

Original Research Article

Effect of different levels of pruning intensity and foliar feeding of NAA on growth, yield and quality attributes of phalsa (*Grewia subinaequalis* D.C.) cv. Sharbati

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 subinaequalis* D.C.) cv. Sharbati, conducted at Horticulture Garden, Department of Fruit Science, C.S.A.U.A.T., Kanpur, (U.P). The results showed significant effects on 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 fruit weight (60.55g), yield per plant (3.65kg), juice content (54.51%), T.S.S. (16.66⁰B), reducing sugars (9.20%), non-reducing sugars (4.25%), total sugars (13.45%), titratable acidity (1.84%) and ascorbic acid (35.51 mg) per 100 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 with was most effective for improving growth, yield and quality attributes.

Keywords Phalsa, NAA, T.S.S, ppm, yield and quality.

Introduction

Phalsa (*Grewia subinaequalis* L.) is an indigenous fruit crop of India, belongs to family tiliaceae with somatic chromosome no. $2n=36$ and is mentioned in the earliest Vedic literature for its medicinal qualities. It is a popular fruit in tropical 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. Phalsa fruits 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 source 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 are mostly used as fresh fruit and have cooling effect. Medicinal properties are that it works as a digestive tonic and the fruits are astringent. It may help in curing inflammation, 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 temperature

44 °C and high temperature favour ripening of the fruits. Although, Phalsa is grown mostly as a wasteland crop because of it being a hardy plant, but the annual manuring programme if followed regularly, gives very profitable results. Also, pruning and regular irrigation plays 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 good yield. Besides, severity of pruning as well as, the proper time of pruning, may also be very important for improving yield and quality of fruits. Hayes (1957) suggested late December or early January as the best time of phalsa pruning. The flowering and fruiting are confined to 15-20 nodes from the base depending on vigor. In general, under north Indian condition, it is pruned when it sheds off leaves during middle of winter (Singh, 1979). 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 consumer. NAA helps to induce flowering, to prevent shedding of buds, Flowers and unripe fruits. It also enlarges fruit size and increase 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 prevent fruit drop in Mango and Citrus, blossom thinning in Peach and Guava and fruit thinning in Apple and Pear (Singh, *et al*, 2017). The present investigation was therefore aimed at, to assess, the effect of different pruning intensity and NAA concentrations on growth, yield and quality of Phalsa.

Materials and methods

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 planted at distance at 3x2.5 m were selected. The experiment was laid out in Factorial RBD with three replications having 12 treatment combination including three levels of pruning viz. pruned at 40 cm, 60 cm and 80 cm 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 first week of February and spray of NAA concentrations was done on second fortnight of March (pre 100 m stage) while second spray was done after fruit setting. Observations were recorded on number of shoots/fruitlet nodes, length of shoot, number of fruit/nodes, fruit yield/plant, weight of 100 fruits, juice percent and quality of juice in terms 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 Refractometer. Titratable acidity and total sugars were determined by methods described by Rangana (1986). The data collected on various characters at each harvest were subjected to statistical analysis as per the method of "Analysis of Variance". The results were interpreted on the basis of "F" test and C.D. at 5% level of significance was used to study the comparison between the two means.

ANOVA was performed using the statistical software OPSTAT given by Sheoran *et al.*, (1998).

Results and discussion

Growth parameters

The depicted of data in Table-1 revealed that, pruning at 60cm from ground level with spray of NAA 200 ppm was superior showed significant for initial number of shoots and number of fruits per node but length of shoot was showed non-significant. The maximum number of shoots (5.62), length of shoot (136.49cm), and fruits per node (10.90) found to 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 (1999); Tiwari *et al.*, (2017) in aonla; Tripathi *et al.*, (2019) in mango; Singh *et al.*, 2017 in mango and Tripathi and Shukla (2007) in Strawberry.

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 in plants 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 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 (2004) in litchi and Singh (1979) in phalsa and Mahida *et al.* (2022) in phalsa; Tiwari *et al.* 2017 in Aonla.

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 °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 °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 (I₁C₀). 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.* (1995); Meghwal (2006); Singh *et al.*, (2006) and Kumar and Tripathi (2009) in Strawberry; Lal *et al.* (2016) in kinnow mandarin. Aziz *et al.*, (2018) and Sharif *et al.*, (2018) in Ber. Dubey *et al.*, (2017).

Conclusion

Results showed that foliar spray of NAA 200 ppm and pruning at 60 cm above from the ground level showed best effect on all growth, yield and quality parameters of phalsa (*Grewia subinaequalis*). Hence use of foliar spray of NAA 200 ppm along with pruning at 60 cm above from the ground level could be recommended for getting better vegetative growth, substantial higher yield and quality of phalsa growers.

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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 level s(C)	Contr (C ₀)	100pp (C ₁)	150pp (C ₂)	200pp (C ₃)	Me an (A)	Contr (C ₀)	100pp (C ₁)	150pp (C ₂)	200pp (C ₃)	Me an (A)	Contr (C ₀)	100pp (C ₁)	150pp (C ₂)	200pp (C ₃)	Me an (A)
Pruning Intensities(I)																
40cm(I ₁)	4.	5.2	5.3	5.42	5.0	129.	130.	134.	133.	136.	9.78	10.0	10.4	10.5	10.	
)	23	1	8		6	42	66	75	75	49		9	2	0	19	
60cm(I ₂)	5.	5.4	5.5	5.62	5.4	130.	135.	139.	140.	132.	10.2	10.4	10.7	10.9	10.	
)	28	0	7		6	47	25	56	69	14	6	5	8	0	59	
80cm(I ₃)	5.	5.2	5.4	5.47	5.3	130.	130.	136.	137.	133.	9.98	10.0	10.5	10.6	10.	
)	39	0	3		7	28	25	17	20	47	7	2	0		29	
Mean(B)	4.	5.2	5.4	5.50		130.	132.	136.	137.		10.0	10.2	10.5	10.6		
)	96	7	6			05	05	82	21		0	0	7	6		
Factor(s)	A	B	AxB			A	B	AxB			A	B	AxB			
)																
S.E.(m)	0.	0.0	0.08			0.55	0.55	1.09			0.05	0.05	0.09			
±	04	4														
C.D. at	0.	0.1	0.27			1.65	1.65	NS			0.15	0.15	0.27			
5%	13	3														

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

Treatment s	Fruit length(cm)					100 fruit weight(g)					Yield per plant(kg)					
	NAA levels(C)	Contr (C ₀)	100pp (C ₁)	150pp (C ₂)	200pp (C ₃)	Me an (A)	Contr (C ₀)	100pp (C ₁)	150pp (C ₂)	200pp (C ₃)	Me an (A)	Contr (C ₀)	100pp (C ₁)	150pp (C ₂)	200pp (C ₃)	Me an (A)
Pruning Intensities(I)																
40cm(I ₁)	2.	2.1	2.1	2.1	2.1	55.	56.0	57.8	58.3	56.	2.65	2.55	2.65	2.95	2.6	
)	05	0	6	8	2	38	4	7	1	90					5	
60cm(I ₂)	2.	2.1	2.2	2.2	2.1	57.	58.0	59.8	60.5	58.	3.23	3.05	3.23	3.65	3.2	
)	12	7	3	7	9	49	5	7	5	99					3	
80cm(I ₃)	2.	2.0	2.1	2.2	2.1	55.	55.9	58.4	58.8	57.	2.74	2.65	2.78	3.01	2.7	
)	16	8	8	0	5	78	3	3	7	25					4	
Mean(B)	2.1	2.1	2.1	2.2		56.	56.6	58.7	59.2		2.66	2.75	2.88	3.20		
)	1	1	9	1		21	7	2	4							
Factor(s)	A	B	AxB			A	B	AxB			A	B	AxB			
)																
S.E.(m)±	0.	0.0	0.03			0.3	0.33	0.67			0.08	0.08	0.13			
	01	1														
C.D. at	0.	0.0	0.09			1.0	1.01	NS			0.27	0.27	0.39			
5%	03	3														

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(°Brix)					Titratable acidity (%)				
	Contra rol (C ₀)	100 ppm (C ₁)	150pp m (C ₂)	200pp m (C ₃)	Me an (A)	Contra rol (C ₀)	100 ppm (C ₁)	150p pm (C ₂)	200p pm (C ₃)	Me an (A)	Cont rol (C ₀)	10 pp m (C ₁)	150p pm (C ₂)	200p pm (C ₃)	Me an (A)
Pruning Intensities(I)															
40cm(I₁)	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(I₂)	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(I₃)	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	AxB			A	B	AxB			A	B	AxB		
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				
	Contra rol (C ₀)	100p m (C ₁)	150pp m (C ₂)	200pp m (C ₃)	Me an (A)	Contra rol (C ₀)	100p m (C ₁)	150p pm (C ₂)	200p pm (C ₃)	M ea n (A)	Contra rol (C ₀)	100p pm (C ₁)	150p pm (C ₂)	200pp m (C ₃)	Me an (A)	Contra rol (C ₀)	100pp m (C ₁)	150p pm (C ₂)	200pp m (C ₃)	Me an (A)
Pruning Intensities(I)																				
40cm(I₁)	8.46	8.50	8.75	8.88	8.67	3.79	3.93	4.04	4.09	3.96	12.03	12.33	12.74	12.95	12.55	32.21	32.81	33.66	34.16	33.26
60cm(I₂)	8.75	8.80	9.00	9.02	8.90	4.07	4.18	4.25	4.12	4.12	12.83	12.87	13.25	13.40	13.08	33.57	33.97	34.72	35.15	34.38
80cm(I₃)	8.85	8.85	8.85	8.85	8.85	3.35	3.35	4.45	4.45	3.35	12.12	12.12	12.13	12.13	12.12	32.32	32.32	34.34	34.34	33.33

3)	4	45	8	9	6	8	90	09	11	99	.3	.3	.9	.0	6	.5	.6	.1	.3	.4
	9		5	0	7	7					2	5	4	1	5	5	0	6	4	1
Mean(B)	8.	8.	8.	8.		3.	3.	4.	4.		12	12	12	13		32	33	34	34	
	5	58	8	9		8	96	10	15		.3	.5	.9	.1		.6	.1	.0	.2	
	6		8	8		8					9	5	8	3		4	2	2	8	
Factor (s)	A	B	AxB			A	B	AxB			A	B	AxB			A	B	AxB		
S.E.(m)	0.	0.	0.06			0.	0.	0.09			0.	0.	0.19			0.	0.	0.39		
)±	0	03				0	03				10	10				20	20			
	3					3														
C.D. at 5%	0.	0.	0.17			0.	0.	0.27			0.	0.	0.57			0.	0.	1.17		
	0	07				1	15				29	29				59	59			
	7					5														

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