoured by temperature above 20°C. The optimum temperature for growing is between 20°C and 30°C.

Under open environment cucumber is being grown in both summer and rainy seasons, with varying success due to various abiotic (low temperature and unpredictable weather) and biotic (red pumpkin beetle, fruit fly and incidence of downy/powdery mildew) stresses. Under the protected environment we can grow good quality cucumber throughout the year in hills as compared to the open cultivation. The type of cucumber grown in polyhouses is parthenocarpic. The fruits are mild in flavour and have a thin edible skin that requires no peeling.

In protected cultivation, profits are greatly dependent on the quantity and quality of the produce. Shoot training of plants contribute to the ultimate yield in various ways. Shoot training maximizes the plant ability to obtain the sunlight needed for growth and development. It is also important to maintain adequate air movement around the plant to reduce risk of fungus and other insect problems. On the other hand, dense canopy of leaves shade the fruits, causing them to be pale.

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Relatively high perishability has made cucumber plants to be more vulnerable to intensive crop management and unfavorable environmental conditions. Excessive shoot training sometimes causes the plants to cease producing flowers. Therefore, it is important to maintain optimum foliage as well as shoots on the plant for adequate rates of photosynthesis.

2. EXPERIMENTAL DETAILS

The experiment was conducted under a modified naturally ventilated polyhouse having 250 m² area at Experimental Farm of Department of Vegetable Science and Floriculture, CSK Himachal Pradesh Krishi Vishvavidyalaya, Palampur during spring-summer season in 2016. Seeds of parthenocarpic hybrid Kian were sown in plastic plug trays by using soilless media having cocopeat, perlite and vermiculite in the ratio of 3:1:1, respectively inside the growth chamber to get healthy and disease free seedlings of cucumber. The seedlings were ready for transplanting after 21 days. The experiment was laid out in a Randomized Block Design with three replications. The seedlings were transplanted at 70 × 60 cm spacing. Experiment consist of seven treatments of shoot training systems viz., single stem (T₁), single stem with side shoot training after three leaves (T₂), two stems (T₃), two stems with side shoot training after three leaves (T₄), three stems (T₅), three stems with side shoot training after three leaves (T₆) and control (no training) (T₇). The observation were recorded on five plants taken randomly for the characters viz; days to 50 per cent flowering, days to first picking, fruit weight (g), number of fruits/plant, fruit yield/plant (kg), harvest duration (days), inter-nodal length (cm) and vine length (m). The data pertaining to the present investigation were statistical analyzed using the standard procedures of the Randomized Block Design (RBD). The treatment effects were tested at 5% level of significance.

3. RESULTS AND DISCUSSION

A cursory glance at Table1 clearly indicates that shoot training had significant influence on days to flowering. Plants trained to single stem took minimum number of days (23.67) to produce 50 per cent flowering and was statistically at par with treatment comprising of single stem with side shoot training after 3 leaves (24.00 days) as compared to control (29.00). The reason for early flowering in plants having single stem was the fast growth of main shoot as compared to the rest of the treatments. Plants with single stem appeared to have quick absorption and utilization of nutrients and the various physiological processes boosted up at faster rate with a favorable balance between synthesis and utilization in flower induction. The findings of present investigation are in accordance with the findings of earlier workers [1] and [2]. In cucumber the early crop produce fetch higher returns in the market and shoot training of plants also had significant influence on days to first picking. Plants trained to single stem took minimum number of days (35.00) to first picking which was statistically at par with treatment comprising of single stem with side shoot training after 3 leaves (35.33 days). Early appearance of flowers at lower nodes coupled with exposure of fruits to sunlight and aeration could be the reasons for early picking in plants trained to single stem. Similar results were also reported by [3] and [4]. Fruit weight in parthenocarpic cucumber also plays important role and training of plants also had significant affect on fruit weight. Plants trained to single stem recorded maximum fruit weight (136.23 g) which was statistically at par with treatment comprising of single stem with side shoot training after 3 leaves (135.17 g) and were significantly superior to rest of the treatments. More fruit weight from single stem plants was probably due to the better exposure of the plants to light, enhanced synthesis of photosynthates and more assimilation of carbohydrates. The above findings are supported with the conclusions drawn by [5], [6] and [7]. Shoot training also had significant influence on number of fruits/plant. Plants trained to three stems with side shoot training after 3 leaves recorded maximum number of fruits/plants (28.23) followed by treatments three stems (26.17). However, minimum number of fruits/plant (16.17) was recorded in single stem treatment. More fruits/plant in plants with three stems than the plants trained to one stem and two stems could be attributed to availability of more number of fruit producing shoots, which resulted into higher number of fruits/plant. In case of untrained plants there was excessive vegetative growth, so fruits number/plant were lesser than three stems plants. Similar results were also recorded by [8] and [9]. Shoot training also had significant affect on inter-nodal length. Minimum inter-nodal length (9.34cm) was noticed when plants were trained to single stem, which was statistically at par with treatment comprising of single stem with side shoot training after 3 leaves (9.39 cm). Maximum inter-nodal length (9.78 cm) was observed in control (no training). The reason for minimum inter-nodal length of single stemmed plants was probably due to the better exposure of the plants to light, enhanced synthesis of photosynthates and more assimilation of carbohydrates. Similar finding was also reported by [6]. Among various training methods, maximum vine length (2.26 m) was noticed when plants were trained to single stem, which was statistically at par with treatment comprising of single stem with side shoot training after 3 leaves (2.21 m). This increase in vine length may be due to training of side branches causing flow of nutrients to the axillary branches might have reduced, which in turn lead to flow to the apical tissues leading to elongation of shoot. These results are in line with the findings of [5] and [6].

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Comment [J6]: Please give a brief description of the polyhouse

Comment [J7]: Parthenocarpic plants produce seedless fruits or fruits with rudimentary seeds. How did you get the parthenocarpic hybrid seeds?

Comment [J8]: What were the cultural practices you carried out before transplanting the seedlings, such as irrigation, weeding etc? How many seeds were sown per tray? Did you take the records of days to first seedling emergence, days to 50% and 100% seedling emergence, total percentage seedling emergence? (Very important).

Comment [J9]: I suppose you mean 'randomized complete block design (RCBD). Was this design adopted in an open field or an enclosed environment? Please give the reason for blocking in the polyhouse.

Comment [J10]: How did you select your seedlings for transplanting? Randomly? Were they of uniform growth pattern in terms of vine length, number of leaves, leaf area etc? These morphological growth parameters will affect the subsequent performance of individual seedling after transplanting.

Comment [J11]: Please throw more light on these treatments. How possible was it to obtain these treatments 21 days after planting the seeds in seed trays? OR Were the treatments imposed after transplanting the seedlings? What was the platform for unbiased uniform treatment?

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Comment [J15]: Was this part of your result? Please quote the authorities.

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Comment [J19]: 'Statistically similar to' instead of 'statistically at par'

Comment [J20]: 'Significantly higher (p < 0.05) than' instead of 'significantly superior to'

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Shoot training also had significant affect on harvest duration. Maximum harvest duration (56.00 days) was noticed when plants were trained to single stem, which was statistically at par with treatment comprising of single stem with side shoot training after 3 leaves (55.67 days). Extended harvesting duration was also due to early appearance of pistillate flowers at lower nodes coupled with exposure of fruits to sunlight and aeration could be the reasons for early pickings and longer harvest duration in plants trained to single stem. The findings of [1] and [8] corroborates the above results. It is apparent from the data presented in Table1 that shoot training also had significant effect on fruit yield/m² area. Treatment comprising of three stems with side shoot training after 3 leaves had highest fruit yield/m² area (8.27 kg) and was statistically at par with treatment comprising of three stems (7.77 kg). The higher yield from the plants trained to three stems may be attributed to its better performance in number of fruits/plant which ultimately resulted in increase in fruit yield/m² area. Similar results were also reported by [6], [8] and [10].

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Table 1: Influence of shoot training on vegetative growth and yield characteristics of cucumber

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Treatments	Days to 50% flowering	Days to first picking	Fruit weight (g)	Number of fruits/plant	Intermodal length (cm)	Vine length (m)	Harvest duration (days)	Fruit yield/m ² (kg)
T ₁	23.67	35.00	136.23	16.17	9.34	2.26	56.00	5.23
T ₂	24.00	35.33	135.17	17.77	9.39	2.21	55.67	5.73
T ₃	25.67	37.00	131.47	19.83	9.50	2.10	53.33	6.20
T ₄	26.00	38.00	129.80	21.57	9.52	2.05	52.67	6.58
T ₅	27.33	39.00	126.23	26.17	9.63	1.93	51.00	7.77
T ₆	27.67	39.33	124.57	28.23	9.66	1.89	50.33	8.27
T ₇	29.00	41.00	120.97	23.13	9.78	1.76	47.33	6.70
CD (P =.05)	1.45	1.58	2.74	0.92	0.15	0.14	0.69	1.01

4. CONCLUSION

It was concluded that parthenocarpic cucumber plants trained to single stem had better vegetative characters whereas, plants trained to three stems with side shoot training after three leaves produced higher yield/m² area.

COMPETING INTERESTS

We have declared that no competing interests exist.

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