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Full Length Research Paper

Effect of different levels of nitrogen and severity of pruning on growth, yield and quality of Phalsa (*Grevia subinaequalis L*.)

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The experiments were conducted to study the effect of different levels of nitrogen and severity of pruning on growth, yield and quality of Phalsa (*Grevia subinaequalis* L.). The pruning level at 90 cm (P_4) had significantly maximum number of canes (13.66), number of sprouted shoots/cane (29.29), number of fruiting/nodes/shoot (29.29), number of fruits/node (9.18) and number of fruits/bush (4327.28), respectively which ultimately leads to maximum fruit weight (0.59 g), fruit yield/bush (4.25 kg) and fruit yield/hectare (80.5 kg). Moreover, total soluble solids (16.17°Brix), acidity (2.86%) and total sugars (11.22) were also recorded high in light pruning (P_4). Regardless of severity of pruning, application of nitrogen at 100 g/bush showed significantly maximum number of cane bush (11.08), number of sprouted shoots/cane (23.91), number of fruiting nodes/shoot (23.88), number of fruits/node (8.36), number of fruits/bush (6371), fruit weight/bush (0.579 g), fruit yield/bush (3.61 kg) and fruit yield (6080.8) whereas minimum in respect to all parameters were recorded in P_1 level of pruning (ground level).

Key words: Phalsa, pruning, nitrogen, growth, yield, quality.

INTRODUCTION

Phalsa (*Grewia subinaequalis L*.) is an indigenous fruit crop of India and is mentioned in the earliest Vedic literature for its medicinal qualities. It is a popular fruit in tropical and sub- tropical regions. 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 to 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.

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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. 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. The present investigation was therefore aimed at, to assess, the effect of different levels of nitrogen and severity of pruning on growth, yield and quality of Phalsa.

MATERIALS AND METHODS

The field experiments were conducted on the experimental orchard of the Department of Horticulture, Allahabad Agricultural Institute – Deemed University, Allahabad situated at 25.57° North latitude and

81.50° East longitude and at an altitude of 98 m above mean sea level during the year 2003 to 2004 in the month of December to May. The experiment was laid out in an asymmetrical factorial randomized block design with 3 levels of nitrogen and 4 levels of pruning. The treatments were replicated thrice and were allocated at random in each replication. There were four levels of pruning (P_1-at ground level, P_2-30 cm, P_3-60 cm, P_4-90 cm height from ground level) and application of three levels of nitrogen (N_1-50 g, N_2-100 g, N_3-150 g N/bush). Prior to the start of pruning, only 8 to 10 canes were selected from each bush for the observation with average diameter (1.08 cm/cane). The pruning and manuring was done on 19th and 25th December, 2003 respectively and the source of nitrogen was urea (2 split doses) and uniform dose of Muriate of Potash, Di-ammonium Phosphate and farmyard manure was given just after pruning. Irrigation was given as and when required during summer. The total number of canes in each bush was counted after pruning of Phalsa crop and the length of effective shoot was recorded by putting graduated scale from growing point of cane to the effective pruning of top of the shoot. Since the different stages of maturity exist on the bush, the fruits were harvested carefully by hand picking. The weight of harvested fruits was recorded separately at each picking. The final yield/bush in kilograms was obtained by summing up the yield of all the pickings and yield/ha was calculated. The total soluble solids were recorded with the help of hand Refractometer. Titrable 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 SPSS.

RESULTS AND DISCUSSION

The maximum number of canes/bush (13.66) was recorded under light pruning (P_4) whereas significantly minimum number of canes/bush (8.88) was recorded under severe pruning (P_1). The interaction between pruning and nitrogen in case of number of canes/bush was found to be significant in N_2P_4 treatment followed by N_1P_4 and N_3P_4 which were found to be at par with each other (Table 3). Similarly, the maximum number of sprouted shoots/bush (29.29) was recorded under light pruning (P_4) and minimum number of sprouted shoots/bush (18.51) were recorded under severe pruning (P_1) (Table 1). This might be due to higher height of pruning having more number of canes and sub canes ultimately leading to more number of available sprouting nodes on shoots. This finding is in accordance with the reports of Reddy and Reddy (1986), Shinde et al. (1976), Singh and Gaur (1989) and Singh and Singh (1999). The interaction between pruning and nitrogen on sprouted shoots/cane was found to be significant in N_2P_4 treatment combination followed by N_3P_4 and N_1P_4 (Table 3 and Figure 1), respectively and found to be at par with each other. Highest total number of canes/bush and number of sprouted shoots/bush observed in N_2P_4 treatment combination might be due to availability of more nutrition and light/unit area which favorably influence greater photosynthetic activity and there by producing more photosynthates.

The maximum length of the shoot (101.40 cm) was recorded under severe pruning (P_1) and significantly minimum length of the shoots (85.32 cm) was recorded under light pruning (P_4). This might be due to the reason that, the reduced number of fruiting shoots increased and improved the shoot growth by increasing the severity of pruning. These results are in agreement with Said and Ali (1989). Similarly, N_3 level of nitrogen recorded the maximum length of shoot (94.63 cm) and lowest length of the shoot (93.79 cm) due to N_1 level of nitrogen. This might be attributed to the cause as application of nitrogen increases the plant growth as has also been reported by Shinde et al. (1976) and Singh and Gaur (1989). Among the treatment combinations, the maximum length of the shoot was recorded in N_3P_4 treatment combination, which was significantly greater than other treatment combinations. The increase in growth was primarily a function of greater availability of photosynthates and the nutrients in the heavily pruned trees due to proportionate reduction in number of vegetative buds which were likely to develop into new shoots thereby, reducing competition for carbohydrates and other metabolites. Nitrogen being an important constituent of protein and chlorophyll thus, helped in increasing the vegetative growth of Phalsa plant.

The number of fruiting nodes (29.29), number of fruits/node (9.18) and number of fruits/bush (7327.58) were significantly higher under P_4 level of pruning, whereas, lowest number of fruiting nodes (18.51), number of fruits/node (6.81) and number of fruits/bush (487.80) were recorded under P_1 level (Table 1). This might be due to the fact that the shoots were longer in plants pruned to 90 cm above ground such that the number of fruiting nodes, number of fruits/node and number of fruits/ bush were more. Similar observations were made by Chadha and Singh (1991), Singh and Sharma (1961), Sontakke et al. (1976) and Singh and Singh (1999). Similarly, nitrogen application at N_2 level had recorded significantly the highest number of fruiting nodes (23.88), number of fruits/node (8.36), number of fruits/bush (6371.14), respectively whereas lowest due to nitrogen application at N_1 level and is in agreement with observations found by Reddy and Reddy (1986) and Shinde et al. (1976).

The treatment P_4 gave significantly the highest fruit weight (0.59 g); whereas, other treatments remained at par with each other. Application of different levels of nitrogen did not show any significant effect on fruit weight. These findings are in accordance with the findings of Rao and Reddy (1989). Interaction between nitrogen and pruning levels was found to be non significant (Table 4).

The maximum fruit yield/bush (4.25 kg) was recorded in treatment P_4 and was found to be significantly greater than other levels of pruning. Among the treatment combinations, fruit yield/bush and fruit No./ bush was found to be maximum in N_2P_4 (Figure 2) which was

Table 1. Effect of different levels of pruning and nitrogen on growth and yield of Phalsa.

Treatments	No. of cones / bush	No. of sprouted shoots/ cone	Length of shoots (cm)	No. of fruiting nodes/ shoot	No. of fruits / node	No. of fruits / bush
Pruning levels (P)						
P_1 (ground level)	8.88	18.51	101.40	18.51	6.81	4807.80
P_2 (30 cm)	10.33	19.77	96.47	19.77	7.66	5674.85
P_3 (60 cm)	10.55	23.21	87.47	12.21	8.20	6344.84
P_4 (90 cm)	13.66	29.26	85.32	29.29	9.18	7327.58
C.D at 5%	0.67	0.36	1.81	0.67	0.41	4.03
Nitrogen levels (N)						
N_1 (50 g/bush)	10.41	21.71	93.79	21.71	7.48	5715.45
N_2 (100 g/bush)	11.08	23.91	89.57	23.88	8.36	6371.14
N_3 (150 g/bush)	11.07	22.46	94.63	22.49	8.05	6029.84
C.D at 5%	0.58	0.42	1.56	0.58	0.35	3.49

Table 2. Effect of different levels of pruning and nitrogen on quality of phalsa.

Treatments	Fruit wt. (g)	Yield/bush (kg)	Yield/ha (kg)	TSS^o Brix	Acidity (%)	Total sugars (%)
Pruning levels (P)						
P_1 (ground level)	0.564	2.75	4581.5	12.10	2.35	9.97
P_2 (30 cm)	0.572	3.23	5386.6	13.32	2.49	10.41
P_3 (60 cm)	0.573	3.50	6025.4	14.58	2.66	10.75
P_4 (90 cm)	0.590	4.25	7080.5	16.17	2.86	11.22
C.D at 5%	0.015	0.13	65.39	0.37	0.031	0.083
Nitrogen levels (N)						
N_1 (50 g/bush)	0.574	3.25	5456.2	13.49	2.53	10.41
N_2 (100 g/bush)	0.579	3.61	6080.8	14.54	2.66	10.74
N_3 (150 g/bush)	0.572	3.43	5768.5	13.51	2.59	10.60
C.D at 5%	NS	0.11	56.63	0.32	0.027	0.072

significantly greater than the other treatment combinations. This might be attributed to the fact that poor nutritional conditions as well as, higher levels of nitrogen beyond the optimum are ineffective to plant growth. Similar trend was also observed in respect to fruit yield/ha (7080.5 kg). N_2 showed significantly higher fruit yield/bush and yield/ha (Table 2). Phalsa yield decreased with increase in the severity of pruning up to ground level. This could be due to the reduction in the number of new shoots/plant wherever severe pruning is resorted to. Reduction in total yield of

Table 3. Effect of different Treatment combinations on growth and yield of Phalsa.

Parameter	Nitrogen levels (N)								
	No. of cones/bush			No. of sprouted shoots/cone			Length of shoots (cm)		
Treatment combinations	N_1 (50 g/ bush)	N_2 (100 g/ bush)	N_3 (150 g/ bush)	N_1 (50 g /bush)	N_2 (100 g/ bush)	N_3 (150 g/ bush)	N_1 (50 g/ bush)	N_2 (100 g/ bush)	N_3 (150 g/ bush)
Pruning levels (P)									
P_1 (ground level)	8.00	9.66	9.00	18.33	19.22	17.99	102.1	98.33	103.77
P_2 (30 cm)	9.33	10.00	11.66	19.33	20.66	19.33	96.88	95.33	97.21
P_3 (60 cm)	11.00	10.33	10.33	21.33	24.22	24.10	89.55	83.10	89.77
P_4 (90 cm)	13.33	14.33	13.33	27.88	31.55	28.44	86.66	81.55	87.77
Interaction (P x N) C.D at 5%		0.99			0.73			3.13	

Treatment combinations	No. of fruiting nodes/shoot			No. of fruits/node			No. of fruits/bush		
	N_1 (50 g/ bush)	N_2 (100 g/ bush)	N_3 (150 g/ bush)	N_1 (50 g/ bush)	N_2 (100 g/ bush)	N_3 (150 g/ bush)	N_1(50 g/ bush)	N_2 (100 g/ bush)	N_3 (150 g/ bush)
Pruning levels (P)									
P_1 (ground level)	18.33	19.22	17.99	6.00	7.15	7.29	4385.96	5263.15	4774.30
P_2 (30 cm)	19.33	20.66	19.33	7.29	8.00	7.71	5438.95	5883.85	5701.75
P_3 (60 cm)	21.33	24.10	24.22	8.23	8.28	8.10	6140.35	6578.94	6315.74
P_4 (90 cm)	27.88	31.55	28.44	8.41	10.03	9.10	6896.55	7758.62	7327.58
Interaction (P x N) C.D at 5%		1.17			0.71			6.89	

Table 4. Effect of different treatment combinations on quality of Phalsa.

Parameter	Nitrogen levels (N)								
	Fruit wt. (g)			Yield/bush (kg)			Yield/ha (kg)		
Treatment combinations	N_1 (50 g/ bush)	N_2 (100 g/ bush)	N_3 (150 g/ bush)	N_1 (50 g/ bush)	N_2 (100 g/ bush)	N_3 (150 g/ bush)	N_1 (50 g/ bush)	N_2 (100 g/ bush)	N_3 (150 g/ bush)
Pruning levels (P)									
P_1 (ground level)	0.570	0.570	0.576	2.5	3	2.75	4165	4998	4581.5
P_2 (30 cm)	0.570	0.580	0.570	3.1	3.35	3.25	5164.6	5580.7	5414.5
P_3 (60 cm)	0.573	0.570	0.550	3.4	3.6	3.5	5831.3	6247.5	5997.6
P_4 (90 cm)	0.583	0.596	0.593	4	4.5	4.25	6664.0	7497.0	7080.5
Interaction (P x N) C.D at 5%		NS			0.23			113.27	

Table 4. Contd.

Parameter	Nitrogen levels (N)								
	TSS° Brix			Acidity (%)			Total sugars (%)		
Treatment combinations	**N_1 (50 g /bush)**	**N_2 (100 g /bush)**	**N_3 (150 g /bush)**	**N_1 (50 g /bush)**	**N_2 (100 g /bush)**	**N_3 (150 g /bush)**	**N_1(50 g /bush)**	**N_2 (100 g /bush)**	**N_3 (150 g /bush)**
Pruning levels (P)									
P_1 (ground level)	11.33	12.55	12.44	2.32	2.39	2.36	9.81	10.13	9.98
P_2 (30 cm)	12.88	13.77	13.33	2.42	2.56	2.49	10.26	10.55	10.42
P_3 (60 cm)	14.11	14.88	14.77	2.61	2.72	2.67	10.49	10.95	10.82
P_4 (90 cm)	15.66	16.99	15.77	2.78	2.98	2.84	11.09	11.36	11.21
Interaction (P x N) C.D at 5%		NS			0.71			NS	

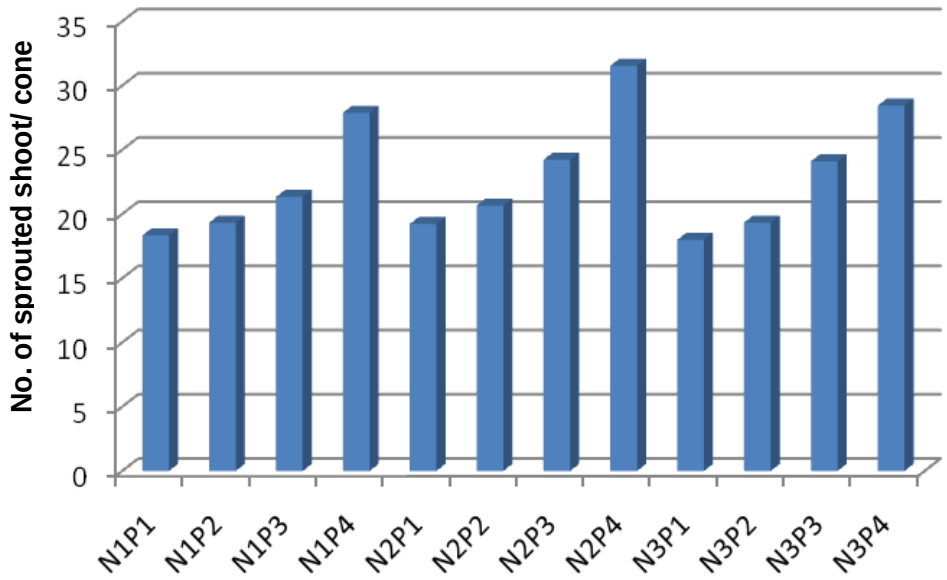

Figure 1. Effect of different treatment combinations on number of Sprouted shoots/ cone.

Reddy (1987), Reddy and Reddy (1986) and Singh and Singh (1999).

The highest total soluble solid (16.17°Brix), acidity (2.86%) and total sugars (11.22%) was recorded under the light pruning (P_4) level whereas, lowest T.S.S (12.10°Brix), acidity Phalsa has also been reported by Hayes (1957), (2.35%) and total sugars (9.97%) was recorded under the severe pruning (P_1) level. However,

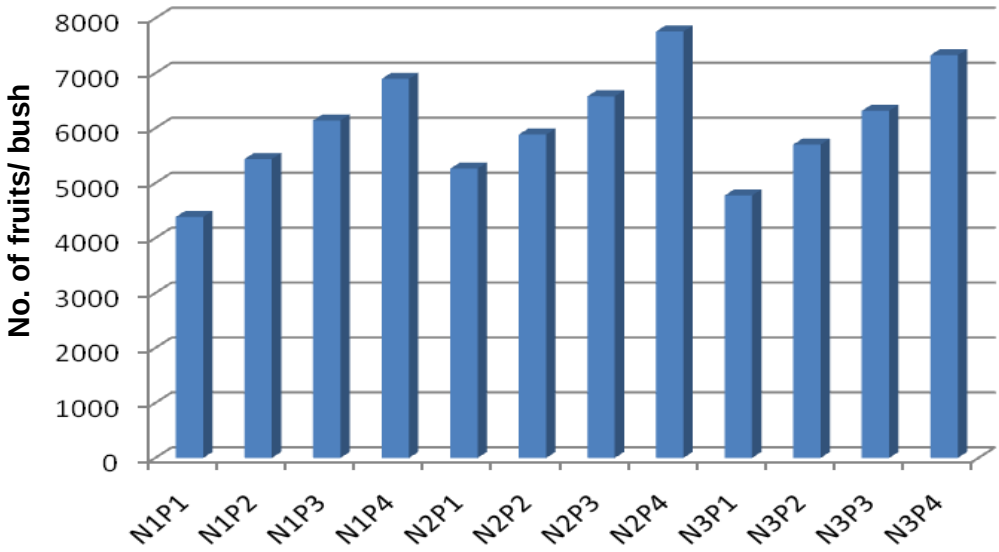

Figure 2. Effect of different treatment combinations on no. of fruits/ bush.

the interaction between the nitrogen and pruning shows non significant effect on T.S.S and total sugars; whereas, maximum acidity was recorded in N_2P_4 treatment combination which was found to be significantly greater than all the other treatment combinations. Similarly, N_2 level recorded significantly the highest T.S.S (14.54°Brix), acidity (2.66%) and total sugars (10.74%) and was found to be at par with N_1 and N_3 level of Nitrogen. The T.S.S, acidity and total sugars decreased with the increase in severity of pruning. It may possibly be due to small fruits obtained from lightly pruned bushes than the heavy pruned ones. These findings were also observed by Schneider et al. (1998) in Peach and Singh and Sharma (1961) in Phalsa.

Conclusion

The pruning level at 90 cm had significantly maximum number of canes (13.66), number of sprouted shoots cane (29.29), number of fruiting nodes/shoot (29.29), number of fruits/node (9.18) and number of fruits/bush (4327.28), which ultimately leads to maximum fruit weight (0.59 g), fruit yield/bush (4.25 g) and fruit yield (80.5 kg). Moreover, total soluble solids, acidity and total sugars were also recorded maximum in light pruning (P_4). Regardless of severity of pruning, application of nitrogen at 100 g/bush showed significantly maximum number of canes/bush, number of sprouted shoots/cane, number of fruiting nodes/shoot, number of fruits/node, number of fruits/bush, fruit yield/bush and fruit yield/ha.

From the findings of the present investigation, it may be concluded that to obtain highest yield of good quality Phalsa, the canes in the bushes should be pruned at the height of 90 cm above ground level and nitrogen should be applied at the rate of 100 g/bush.

REFERENCES

Chadha KL, Singh L (1991). Effect of varying levels of nitrogen on growth, yield and quality of Phalsa. India J. Hortic. 28(4):257.
Hayes WB (1957). Fruit growing in Indian Kitabistan, Allahabad. p. 232.
Rangana S (1986). Manual analysis of fruit and vegetable products. Tata Publishing Ltd, New Delhi.
Rao J, Reddy MGR (1989). Effect of time and severity of pruning on yield of Phalsa (*Grevia subinaequalis*). South Indian Hort. 37(1):5-7.
Reddy YN (1987). Studies on growth pattern, adaptability and crop regulation in semi arid fruit crops. Annu. Rep. IIHR Bangalore pp. 24-25.
Reddy YTN, Reddy YN (1986). Standardization of agro techniques for some semi-arid fruits pomegranate, ber, phalsa and anona. Annu. Rep. IIHP, Bangalore p. 25.
Said M, Ali SSM (1989). Pruning requirements of peach trees, variety-6-A. Agric. Pak. 10:65-72.
Schneider GW, Jones ID, Meelung AC (1998). Studies on pruning effects, rate and time of nitrogen fertilization on certain chemical and physical characteristics of the peach fruit. Proc. Am. Soc. Hort. Sci. 71:110-111.
Shinde NM, Warke DC, Sontakke MB (1976). Effect of different /iod on growth and yield of Phalsa. J. Maharashtra Agric. 1:157-58.
Singh RP, Gaur GS (1989). Growth and yield of Phalsa as affected by N, P and k. Haryana J. Hort. Sci. 18:1-2, 40-45
Singh AR, Singh GN (1999). Effect of different levels of nitrogen and pruning on growth and yield of Phalsa. Orrisa of Hort. 31(2):2003.
Singh JP, Sharma (1961). Effect of time and severity of pruning on growth, yield and quality of Phalsa. India J. Hort. 18(1):20-27.
Sontakke MB, Shinde NN, Wark DC (1976). Effect of pruning at different /iods on growth and yield of Phalsa under Pharbani (Maharashtra) conditions. J. Maharashtra Agric. Univ. 1(2-6):157-158.