Journal of Pharmacognosy and Phytochemistry
Available online at www.phytojournal.com

E-ISSN: 2278-4136
P-ISSN: 2349-8234
JPP 2018; SP2: 35-37

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National Conference on Conservation Agriculture
(ITM University, Gwalior on 22-23 February, 2018)

Effect of pruning intensity, foliar feeding of P.G.R. and micro nutrients on vegetative growth of phalsa (*Grewia subinaequalis*)

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Abstract
A field experiment was conducted in order to find out the effect of pruning intensity, foliar feeding of plant growth regulators and micro-nutrients on vegetative growth of phalsa (*Grewia subinaequalis*). The maximum shoot length was measured with the foliar spray of Urea @ 2.0 per cent at 50cm above from the ground level. Interaction effect due to pruning levels and chemicals spray were found non-significant with respect to shoot length. The maximum number of shoot per plant was recorded with the foliar spray of Urea @ 2.0 per cent with pruning level at 50cm above from the ground level. Foliar application of Urea @ 2.0 per cent showed highest number of leaves per shoot and maximum value was recorded with pruning at 50cm above from the ground level. Highest inter nodal length was measured with foliar spray of Urea k2.0 per cent as compared to other treatments. It was evident that foliar application of Urea @ 2.0 per cent and $ZnSO_4$ @ 0.4 per cent respectively at 50 cm pruning level effective to increase vegetative growth in phalsa fruits.

Keywords: Phalsa, Pruning intensity, Micro nutrients, Vegetative growth, foliar spray

Introduction
Phalsa (*Grewia subinaequalis* D.C.), a subtropical fruit, belongs to family Tilliaceae, with chromosome no. (2n) = 36, is native to India. Propagation by cutting and layering is also possible with the help of growth regulators (IBA, 2500-3000 ppm). Phalsa can be grown on a wide range of soil including moderately alkaline soil. However, best results are obtained in well drained lomy soil. Only few varieties of phalsa are available among which local and Sharbati are popular. Two distrinct type tall and dwarf have been recognized. Dwarf type is commonly grown. It is quite productive (Singh, 2002) [6]. Phalsa ripe fruit are deep reddish-brown colour, sub acidic in taste, rich source of vitamins (A, C) and minerals (phosphorus and iron), 2-2.5% acids, calories 329 per lb (724 per kg), moisture 81.13%, protein 1.58%, fat 1.82%, crude fiber 1.77%, sugar 10.27%. In addition to nutrient intensity and pruning has also been reported to manage plant canopy and enhance the flowering, fruiting, yield and quality of many fruit crops (Singh and Singh, 2008 [7] and Ali *et al*., 2001) [1]. The application of fertilizer enhances the vegetative growth. Considering the importance of phalsa there is dire need to initiate the nutrient management and pruning intensity programme to increase vegetative growth. Nevertheless, a lot of approaches have been made on foliar feeding of PGR and micronutrients on different fruit crops, however, meagre work has been done on phalsa crop.

Materials and methods
A field experiment was conducted at Main Experimental Station of Department of Horticulture, Narendra Deva University of Agriculture and Technology, Kumarganj, Faizabad during the year 2011-12. The experimental site is situated between 24.47º and 26.56º N latitude and 82.12º and 83.98º E longitude at an elevation of about 113 meters above mean sea level. The experiment was laid out in factorial random block design having fifteen treatment combinations with three replications. Twenty years old uniform phalsa plants planted at 3 x 2 m apart were taken in the present investigation. Manure, fertilizer and other orchard management practices were followed as per recommended package and practices for phalsa. Pruning was done in first week of February and spray of P.G.R. and nutrients in second

fortnight of March (Pre blooming Stage). The data were recorded on growth parameters Shoot length per plant (m), number of shoots per plant, number of leaves per shoot and internodal length (cm) which were subjected to statistical analysis as suggested in order to draw the valid conclusions on the basis C.D. value. Statistical analysis of the data obtain in the different sets of experiments were calculated as suggested by Panse and Sukhatme (1985) [4].

Results and discussion

Data revealed that various vegetative growth parameters of phalsa were influenced by foliar application of chemicals, plant growth regulators and different levels of pruning.

Table 4.1: Effect of pruning intensity, plant growth regulators and micro nutrients on Shoot length (cm).

	Pruning intensity (Above from the ground level)			
Chemicals	**25 cm**	**50 cm**	**75 cm**	**Mean**
NAA @ 50 ppm	213.00	215.07	214.27	214.11
GA_3 @ 20 ppm	213.40	215.13	214.67	214.40
$ZnSo_4$ @ 0.4%	215.47	215.37	216.00	215.61
Urea @ 2%	217.00	220.00	219.00	219.66
Water (Control)	202.43	205.83	203.78	204.02
MEAN	212.26	214.28	213.54	
	P	C	P X C	
SEm+	1.03	1.33	2.31	
CD at 5%	N.S.	3.86	N.S.	

It is clear from Table 4.1 that number of shoot per plant was also influenced significantly by the application of plant growth regulators and micro-nutrients spray and pruning levels. However, the maximum number of shoot per plant was measured with foliar spray of Urea @ 2 percent and pruning at 50 cm above from the ground level. Interaction effect due to pruning levels and chemical spray were found non-significant with respect to number of shoot per plant.

Table 4.2: Effect of pruning intensity, plant growth regulators and micro nutrients on number of shoot per plant.

	Pruning intensity (Above from the ground level)			
Chemicals	**25 cm**	**50 cm**	**75 cm**	**Mean**
NAA @ 50 ppm	31.33	31.33	30.33	31.00
GA_3 @ 20 ppm	31.67	31.00	30.67	31.11
$ZnSo_4$ @ 0.4%	31.00	32.00	32.33	31.78
Urea @ 2%	32.67	33.33	32.33	32.78
Water (Control)	22.00	22.67	24.00	22.89
MEAN	29.73	30.07	29.93	
	P	C	P X C	
SEm+	0.48	0.62	1.07	
CD at 5%	N.S.	1.80	N.S.	

It is clear from the Table- 4.2 that average shoot length and number of shoots per plant were increased with the application of pruning levels and nutrients spray. Increase in plant growth parameters might be due to fact that nitrogen (given in the form of urea sprayed) is a constituent of protein which is essential for formation of protoplasm and thus, affecting cell division and cell elongation. All these contributed towards enhancing shoot length and number of shoot per plant of phalsa. The present findings are in conformity with the reports of Kumar (2004) [2], Pankaj *et al* (2009) [3] and Rathore (2010) [5] in phalsa.

Table 4.3: Effect of pruning intensity, plant growth regulators and micro nutrients on number of leaves per shoot.

	Pruning intensity (Above from the ground level)			
Chemicals	**25 cm**	**50 cm**	**75 cm**	**Mean**
NAA @ 50 ppm	82.67	82.67	83.00	82.78
GA_3 @ 20 ppm	85.00	84.00	86.00	85.00
$ZnSo_4$ @ 0.4%	88.00	91.00	90.00	89.33
Urea @ 2%	87.00	93.00	91.00	90.03
Water (Control)	71.33	72.00	69.67	71.00
MEAN	82.80	84.13	83.93	
	P	C	P X C	
SEm+	0.79	1.02	1.76	
CD at 5%	N.S.	2.94	N.S.	

It is clear from the Table 4.3 that the number of leaves per shoot increased significantly with the application of pruning levels and foliar feeding of plant growth regulators and micro-nutrients. However, the highest number of leaves was obtained with spraying of Urea 2.0 per cent at 50 cm pruning above from the ground level. Interaction effect due to plant growth regulators and micro-nutrients spray and pruning level were found non-significant. The favorable effect of nitrogen, potassium and zinc in promoting number of leaves might be due to abundant supply of N, P, K and Zn on plant growth moreover, the increase in vegetative growth may be attributed to an increase uptake of these elements which being a constituent of protein component of protoplasm, favorably influenced chlorophyll content in leaves. All these factors contributed to cell multiplication, which has resulted in to better photosynthetic activity and it's translocation to promote

better vegetative growth. Thus increased number of leaves per shoot with urea 2.0 per cent and pruning at 50 cm above from the ground level was obtained. The findings are in agreement with result of Kumar (2004) in litchi; and Pankaj *et al* (2009) in phalsa.

Table 4.4: Effect of pruning intensity, plant growth regulators and micro nutrients on inter nodal length (cm).

	Pruning intensity (Above from the ground level)			
Chemicals	**25 cm**	**50 cm**	**75 cm**	**Mean**
NAA @ 50 ppm	8.40	8.86	8.40	8.55
GA_3 @ 20 ppm	8.46	9.00	8.49	8.65
$ZnSo_4$ @ 0.4%	9.02	9.05	9.10	9.06
Urea @ 2%	9.13	9.17	9.14	9.15
Water (Control)	6.52	6.16	6.22	6.30
MEAN	8.30	8.45	8.27	
	P	C	P X C	
SEm+	0.07	0.09	0.15	
CD at 5%	N.S.	0.26	N.S.	

It is clear from the Table 4.4 that inter-nodal length was increased significantly with plant growth regulators and micro-nutrients spray and pruning levels. The maximum inter nodal-length was achieved with foliar spray of Urea 2.0 per cent with pruning at 50 cm above from the ground level. Interaction effects were found non-significant. Higher inter-nodal length achieved might be due to growth enhancing properties of nitrogen, potassium and zinc. The similar findings were also reported by Pankaj *et al* (2009) in phalsa.

Conclusion

Results showed that foliar spray of Urea @ 2 percent and pruning at 50 cm above from the ground level showed best effect on all growth parameters of phalsa (*Grewia subinaequalis*). Hence use of foliar spray of Urea @ 2 percent along with pruning at 50 cm above from the ground level could be recommended for phalsa growers for getting better vegetative growth and substantial higher yield.

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