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Standardization of Training and Pinching in Bottle Gourd cv CBgH1 for Yield and Quality

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Abstract Field experiment was conducted during 2012-2013 to study the effect of training and pinching on growth, flowering, yield and quality bottle gourd cv CBgHI. The treatment consisted of different types of pinching on secondary laterals were imposed upto 3rd, 4th, 5th and 6th node and control (no pinching) and laid out in randomized block design replicated three times. Results revealed that plant height, days to first female appearance and fruit weight were favored by unpruning. Thus pruning and training (T_4) may reduces growth (4.70 and 4.64 m) and increases yield (15.63 and 15.68 kg) and quality [carbohydrate (2.713 and 2.723%), protein (0.268 and 0.269%) and crude fiber (0.626 and 0.627%)] of bottle gourd. Reduced growth in pruned plants may translate to higher number of fruit/vine and total fruit yield/vine. Pruning and training resulted in yield and quality of bottle gourd. Considering results with regards to increase number of fruit, total and quality it could be concluded that, the pinching on secondary lateral at 6th node suggested for commercial cultivation of bottle gourd under Coimbatore condition.

Keywords Bottle gourd, Pinching, Yield, Quality, Training.

Introduction

India is the second largest producer of vegetables in world next to China, producing about 16.83 million tones of vegetables annually from an area of 9.41 million hectares [1]. India is the center of origin for many cucurbitaceous vegetables, where the cucurbits are performing well even under hot summer. Cucurbits are the largest group of summer vegetables of which bottle gourd, bitter gourd, ash gourd, snake gourd, pumpkin, cucumber, water melon, ivy gourd and ridge gourd are the most important among farmers. Under the genus *Lagenaria*, six species were reported in which *Lagemaria abyssinia, Lagenaria siceraria* and *Lagenaria lencantha* are common. Among them *Lagenaria siceraria* is generally cultivated in all tropical parts of world, expecially in India and a few African countries. Remaining species are wild, perennial

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and dioecious in nature. The wild species i.e. *Lagenaria abyssinia, Lagenaria bravifolia* are perennial in nature [2].

The major producing countries of bottle gourd in the world are India, Sri Lanka, Indonesia, Malaysia, Philippines, China, Hong Kong, Tropical Africa, Colombia and Brazil. India is the second largest producer of bottle gourd in the world after China. It is extensively grown in India (UP, Punjab, Gujarat, Assam, Rajasthan, Tamil Nadu, Karnataka) and is cultivated almost throughout the year in an area of 1.18 lakh ha with a production of 18.36 lakh tonnes with a productivity of 20.80 tonnes/ha [1]. Bottle gourd is valued for its nutritive and medicinal pro/ties. The fruit has protein (0.2 g), carbohydrate (2.5 g) and traces of minerals like calcium (20 mg), phosphorus (10 mg) and iron (0.7 mg) in 100 g of fruit [3]. Its tender fruits are used as cooked vegetable and also for making sweets in Africa and Asia.

The dried fruit is used as containers, utensils, fishing floats and some music instruments. The cooked vegetable has cooling, diuretic, sedative and anti-bilious effect. The gourd fruit juice can be used in the treatment of epilepsy and other nervous diseases. The juice can also be used in the treatment of stomach acidity, indigestion and ulcers. The bottle gourd fruit also helps in relieving constipation. Bottle gourd is a highly cross-pollinated crop due to its and romonoecious nature and has a wide genetic diversity [4]. Being a cross-polinated crop, it has wide range of variability for maturity, yield and fruit characters like shape and size [5].

Even though, bottle gourd is commercially cultivated as ground trailing in Tamil Nadu. The training and pinching is not commonly being practiced by farmers. The recent past development of small fruited hybrids made the crop to grow in bower system of cultivation as like other cucurbits snake gourd, bitter gourd and ribbed gourd. This made the researchers to develop the training and pruning technique to maximize the yield. The research on effect of training and pinching to improve the growth, yield and quality characters in bottle gourd is very scanty and it has to be standardized for various environments. Hence the present study was under taken with the following the objectives; to study the influence of pinching on fruit yield and quality.

Materials and Methods

The present investigation on standardization of training and pinching in bottle gourd cv CBgHI was carried out in the experimental farm of Department of Vegetable Crops, Horticultural College and Research Institute, Tamil Nadi Agricultural University, Coimbatore during 2012-13. Plants were raised with the spacing of 2.0 × 2.0 m. Seeds were soaked in water for 5–6 hours before sowing will stimulate germination. All horticultural practices were adopted. Recommended cultural practices and plant protection measures were also followed to obtain a successful crop. The removal of all auxiliary buds from 1st to 10th node upto 25–30 days after sowing were made to maintain single stem leader. The apical bud was pinched just 10 cm below the bower and allowed only two primary branches to trail on the pandal. From that primary laterals pinching was excised on 5th–6th node to allow more secondary branches. On the secondary laterals the treatments were imposed upto 3rd, 4th, 5th and 6th node and control as follows.

T_1–Pinching on secondary lateral at 3rd node, T_2–Pinching on secondary lateral at 4th node, T_3–Pinching on secondary lateral at 5th node, T_4–Pinching on secondary lateral at 6th node, T_5–No pinching on secondary lateral shoots (control).

Five plants in each treatment / replication were tagged randomly for recording the observation on growth; yield and quality were recorded. Data were recorded on vine length, days to first female appearance, node at first female appearance, female flowers / vine, fruit weight (kg), fruits / vine, seeds / fruit, seed weight / fruit (g), fruit yield (kg), carbohydrates (%), protein (%), crude fiber (%). The statistical analysis of data was done by adopting the standard procedures [6].

Table 1. Effect of training and pinching on growth and yield traits in bottle gourd cv CBgH1.

Treat-ments	Vine length (m)		Days at first felmle appearance		Node at first female appears		Female flowers/ vine		Fruit weight (kg)		Fruits/vine	
	Season I	Season II	Season I	Season II	Season I	Season II	Season I	Season II	Season I	Season II	Season I	Season II
T_1	5.98	6.03	45.3	44.9	14.4	12.65	12.65	16.50	0.942	0.946	12.65	12.40
T_2	5.24	5.32	45.4	45.4	14.7	13.35	13.35	17.87	0.934	0.934	13.35	13.65
T_3	5.08	5.11	45.2	44.6	14.4	14.60	14.60	18.22	0.925	0.930	14.60	14.42
T_4	4.70	4.64	45.1	45.3	14.4	16.30	16.30	20.58	0.921	0.919	16.30	16.26
T_5	6.52	6.44	45.2	45.6	14.2	10.75	10.75	15.53	1.089	1,039	10.75	10.54
SED	0.08	0.10	0.70	0.92	0.24	0.17	0.17	0.13	0.042	0.029	0.17	0.21
CD (p=0.05)	0.18	0.22	–	–	–	0.38	0.38	0.30	0.091	0.064	0.38	0.47

Results and Discussion

The vine length differed significantly among the treatments. It ranged from 4.70 to 6.52 m and 4.64 to 6.44 m during the first and second season respectively (Table 1), In both the season highest vine length (6.52 and 6.44 m) was noticed at T_5 (no pinching on secondary lateral) and the treatment T_4 (pinching on secondary lateral at 6th node) registered the lowest vine length (4.70 and 4.64 m). Similar findings were reported and found that pruned plants had reduced height and helped in greater exposed of plants to light and leads to higher photosynthetic activity in tomato [7] and pruning treatment restricted the growth of side branches in okra [8]. Effect of training and pinching had no significant effect on days to first female appearance and node at first female appears for both season. The mean values ranged from 45.1 to 45.3 days during first season crop and from 44.6 to 46.6 days in second season for days to first female appearance. For node at first female appears the mean value ranged from 14.2 to 14.7 during first season crop and from 14.1 to 14.6 in second season crop. The appearance of female flowers occurred in the primary branches itself, even before pinching Produced any effect of first female flower appearance. This is conformity with the results reported in bitter gourd [9].

The differences in the number of female flowers/ vine among the treatments were statistically significant in both seasons. T_4 (pinching on secondary lateral at 6th node) was recorded the higher number of female flowers of 20.35 and 20.58 in first and second season. The treatment T_5 (control) was produced least number of female flowers of 15.55 and 15.53 during the first and second season crop (Table 1). In the present study, more female flowers were produced in the pinched plants, the increase in number of female tertiary branches due to pinching favoring the production of female flowers in the basal modes might have actail as become one among the factor to produce more number of female flowers. This is in conformity with research contribution by various workers in different crops [8—10]. The fruit weight was significantly influenced by pinching treatments. In both the season crop, the treatment T_5 (no pinching on secondary laterals) which recorded maximum of 1.089 and 1.039 kg of fruit weight. But the treatment T_4 (pinching on secondary laterals at 6th node) registered the lowest fruit weight of 0.921 and 0.919 kg and was on par with T_1, T_2 and T_3 (Table 1). This is due to the fact that higher number of female flowers and fruit set lead to reduction of source sink relation and there is no proportionate increase of source as like that of sink in pinched plants as compared to unpinched plants. So, there is ample possibility of diversion of photosynthates to multiple sink. Thia might be reason for size reduction of fruits in pinched plants (i.e)

Table 2. Effect of training and pinching on yield and quality traits in bottle gourd cv CBgH1.

Treatments	Seeds/fruit		Seed weight/fruit (g)		Fruit yield (kg/vine)		Carbohydrate (%)		Protein (%)		Crude fiber (%)	
	Season I	Season II	Season I	Season II	Season I	Season II	Season I	Season II	Season I	Season II	Season I	Season II
T_1	359.03	359.20	133.30	133.64	12.55	12.60	2,642	2.643	0.261	0.261	0.617	0.617
T_2	342.48	340.78	129.47	127.18	12.98	13.03	2.646	2.646	0.262	0.262	0.619	0.620
T_3	329.78	331.15	124.48	124.13	13.86	13.89	2.662	2.650	0.264	0.264	0.622	0.623
T_4	322.45	316.90	102.22	103.55	15.63	15.68	2.713	2.723	0.268	0.269	0.626	0.627
T_5	391.08	388.85	145.29	152.28	12.43	12.45	2.626	2.618	0.253	0.252	0.612	0.613
SED	3.18	4.36	1.92	1.35	0.18	0.16	0.0111	0.0029	0.0008	0.0005	0.0008	0.0006
CD (p=0.05)	6.93	9.50	4.20	2.94	0.41	0.35	0.0242	0.0063	4.20	2.94	0.41	0.35

smallest fruits were observed in pinching of secondary laterals at 6th node. Whereas the reverse in the case in non pinched plants which had minimum number of fruits with all physiological support of source for bulking made the fruit become longest and largest width size. This view was opined by various workers [11—13]. Pinching on secondary lateral at 6th node (T_4) registered the highest number of fruits/plant (16.30) followed by T_3 (14.60) and T_2 (13.35) compared to control (T_5) in the first season. During the second season, the results were similar that of first season crop and the maximum number of fruits/plant (16.26) was noticed at T_4 and the treatment T_5 (10.54) registered the minimum number of fruits/plant. The higher number of fruits/vine may be ascribed to the fact that pinching on secondary branches has induced vigorous growth of plants which resulted in development of more number of tertiary shoots, leaves and flowering axils which trapped the solar energy for more photosynthates production and more number of female flowers and these lead to the production of more fruits/plants and this will inturn reflected on total yield. The four pruning methods examined and resulted that pinching on secondary shoots resulted higher marketable fruits (18—20 fruits/plant) in cucumber [14]. This is in confirmtion with the findings in Dolichus bean [15, 16].

In the present study, there was a significant difference in the number of seeds and weight of seeds/fruit in both the seasons (Table 2). Highest number of seeds/fruit (391.08 and 388.85) was noticed at T_5 followed by T_1 and T_2. The treatment T_4 (pinching on secondary lateral at 6th node) registered the lowest number of seeds/fruit (322.45 and 316.90). The seeds weight/fruit was differed significantly among the pinching treatments in both seasons. The treatment T_5 (no pinching on secondary lateral) was recorded the highest seeds weight/fruit (145.29 and 152.28 g), followed by the treatment T_1 (pinching on secondary lateral at 3rd node) which recorded 133.30 and 133.64 g of seeds/fruit. The treatment T_4 (pinching on secondary lateral at 6th node) produced the lowest weight of seeds/fruit (102.27 and 103.55 g). The date showed the increased number of seeds/fruit and weight of seeds/fruit in no pinching (T_5), this might be due to the greater fruit size and weight of fruit as indicted by more fruit diameter. The limited number of fruits/plant had large ovary size might have accommodated more number of ovules. This more number of ovules had higher % of fertilization and seed development. These in turn will synthesis GA and that might have leaded to cell enlargement and more cells production during the course of development of fruits [17, 18].

Fruit yield was differed significantly among the pinching treatments. In the first and second season crop, T_4 (pinching on secondary lateral at 6th node)

was recorded the highest fruit yield/plant (15.63 and 15.68 kg) and the treatment T_5 (control) was produced least fruit yield (12.43 and 12.45 kg) and was on par with T_1 (12.55 and 12.60 kg). It is interesting to note that yield attributing characters like female flowers/ vine and fruits/vine was high in pinching on secondary lateral at 6th node (Table 2). This might be the reason for increased in the yield/vine in pinched plants which ultimately increased the yield/unit area Dhivya [16] Aurin and Rasco [19] supported that increased yield may be because of difference in yield components. The important quality parameters identified to assess the value of bottle gourd fruits are of carbohydrate, protein and crude fiber. The results on the quality parameters showed similar trend in both the seasons (Table 2). The carbohydrate content was differed significantly among the pinching treatments in both seasons. In the present study, the carbohydrate content of fruits was improved significantly due to pinching on secondary laterals and was highest at 6th node (2.713 and 2.723%). This may be ascribed to the fact that pinching on apical buds helped in diverting the flow of nutrients towards the production of more number of branches and leaves leading to higher photosynthetic activity and ultimately more food materials like carbohydrates were assimilated [20]. Greater production of photosynthates and translocating the assimilated materials to developing sink under this treatment appears to have increased the carbohydrate content of the fruits [21]. In the present study, the effect of pinching on secondary laterals in all the treatments did not show any appreciable variation in protein and crude fiber content (Table 2). The pinching treatments had influenced only the carbohydrate content which efficiently translocated to the sink. The nitrogen which was applied as uniform dose could not had much influence on the uptake did not reflect on the total protein content of the fruits as evidenced from all pinching treatments [22]. The crude fiber is a modification of the carbohydrate and components of cellulose which could not be influenced by the pinching treatment due to the reason that, the linkage or the bonds required for the synthesis of crude fiber did not exist [23]. Considering all the above findings with regards to increased number of fruit, total yield and quality. It could be concluded that, the pinching on secondary lateral at 6th node suggested for commercial caltivation of bottle gourd under Tamil Nadu condition.

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