



Response of Nutrient Spray and Pruning on Growth, Yield and Quality of Bitter Gourd (*Momordica charantia* L.)

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

Article Information

DOI: <https://doi.org/10.9734/jabb/2024/v27i111618>

Open Peer Review History:

This journal follows the Advanced Open Peer Review policy. Identity of the Reviewers, Editor(s) and additional Reviewers, peer review comments, different versions of the manuscript, comments of the editors, etc are available here: <https://www.sdiarticle5.com/review-history/125032>

Original Research Article

Received: 21/08/2024

Accepted: 23/10/2024

Published: 05/11/2024

ABSTRACT

A field experiment was conducted at Research Farm, Department of Agriculture (Horticulture), Faculty of Agriculture and Veterinary Sciences, Mewar University Gangrar, Chittorgarh (Rajasthan) during summer season of 2023-24 to response of nutrient spray and pruning on growth, yield and quality of bitter gourd variety "Arka Harit " was used in this study. The result revealed that the both levels maximum vine length (192.29 and 187.26 cm), number of branches per plant (8.98 and 8.79),

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Cite as: Regar, Indira, Champa Lal Regar, Manohar Lal Meghwal, Rajendra Bairwa, and Indra Raj Yadav. 2024. "Response of Nutrient Spray and Pruning on Growth, Yield and Quality of Bitter Gourd (*Momordica Charantia* L.)". *Journal of Advances in Biology & Biotechnology* 27 (11):332-38. <https://doi.org/10.9734/jabb/2024/v27i111618>.

minimum appearance of first female flower (44.43 and 44.75 days) and yield parameter such as maximum number of fruit per plant (17.04 and 16.67), length of fruit (13.14 and 13.09 cm), girth of fruit (4.24 and 4.29 cm), average fruit weight (85.04 and 84.26 g), fruit yield (10.79 and 10.74 t/ha) and quality parameters such as leaf chlorophyll content (1.24 and 1.24 mg/g), TSS (2.67 and 2.65 °Brix), Vitamin C (69.20 and 68.93 mg/100 g) recorded with treatment combination of 3% spray and pruning at 9 nodes. Therefore, it was concluded that the application of 3% spray and pruning at 9 nodes found superior to all treatment.

Keywords: Nutrient; NPK spray; bitter gourd; yield; pruning.

1. INTRODUCTION

Vegetables are important source of protective foods and also play an important role in human balanced diet. These are rich source of vitamins, proteins, carbohydrates and minerals. The per capita vegetable consumption of India is only 135 g/day compared to minimum requirement of 300/day. Bitter melon fruit is a nutritious vegetable, rich in vitamins, iron, minerals, phosphorous and dietary fibre. The fruit can be cooked with other vegetables, stuffed, stir-fried or added in small quantities to beans and soups to provide a slightly bitter flavour (Behera et al. 2010).

Modern nutrient management strategy has shifted its focus towards the concept of sustainability and eco friendliness. Intensive use of only chemical fertilizers to achieve high production has created a various problem. Supplementation of nutrient through foliar spray to majority application of nutrient and improving plant health may be use full for nutrient management practices. The basic principle behind this concept is to supply with increase from pruning must utilize the resources sustainability for a sustainable crop production in most efficient manner, although the modern technique of intensive crop production needs to use of chemical fertilizers. Plants are blessed with the power of regeneration and can re-grow their lost organs caused due to injuries, wound or removal of their parts by the grower/ men and animals. Usually, the growers remove the excess or undesirable, unproductive branches, shoots, roots or any other plant part judiciously as a regular garden practice to develop a desired framework, to control and maintain the plant stature and the reproductive phase. This operation or intentional removal of the plant parts is known as pruning (Anon 2018).

Pruning has an effect on the function of plant as it influences bearing or fruiting of plant. By pruning the flow of sap is drive or direct towards

fruiting area on plant and the plant or vine are forced to bear better quality of fruits. Leafy greens, herbs and small statured plants have little or nothing to worry about training and pruning of leaves or branches to modify their structure. Removing extra vegetation improves light penetration and also enhances the aeration which thus removes or reduces the disease and pest attack. Foliar spray of nutrient is a successful method which increases the accessibility of nitrogen to crop. Foliar applications of nitrogen have increased grain yield, especially when applied at tillering stage (Veesar et al. 2017).

2. MATERIALS AND METHODS

A field experiment was conducted during summer season of 2023-24 at experimental farm, Department of Agriculture (Horticulture), Faculty of Agriculture and Veterinary Sciences, Mewar University Gangrar, Chittorgarh (Rajasthan). Soil of the experimental field was sandy loam in texture, saline in reaction with a pH value of 7.6, poor in organic carbon (0.16%), deficient in available zinc (0.48 ppm) and iron (1.2 ppm) low in available nitrogen (176 kg/ha) and phosphorus (20.2 kg/ha) but medium in available potassium (320 kg/ha). The experiment was laid out in factorial randomized block design with three replications and two levels *i.e.* Levels-1 nutrient spray - N₀-No spray, N₁-2% spray, N₂-2.5% spray, N₃-3% spray and Level-2 pruning- P₀-No pruning, P₁-Pruning at 5 nodes, P₂-Pruning at 9 nodes P₃-Pruning at 12 nodes. Total treatment combination is 16 and three replications than total number of plots is 48. The leaf chlorophyll content was estimated from fresh fully opened 3rd leaf and middle leaf at the time of flowering by Dimethyl sulphoxide (DMSO) method and chlorophyll content in the leaf extract was read in spectrophotometer. Fresh fruit samples from different treatments were taken from second picking and 5g fruit sample were macerated by using pestle. The single drop of extracted juice put in hand refractometer for estimation of total

soluble solids (TSS). The results were expressed in °Brix. Volumetric method was followed for estimation of vitamin C and expressed in milligram per 100g edible portion (mg/100g).

3. RESULTS AND DISCUSSION

The purpose of this study was to determine the extent of performance for growth and yield parameters.

3.1 Growth Attributes

The data in Table 1 showed that nutrient spray and pruning had a significant response on vine length, number of branches per plant and appearance of first female flower of bitter gourd.

In the nutrient spray the maximum vine length was recorded with N₃-3% spray (192.29 cm). The minimum vine length was recorded with no spray (171.13 cm). In the respect of pruning maximum vine length was recorded with P₃-Pruning at 12 nodes (187.76 cm). The minimum vine length was recorded with no pruning (165.66 cm). Similar findings also reported by Saha et al. 2016, Anand et al. 2017 and Ekwu et al. 2017.

In the nutrient spray the maximum number of branches per plant was recorded with N₃-3% spray (8.98). The minimum number of branches per plant was recorded with no spray (7.32). In the respect of pruning maximum number of branches per plant was recorded with P₂-Pruning at 9 nodes (8.79 cm). The minimum number of branches per plant was recorded with no pruning (7.53). In the nutrient spray the minimum appearance of first female flower was recorded with N₃-3% spray (44.43 days). This may be due to the highest vine length and leaf area which supplemented assimilates required and promoted early flowering and early harvest is due to the early flowering of that treatment. The present findings are comparable with that of Suthar et al. 2006. The maximum appearance of first female flower was recorded with no spray (48.13 days). In the respect of pruning minimum appearance of first female flower was recorded with P₂-Pruning at 9 nodes (44.75 days). The maximum appearance of first female flower was recorded with no pruning (48.17 days). These fertilizers increased the vine length in plant may be attributed to improved root system of plants resulting in it absorb more water and nutrients

from soil and consequently they improved different plant organs and also entire plant. There is an enhancement of cell elongation and cell multiplication resulting in more vine length. More or less the above findings are in close agreement with the results of Sureshkumar and Karuppaiah and Balasankari 2008, Prasad et al. 2009, and Thriveni et al. 2015 in bitter gourd. These might be due to application of spray of nutrient which facilitates quick and greater availability of plant nutrients and thus provides a better environment for root growth and proliferation. These results are in agreement with the result of Prasad et al. 2009, Rekha and Gopalakrishna 2001, Reddy and Rao 2004 and Thriveni et al. 2015 in bitter gourd. Early flowering of female flower due to best treatment might be due to better nutritional status and it enhanced production of growth promoting substances like gibberellic acid, IAA by application of organic manure and biofertilizers resulting in minimum days to first female flowering. Concurrent results are in agreement with the result of Prasad et al. 2009 and Thriveni et al. 2015 in bitter gourd.

3.2 Yield Attributes

The data in Table 2 showed that nutrient spray and pruning had a significant response on number of fruits per plant, length of fruit, girth of fruit, average fruit weight and average fruit yield of bitter gourd.

The data revealed that the nutrient spray the maximum number of fruits per plant was recorded with N₃-3% spray (19.04). The minimum number of fruits per plant was recorded with no spray (12.02). In the respect of pruning maximum number of fruits per plant was recorded with P₂-Pruning at 9 nodes (18.67). The minimum number of fruits per plant was recorded with no pruning (12.10). The increased number of fruits might be due to combined effect of nutrient (NPK) spray which favorably influenced translocation of nutrient to the fruiting nodes results in higher fruiting and fruit development. Fruiting ultimately resulted in increased the number of fruits per plant. The significant variation for number of fruits per vine fruit length and diameter might be due to the maximum leaf area of this treatment which lead to enhanced photosynthetic activities and their accumulation. Similar results were reported by Reddy and Rao 2004, Prasad et al. 2009 and Thriveni et al. 2015 in bitter gourd. In the nutrient spray the maximum length of fruit was recorded with N₃-3% spray (13.14 cm). The minimum length of fruit was

recorded with no spray (11.08 cm). In the respect of pruning maximum length of fruit was recorded with P₂-Pruning at 9 nods (13.09 cm). The minimum length of fruit was recorded with no pruning (11.11 cm). Similar results also noted by Biradar 2008, Hari 2016 and Rathor et al. 2022.

In the nutrient spray the maximum girth of the fruit was recorded with N₃-3% spray (4.24 cm). The minimum girth of the fruit was recorded with no spray (3.38 cm). In the respect of pruning maximum girth of the fruit was recorded with P₂-Pruning at 9 nods (4.29 cm). The minimum girth of the fruit was recorded with no pruning (3.44 cm). It might be due to higher accessibility of nitrogen in chemical fertilizer and foliar spray that induced protein production which cause more meristem cell, cell division, increase photosynthesis activity and carbohydrate assimilation that finally led to higher fruit girth. It was previously reported by Deka et al. 2022 in bottle gourd. In the nutrient spray the maximum average fruit weight was recorded with N₃-3% spray (85.04 g). The minimum average fruit

weight was recorded with no spray (69.74 g). In the respect of pruning maximum average fruit weight was recorded with P₂-Pruning at 9 nods (84.26 g). The minimum average fruit weight was recorded with no pruning (70.44 g). This might be due to increase in phosphorous content of plant tissue, which results in proper formation of nucleic acids and due to cell division average fruit weight might have increased. This might be due to less fruit number, average fruit length, and diameter. These findings are in line with the reports of Mehdi et al. 2012. In the nutrient spray the maximum average fruit yield was recorded with N₃-3% spray (10.79 t/ha). The minimum average fruit yield was recorded with no spray (8.38 t/ha). In the respect of pruning maximum average fruit yield was recorded with P₂-Pruning at 9 nods (10.74 t/ha). The minimum average fruit yield was recorded with no pruning (8.59 t/ha). The highest marketable yield is due to the pruning methods followed which allowed the fruits to expose to light conditions and resulted in production of healthy fruits. The results were inconsistent with the reports of Hao et al. 2010.

Table 1. Response of nutrient spray and pruning on growth parameters of bitter gourd

Sr. No.	Treatments	Vine length (cm)	Number of branches per plant	Appearance of first female flower (Days)
A. Level-1 (Nutrient spray)				
1	N ₀ -No spray	171.13	7.32	48.13
2	N ₁ -2% spray	180.74	8.43	46.52
3	N ₂ -2.5% spray	186.02	8.92	45.47
4	N ₃ -3% spray	192.29	8.98	44.43
	S. Em. ±	2.82	0.15	0.71
	CD%	8.15	0.42	2.05
B. Level-2 (Pruning)				
1	P ₀ -No pruning	176.91	7.53	48.17
2	P ₁ -Pruning at 5 nods	180.25	8.60	46.83
3	P ₂ -Pruning at 9 nods	185.26	8.79	44.75
4	P ₃ -Pruning at 12 nods	187.76	8.73	44.79
	S. Em. ±	2.82	0.15	0.71
	CD%	8.15	0.42	2.05
	Interaction effect (A x B)	NS	NS	NS

Table 2. Response of nutrient spray and pruning on yield parameters of bitter gourd

Sr. No.	Treatments	Number of fruits per plant	Length of fruit (cm)	Girth of the fruit (cm)	Average fruit weight (g)	Average fruit yield (t/ha)
A. Level-1 (Nutrient spray)						
1	N ₀ -No spray	13.02	11.08	3.38	69.74	8.38
2	N ₁ -2% spray	15.80	11.58	3.79	79.88	10.18

Sr. No.	Treatments	Number of fruits per plant	Length of fruit (cm)	Girth of the fruit (cm)	Average fruit weight (g)	Average fruit yield (t/ha)
3	N ₂ -2.5% spray	17.20	12.82	4.03	80.05	10.37
4	N ₃ -3% spray	19.04	13.14	4.24	85.04	10.79
	S. Em. ±	0.25	0.23	0.07	1.63	0.20
	CD%	0.73	0.66	0.21	4.92	0.60
B.	Level-2 (Pruning)					
1	P ₀ -No pruning	12.10	11.11	3.44	70.44	8.59
2	P ₁ -Pruning at 5 nods	16.31	11.94	3.74	79.36	10.15
3	P ₂ -Pruning at 9 nods	18.67	13.09	4.29	84.26	10.74
4	P ₃ -Pruning at 12 nods	16.98	12.47	3.97	82.21	10.30
	S. Em. ±	0.25	0.23	0.07	1.63	0.20
	CD%	0.73	0.66	0.21	4.92	0.60
	Interaction effect (A x B)	NS	NS	NS	S	S

Table 3. Response of nutrient spray and pruning on quality parameters of bitter gourd

Sr. No.	Treatments	Leaf chlorophyll content (mg g ⁻¹)	TSS (⁰ Brix)	Vitamin C (mg/100 g)
A.	Level-1 (Nutrient spray)			
1	N ₀ -No spray	1.18	2.03	60.80
2	N ₁ -2% spray	1.20	2.36	65.28
3	N ₂ -2.5% spray	1.21	2.51	67.30
4	N ₃ -3% spray	1.24	2.67	69.20
	S. Em. ±	0.01	0.03	1.28
	CD%	0.04	0.09	3.69
B.	Level-2 (Pruning)			
1	P ₀ -No pruning	1.18	2.06	61.31
2	P ₁ -Pruning at 5 nods	1.19	2.36	65.37
3	P ₂ -Pruning at 9 nods	1.24	2.65	68.93
4	P ₃ -Pruning at 12 nods	1.22	2.50	66.96
	S. Em. ±	0.01	0.03	1.28
	CD%	0.04	0.09	3.69
	Interaction effect (A x B)	NS	S	S

3.3 Quality

The data in Table 3 showed that nutrient spray and pruning had a significant response on number of leaf chlorophyll content, TSS and vitamin C of bitter gourd.

The data showed the nutrient spray the maximum leaf chlorophyll content was recorded with N₃-3% spray (1.24 mg/g). The minimum leaf chlorophyll content was recorded with no spray (1.18 mg/g). In the respect of pruning maximum leaf chlorophyll content was recorded with P₂-Pruning at 9 nods (1.24 mg/g). The minimum leaf chlorophyll content was recorded with no pruning (1.18 mg/g). In the

nutrient spray the maximum TSS was recorded with N₃-3% spray (2.67 ⁰Brix). The minimum TSS was recorded with no spray (2.03 ⁰Brix). In the respect of pruning maximum TSS was recorded with P₂-Pruning at 9 nods (2.65 ⁰Brix). The minimum TSS was recorded with no pruning (2.06 ⁰Brix). TSS content of fruit in these treatments could be attributed to application of nutrient through foliar application which helped in better uptake of NPK nutrients including micronutrients, which in turn influenced the quality traits in fruit. More or less the above findings are in close agreement with the results of Mohan et al. 2016 in cucumber, Meerabai et al. 2007 and Thriveni et al. 2005 in bitter gourd. In the nutrient spray the maximum vitamin C was

recorded with N₃-3% spray (69.20 mg/100 g). The minimum vitamin C was recorded with no spray (60.80 mg/100 g). In the respect of pruning maximum vitamin C was recorded with P₂-Pruning at 9 nodes (68.93 mg/100 g). The minimum vitamin C was recorded with no pruning (61.31 mg/100 g). Nitrogen is a major constituent of plant protein, amino acids, chlorophyll and protoplasm. It is also a constituent nucleic acid, phospholipids and more vitamins, all of which play definite role in the physiology of plant and growth. The present similar results accordance with Meerabai et al. 2007 and Thriveni et al. 2015 in bitter gourd.

4. CONCLUSION

Based on the one-year experimentation the application of 3% spray and pruning at 9 nodes found superior to all treatment. Therefore, proved the 3% spray and pruning at 9 nodes best treatments which produced superior growth, yield and quality parameters suitability than other treatments.

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc) and text-to-image generators have been used during writing or editing of this manuscript.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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