Current Journal of Applied Science and Technology

Volume 42, Issue 10, Page 15-21, 2023; Article no.CJAST.99428
ISSN: 2457-1024
(Past name: British Journal of Applied Science & Technology, Past ISSN: 2231-0843, NLM ID: 101664541)

Effect of Different Levels of Pruning Intensity and Foliar Feeding of NAA on Growth, Yield and Quality Attributes of Phalsa (*Grewia asiatica* L.) cv. Sharbati

Rajat Verma [a++], A. K. Dwivedi [a#], V. K. Tripathi [b†] and Manuj Awasthi [a‡*]

[a] *Department of Fruit Science, C.S. Azad University of Agriculture and Technology, Kanpur-208002, U.P., India.*
[b] *Department of Horticulture & Fruit Science, C.S. Azad University of Agriculture and Technology, Kanpur-208002, U.P., India.*

Authors' contributions

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

Article Information

DOI: 10.9734/CJAST/2023/v42i104095

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/99428

Original Research Article

Received: 24/02/2023
Accepted: 27/04/2023
Published: 01/05/2023

ABSTRACT

Two factors of different levels of pruning intensities, *i.e.* 40cm, 60cm and 80cm from ground level, with foliar feeding of NAA concentrations, *i.e.* 100ppm, 150ppm and 200ppm, were tried to investigate their effects on growth, yield and quality attributes of phalsa (*Grewia asiatica* L.)cv. Sharbati, conducted at Horticulture Garden, Department of Fruit Science, C.S.A.U.A.T., Kanpur,

[++] *Student;*
[#] *Assistant Professor;*
[†] *Professor & Head;*
[‡] *Teaching Associate;*
**Corresponding author: E-mail: awasthi.m227@gmail.com;*

(U.P). The results showed significant effects on the maximum number of shoots per plant(5.62), shoot length(140.69 cm), number of fruits/node (10.90), length of fruit (2.27 cm), 100 fruitweight (60.55g), yield per plant(3.65kg), juice content(54.51%), T.S.S. (16.66^{0}B), reducing sugars (9.20%), non-reducing sugars (4.25%), total sugars (13.45%), titratable acidity(1.84%) and ascorbic acid (35.51 mg) per100 g fruit pulp were observed on spray of NAA @ 200 ppm with 40 cm pruning intensity from ground level. Hence concluded from the results in phalsa plants cv. Sharbati,spray of 200 ppm NAA with pruning at 40 cm from ground level was most effective for improving growth, yield and quality attributes.

Keywords: Phalsa; NAA; T.S.S; ppm; yield and quality.

1. INTRODUCTION

Phalsa (*Grewia asiatica* L.) is an indigenous fruit crop of India that belongs to the family of Tiliaceae with somatic chromosome no. 2n=36 and is mentioned in the earliest Vedic literature for its medicinal qualities. It is a popular fruit intropical and sub-tropical regions and introduced into the Philippines before 1914. In India, it is commercially cultivated in Punjab, Haryana, Uttar Pradesh and Andhra Pradesh. Phalsa is a hardy crop and drought resistant which requires little care. Phalsafruits are categorized as non-climatic fruit and hence, well-ripened fruits are harvested for marketing. Fruits are delicious, sour too sweet in taste with attractive colour, and are good sources of phosphorus and iron. Fruits contain 50 to 60% juice, 10 to 11% sugar and 2.0 to 2.5% acids. Fruits are excellent for making juice and squash and aremostly used as fresh fruit and have a cooling effect. Medicinal properties are that it works as a digestive tonic and the fruits are astringent. It may help in curingin flammation, heart and blood disorders, fever, heat troubles and constipation.

Phalsa can be grown on a wide range of soil including moderately alkaline soil. However, best results are obtained in well-drained loamy soil. The plants can tolerate a temperature44 ^{0}C and high temperatures favour ripening of the fruits. Although, Phalsa is grown mostly as a wasteland cropbecause of it being a hardy plant, but the annual manuring programme if followed regularly, gives veryprofitable results. Also, pruning and regular irrigationplay a vital role in its production.

Pruning in Phalsa is considered as an essential operation since the fruit buds are found on current season growth to get a good yield. Besides, the severity of pruning as well as, the proper time of pruning, may also be very important for improving the yield and quality of fruits. Hayes [1] suggested late December or early January as the best time for phalsa pruning. The flowering and fruiting are confined to 15-20 nodes from the base depending on vigor. In general, under north Indian conditions, it is pruned when it sheds off leaves during middle of winter [2]. It has also been reported that the time of pruning may regulate fruit maturity in Phalsa which may ultimately result into orderly marketing of this perishable fruit, which can prove to be advantageous to both the fruit growers and consumers. NAA helps to induce flowering, to prevent shedding of buds, Flowers and unripe fruits. It also enlarges fruit size and increases the yield. It also improves the quality of fruits. NAA is widely used in horticulture for various purposes and play many important roles in flowering, fruit setting, increase in fruit set or preventing fruit drop in Mango and Citrus, blossom thinning in Peach and Guava and fruit thinning in Apple and Pear [3]. The present investigation was therefore aimed atassessing the effect of different pruning intensities and NAA concentrations on the growth, yield and quality of phalsa (*Grewia asiatica* L.).

2. MATERIALS AND METHODS

The field experiment was conducted at Horticulture Garden, Department of Fruit Science, C.S.U.A.T., Kanpur, (U.P.). Thirty-two-years old phalsa cv. Sharbati, uniform in size and vigour were plantedat distance at 3x2.5 m were selected. The experiment was laid out in Factorial RBD with three replications having12 treatment combinations including three levels of pruning viz. pruned at 40 cm, 60 cm and 80cm above ground level and Five NAA concentrations viz. control (water spray), 100 ppm,150 ppm and 200 ppm solution. Pruning of phalsa bushes was done in the first week of February and a spray of NAA concentrations was done on second fortnight of March (pre 100 m stage) while the second spray was done after fruit setting.

Observations were recorded on number of shoots/fruiting nodes, length of shoot, number of fruit/nodes, fruit yield/plant, weight of100 fruits, juice percent and quality of juice interms of T.S.S., acidity, reducing sugars, non-reducing sugars, total sugars content and ascorbic acid. The total soluble solids were recorded with the help of hand Refracto meter. Titratable acidity and total sugars were determined by methods described by Rangana [4]. The data collected on various characters at each harvest were subjected tostatistical analysis as per the method of "Analysis of Variance". There sults were interpreted on the basis of "F" test and C.D. at 5% levelof significance was used to study the comparison between the twomeans. ANOVA was performed using the statistical software OPSTAT given by Sheoran et al. [5].

3. RESULTS AND DISCUSSION

3.1 Growth Parameters

The data in Table 1 revealed that, pruning at 60cm from ground level with spray of NAA200 ppm was superior showed significant for the initial number of shoots and number of fruits per node but length of shoot showed non-significant. The maximum number of shoots (5.62), length of shoot (136.49cm), and fruits per node (10.90) found to be more effective with pruning at 60cm from ground level with foliar application of 200ppm NAA. Whereas, minimum number of shoots (4.23),length of shoot (129.42cm) and fruits per node (9.78) were recorded with pruning at 40cm with control (I_1C_0). This might be due to availability of more concentration of growth regulator and light/unit area which favorably influence greater photosynthetic activity and there by producing more photosynthates. This might be due to the fact that the shoots were longer in plants pruned to 40 cm above ground with NAA application, such that the number of shoots, length of shoot and number of fruits/nodes was more. Similar findings were made by Singh and Singh [6]; Tiwari et al. [7] in aonla; Tripathi et al., [8] in mango; Singh et al., [3] in mango and Tripathi and Shukla [9] in Strawberry.

3.2 Yield Parameters

A perusal of data presented in (Table 1) all the yield parameters except 100 fruit weight were significantly influenced by pruning intensity and NAA concentrations. Pruning at 60cm from ground level with 200ppm was showed maximum 100 fruit weight (60.55g), fruit yield (3.65kg/plant) and juice content (54.51%), Whereas, minimum 100 fruit weight (55.38g), fruit yield (2.55kg/plant) and juice content (50.34%) was recorded with pruning at 40 cm with control (I_1C_0). Fruit yield is influenced by number of growth parameters such as number of shoots and fruits per node per branch effective nodes etc. This might be due to the fact that the shoots were longer inplants pruned to 40 cm above ground with NAA application, such that the number of shoots, and number of fruits/nodes was more. Uptake of NAA in plant with minerals led to an increase in turgor pressure which resulted in increased juice percent. The highest fruit yield recorded by light pruning (60cm) may be attributed to higher number of new shoots with greater number of effective nodes. The present findings are also in agreement with Kumar [10] in litchi and Singh (1979) in phalsaand Mahida et al. [11] in phalsa; Tiwari et al. [7] in Aonla.

3.3 Quality Attributes

The data regarding effect of pruning intensity and NAA on all quality parameters of phalsa are presented in Table 1 were showed significantly. Maximum T.S.S (16.66 ^{0}B), titratable acidity (1.84%), reducing sugars (9.20%), non-reducing sugar(4.25%), total sugars (13.45%), and ascorbic acid content (35.51%) were recorded with pruning at 60cm from ground level with foliar spray of 200ppm NAA (I2C3). Whereas, the minimum T.S.S content (15.42 ^{0}B) was recorded with pruning at 40cm from ground level with spray of 100ppm NAA, and minimum titratable acidity (1.56%), reducing sugars (8.46%), non-reducing sugar (3.78%), total sugars (12.03%),and ascorbic acid content (32.22mg) per 100g fruit pulp were noted with pruning at 40cm from ground level with no foliar application of NAA (I_1C_0). The quality of phalsa fruits was better in summer season crop than rainy and winter season crop. This might be due to higher temperatures in summer season increased the photosynthetic activity which ultimately leads to the accumulation of large amount of carbohydrates and sugars which increased juice content, total soluble solids and decreased acidity and other qualitative characters of the fruits. Similar results were reported by Bhuva et al. [12]; Meghwal [13]; Singh et al. [14] and Kumar and Tripathi [15] in Strawberry; Lal et al. [16] in Kinnow mandarin, Aziz et al. [17] and Sharif et al. [18], in Ber. Dubey et al. [19].

Table 1. Effect of different levels of pruning intensities and NAA concentration on number of shoots, length of shoots and number of fruits per nodes in phalsa

Treatments	Number of shoots					Length of shoots(cm)					Number of fruits/ nodes				
NAA levels(C) / **Pruning Intensities(I)**	**Control (C_0)**	**100ppm (C_1)**	**150ppm (C_2)**	**200ppm (C_3)**	**Mean (A)**	**Control (C_0)**	**100ppm (C_1)**	**150ppm (C_2)**	**200ppm (C_3)**	**Mean (A)**	**Control (C_0)**	**100ppm (C_1)**	**150ppm (C_2)**	**200ppm (C_3)**	**Mean (A)**
40cm(I_1)	4.23	5.21	5.38	5.42	5.06	129.42	130.66	134.75	133.75	136.49	9.78	10.09	10.42	10.50	10.19
60cm(I_2)	5.28	5.40	5.57	5.62	5.46	130.47	135.25	139.56	140.69	132.14	10.26	10.45	10.78	10.90	10.59
80cm(I_3)	5.39	5.20	5.43	5.47	5.37	130.28	130.25	136.17	137.20	133.47	9.98	10.07	10.52	10.60	10.29
Mean(B)	4.96	5.27	5.46	5.50		130.05	132.05	136.82	137.21		10.00	10.20	10.57	10.66	
Factor(s)	A	B	A×B			A	B	A×B			A	B	A×B		
S.E.(m)±	0.04	0.04	0.08			0.55	0.55	1.09			0.05	0.05	0.09		
C.D. at 5%	0.13	0.13	0.27			1.65	1.65	NS			0.15	0.15	0.27		

Table 2. Effect of different levels of pruning intensities and NAA concentration on fruit length, 100 fruit weight and yield per plant in phalsa

Treatments	Fruit length(cm)					100 fruit weight(g)					Yield per plant(kg)				
NAA levels(C) / **Pruning Intensities(I)**	**Control (C_0)**	**100ppm (C_1)**	**150ppm (C_2)**	**200ppm (C_3)**	**Mean (A)**	**Control (C_0)**	**100ppm (C_1)**	**150ppm (C_2)**	**200ppm (C_3)**	**Mean (A)**	**Control (C_0)**	**100ppm (C_1)**	**150ppm (C_2)**	**200ppm (C_3)**	**Mean (A)**
40cm(I_1)	2.05	2.10	2.16	2.18	2.12	55.38	56.04	57.87	58.31	56.90	2.65	2.55	2.65	2.95	2.65
60cm(I_2)	2.12	2.17	2.23	2.27	2.19	57.49	58.05	59.87	60.55	58.99	3.23	3.05	3.23	3.65	3.23
80cm(I_3)	2.16	2.08	2.18	2.20	2.15	55.78	55.93	58.43	58.87	57.25	2.74	2.65	2.78	3.01	2.74
Mean(B)	2.11	2.11	2.19	2.21		56.21	56.67	58.72	59.24		2.66	2.75	2.88	3.20	
Factor(s)	A	B	A×B			A	B	A×B			A	B	A×B		
S.E.(m)±	0.01	0.01	0.03			0.33	0.33	0.67			0.08	0.08	0.13		
C.D. at 5%	0.03	0.03	0.09			1.01	1.01	NS			0.27	0.27	0.39		

Table 3. Effect of different levels of pruning intensities and NAA concentration on juice content, total soluble solid and titratable acidity in phalsa

Treatments	Juice content (%)					Total soluble solid(^{0}Brix)					Titratable acidity (%)				
NAA levels(C) / Pruning Intensities(I)	Control (C_0)	100 ppm (C_1)	150ppm (C_2)	200ppm (C_3)	Mean (A)	Control (C_0)	100 ppm (C_1)	150ppm (C_2)	200ppm (C_3)	Mean (A)	Control (C_0)	100 ppm (C_1)	150ppm (C_2)	200ppm (C_3)	Mean (A)
40cm(I_1)	50.34	50.45	52.10	52.50	51.34	15.45	15.42	15.92	16.05	15.71	1.56	1.70	1.75	1.77	1.69
60cm(I_2)	51.67	52.26	53.90	54.51	53.08	15.58	15.97	16.47	16.66	16.17	1.67	1.76	1.81	1.84	1.77
80cm(I_3)	53.28	50.35	52.60	53.10	52.31	15.56	15.39	16.08	16.25	15.82	1.65	1.69	1.77	1.80	1.72
Mean(B)	51.76	51.02	52.86	53.34		15.53	15.59	16.15	16.32		1.62	1.71	1.77	1.80	
Factor(s)	A	B	A×B			A	B	A×B			A	B	A×B		
S.E.(m)±	0.27	0.27	0.53			0.15	0.15	0.29			0.01	0.01	0.03		
C.D. at 5%	0.81	0.81	1.63			0.45	0.45	0.93			0.03	0.03	0.09		

Table 4. Effect of different levels of pruning intensities and NAA concentration on reducing sugars, non-reducing sugars, total sugars and ascorbic acid content in phalsa

Treatments	Reducing sugars (%)					Non-reducing sugars (%)					Total sugars (%)					Ascorbic acid (mg) per 100 g fruit pulp				
NAA levels(C) / Pruning Intensities(I)	Control (C_0)	100ppm (C_1)	150ppm (C_2)	200ppm (C_3)	Mean (A)	Control (C_0)	100ppm (C_1)	150ppm (C_2)	200ppm (C_3)	Mean (A)	Control (C_0)	100ppm (C_1)	150ppm (C_2)	200ppm (C_3)	Mean (A)	Control (C_0)	100ppm (C_1)	150ppm (C_2)	200ppm (C_3)	Mean (A)
40cm(I_1)	8.46	8.50	8.75	8.85	8.64	3.78	3.93	4.04	4.09	3.96	12.03	12.43	12.79	12.94	12.54	32.22	32.81	33.86	34.16	33.26
60cm(I_2)	8.75	8.80	9.05	9.20	8.95	4.01	4.07	4.18	4.25	4.12	12.83	12.87	13.23	13.45	13.09	33.15	33.97	34.92	35.51	34.38
80cm(I_3)	8.49	8.45	8.85	8.90	8.67	3.87	3.90	4.09	4.11	3.99	12.32	12.35	12.94	13.01	12.65	32.55	32.60	34.16	34.34	33.41
Mean(B)	8.56	8.58	8.88	8.98		3.88	3.96	4.10	4.15		12.39	12.55	12.98	13.13		32.64	33.12	34.02	34.28	
Factor(s)	A	B	A×B			A	B	A×B			A	B	A×B			A	B	A×B		
S.E.(m)±	0.03	0.03	0.06			0.03	0.03	0.09			0.10	0.10	0.19			0.20	0.20	0.39		
C.D. at 5%	0.07	0.07	0.17			0.15	0.15	0.27			0.29	0.29	0.57			0.59	0.59	1.17		

4. CONCLUSION

Results showed that foliar spray of NAA 200 ppm andpruning at 60 cm above from the ground level showed besteffect on all growth, yield and quality parameters of phalsa (*Grewia asiatica* L.) Hence use of foliar spray of NAA 200 ppmalong with pruning at 60 cm above from the ground levelcould be recommended for getting bettervegetative growth, substantial higher yield and quality of phalsa growers.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Hayes WB. Fruit growing in Indian Kitabistan, Allahabad. 1957:232.
2. Singh R. Fruits. National Book Trust. New Delhi; 1979.
3. Singh T, Tripathi VK, Tiwari P. Influence of pre-harvest application of plant bio-regulators and micronutrients on fruit retention, yield and quality attributes of mango. Progressive Research - An International Journal. 2017;12(4):2640-2644.
4. Rangana S. Manual analysis of fruit and vegetable products. Tata Publishing Ltd, New Delhi; 1986.
5. Sheoran OP, Tonk DS, Kaushik LS, Hasija RC, Pannu RS. Statistical software package for agricultural research workers. Recent Advances in Information theory, Statistics & Computer Applications by D.S. Hooda & R.C. Hasija Department of Mathematics Statistics, CCS HAU, Hisar. 1998:139-143.
6. Singh AR, Singh GN. Effect of different levels of nitrogen and pruning on growth and yield of phalsa. Orrisa of Hort. 1999;31(2):2003.
7. Tiwari P, Tripathi VK, Singh A. Effective foliar application plant bio-regulators and micronutrients on fruit retention, yield and quality attributes of aonla. Progressive Research International. 2017;12(Special-IV):2565-2568.
8. Tripathi VK, Singh A, Bhadauria AS, Gupta S. Influence of GA_3 and naphthalene acetic acid alone and in combination on fruit drop, yield and quality of mango cv. Amrapali, Progressive Research-An International Journal. 2019;14(1):10-13.
9. Tripathi VK, Shukla PK. Influence of plant bioregulators, boric acid and zinc sulphate on yield and fruit characters of strawberry cv. Chandler, Progressive Horticulture. 2007;39(2):154-158.
10. Kumar S, Kumar S, Verma DK. Effect of micronutrients and NAA on yield and quality of litchi (*Litchi chinesis* Sonn) cv. Dehradun fruits Abstr: In Proc. of International Seminar on Rec. Trend in Hi. Tech. Hort. and Pht., Organized by CSAUAT, Kanpur. 2004;4-6:193.
11. Mahida SV, Shah NI, Patel HT. Influence of double pruning in a year and fertilizer application time on yield and quality parameters of phalsa (*Grewia asiatica* L.) cv. local. International Journal of Chemical Studies. 2022;10(3):8-10.
12. Bhuva HP, Jadav RG, Katrodia JS, Patel RL, Raja KRV. Studies on production potential through single and doublecropping of phalsa (*Grewia subinaequalis* D.C). Indian Journal of Horticulture. 1995;52(1):19-23.
13. Meghwal PR. Effect of time and intensity of pruning on vegetative growth, fruit yield and quality of phalsa. Annals of Arid Zone. 2006;45(1):59-62.
14. Singh L, Singh S, Singh B. Effect of pruning levels and growth regulators on vegetative and fruit characteristics of phalsa during summer and winter crops under Punjab conditions. In: Proceedings of the national symposium on production, utilization and export of underutilized fruits with commercial potentialities, Bidhan Chandra Krishi Viswavidyalaya, Kalyani, Nadia, West Bengal. 2006:132-144.
15. Kumar R, Tripathi VK. Influence of NAA, GA_3 and boric acid on growth, yield and quality of strawberry cv. chandler. Progressive Horticulture. 2009;41(1):113-115.
16. Lal D, Tripathi VK, Nayyer MA, Kumar S, Ahmed M, Siddiqui MW. Pre-harvest spray of gibberellic acid, naa, and calcium nitrate on fruit retention, yield and quality of kinnow mandarin. Environment & Ecology. 2016;34(4C):2288-2292.
17. Aziz MM, Rashid S, Abbbas MM. Effect of differentpruning intensities and times on fruit yield and quality of phalsa (*Grewia asiatica* L.). Journal of Agricultural Research. 2018;56(2):107-111.
18. Sharif N, Ishfaq M, Javaid MA, Bashir MA. Effects ofdifferent pruning times on growth and yield of ber (*Zizyphus mauritiana* L.),

cv. Alu-Bukhara. Journal ofAgricultural Research. 2018;54(2):251-259.

19. Dubey V, Meena ML, Tripathi VK. Effect of plant bio-regulators and micronutrient on vegetative growth, yield and quality of strawberry cv. Chandler. Progressive Research - An International Journal. 2017; 12(3):330-332.

Peer-review history:
The peer review history for this paper can be accessed here:
https://www.sdiarticle5.com/review-history/99428