GROWTH AND YIELD RESPONSE OF PHALSA/FALSA(*GREWIA ASIATICA* L.) TO VARIOUS PRUNING INTENSITIES AND DATES

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Abstract

The project was launched to check the effect of different pruning intensities (75 cm, 100 cm, 125 cm & 150 cm above the ground level) as Factor-A and various pruning dates (22 Dec:, 07 Jan:, 23 Jan: & 08 Feb:) as Factor-B on the production of phalsa/falsa. Pruning levels significantly affected the days taken to sprouting, flowering, fruit setting, number of branches/plant, length of branches, number of fruit clusters/plant and weight of clusters. Among different pruning intensities, 100 cm pruning gave the maximum number of clusters/plant (1771) and the highest yield/plant (18.41 kg). Various pruning dates significantly affected the days taken to sprouting, number of leaves/ branch and number of branches/ plant. Comparing to other dates, pruning on 22 December produced maximum number of fruit clusters/plant (1660) and the highest yield/plant (18.17 kg).

Keywords: *Phalsa/falsa, Grewia asiatica, Pruning intensities, Pruning dates, Drupe, Sprouting, Flowering, Clusters.*

Introduction

Phalsa (*Grewia asiatica* L.) belongs to the family Tiliaceae and is probably native to Indo-Pak subcontinent. More than one hundred species are established in the genus *Grewia,* but the two important and known species of falsa are *tall* and *dwarf.* Tall is found in wild form in the central and southern India, but the dwarf is cultivated both in Pakistan and India. It is a middle size, bushy and deciduous tree with greyish-white to grey-brown bark, whitish sapwood and leaves 7.5cm- 12.5cm x 5cm x 7.5cm, obeliquly ovate rounded or slightly cordate at the base, acuminate, minutely serrate, shoots tomentose *(Ginai, 1969).* Phalsa thrives best in tropical climates. Sandy or rich loamy soils free from alkalies are best suited for its growth and development. Clay soils produce heavy vegetative growth and plants become tall and bushy. It is a successful crop of arid and semi-arid regions. Hot dry summers are considered necessary for the ripening of fruits. It can withstand light frost. It can tolerate high temperature upto 40°C and drought. (Singh, 1980)

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Flowers are hermaphrodite and are borne laterally on new growth of the current season which arises from lateral buds on the canes. Fruit is a glubose drupe with pleasantly acid pulp, indistinctly lobed. The fruit is borne in clusters of 18-24 drupes, in the axils of leaves only on the growing shoots. The fruits are globular, smooth, deep and reddish brown. Owing to its poor storage quality, phalsa is grown on a very limited scale, mostly in the vicinity of towns. It has, however, considerable prospects for making Phalsa juice and syrup which are highly esteemed as a refreshing and cooling drink. Phalsa is also a good source of vitamin A & C. There are many factors responsible for its decline in fruit production such as un-pruning and inadequate levels of fertilizers etc. Pruning is considered to be the most suitable and cheepest practice to regulate yield and quality in Falsa (Ahmad and Ghafoor 1962). In pruned trees, the size and colour of the fruit also improves due to more exposure to light. Pruning at a height of 1.04 to 1.20 m is considered best which produces a greater number of shoots and a much higher yield than pruning at 0.5 to 0.75 m or at just ground level. The size of the fruit was in immense proportion to the yield but the small fruit gave juice of a higher specific gravity (*Ginai, 1969*). Ghaffoor *et al.,* (2001) reported that maximum number of branches, number of clusters per plant, number of fruits per cluster weight of cluster per plant and total yield per plant was obtained in the pruning level of 90 cm above the ground level. Annual pruning encourages new vigorous shoots and ensures regular and heavy fruiting.

Plants can be pruned any time during December or January when they are dormant. Flowering is greatly influenced by pruning time. It has been reported that flower initiation is advanced if the pruning is done during November to January as compared to February pruning. However, fruit yield obtained is extremely low from November to December pruning whereas February pruning gave maximum fruit yield (Chanker, 1969).

Non pruning is one of the most important factor responsible for the decline in yield and quality of phalsa in D.I.Khan., therefore, the present studies were undertaken to find out the optimum level of pruning and also the suitable time of pruning for obtaining better yield.

Materials and Methods

An investigation was conducted to evaluate the "Effect of different dates and pruning intensities on the growth and yield of phalsa" at an established Phalsa Orchard of Fruit and Vegetable Development Board, D.I.Khan., N.W.F.P, Pakistan, during the year 1997-98. The project was performed

according to 2-Factorial experiment (Pruning Intensities as Factor-A and Pruning Dates as Factor-B) with three replicates using Randomized Complete Block Design. Two trees were selected for each treatment. About seven years old phalsa trees were selected for the study. The plants of similar size and vigour were included in each level of both the factors. All the cultural requirements (weeding, irrigations, fertilization and spraying for insects and diseases) were uniformly performed for each tree. The distance between two successive trees was 2.5 m and the rows were spaced 3 m apart. The detail of both the factors is given as under;

	PRUNING INTENSITIES			PRUNING DATES
P1	075 cm above ground level.		D1	22 December 1997
P2	100 cm	---do---	D2	07 January 1998
P3	125 cm	---do---	D3	23 January 1998
P4	150 cm	---do---	D4	08 February 1998

The parameters recorded in the study were number of branches/plant, length of branches (cm), number of leaves/branch, days taken to bud sprouting, days taken to flowering, days taken to fruit setting, number of fruit clusters/plant, number of fruits/cluster, weight of clusters (g) and yield of fruit/ plant (kg). All the data were collected in April-June.

Statistical analysis

The data were analyzed using the Analysis of Variance Techniques *(Steel & Torrie, 1980)* and Duncan's Multiple Range Test *(Duncan, 1955)* to check the differences among the different treatment means. The analysis were performed by the help of computer using MSTATC software package.

Results and Discussion

1. Number of branches per plant

Branches are the major part of the tree bearing fruits. The large number of branches means the higher production of the fruit. Data on number of branches per plant (Table 2) expressed significant results in both cases. Pruning at 100 cm height and on 23 January gave the highest number of branches and these results are in accordance with those the findings of Ghaffoor *et al.*, (2001) who reported that pruning at 90 cm above the ground level gave more number of branches per tree.

2. Length of branches

The results pertaining to length of branches are presented in Table 2. Significant differences were observed with pruning at different levels. 75 cm and 7 January pruning produced the longest branches (145.8 & 135.8 cm) due to suitability of this level.

3. Number of leaves per branch

The results (Table 2) indicated that the different levels of pruning had no significant effect on number of leaves per branch. However, pruning at different dates gave significant results in case of leaves production. The maximum number of leaves (21.48) from 7 January which was at par with 23 January pruning (21.00) emphasizes these dates for increased leaf initaition while 75 cm pruning intensity also increased the number of leaves (21.10).

4. Days taken to sprouting

Sprouting is an essential factor which plays an important role in the higher production of phalsa. Statistically number of days taken to sprouting showed significant results (Table 2) in case of different pruning intensities as well as different pruning dates. 150 cm and 22 December pruning took the lowest number of days (36.50 & 36.75) which show that the said pruning level and date are the most effective.

5. Days taken to flowering

The data regarding the number of days taken to flowering are presented in Table 2. According to that, various pruning levels showed significant variations. The shortest time taken to flowering (26.17 days) by 125 cm pruning while the pruning of 8th February gave the minimum days (26.58) to flowering. Pruning gave more shoot growth, number of flowers and fruits than control (Goldschmidt, 1973).

6. Days taken to fruit setting

Fruit setting is the most vital yield component. The data analysis (Table 2) revealed significant results in case of various pruning intensities. Earlier fruit setting (9.58 days) was observed in case of 75 cm pruning height, which was statistically at par with 100 cm pruning level with 10.08 days. The results

demonstrate that different pruning dates had no significant effect on fruit setting. However, the earliest fruit setting was recorded at 23rd January pruning.

7. Number of fruit clusters per plant

One of the most important yield component is the number of fruit clusters per plant. Different pruning levels significantly affected the number of clusters per plant (Table 2) with maximum fruit clusters (1771) were recorded in 100 cm pruning which showed its significance over other pruning levels while 22 December gave the best response (1660) in the same aspect. Similar results were obtained by Ghaffoor *et al.*,(2001) who also observed that pruning at a height of 90 cm above the ground level, produced more number of fruit clusters.

8. Number of fruits per clusters

In case of number of fruits per cluster (Table 2), there was no prominent effect of pruning levels and pruning dates observed. Maximum number of fruits were counted as 16.42 per cluster at 125 cm pruning level whereas 7 January gave the maximum number of fruits (16.00) per cluster.

9. Weight of clusters (g)

The data concerning the weight of cluster are given in Table 2. Different pruning intensities significantly affected the weight of clusters. Weight of cluster (11.31 gm) produced by 125 cm pruning level was the best whereas the maximum weight of cluster (11.18 gm) was obtained at 23 January pruning date. This may be due to the environmental conditions, pruning level and pruning dates. The results are in agreement with the findings of Ghaffor *et al.*, (2001) who stated that fruit weight was much influenced at the pruning level of 90 cm above the ground level.

10. Yield of fruit per plant (kg)

The ultimate aim of the research is to get the maximum yield. The results regarding the yield of fruit per plant Table 2 revealed the non-significant results in both the factors. However, 100 cm pruning gave the highest yield i.e. 18.41 kg which was at par with 125 cm pruning level (18.39 kg). As far as the pruning dates are concerned, 22 December gave the maximum yield (18.17 kg). Wazir (1980), Shanker (1985), Ghafoor and Rehman (1987) and Rao and Reddy (1989) reported that the highest fruit yields were obtained by pruning the Phalsa trees upto 125 cm height.

Table 1. Analysis of variance table

SOV	D.F.	S.S.	M.S.	F.Ratio	Prob:	LSD Value
DAYS TAKEN TO SPROUTING						
Replication	2	12.125	6.063			
Intensities	3	39.063	13.021	3.5769	0.0253	1.591
Dates	3	23.729	7.910	2.1728	0.1119	1.591
Interaction	9	28.688	3.188	0.8756		3.181
Error	30	109.208	3.640			
Total	47	212.813	Coefficient of Variation. = 5.03 %			
DAYS TAKEN TO FLOWERING						
Replication			**2**	**8.792**		**4.396**
Intensities	3	8.667	2.889	1.8103	0.1666	1.053
Dates	3	3.000	1.000	0.6266	0.0036	1.053
Interaction	9	52.333	5.815	3.6437		2.107
Error	30	47.875	1.596			
Total	47	120.667	Coefficient of Variation. = 4.71 %			
DAYS TAKEN TO FRUIT SETTING						
Replication	2	4.042	2.021			
Intensities	3	14.167	4.722	3.7322	0.0216	0.9377
Dates	3	0.833	0.278	0.2195	0.0460	0.9377
Interaction	9	25.667	2.852	2.2539		1.875
Error	30	37.958	1.265			
Total	47	82.667	Coefficient of Variation. = 10.39 %			
LENGTH OF BRANCHES (CM)						
Replication	2	172.246	86.123			
Intensities	3	4685.678	1561.893	36.6784	0.0000	5.441
Dates	3	188.789	62.930	1.4778	0.2405	5.441
Interaction	9	3432.052	381.339	8.9551		10.88
Error	30	1277.503	42.583			
Total	47	9756.268	Coefficient of Variation. = 4.93 %			

NUMBER OF LEAVES PER BRANCH

Replication	2	18.539	9.270			
Intensities	3	04.810	1.603	0.7482	0.0586	1.221
Dates	3	17.823	5.941	2.7722	0.0025	1.221
Interaction	9	74.118	8.235	3.8428		2.441
Error	30	64.292	2.143			
Total	47	179.582	Coefficient of Variation.			= 7.05 %

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NUMBER OF BRANCHES PER PLANT

Replication	2	113.167	56.583			
Intensities	3	2540.500	846.833	18.4518	0.0000	5.648
Dates	3	479.167	159.722	03.4802	0.0280	5.648
Interaction	9	7666.000	851.778	18.5595		11.30
Error	30	1376.833	45.894			
Total	47	12175.667	Coefficient of Variation.			= 3.06 %

NUMBER OF FRUIT CLUSTERS PER PLANT

Replication	2	145876.792	72938.396			
Intensities	3	418877.229	139625.743	4.4006	0.0111	148.5
Dates	3	111778.563	37259.521	1.1743	0.3360	148.5
Interaction	9	730123.354	81124.817	2.5568		297.0
Error	30	951868.542	31728.951			
Total	47	2358524.479	Coefficient of Variation.			= 10.97 %

NUMBER OF FRUIT PER CLUSTER

Replication	2	9.735	04.867			
Intensities	3	35.648	11.883	1.3322	0.2824	2.490
Dates	3	24.940	08.313	0.9320	0.0161	2.490
Interaction	9	225.604	25.067	2.8103		4.980
Error	30	267.594	08.920			
Total	47	563.521	Coefficient of Variation.			= 19.44 %

WEIGHT OF CLUSTERS (g)

Replication	2	3.947	1.974			
Intensities	3	11.667	3.889	2.4519	0.0827	1.050
Dates	3	8.501	2.834	1.7866	0.1710	1.050
Interaction	9	35.642	3.960	2.4968		2.100
Error	30	47.584	1.586			
Total	47	107.342	Coefficient of Variation.			= 11.73 %

YIELD OF FRUIT PER PLANT (Kg)

Replication	2	45.571	22.785			
Intensities	3	44.598	14.866	1.8188	0.1650	2.384
Dates	3	18.141	06.047	0.7398	0.0312	2.384
Interaction	9	180.747	20.083	2.4571		4.767
Error	30	245.201	08.173			
Total	47	534.258	Coefficient of Variation.			= 16.36 %

Table 2. Effect of different pruning intensities and various dates on the growth and yield of phalsa.

Pruning Intensities	*Pruning Dates* 22 Dec:	07 Jan:	23 Jan:	08 Feb:	*Means*
NUMBER OF BRANCHES PER PLANT					
075 cm	208.3 de	215.0 cd	202.7 de	225.0 bc	212.8b
100 cm	245.0 a	235.0 ab	229.0 b	215.0 cd	231.0a
125 cm	211.7 d	237.7 ab	245.0 a	208.3 de	225.7a
150 cm	204.7 de	197.7 e	228.3 b	234.3 ab	216.3b
Means	217.4 b	221.3 ab	226.3 a	220.7 ab	
LENGTH OF BRANCHES (cm)					
075 cm	125.1 cd	161.0 a	159.4 a	137.7 b	145.8a
100 cm	139.3 b	137.9 b	130.9 bc	137.9 b	136.5b
125 cm	139.9 b	128.4 bcd	120.8 cd	124.2 cd	128.3c
150 cm	119.1 cd	115.9 d	116.7 d	124.6 cd	119.1 d
Means	130.8 N.S	135.8	131.9	131.1	
NUMBER OF LEAVES PER BRANCH					
075 cm	19.97 bcde	23.50 a	22.76 ab	18.16 e	21.10N.S
100 cm	19.39 de	20.62 bcde	20.18 bcde	21.66 abcd	20.46
125 cm	22.44 abc	20.33 bcde	21.96 abcd	19.58 cde	21.08
150 cm	21.39 abcd	21.47 abcd	19.11 de	19.83 cde	20.45
Means	20.80 ab	21.48 a	21.00 ab	19.81 b	
DAYS TAKEN TO SPROUTING					
075 cm	37.00 abc	39.00 ab	39.33 ab	40.33 a	38.92a
100 cm	37.33 abc	38.00 abc	38.67 ab	37.67 abc	37.92ab
125 cm	38.00 abc	39.67 ab	39.00 ab	37.00 abc	38.42a
150 cm	34.67 c	36.00 bc	37.33 abc	38.00 abc	36.50b
Means	36.75 b	38.17 ab	38.58 a	38.25 ab	

DAYS TAKEN TO FLOWERING

075 cm	29.00 a	28.00 abc	24.33 d	26.00 cd	26.83ab
100 cm	27.00 abc	26.00 cd	28.00 abc	27.00 abc	27.00ab
125 cm	26.67 abcd	25.67 cd	26.00 cd	26.33 bcd	26.17 b
150 cm	26.33 bcd	27.33 abc	28.67 ab	27.00 abc	27.33 a
Means	27.25 N.S	26.75	26.75	26.58	

DAYS TAKEN TO FRUIT SETTING

075 cm	8.333 d	9.667 bcd	10.33 abcd	10.00 abcd	9.58 b
100 cm	11.00 abc	9.000 cd	10.33 abcd	10.00 abcd	10.08 ab
125 cm	10.67 abc	11.33 ab	9.667 bcd	11.00 abc	10.67 a
150 cm	12.00 a	11.67 ab	10.33 abcd	10.00 abcd	1.00 a
Means	10.50 N.S	10.42	10.17	10.25	

Any two means not sharing a common letter are significant at 5% level of probability.

NUMBER OF FRUIT CLUSTERS PER PLANT

075 cm	1623 b	1676 b	1250 c	1526 bc	1519b
100 cm	2057 a	1740 b	1649 b	1637 b	1771a
125 cm	1527 bc	1663 b	1619 b	1708 b	1629ab
150 cm	1432 bc	1541 bc	1647 b	1687 b	1577 b
Means	1660 N.S	1655	1541	1639	

NUMBER OF FRUITS PER CLUSTER

075 cm	16.45 abc	18.47 ab	16.10 abc	12.94 bc	15.99N.S
100 cm	15.69 abc	16.37 abc	15.00 abc	11.61 c	14.67
125 cm	17.39 abc	16.26 abc	19.28 a	12.76 bc	16.42
150 cm	13.00 bc	12.90 bc	12.36 c	19.25 a	14.38
Means	15.63 N.S	16.00	15.68	14.14	

WEIGHT OF CLUSTERS (g)					
075 cm	11.56 ab	11.13 abcd	12.02 ab	9.80 bcd	11.13 ab
100 cm	10.24 abcd	11.32 abc	11.14 abcd	8.86 d	10.39 ab
125 cm	12.33 a	11.57 ab	11.62 ab	9.72 bcd	11.31 a
150 cm	9.77 bcd	8.98 cd	9.92 abcd	11.85 ab	10.13 b
Means	10.98 N.S	10.75	11.18	10.06	
YIELD OF FRUIT PER PLANT (Kg)					
075 cm	18.73 abc	18.68 abc	15.10 bc	15.29 bc	16.95 N.S
100 cm	21.06 a	19.78 ab	18.31 abc	14.49 bc	18.41
125 cm	18.86 abc	19.36 abc	18.75 abc	16.59 abc	18.39
150 cm	14.02 c	13.75 c	16.96 abc	19.92 ab	16.16
Means	18.17 N.S	17.90	17.28	16.57	

Any two means not sharing a common letter are significant at 5% level of probability.

Conclusions

On the basis of the current research work done in Dera Ismail Khan, the following recommendations can be made to the growers of Phalsa.

1. The pruning at 100 cm (above the ground level) is considered to be the best as it produced maximum number of branches per plant, maximum number of fruit clusters per plant and the highest yield among the other pruning intensities.
2. In case of different dates, pruning on 22 December is recommended. Although maximum number of days to flowering and fruit setting were taken by this pruning date, yet the major concern of our growers is to get maximum production. That is why this date of pruning (22 December) is suggested because it produced largest number of fruit clusters per plant and the highest yield of fruit per plant as compared to other pruning dates.

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