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Research Article

EFFECT OF PRUNING TIME AND INTENSITY ON YIELD AND QUALITY OF PHALSA

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Abstract: Pruning in fruits is a prerequisite for better yield and quality practiced with respect to their bearing habit. Phalsa bear fruits on current season growth, hence the present investigation was carried out to study the effect of pruning time and intensity on yield and quality of phalsa. The research study was conducted with two factors *i.e.*, pruning time (1st Jan, 15th Jan, 1st Feb and 15th Feb) and pruning intensity (60, 80, 100, 120 cm above ground level). The results of the study revealed that pruning on 1st Feb proved to be the best in minimizing the days taken to sprouting and flowering. It was also superior in increasing the yield and quality parameters of phalsa fruits. Among pruning intensity, the plants pruned at 100 cm above ground level (AGL) was found to be the most effective than other treatments in terms of minimizing the time for sprouting, flowering and resulted in to good fruit quality attributes. Among interaction between pruning time and intensity, the treatment combination of 1 Feb and 100 cm AGL has been found most effective to increase the vegetative growth, flowering, fruiting and improving the quality of phalsa fruits regarding their quality attributes.

Keywords: *Phalsa, Pruning time, Pruning intensity, Quality, Yield*

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Introduction

Phalsa, *Grewia asiatica* L. (syn. *Grewia subinaequalis* DC) is native to the Indian sub-continent and South-East Asia belongs to family Tiliaceae, to which our major money earning fibre crop, jute also belongs. It is a minor crop of arid and semi-arid regions and it can tolerate high temperature. Phalsa is considered to be an antioxidant in nature; it is highly admired for its refreshing and flavorsome taste, appealing bright colour, excellent aroma, nutritional and medicinal value [1]. Grewia species is one of the best multipurpose fruit species which are useful source of food, fodder, fiber, fuel wood, timber and range of traditional medicines which cure a number of diseases [2].

Normally, in phalsa many pickings have to be done because the fruits on the bush do not ripen at the same time. There are some factors which affect the quality and production among those, pruning plays a dynamic role in obtaining good quality and high yield of phalsa as the fruit buds are developed on current year growth which improves its colouration and size of fruit. Pruning is the critical operation to maintain the plant vigour and good quality fruit with higher yield [3]. In addition to pruning intensity, appropriate time of pruning is also an important factor for better production and good quality fruit. As pruning can regulate the maturity of phalsa fruits which results in the systematic marketing of this perishable fruit that gives benefit to both consumer and grower [4]. Hence, the present research was conducted to evaluate the appropriate pruning time and intensity for obtaining the good quality fruits with better yield in phalsa.

Materials and Methods

The present study on the effect of pruning time and intensity on yield and quality of phalsa was carried out during 2019-20 in the phalsa block of orchard, P.G. Department of Agriculture, Khalsa College, Amritsar. The prevailing climatic condition of Amritsar is sub-tropical humid. It receives an annual rainfall of 703 mm, the major portion of which falls from July to September. During winter, frost is of common occurrence while in summer, the atmospheric temperature occasionally reaches up to 44°C. The soil of the orchard was well drained and fairly fertile with pH of 7.5, electrical conductivity of 0.15 mmhos per cm and the source of irrigation was tube well in the orchard. The study will be carried out on 6 years old phalsa plants which were provided with uniform cultural practices. Uniform healthy plants were selected and subjected to the following treatments. Plants were pruned at different dates and provided with different pruning intensities and observed for their effect on tree yield and quality of their fruits. Single plant was kept as a unit of per replication. The plants were pruned with the help of secateurs at different pruning intensities and the cut ends were smeared with a Bordeaux paste. Four pruning time (D_1: 1st January, D_2: 15th January, D_3: 1st February and D_4: 15th February) were considered as Factor-A and four pruning intensities (T_1: 60 cm AGL, T_2: 80 cm AGL, T_3: 100 cm AGL, T_4: 120 cm AGL and T_5: Control (Un-pruned plants) were considered as Factor B.

Vegetative and Floral Parameters

Days taken for sprouting

The days taken for sprouting were recorded by calculating the days taken to sprouting from the pruned shoots.

Emergence of new shoots per branch

The emergence of new shoots per branch was calculated by counting the number of new shoots per branch produced on each pruned bush.

Number of leaves per branch

It was calculated by randomly selecting ten branches from each bush and average number of leaves on those branches was counted.

Total number of flowers per plant

It was calculated by product of average number of flowers per branch and total number of branches.

Days taken to fruit setting

Days taken to fruit setting were counted from flowering to fruiting setting.

Physical parameters

Fruit weight

Fruit weight was calculated by taking random sample of fifty selected fruits from each treatment and weighed with the help of electronic weighing balance. Average weight per fruit in terms of gram was calculated by dividing cumulative weight to the total number of fruits.

Fruit quality measurements

Total soluble solids

The juice of randomly selected mature fruits was extracted through muslin cloth. Total soluble solids content of juice was determined with the help of ATAGO digital hand refractometer. Few drops of juice were placed on the surface of prism and TSS value was displayed digitally.

Titratable acidity

Two ml of strained juice was titrated against 0.1N NaOH solution using phenolphthalein as an indicator. The end point was noted with change in colour from colourless to light pink. The results were expressed in terms of per cent acidity.

Titratable acidity = (0.0067 × 0.1 N NaOH) / (Volume of juice taken (ml)) × 100

Yield measurement

Fruit yield

Fruit yield (Kg/plant) estimated by weighing total number of fruits picked per plant.

Statistical analysis

The experiment was laid out in Completely Randomized Design having three replications. The data were analyzed with two-way analysis of variance (ANOVA) and LSD test was used to separate the means. Data were statistically considered significant at p≤0.05 with the statistical software Statistix 10.

Results and Discussion

Emergence of new shoots/plant

The data regarding to the emergence of new shoots per plant are presented in the [Table-1]. Maximum emergence of new shoots/plant were counted in plants pruned on 1st Feb whereas, minimum emergence was registered on 1st Jan. Pruning intensity also showed significant findings with respect to emergence of new shoots/plant. Maximum emergence of new shoots/plant was recorded in pruning at 100 cm AGL and minimum emergences were in un-pruned plants. Similar results with respect to enhanced number of new shoots correspondingly to the pruning intensity were reported in plum [5] and ber plants [6].

Table-1 Effect of pruning on emergence of new shoots per plant in phalsa

Time of pruning	Level of pruning					Mean D
	T1	T2	T3	T4	T5	
D1	26.57	28.82	29.79	26.68	24.89	27.35
D2	27.23	29.72	31.98	29.56	26.66	29.03
D3	29.95	33.26	35.57	31.45	27.96	31.63
D4	28.77	31.93	33.54	30.57	26.74	30.31
Mean T	28.13	30.93	32.72	29.56	26.56	
CD at 5% D: 0.021; T: 0.024; D×T: 0.049						

Table-2 Effect of pruning on number of leaves per branch in phalsa

Time of pruning	Level of pruning					Mean D
	T1	T2	T3	T4	T5	
D1	19.1	21.4	22.3	21.8	18.7	20.66
D2	20.5	21.9	23.8	21.6	19.8	21.52
D3	21.8	23.7	24.5	22.7	20.9	22.72
D4	19.5	21.8	22.7	22.5	18.9	21.08
Mean T	20.22	22.21	23.32	22.15	19.57	
CD at 5% D: 0.16; T: 0.18; D×T: 0.37						

Number of leaves/branch

The effect of pruning time and intensity on number of leaves/branch of phalsa is shown in the [Table-2]. Maximum mean number of leaves per branch was counted on pruning date of 1st Feb while minimum was registered on 1st Jan. Pruning intensity had significant effect (p≤0.05) on the number of leaves per branch. Highest mean number of leaves was counted in the plants pruned at 100 cm AGL and minimum leaf count was noted in Control. The increase in the number of leaves is might be due to pruning leads to more vegetative growth so that more number of leaves was produced. The results of the present studies corroborate with the findings in guava plants [7] and plum plants [5].

Days taken to sprouting

The data presented in [Table-3] showed that the days taken to sprouting was significantly influenced by pruning time. Minimum days taken to sprouting were recorded on 1st Feb pruning while the maximum days taken to sprouting were noted on 1st Jan pruning. While going through the data on pruning intensities, it was noted that the maximum days taken to sprouting was recorded in control whereas, minimum days were noted in pruning at 100 cm AGL. The early sprouting might be due to pruning leads to more light interception and not promoting apical dominance thus more buds were produced. These results are supported by the findings in guava plants [7] and ber plants [8].

Table-3 Effect of pruning on days taken to sprouting in phalsa

Time of pruning	Level of pruning					Mean D
	T1	T2	T3	T4	T5	
D1	40.7	38.6	35.9	37.2	41.8	38.84
D2	36.7	33.6	30.4	33.8	40.7	35.04
D3	33.6	30.7	28.5	29.3	37.9	32.12
D4	32.7	31.2	30.6	31.8	38.5	32.96
Mean T	35.92	33.52	31.35	33.02	39.72	
CD at 5% D: 0.162; T: 0.181; D×T: 0.363						

Number of flowers per plant

The data with regard to number of flowers per plant as affected by pruning time and pruning levels are presented in [Table-4]. Time of pruning effectively influenced the number of flowers per plant with highest number of flowers per plant were registered on 1st Feb pruning while minimum number of flowers were counted on 1st Jan pruning. Pruning intensity also showed their effect with respect to number of flowers per plant. Maximum mean number of flowers per plant was counted in the plants pruned at 100 cm AGL while minimum number of flowers per plant was recorded in Control. These results are in agreement to the previous findings in peach plants [9, 10].

Table-4 Effect of pruning on number of flowers per plant in phalsa

Time of Pruning	Level of pruning					Mean D
	T1	T2	T3	T4	T5	
D1	1279.27	1297.34	1372.57	1325.29	1199.72	1294.83
D2	1331.85	1385.92	1410.62	1374.94	1233.18	1347.30
D3	1369.29	1399.08	1418.18	1392.02	1245.55	1364.82
D4	1354.58	1389.37	1378.43	1395.52	1226.41	1348.86
CD at 5% D: 0.022; T: 0.025; D×T: 0.049						

Days taken to fruit setting

The results of the present study indicated that the time of pruning and pruning intensity significantly influenced the days taken to fruit setting as presented in [Table-5]. Maximum days taken to fruit setting were recorded in plants pruned on an and minimum fruit setting was observed in 1st Feb pruning. The days taken to fruit setting was also significantly (p≤0.05) affected by the intensity of pruning. Minimum number of days taken to fruit setting was noted plants pruned at 100 cm AGL while maximum days taken for fruit setting were observed in control. The early sprouting of bud led to early flowering and fruiting. Similar results for fruit setting with respect to pruning time and pruning intensity is found in mango [11] and phalsa [12].

Table-5 Effect of pruning on days taken to fruit setting in phalsa

Time of pruning	Level of pruning					Mean D
	T1	T2	T3	T4	T5	
D1	91.17	90.72	88.68	89.67	92.35	90.51
D2	88.54	87.41	85.58	87.63	89.23	87.67
D3	87.51	85.96	83.14	85.24	87.72	85.91
D4	87.64	86.81	85.86	87.88	88.86	87.41
Mean T	88.71	87.72	85.81	87.60	89.54	
CD at 5% D: 0.016; T: 0.018; D×T: 0.036						

Fruit weight

It is evident from the results shown in [Table-6] that a marked significant variation was found in the weight of fruits of phalsa with respect to pruning time and intensity. The pruning on 1st Feb registered heaviest fruits followed by lesser in case of 1st Jan 1 pruning. The pruning at 100 cm AGL was the most effective in producing heaviest fruits while the lowest fruit weight was recorded in un-pruned plants. The increase in weight of fruit might be due to the more number and area of leaves results in more photosynthates formation consequently increased the fruit weight. These results were confirmed with the previous findings in nectarine peach [9] and mango [11].

Table-6 Effect of pruning on fruit weight (g) in phalsa

Time of Pruning	Level of pruning					Mean D
	T1	T2	T3	T4	T5	
D1	0.62	0.73	0.79	0.77	0.56	0.69
D2	0.65	0.78	0.85	0.79	0.59	0.73
D3	0.71	0.81	0.83	0.82	0.65	0.76
D4	0.69	0.76	0.79	0.75	0.61	0.72
Mean T	0.66	0.77	0.81	0.78	0.60	
CD at 5% D: 0.021; T: 0.023; D×T: NS						

Total soluble solids

The results of the present study with respect to the total soluble solids are presented in [Table-7]. The highest TSS were recorded in fruits of plants pruned on 1st Feb while the lowest TSS were analyzed in fruits from 1st Jan pruned plants. Regard to pruning intensity, highest TSS was recorded in plants pruned at 100 cm AGL while least TSS was estimated in control plants. The high TSS might be due to the pruning, there is less competition for metabolites and more photosynthetic material is formed in the leaves, thus it improves growth of the plant and quality parameters of fruits. Similar findings have been noted in nectarine peach [9], peach [10] and mango [11].

Table-7 Effect of pruning on total soluble solids (%) in phalsa

Time of Pruning	Level of pruning					Mean D
	T1	T2	T3	T4	T5	
D1	17.96	19.53	20.34	19.43	17.72	18.99
D2	18.51	19.98	21.12	19.65	18.23	19.49
D3	18.94	19.76	21.56	20.31	18.56	19.82
D4	18.43	19.88	20.75	18.91	17.88	19.17
Mean T	18.46	19.78	20.94	19.57	18.09	
CD at 5% D: 0.019; T: 0.022; D×T: 0.044						

Titratable Acidity

Titratable acidity of phalsa fruits was significantly influenced with the pruning time and intensity as presented in [Table-8]. Pruning time had its marked effects on titratable acidity of phalsa fruits with highest titratable acidity was detected in 1st Jan pruning while lowest titratable acidity was noted on 15th Feb pruning. Pruning intensity provided to the experimental plants markedly influenced the titratable acidity as lowest titratable acidity was observed in un-pruned plants, however highest acidity was noted in planed pruned at 60 cm AGL. Results are in line with finding in ber [8].

Table-8 Effect of pruning on titratable acidity (%) in phalsa

Time of Pruning	Level of pruning					Mean D
	T1	T2	T3	T4	T5	
D1	3.06	3.01	2.52	2.64	2.04	2.65
D2	2.69	2.49	2.34	2.68	2.11	2.46
D3	2.82	2.61	2.15	2.51	2.22	2.46
D4	2.58	2.47	2.33	2.46	2.13	2.39
Mean T	2.78	2.64	2.33	2.57	2.12	
CD at 5% D: 0.021; T: 0.023; D×T: 0.047						

Yield per bush

Time and intensity of pruning showed significant effects on the yield of phalsa as presented in [Table-9]. Maximum fruit yield was recorded in 1st Feb pruned plants whereas, least fruit yield was produced by plants pruned on 1st Jan. Pruning intensity also had marked effect on the fruit yield per tree. Maximum fruit yield was recorded in pruning at 100 cm AGL while lowest yield was recorded in control plants. The main reason for increase in the yield might be that pruning leads to more canopy and leaf area which results in high light penetration and assimilation of photosynthetic material thus more number of fruits were produced. The above results are in conformity with ber [8] and peach [10].

Table-9 Effect of pruning on yield per bush (Kg/tree) in phalsa

Time of pruning	Level of pruning					Mean D
	T1	T2	T3	T4	T5	
D1	1.76	2.22	2.74	1.77	1.71	2.04
D2	1.84	2.61	2.83	2.14	1.89	2.26
D3	2.21	2.72	3.12	2.35	1.82	2.44
D4	1.74	2.45	2.71	2.47	1.75	2.22
Mean T	1.88	2.51	2.85	2.18	1.79	
CD at 5% D: 0.022; T: 0.025; D×T: 0.050						

Conclusion

Among the different pruning time, 1st February was found to be the best pruning time for increasing the number of flowers and fruits, fruit size, yield and fruit quality parameters. Regarding pruning intensity, 100 cm above ground level can be utilized for maximum number of shoots resulting in excellent responses on the yield and better fruit quality. On the basis of overall performance, the study indicated that 100 cm AGL pruning on 1st Feb was found superior among all the treatments for yield and improvement of fruit quality of phalsa in subtropical climatic condition of Punjab.

Application of research: Research is helpful throughout the international level in order to improve the yield and quality of phalsa because there are huge yield and quality losses due to the improper pruning or no pruning.

Research Category: Preharvest Management (Pruning Time and Pruning Intensity), Yield and Quality Control.

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Study area / Sample Collection: Orchard of Horticulture Department, Khalsa College, Amritsar

Cultivar / Variety / Breed name: Phalsa variety Local

Conflict of Interest: None declared

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References

[1] Lakra S., Kerketta A., Ekka R.A., Saravanan S. (2018) *International Journal of Current Microbiology and Applied Science*, 7, 2882-2885.
[2] Sharma N., Patni V. (2012) *Asian Journal of Pharmaceutical Clinical Research*, 5(3), 28-32.
[3] Meghwal P.R. (2006) *Annals Arid Zone*, 45, 59-62.
[4] Ghaffoor, Rahman A.S., Jilani S., Waseem K., Nadeem M.A. (2001) *Journal of Biological Sciences*, 1, 338-340.
[5] Kumar J., Thakur D (2012) *Asian Journal of Horticulture*, 7(2), 484-487.

[6] Kumar H., Katiyar P.N., Singh A.K., Rajkumar B.V. (2014) *International Journal of Current Microbiology and Applied Science*, 3(5), 935-940.
[7] Adhikari S., Kandel T.P. (2015) *International Journal of Fruit Science*, 15(3), 290-301.
[8] Gola A.Q., Jakhro M.I., Tareen A.K., Mastoi M.S., Khosa M.A. (2018) *Pure and Applied Biology*, 7(4), 1261-1267.
[9] Thakur N., Rana V.S. (2014) *Journal of Horticultural Sciences*, 9(1), 23-26.
[10] Singh A., Deka B.C., Patel R.K., Nath A., Mulieh S.R. (2012) *Indian Journal of Agricultural Sciences*, 82(10), 862– 866.
[11] Uddin M.S., Hossain M.F., Islam M.S., Hossian M.M., Uddin M.S. (2014) *Bulletin of the Institute of Tropical Agriculture, Kyushu University*, 37, 41-47.
[12] Chaturvedi S.K., Ram R.M., Dwivedi H.D., Meena M.L. (2014) *Indian Journal of Horticulture*, 71(6), 481-485.