Response of Nutrient spray and Pruning on Growth, Yield and Quality of Bitter gourd (*Momordicacharantia* L.)

Abstract

A field experiment was conducted at Research Farm, Department of Agriculture (Horticulture), Facultyof Agriculture and Veterinary Sciences, Mewar University Gangrar, Chittorgarh (Rajasthan)duringsummerseasonof2023-24to responseofnutrient spray and pruning on growth, yield and quality of bitter gourdvariety "Arka Harit " wasused 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), 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 ^{0}Brix), Vitamin C (69.20 and 68.93 mg/100 g) recorded with treatment combination of 3% sprayand pruning at 9 nods. Therefore, it was concluded that the application of 3% spray and pruning at 9 nods 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 throw 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. MaterialsandMethods

A field experiment was conducted during summer season of 2023-24 at experimentalfarm, Department of Agriculture (Horticulture), Faculty of Agriculture and Veterinary Sciences, MewarUniversity Gangrar, Chittorgarh (Rajasthan). Soil of the experimental field was sandy loam intexture, saline in reaction with a pH value of 7.6, poor in organic carbon (0.16%), deficient inavailable zinc (0.48 ppm) and iron (1.2 ppm) low in available nitrogen (176 kg/ha) andphosphorus (20.2 kg/ha) but medium in available potassium (320 kg/ha). Theexperiment was laid out in factorial randomized block design with three replications and two levels*i.e.* Levels-1 nutrient spray - N_0-No spray, N_1-2% spray, N_2-2.5% spray, N_3-3% spray and Level-2 pruning- P_0-No pruning, P_1-Pruning at 5 nods, P_2-Pruning at 9 nods P_3-Pruning at 12 nods. 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. ResultsandDiscussion

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 N_3-3% 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 P_3-Pruning at 12 nods (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 N_3-3% 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 P_2-Pruning at 9 nods (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 flowerwas recorded with N_3-3% 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 flowerwas recorded with no spray (48.13 days). In the respect of pruning minimum appearance of first female flowerwas recorded with P_2-Pruning at 9 nods (44.75 days). The maximum appearance of first female flowerwas 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 gibbrelic 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 yieldof bitter gourd.

The data revealed that the nutrient spray the maximum number of fruits per plantwas recorded with N_3-3% spray (19.04). The minimum number of fruits per plantwas recorded with no spray (12.02). In the respect of pruning maximum number of fruits per plantwas recorded with P_2-Pruning at 9 nods (18.67). The minimum number of fruits per plantwas 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 fruitwas recorded with N_3-3% spray (13.14 cm). The minimum length of fruitwas recorded with no spray (11.08 cm). In the respect of pruning maximum length of fruitwas recorded with P_2-Pruning at 9 nods (13.09 cm). The minimum length of fruitwas 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 N_3-3% 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 P_2-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 weightwas recorded with N_3-3% spray (85.04 g). The minimum average fruit weightwas recorded with no spray (69.74 g). In the respect of pruning maximum average fruit weightwas recorded with P_2-Pruning at 9 nods (84.26 g). The minimum average fruit weightwas 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 yieldwas recorded with N_3-3% spray (10.79 t/ha). The minimum average fruit yieldwas recorded with no spray (8.38 t/ha). In the respect of pruning maximum average fruit yieldwas recorded with P_2-Pruning at 9 nods (10.74 t/ha). The minimum average fruit yieldwas 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).

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 contentwas recorded with N_3-3% spray (1.24 mg/g)0 The minimum leaf chlorophyll contentwas recorded with no spray (1.18 mg/g). In the respect of pruning maximum leaf chlorophyll contentwas recorded with P_2-Pruning at 9 nods (1.24 mg/g). The minimum leaf chlorophyll contentwas recorded with no pruning (1.18 mg/g). In the nutrient spray the maximum TSSwas recorded with N_3-3% spray (2.67 ^{0}Brix). The minimum TSSwas recorded with no spray (2.03 ^{0}Brix). In the respect of pruning maximum TSSwas recorded with P_2-Pruning at 9 nods (2.65 ^{0}Brix). The minimum TSSwas recorded with no pruning (2.06 ^{0}Brix). 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*. (2015) in bitter gourd. In the nutrient spray the maximum vitamin C was recorded with N_3-3% 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 P_2-Pruning at 9 nods (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.

Conclusion

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

Disclaimer (Artificial intelligence)

Option 1:

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 the writing or editing of this manuscript.

Option 2:

Author(s) hereby declare that generative AI technologies such as Large Language Models, etc. have been used during the writing or editing of manuscripts. This explanation will include the name, version, model, and source of the generative AI technology and as well as all input prompts provided to the generative AI technology

Details of the AI usage are given below:

1.

2.

3.

Table 1Responseof 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 2Responseof 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
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 Responseof 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

References

Anand M, Sadasakthi A, Rohini N. 2017. Standardization of training and pinching in bottle gourd cv CBgH1 for yield and quality. *Environment and Ecology*.; **35**(2):1281-1286.

Anon. 2018. Understanding Pruning': The Important Gardening Activity. UGAO For the love of gardening. URL, /*http://www.ugaoo.com/knowledge-center/how-to-prune-plants*.

Behera, T. K., S. Behera, L. K. Bharathi, K. J. John, P. W. Simon and J. E. Staub (2010). "Bitter Gourd: Botany, Horticulture, Breeding." *Horticultural reviews***37**(2): 101-141.

Biradar, G. S. (2008). Effect of plant growth regulators on physiology and quality in bitter ground (*Momordicacharantia* L.) (Doctoral dissertation, UAS, Dharwad).

Deka, B., Handique, K., Borthakur, P. K., Kotoky, U., Saikia, A., Kalita, P., & Hazarika, J. (2022). Effect of crop geometry, fruit thinning and nutrient management on yield parameters of watermelon (*Citrulluslanatus* Thumb.).

Ekwu, L. G., Nwokwu, G. N., & Utobo, E. B. (2017). Effect of mulching materials and pruning on growth and yield of cucumber (*Cucumis sativu*s L.). *Nigeria Agricultural Journal*, **48**(2), 51-59.

Hao, X., Wen, G., Papadopoulos, A.P. and Khosla, S. 2010. A twin–head "V" High –wire greenhouse Cucumber production system for reducing crop start-up costs. *Hort Technology*. **20**(6): 963-970.

Hari, A. A. (2016). *Studies on fertigation in bitter gourd (Momordicacharantia L.)* (Doctoral dissertation, Department of Horticulture, College of Agriculture, Vellayani).

Karuppaiah, P. and Balasankari, K. (2008). Effect of tillage system and nutrients on growth, yield on snake gourd and residual soil fertility under rice fallow condition. *Asian J. Hort*., **3** (1): 70-73

Meerabai, M.; Jayachandran, B. K. and Asha, K. R. (2007). Biofarming in bitter gourd (*Momordicacharantia* L.) International Conference on Indigenous Vegetables and Legumes. Prospectus for Fighting Poverty, Hunger and Malnutrition, *ISHS Acta Hort*., **75** (2): 1-300.

Mehdi, M.; Ahmed, N.; Jabeen, N. and BaseeratAfroza., 2012, Effect of different concentration of ethereal on growth, fruiting behaviour and yield of cucumber (*Cucumis sativus* L.) under greenhouse conditions. *Asian. J. Hort*. **8** (2): 579- 581.

Mohan, L.; Singh, B. K.; Singh, A. K.; Moharana, D. P.; Harit, K. and Mahapatra, A. S. (2016). Effect of integrated nutrient management in growth and yield attributes of cucumber (*Cucumis sativus* L.) cv. Swarnaageti under polyhouse conditions. *An. Int.*

Quart. J. Life Sci., **12** (1): 305-308.

Prasad, P. H.; Mandal, A. R.; Sarkar, A.; Thapa, U. and Maity, T. K. (2009). Effect of biofertilizers and nitrogen on growth and yield attributes of bitter gourd (*Momordicacharantia* L.). *International Conference on Horticulture*–2009, pp.738-739.

Rathor, M., Sharma, A., Maurya, D., Tyagi, D. B., & Pathak, S. K. 2022. Short Communication Response of Integrated Nutrient Management on Growth and Yield of Cucumber (*Cucumis Sativus* L.) cv. Pusa Sanyog.

Reddy, P. K. and Rao, P. V. (2004). Growth and yield of bitter gourd (*Momordicacharantia* L.) as influenced by vermicompost and nitrogen management practices, *J. Res. ANGRAU***32**, (3): 15-20.

Rekha, C. R. and Gopalakrishnan, T. R. (2001). Effect of levels and frequencies of organic manures and inorganic fertilizers on growth and productivity of bitter gourd (*Momordicacharantia* L.) genotypes. *J. Soil Crops*., **13** (1): 91-4.

Saha T, Nithya C, Kalmesh M, Ray SN. 2016. Evaluation of trellis system for pest management in bitter gourd. *Indian Journal of Horticulture*. **73**(3):383-386.

Suthar, M. R., Arora, S. K., Bhatia, A. K. and Dudi, B. S. (2006). Effect of pruning and ethrel treatments on cucumber production in polyhouse. Haryana Journal of Horticultural Sciences, 35 (3/4): 299-302.

Thriveni, V.; Mishra, H.; Pattanayak, S.; Sahoo, G. and Thomson, T. (2015). Effect of inorganic, organic fertilizers and biofertilizers on growth, flowering, yield and quality attributes of bitter gourd, (*Momordicacharantia* L.). *Int. J. Farm Sci*., **5** (1): 24-29.

Veesar SA, GM Laghari, MA Ansari, FC Oad and AA Soomro, 2017. Effect of foliar application of nitrogen on different growth stages of wheat. Life: *International Journal of Health and Life Science*, 3: 1-9.