Madras Agric. J., 2021; https://doi.org/10.29321/MAJ.10.000504

RESEARCH ARTICLE

Performance Analysis of Bitter Gourd (*Momordica charantia* L.) under Different Training Systems

Bhanuprakash C[1], Sankari A[1], Ushanandhini Devi H[1] and Murali Arthanari[2]

[1]Department of Vegetable Science, Horticultural College and Research Institute, Tamil Nadu Agricultural University , Coimbatore -641003

[2]Department of Agronomy, College and Research Institute, Tamil Nadu Agricultural University, Coimbatore - 641 003

Received : 02nd, June 2021

Revised : 15th,June 2021

Revised : 24th, June 2021

Accepted : 29th, June 2021

ABSTRACT

The present study aimed to identify suitable training system for bitter gourd cultivation, The experiment was conducted at College Orchard, Horticultural College and Research Institute, Tamil Nadu Agricultural University, Coimbatore. Among the different training systems evaluated, pandal system recorded the highest vine length (481.81 cm), followed by the bamboo training system (476.76cm). The treatment using fish net training system showed the highest internodal length (6.34 cm). Pandal training system exhibited the highest number of branches (10.04). Earliness in terms of days for the appearance of male and female flowers was observed in pandal training system (41.33 and 53.16 days respectively). Days to 50% flowering was also found earlier in the pandal system (64.23 days). The narrow sex ratio (5.86) was observed in the bamboo pole support system tied with gunny thread. The pandal system recorded the highest number of fruits per vine (78.66) and gunny thread training system recorded the lowest number of fruits (34.83). The highest fruit length of 21.35 cm and fruit diameter of 3.57 cm were recorded in the pandal training system. The maximum fruit weight was recorded in the pandal system (74.12 g fruit^{-1}) and the minimum fruit weight was observed (52.74g fruit^{-1}) in the fish net system. Pandal training system exhibited the highest yield plant^{-1} (5.79 kg plant^{-1}), yield plot^{-1} (132.65 kg) and yield hectare^{-1} (119.16 q ha^{-1}) while the lowest values were recorded under gunny thread system of cultivation. Among the different training systems pandal/conventional training system is more economical with a benefit-cost ratio of 2.51 followed by bamboo system, fish net system and bamboo poles support system tied with gunny thread

Keywords: *Bitter gourd; Pandal training system; Bamboo training system; Fish net training system; Gunny thread training system*

INTRODUCTION

Bitter gourd (*Momordica charantia* L.) is one of the most important cucurbitaceous vegetables extensively grown in Uttar Pradesh, with an area of 10.25 million hectares and production of 28.3 million tonnes in 2017-18 (NHB database, 2019). It has got significant importance because of its great nutritive value and medicinal properties. Among all other cucurbitaceous vegetables, it is an abundant source of vitamin-C, proteins, phosphorous, potassium and iron. It is found that it has anti-diabetic properties. Immature fruits are cooked as vegetable, as well as pickles can be made out of mature fruits. Due to its considerably high yields, ease in cultivation, steady market demand and export potential, bitter gourd has gained commercial importance and thus it is considered the commercial vegetable of the state.

Till now the traditional method is being followed to cultivate bittergourd *i.e.*, sowing the seeds in furrows opened at a wider distance and training the vines on the ground. Limited attempts are being conducted to grow the vines with the help of some supports. Some of the well-versed cultivators do train the vines on either kniffin or bower. Different training systems has several advantages when compared to growing the vines on the ground such as:

1. The training renders good scope for growth and enlargement of fruiting area and thus the number of fruits is more and thereby there is maximum yield.
2. The fruits remain pendent due to which they grow straight and slightly longer.
3. Appropriate illumination of light promotes the growth and productivity of the vines.

*Corresponding author's e-mail: banushekar21@gmail.com

The approach towards the aspect of traditional cultivation of bitter gourd is as creeper so far. In order to grow it vertically under different training systems, it is necessary to standardize various systems of training and to study the cost economics on yield of bitter gourd.

MATERIAL AND METHODS

The experiment was conducted at the orchard, Department of Vegetable Science, Horticultural College and Research Institute, Tamil Nadu Agricultural University, Coimbatore. The experimental material consists of bitter gourd variety CO- 1 which was raised in Randomized Block Design with four treatments and six replications for each treatment. The seeds were sown at the distance of 1.5 × 1.5 m and the agronomic practices were carried out timely to maintain the crop. Ten plants from each replication were selected randomly to record the observation *viz.,* vine length (cm), inter nodal length (cm), number of branches per plant, days to first female flowering, days to first male flowering, number of days for 50% flowering, sex ratio, number of fruits per vine, fruit length (cm), fruit weight (g), yield per plant (kg) and yield per hectare (q/ha). The mean value of ten plants were taken for statistical analysis. The statistical analysis was done by using the assistance of TNAU *Stat.*

Pandal training system/ Conventional method

In this system, a full pandal was erected at a height of 6 feet from the ground floor. At the top of the boundary poles, 15-gauge double G.I. wire was attached, and the other end of the wire was fastened to the soil pegs. Using a specially made puller, the wires were secured. The G.I. wires were spread over the pandal in crosswise direction.

Fig.1 Conventional or pandal training system Gunny thread training system

The bamboo poles were buried at 45 cm and were spaced 5 meters apart along the pits. Every gunny thread system was strengthened using larger diameter end poles (7 ft. x 4 inches). At 45 and 90 cm above the lines, thread was extended and fastened to the poles. All threads were tied with pegs set in the soil at the end of the chain.

Fig.2 Bamboo poles for support tied with gunny thread training systems

Fish net training system

The bamboo poles were buried at 45 cm depth and spaced 5 meters apart down the axis. Larger diameter end poles (7 ft. x 4 inch) were used to reinforce fish net framework. Fish net Threads were stretched and fastened on poles 45 and 90 cm above the lines. At the end of the rope, pegs were inserted into the soil to connect the wire together.

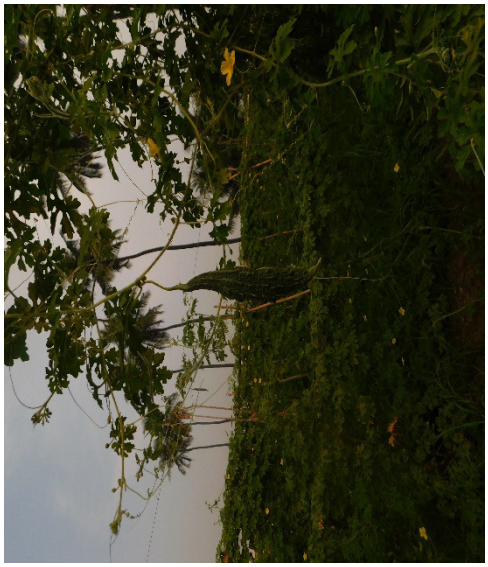

Fig.3 Bamboo poles for support tied with fish net training system

Bamboo training system

The bamboo poles were buried at 45 cm depth and were spaced 5 meters apart along the line. Every bamboo system was strengthened by using larger diameter end poles (7 ft x 4 inches). At 45 and 90 cm above the lines, 15-gauge G.I. wires were extended and fastened on poles. All two wires were tied with pegs set in the soil at the end of the chain.

Fig.4 Bamboo poles for support tied with small size poles

RESULTS AND DISCUSSION

Analysis of variance (ANOVA) for four treatment of bitter gourd showed highly significant for all the character except inter nodal length and fruit diameter. The results of performance analysis of different training system is presented in Table 1. Wide variability was observed among the treatments concerning various traits. The mean performance of growth parameters is presented in Fig. 5. The different training systems influence numerous traits including growth, flowering, fruiting, and yield. The vine growth was robust on the pandal system followed by the bamboo system, fish net system and gunny system. The highest vine length of 481.12 cm was recorded in the pandal system and the lowest of 430.74 cm was recorded in the gunny thread system. Intermodal length ranged from 5.83 cm to 6.34 cm. The maximum number of branches per plant (10.04) was observed in the pandal system due to the enhanced aeration and sunlight, enhanced photosynthesis and more carbohydrates assimilation. Similar findings were reported by Santi *et al.*(2013) and the minimum of 7.22 in the gunny system. The training systems don't have any effect on the position of first female flower, however, the days taken for the first male flowering ranged between 41.33 and 50.66 days and the days taken for the first female flowering ranged from 53.16 to 62.33 days. Earliness in female flowering noticed in pandal/conventional method was 53.16 days. The number of days for 50% of flowering ranged between 64.23 days to 74.05 days, pandal system showed early flowering comparing all other systems of training. The reason is , pandal system provides space for spreading of each branch, which results in obtaining more sunlight and aeration, similar findings were also reported by Dhillon *et al*.(2017) and Devi (2004). The highest sex ratio of 7.88 was observed in pandal system and lowest of 5.86 was observed in gunny thread system. More vegetative growth in terms of vine length and branches in bottle gourd and ridge gourd is observed by Magdum (1971), when trained on bower system than on kniffin and ground. The early harvest due to pergola system in cucumber has been reported by Stan *et al.* (1980). The results regarding days to the first female flowering are in accordance with the reports of Stan *et al*.(1980).

Table 1. Analysis of variance for growth and yield characters in bitter gourd

Character	Mean sum of square		
	Replication	Treatment	Error
Vine length (cm)	1.619	3371.643**	1.723
Inter nodal length	0.050	0.269	0.040
Number of branches per plant	0.034	11.710**	0.018
Days taken for First male flowering	2.566	106.777**	4.544
Days taken for first female flower	3.341	99.708**	3.208
Number of days for 50% of flowering	0.092	117.845**	0.134
Sex ratio	0.150	4.284*	0.095
Number of fruits per plant	3.075	2393.597**	12.630
Fruit length (cm)	2.024	5.038**	1.047
Fruit diameter (cm)	0.374	0.139	0.063
Fruit weight (gm)	2.918	603.276**	1.582
Yield per plant (kg)	1.498	18.924**	2.142
Yield per plot (kg)	3.640	2841.758**	1.851
Yield per hectare (q/ha)	1.530	4171.021**	1.382

The mean performance for fruit characters of bitter gourd under different training systems is presented in Fig. 6. The characters like fruit weight, fruit length and fruit diameter were also greatly influenced by different training systems. The average weight of fruit, length of fruit and diameter of fruit were highest in the pandal system when compared to bamboo system. Least in the fish net and gunny system. There was 40 per cent increase in fruit weight and 11 per cent increase in fruit length due to pandal system as compared to gunny system. The increased fruit length is because the fruits remained hanging freely on pandal as well as in bamboo system as compared to those in the fish net and gunny thread owing to the exposure of sunlight and aeration (Ekwu, 2010; Suthar, 2005). However, melons yielded heavier fruits when the vines trained on vertical trellis. The current findings are in agreement with the above reports.

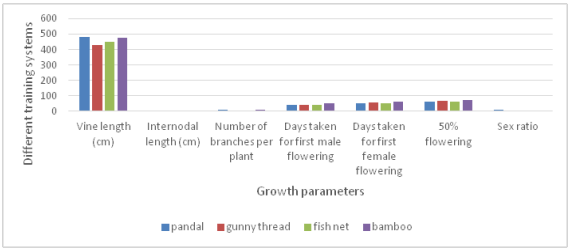

Fig. 5 Performance of growth characters of bitter gourd under different training systems

Average number of fruits per plant was more in plants trained on pandal system (78.66). This was due to the fact that plants trained on pandal system produced a greater number of branches, which provides space for the production of more flowers. Increase in number of flowers ultimately enhanced the increase in average number of fruits. Similarly, a greater number of fruits producing shoot enhanced the number of fruits in plants trained on pandal system compared to the plants trained on other systems. Similar results for number of fruits per plants were also reported by Umekwe PN, (2015) in cucumber.

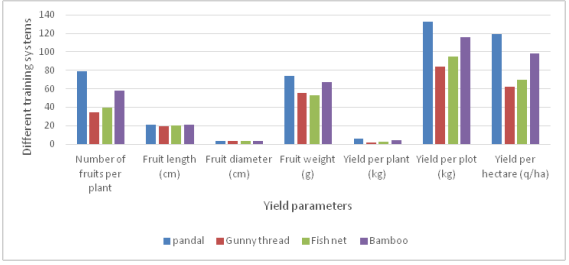

Fig. 6 Performance of fruit characters of bitter gourd under different training systems

The training systems also have great impact on the yield per plant, per plot which is finally converted to hectare basis. The maximum fruit yield was recorded (119.16q/ha) in pandal system. It was found that there is an increase in fruit yield of about 92.57 per cent in pandal system over gunny thread system. Followed by bamboo taring system (58.79 percent).

The yield rise, in the pandal system is mainly due to efficient vine growth with proliferative growth of branches, perfect allotment of fruiting area. Increase in yield also depends on the exposure of vine to sunshine as it increases the assimilation of carbohydrates is bound to exercise. When fruits remain suspended, it was found that fruits were straight and maximum in length, weight as well as in diameter. Thus, in the end, led to increased production when compared to other training systems. Maximum yield due to training system has been reported in various cucurbitaceous crops by many workers and important amongst them are Stan *et al.*(1980) in cucumber, Magdum (1971) in bottle gourd, melons and bitter gourd.

CONCLUSION

The pandal system of training was observed to be superior to all the other training systems, as it has recorded the highest yield of marketable fruits. There was 93, 71 and 21 per cent increase in yield due to pandal system over gunny thread, fish net and bamboo systems, respectively. This increase in yield was mainly due to vigorous vine growth, higher number of branches, proper distribution and exposure of fruiting area to sunshine which resulted in higher number of fruits, with more length and diameter. The higher position of the fruiting area from ground level not only helped to increase the length of fruit but also helped to produce clean and attractive marketable quality fruits.

It was clearly observed that the planting with the training of vines on pandal system was the most ideal having recorded 119.16 quintals of fruit yield per hectare which was much higher than in other combinations. The pandal system of training was observed to be stronger, durable and economically viable as it had given the highest returns for money invested in its installation (Rs. 2.51).

REFERENCES

Devi, M.J. and T.R. Gopalakrishnan,2006. Spacing influences growth and productivity of less spreading and short duration oriental pickling melon (*Cucumis melo* var.conomon Mak.) cv.'Saubhagya'. *J. Trop. Agric.,* **42**:59-61.

Dhillon, N.S., Sharma, P., Kumar, P. and H. Singh.2017. Influence of Training on Vegetative Growth Characteristics and Yield of Polyhouse Grown Cucumber (*Cucumis sativus* L.). *J. Exp. Agric. Int.,* **18(1)**: 1-5.

Ekwu, L.G., Nwokwu, G.N. and E.B. Utobo.2017. Effect of mulching materials and pruning on growth and

yield of cucumber (*Cucumis sativus* L.). *J. Agri. Rural Dev.*, ***15***: 1014-1021.

MB, M., Effect of Manuring, Training Systems and Planfing Distances on the Growth and Production of Pusa Summer Prolific Long'Bottle Gourd *Lagenaria siceraria,* Standl.*)* and Selection-18'Ridge Gourd *(Luffa acutangula,* Roxb.*)* (Doctoral dissertation, Mahatma Phule Krishi Vidaypeeth, Rahuri).

Santi, A., Scaramuzza, W.L., Soares, D.M., Scaramuzza, J.F., Dallacort, R., Krause, W. and R.C. Tieppo.2013. Performance and growth conduction of Japanese cucumber in protected environment. *Hortic. Bras.*, ***31***: 649-653.

Shanmugavelu, K.G. 1989. *Production technology of vegetable crops*. Oxford & IBH Publishing Co.,

Singh, P.M., SINGH, R. and D.R. Bhardwaj.2014. Effect of training system on seed yield and quality of bitter gourd cv.'Kalyanpur Baramasi'under herbicide managed crop. *Ann. Plant Soil Res.*, ***16***(**2**): 155-158.

Stan, N., Savitchi, P. and D. Covaciu.1980. Influence of training system and pruning on the productivity of greenhouse cucumbers. *Cercet. Agron. Mold.*, ***1***: 81-83.

Suthar, M.R. 2005. Effect of Pruning And Ethrel Application On Vegetative Growth And Fruit Yield Of Cucumber Under Greenhouse Condition, Haryana.*J. Hortic. Sci.,* **35**: 92-95

Umekwe, P.N., Okpani, F.M. and I. O. Okocha.2015. Effects of different rates of NPK 15: 15: 15 and pruning methods on the growth and yield of cucumber (Cucumis sativus L.) in Unwana-Afikpo. *Int. J. Sci. and Res.,* **4**:10.