Original Research Article

Effect of differentlevels of pruning intensity and foliar feeding of NAAon growth, yield and quality attributes of phalsa(*Grewia asiatica*L.) 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 ofphalsa (*Grewia asiatica* L.)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 fruitweight (60.55g), yield per plant(3.65kg), juice content(54.51%), T.S.S. (16.66^0B), 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 withwas most effective for improving growth, yield and quality attributes.

KeywordsPhalsa,NAA, T.S.S, ppm,yield and quality.

Introduction

Phalsa (*Grewia asiatica* L.)is an indigenous fruitcrop of India, belongs to family tiliaceae with somatic chromosome no. 2n=36 and is mentioned in the earliest Vedicliterature for its medicinal qualities. It is a popular fruit intropical and sub-tropical regions and introduced into the Philippines before 1914. In India, it iscommercially cultivated in Punjab, Haryana, UttarPradesh and Andhra Pradesh. Phalsa is a hardy cropand drought resistant which requires little care. Phalsafruits are categorized as non-climatic fruit and hence, wellripened fruits are harvested for marketing. Fruits aredelicious, sour too sweet in taste with attractive colour andare good source of phosphorus and iron. Fruits contain50 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 cooling effect.Medicinal properties are that it works as a digestive tonicand the fruits are astringent. It may help in curinginflammation, heart and blood disorders, fever, heattroubles 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 temperature44 ^{0}C and high temperature favour ripening of the fruits. Although, Phalsa is grown mostly as a wasteland cropbecause of it being a hardy plant, but the annualmanuring programme if followed regularly, gives veryprofitable results. Also, pruning and regular irrigationplays a vital role in its production.

Pruning in Phalsa isconsidered as an essential operation since the fruit budsare found on current season growth to get good yield.Besides, severity of pruning as well as, the proper time ofpruning, may also be very important for improving yieldand 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 thetime of pruning may regulate fruit maturity in Phalsawhich may ultimately result into orderly marketing of thisperishable fruit, which can prove to be advantageous toboth 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 presentinvestigation was therefore aimed at, to assess, the effectof different pruning intensity and NAAconcentrations ongrowth, yield and quality of phalsa(*Grewia asiatica* L.).

Materials and methods

Field experiment was conducted at Horticulture Garden, Department ofFruit Science, C.S.U.A.T., Kanpur, (U.P.). Thirty-two-years oldphalsa cv. Sharbati, uniform in size andvigour were plantedat distance at 3x2.5 m wereselected. The experiment was laid out inFactorial RBD with three replications having12 treatment combination including three levelsof pruning viz. pruned at 40 cm, 60 cm and 80cm above ground level and FiveNAAconcentrations viz. control (water spray), 100 ppm,150 ppm and 200 ppm solution. Pruning of phalsa bushes was done in firstweek of February and spray of NAA concentrations was done on second fortnight ofMarch (pre 100 m stage) while second spraywas done after fruit setting.Observationswere recorded on number of shoots/fruitingnodes, 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 sugarscontent and ascorbic acid. The total soluble solids were recorded with the helpof hand Refractometer. Titratable acidity and total sugars weredetermined by methods described by Rangana (1986). The datacollected on various

characters at each harvest were subjected tostatistical analysis as per the method of “Analysis of Variance”. Theresults 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 bySheoran *et al*., (1998).

Results and discussion

Growth parameters

The depicted of data in Table-1 revealed that,pruning at 60cm from ground levelwith spray of NAA200 ppm was superior showed significant forinitial number of shoots and number of fruits per node but length of shoot was showed non-significant.Themaximum 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, minimumnumber of shoots (4.23),length of shoot(129.42cm) and fruits per node(9.78)wererecorded 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 greaterphotosynthetic activity and there by producing morephotosynthates.Thismight 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, length of shoot and number of fruits/nodes was more. Similar findings were made bySingh andSingh (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 with200ppm 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. Thismight 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 inplant with minerals led to increase in turgorpressure which resulted in increased juicepercent. The highest fruit yield recorded by light pruning (60cm) may be attributedto highernumber of new shoots with greater number of effective nodes. The present findings are also inagreement with Kumar (2004) in litchi and Singh (1979) in phalsaand Mahida *et al*. (2022) in phalsa; Tiwari *et al*. 2017 in Aonla.

Quality attributes

The data regarding effect of pruning intensity andNAA on all quality parameters of phalsa arepresented 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 insummer season crop than rainy and winter season crop. Thismight be due to higher temperatures in summer seasonincreased the photosynthetic activity which ultimately leads tothe accumulation of large amount of carbohydrates and sugars which increased juice content, total soluble solids and decreased acidity and other qualitative characters ofthe fruits. Similar results were reported by Bhuva *etal.* (1995);Meghwal (2006); Singh *et al.,* (2006) andKumar and Tripathi (2009) in Strawberry; Lal *et al.* (2016) in kinnow mandarin. Aziz *et al*.,(2018) and Sharif *etal*., (2018) in Ber.Dubey *et al.,* (2017).

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.

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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 levels(C)	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)
Pruning Intensities(I)															
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)	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)
Pruning Intensities(I)															
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)	100pm (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)	8.44	8.50	8.77	8.88	8.66	3.77	3.93	4.04	4.09	3.96	12.0	12.4	12.7	12.9	12.5	32.2	32.8	33.8	34.1	33.2

	6		5	5	4	8					3	3	9	4	4	2	1	6	6	6
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		