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Influence of Pruning Intensity and Foliar Application of Nutrients on Growth, Yield and Sugar Content of Phalsa (*Grewia subinaequalis* D.C.)

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A B S T R A C T

The experiment was conducted to study the effect of different levels of pruning and foliar feeding of nutrients on growth, sugar content and yield of Phalsa (*Grewia subinaequalis* D.C.). The pruning level at 25 cm above ground level had significantly maximum shoot length (210.25 cm) and number of leaves per shoot (85.27). While, number of shoots per plant (30.60) was recorded highest with pruning at 50cm above ground level. Moreover, reducing sugars (12.95 %), total sugar contents (16.50 %) and fruit yield per hectare (62.39 q/ha) were recorded high with pruning at 50 cm above ground level. Regardless of severity of pruning, application of $ZnSO_4$ (0.4%) showed significantly maximum shoot length (213.83 cm), number of shoots per plant (32.22), and fruit yield per ha (63.26 q/ha). While, number of leaves per shoot (90.44) was noted maximum with foliar spray of urea (2.0 %). All quality parameters *viz.*, reducing sugars (13.43), total sugar contents (17.12) were better with $ZnSO_4$ (0.4%). The interaction effect of pruning levels and chemicals spray on total sugar contents and fruit yield per ha was found significant and the maximum total sugar contents (17.53) and fruit yield per ha (66.55 q/ha) were recorded with spray of ZnSO4 (0.4%) along with pruning at 50 cm above ground level.

Introduction

Phalsa (*Grewia subinaequalis* D.C.), is popular fruit in subtropical and tropical regions and can be grown throughout the country (Singh, 1992; Singh and Singh, 2003). Phalsa which is also known as star apple belong to family Tilliaceae. The family has about 41 genera and 400 species. Phalsa plant is indigenous to India. Phalsa is small bush that bears many small berries like fruits of deep radish purple color. It is a rich source of vitamins A and C and comes in market in June when other fresh fruits are not available (Sharma *et al.*, 2008). Children use its fruit as table fruit, otherwise; basically it makes ready-to-serve, beverages like juice, squash, syrup etc. (Singh *et al.*, 2006). Ripe fruits are acidic in taste and containing 50-60% juice, 10-11% sugars and 2-2.5% acid. It is one of the hardiest fruit crop and does not affected by any insects, pest and disease. Phalsa can be grown as an intercrop with mango, aonla, bael and ber.

The continuous application of amount of chemical fertilizers hampers the fruit quality, soil health and generates pollution. Considering these points there is need to initiate the nutrient management programmed

to increase berry size, uniform ripening, and higher fruit yield to improve the quality of fruits. In addition to nutrients, pruning intensity has also been reported to manage plant canopy and enhance the flowering, fruiting, yield and quality of many fruit crops (Singh and Singh, 2008 and Ali *et al.,* 2001). Keeping in view, enhancing the yield and quality in Phalsa, the investigation was undertaken. The objective of present investigation was to study the effect of pruning intensity and foliar feeding of different nutrients on growth, yield and quality of phalsa cv. Sharbati.

Materials and Methods

The present investigation was carried out to investigate "Effect of pruning intensity and foliar feeding of nutrients on growth, yield and quality of phalsa (*Grewia subinaequalis* D.C.)". The experiment was conducted at Main Experiment Station, Department of Horticulture, Narendra Deva University of Agriculture and Technology, Kumarganj, Faizabad (U.P.) during 2010-11 growth season. Twenty years old uniform phalsa plants cv. Sharbati, planted at 3×2 m apart were used as experimental material for the present investigation. One plant was taken as unit per plot. Fifteen treatments were taken for the study *viz.*, T_1: 25 cm +Water spray, T_2: 25 cm + $ZnSO_4$ 0.4%, T_3: 25 cm + $CuSO_4$ 0.4%, T_4: 25 cm + K_2SO_4 0.2%, T_5: 25 cm + Urea 2.0%,T_6: 50 cm +Water spray, T_7: 50 cm + $ZnSO_4$ 0.4%, T_8: 50 cm + $CuSO_4$ 0.4%, T_9: 50 cm + K_2SO_4 0.2%, T_{10}: 50 cm + Urea 2.0%,T_{11}: 75 cm +Water spray,T_{12}: 75 cm + $ZnSO_4$ 0.4%,T_{13}: 75 cm + $CuSO_4$ 0.4%, T_{14}: 75 cm + K_2SO_4 0.2%,T_{15}: 75 cm + Urea 2.0%. Pruning was done in first week of February 2011 and first spray of nutrients was done in second fortnight of March 2011 (Pre blooming stage) and second spray just after fruit setting. The experiment was laid out in Randomized Block Design (factorial) with three replications. At the end of the growing season, each plant was evaluated in terms of the shoot length, number of shoot per plant, number of leaves per shoot, reducing sugars (%), total sugars (%) and fruit yield per hectare (q/ha). The reducing sugars and total sugars were estimated by using the procedure given in AOAC (1990). Data were tested for normality, and then subjected to analysis of variance (ANOVA) suggested by Gomez and Gomez (1984). Significant differences between mean values were determined using the randomized block design and following two-way ANOVA.

Results and Discussion

The maximum (Table 1) shoot length (213.83 cm) was recorded with foliar spray of $ZnSO_4$ (0.4%) treatment and statistically at par with application of Urea (2.0%) and $CuSO_4$ (0.4%).The minimum (202.37 cm) shoot length was recorded with water spray. The pruning levels also showed significant effect on shoot length of phalsa. The maximum shoot length (210.25 cm) was recorded at pruning 25cm above ground level and statistically at par with pruning at 50cm above ground level while, minimum (207.23 cm) shoot length was recorded at pruning 75cm above ground level (P_3).The interaction of pruning levels and chemical spray was found non-significant. The present findings were in conformity with Pankaj *et al.,* (2009) and Rathore *et al.,* (2008) in phalsa.

Significantly maximum (Table 2) number of shoots per plant (32.22) was recorded with foliar spray of $ZnSO_4$ (0.4%) closely followed by (32.11) application of Urea (2.0%) while, minimum number of shoots/plant (23.44) was recorded with water spray. In case of pruning levels, the maximum number of shoots per plant (30.60) was recorded with pruning at 50cm above ground level closely followed by (29.27) pruning at 25cm above ground level

while minimum number of shoots per plant (28.27) were recorded with pruning at 75cm above ground level (P_3). The interaction of pruning levels and chemical spray was found non-significant. These findings were in conformity with Kumar *et al.,* (2004) in litchi and Rathore *et al.,* (2008) in phalsa.

The maximum (Table 3) number of leaves per shoot (90.44) was noted with foliar spray of Urea (2.0) followed by spray of K_2SO_4 (0.2). The minimum (73.11) numbers of leaves per shoots were recorded with water spray. Different pruning levels also had interesting influence on number of leaves per shoot and highest number of leaves (85.27) was noted with pruning at 25cm above ground level followed by pruning at 50cm above ground level. The lowest number of leaves (81.20) was recorded with pruning at 75cm above ground level (P_3). Combined interaction effect of pruning levels and chemical application was found to be non-significant. The findings were in agreement with Kumar *et al.,* (2004) in litchi and Pankaj *et al.,* (2009) in phalsa.

The maximum (Table 4) reducing sugars (13.43) were recorded with the spray of $ZnSO_4$ (0.4) and statistically at par with application of K_2SO_4 (0.2) while, the value was minimum (11.34) with water spray. Pruning levels also influenced significantly reducing sugars. The maximum reducing sugars (12.95) were recorded with pruning at 50cm above ground level followed by pruning at 25cm above ground level and minimum (12.37) with pruning at 75cm above ground level. The interaction effect of pruning levels and chemicals spray on reducing sugars was found non-significant. Similar findings were also reported by Singh *et al.,* (1979) in grapes and Bhatia and Yadav (2005) in ber.

Total sugar contents (Table 5) were influenced significantly by chemicals spray and pruning levels. The maximum total sugar contents (17.12) was recorded with foliar spray of $ZnSO_4$ (0.4) and statistically at par with application of K_2SO_4 (0.2) while, the minimum of total sugars (14.45) were recorded with water spray. Different pruning levels also significantly influenced the total sugar contents in phalsa fruits. The maximum total sugar contents (16.50) were recorded with pruning at 50cm above ground level followed by pruning at 25 cm above ground level and minimum total sugar content (15.77) was recorded with pruning at 75 cm above ground level.

Table.1 Effect of pruning intensity and foliar feeding of nutrients on shoot length

Treatments	Pruning (Above ground level)			Mean
	25 cm (P_1)	50 cm (P_2)	75 cm (P_3)	
C_0- Control (water spray)	204.33	203.27	199.51	**202.37**
C_1- $ZnSO_4$ 0.4%	215.00	213.88	212.60	**213.83**
C_2- $CuSO_4$ 0.4%	210.92	210.33	208.88	**210.04**
C_3- K_2SO_4 0.2%	208.00	207.95	203.82	**206.59**
C_4- Urea 2.0%	212.30	213.00	211.37	**212.22**
Mean	**210.25**	**209.55**	**207.23**	
	P	**C**	**P × C**	
SEm±	0.31	0.40	0.70	
CD at 5%	0.91	1.18	NS	

Table.2 Effect of pruning intensity and foliar feeding of nutrients on number of shoot per plant

Treatments	Pruning (Above ground level)			Mean
	25 cm (P_1)	50 cm (P_2)	75 cm (P_3)	
C_0- Control (water spray)	22.67	26.67	21.00	**23.44**
C_1- $ZnSO_4$ 0.4%	32.00	33.33	31.33	**32.22**
C_2- $CuSO_4$ 0.4%	29.00	29.67	28.67	**29.11**
C_3- K_2SO_4 0.2%	30.00	30.33	29.67	**30.00**
C_4- Urea 2.0%	32.67	33.00	30.67	**32.11**
Mean	**29.27**	**30.60**	**28.27**	
	P	**C**	**P×C**	
SEm±	0.40	0.51	0.89	
CD at 5%	1.15	1.48	NS	

Table.3 Effect of pruning intensity and foliar feeding of nutrients on number of leaves per shoot

Treatments	Pruning (Above ground level)			Mean
	25 cm (P_1)	50 cm (P_2)	75 cm (P_3)	
C_0- Control (water spray)	76.00	72.33	71.00	**73.11**
C_1- $ZnSO_4$ 0.4%	86.33	83.33	81.00	**83.56**
C_2- $CuSO_4$ 0.4%	83.67	82.00	81.67	**82.44**
C_3- K_2SO_4 0.2%	88.00	86.33	84.33	**86.22**
C_4- Urea 2.0%	92.33	91.00	88.00	**90.44**
Mean	**85.27**	**83.00**	**81.20**	
	P	**C**	**P×C**	
SEm±	0.51	0.65	1.13	
CD at 5%	1.47	1.90	NS	

Table.4 Effect of pruning intensity and foliar feeding of nutrients on reducing sugars (%)

Treatments	Pruning (Above ground level)			Mean
	25 cm (P_1)	50 cm (P_2)	75 cm (P_3)	
C_0- Control (water spray)	11.52	11.93	10.57	**11.34**
C_1- $ZnSO_4$ 0.4%	13.29	13.76	13.25	**13.43**
C_2- $CuSO_4$ 0.4%	12.88	13.07	12.48	**12.81**
C_3- K_2SO_4 0.2%	12.92	13.13	12.73	**12.92**
C_4- Urea 2.0%	12.80	12.87	12.86	**12.84**
Mean	**12.68**	**12.95**	**12.37**	
	P	**C**	**P×C**	
SEm±	0.15	0.19	0.33	
CD at 5%	0.43	0.56	NS	

Table.5 Effect of pruning intensity and foliar feeding of nutrients on total sugars (%)

Treatments	Pruning (Above ground level)			Mean
	25 cm (P_1)	50 cm (P_2)	75 cm (P_3)	
C_0- Control (water spray)	14.68	15.20	13.47	**14.45**
C_1- $ZnSO_4$ 0.4%	16.94	17.53	16.88	**17.12**
C_2- $CuSO_4$ 0.4%	16.42	16.65	15.90	**16.32**
C_3- K_2SO_4 0.2%	16.46	16.73	16.22	**16.47**
C_4- Urea 2.0%	16.32	16.40	16.38	**16.37**
Mean	**16.16**	**16.50**	**15.77**	
	P	**C**	**P×C**	
SEm±	0.19	0.25	0.43	
CD at 5%	0.56	0.71	1.25	

Table.6 Effect of pruning intensity and foliar feeding of nutrients on fruit yield per hectare (q/ha)

Treatments	Pruning (Above ground level)			Mean
	25 cm (P_1)	50 cm (P_2)	75 cm (P_3)	
C_0- Control (water spray)	47.26	50.50	47.20	**48.32**
C_1- $ZnSO_4$ 0.4%	61.61	66.55	61.61	**63.26**
C_2- $CuSO_4$ 0.4%	60.03	64.80	60.42	**61.75**
C_3- K_2SO_4 0.2%	59.31	64.00	63.17	**62.16**
C_4- Urea 2.0%	61.24	66.10	61.84	**63.06**
Mean	**57.89**	**62.39**	**58.85**	
	P	**C**	**P×C**	
SEm±	1.09	1.41	2.45	
CD at 5%	3.17	4.09	7.09	

The interaction effect of pruning levels and chemicals spray on total sugar contents was found significant and the maximum total sugar contents (17.53) were recorded with spray of $ZnSO_4$ (0.4) along with pruning at 50 cm above ground level while, value was minimum (13.47) with water spray along with pruning at 75cm above ground level. Similar results were also reported by Singh *et al.*, (1979) in grapes and Bhatia and Yadav (2005) in ber.

The maximum (Table 6) fruit yield per ha (63.26) was recorded with foliar spray of $ZnSO_4$ (0.4%) and statistically at par with application of Urea (2.0) and K_2SO_4 (0.2). However, value with respect to fruit yield per hectare was noticed minimum (48.32) under water spray. In case of pruning, fruit yield was significantly influenced by various pruning levels. However, the maximum fruit yield per hectare (62.39) was recorded with pruning at 50cm above ground level followed by pruning at 75cm above ground level while, minimum (57.89) fruit yield per hectare was recorded with pruning at 25cm above ground level. The interaction of pruning level and chemical spray on fruit yield (quintal) per hectare was found to be significant. The highest yield (66.55) was noted with combined effect of $ZnSO_4$ (0.4) along with pruning at 50cm above ground level while,

value was minimum (47.20) with water spray along with pruning at 75cm above ground level. The increase in yield due to increase in number of shoots per plant, number of fruiting nodes per shoots, number of fruits per node and increased yield per plant which contributed towards such an increase in average yield per hectare. The present findings were in conformity with Ali *et al.*, (1991) in guava and Singh *et al.*, (2001) in aonla.

From above results it may be concluded that maximum shoot length and number of shoots per plant was noted with $ZnSO_4$ (0.4%) along with 25 cm pruning level above ground fallowed by pruning at 50 cm above ground level. However, more number of leaves per shoot and internodal length was associated with pruning 25 cm along with Urea (2.0%) treatment. Better response of $ZnSO_4$ (0.4%) treatment was noted with yield and yield attributes along with pruning at 50 cm above ground level. The sugar content were better with $ZnSO_4$ (0.4%) treatment along with 50 cm pruning above ground level closely followed by spray of K_2SO_4 (0.2%) along with pruning at 50cm above ground.

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