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Studies on Flowering, Fruiting and Yield Attribute Characters of Phalsa (*Grewia subinaequalis* D.C.) Fruits

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Abstract: ***The present investigation entitled "Studies on flowering, fruiting and yield attributing characters of phalsa (Grewia subinaequalis D.C.) fruits" was carried out at Main Experiment Station, Department of Horticulture, Narendra Deva University of Agriculture and Technology, Kumarganj, Faizabad (U.P.) during the year 2012-13 and data were analyzed using Randomized Block Design (R.B.D.). The experiment was conducted Under the experiment flowering and fruiting behavior of phalsa plant was studied for length of current season shoot, number of leaves per shoot, Number of leaves per shoot bearing axillary flower buds, number of flower buds per shoot, number of flower buds open fruit setting, average fruit weight, volume of fruit and specific gravity which were found significantly. The date of observations was started from 17 March 2013 and thereafter data were recorded at 8 days intervals till the end of experiment. It was found that the phalsa fruit borne on the current season shoots as well as number of leaves on shoots increased during flowering and fruiting. Under Northern Indian conditions phalsa flowering started from mid of March and completed at end of April.***

Keywords: Flowering, Fruiting,Yield, phalsa, Fruits

1. Introduction

Phalsa (*Grewia subinaequalis* D.C.) is one of the important minor fruit of India, which belongs to family Tilliaceae. The family Tilliaceae has about 41 genera and 400 species. It is a subtropical fruits, which is also known as star apple. It is known by different vernacular names in different parts of country for example Dhamini in Bengali, Phalsa in Punjabi and Shurkhi in Hindi. Phalsa plant is indigenous to India, where it is commercially grown in Punjab, Haryana, Uttar Pradesh and Madhya Pradesh. Besides these states, it is also cultivated on limited scale in Maharashtra, Gujarat, Andhra Pradesh, Bihar and West Bengal. But no exact area and production are available of this fruit. Phalsa is small bush which bears many small berries like fruits of deep reddish purple colour. The fruits contain 69 to 93% edible part. Ripe phalsa fruits are sub-acidic and good source of vitamin A and E. The chemical composition of phalsa fruit reveals that it contains moisture 80.80 per cent, protein 1.30 per cent, fat 0.90 per cent, carbohydrates 14.7 mg/100g, niacin 0.8 mg/100g, ascorbic acid 22.0 mg/100g and in addition ripe fruit contains 50-60 per cent juice, 8-11 per cent sugars and 2-2.5 per cent acid and are used for making excellent quality of juice and squash. 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. Flowering in phalsa starts from February-March and continues till May. Flowers were born on all nodes in the leaf axils of the current season's growth in the dwarf genotypes. Phalsa has great utility and its own importance and usefulness but its cultivation is restricted and confined to only small scale in a particular area. The main problem in the phalsa cultivation is the uneven ripening and small berries and lack of information regarding its flowering and fruiting behaviour.

2. Literature Survey

Phalsa is a hardy fruit plant, well suited for cultivation under adverse climatic condition. Although, fruits are quite nutritive and having medicinal value. The relevant information's available on growth, development and fruiting of used as base for planning and execution of the present study are reviewed in this chapter under following heads:- Singh and Sharma (1961) found that pruning level 135cm from the ground level in Phalsa (*Grewia asiatica* L.) plant to highest yield per plant were recorded. Whereas Bajpai *et al.* (1973) observed in guava (*Psidium guajava* L.) cv. Allahabad Safeda fruit yield was maximum under 30cm pruning intensity. Ali and Pathak (1991) studied on in a pot experiment, uniform *Grewia subinaequalis* D.C. seedlings (15 cm height, 8 months old) were planted singly in pots of soil having exchangeable Na levels of 9.30%, 15.50%, 30.25%, 45.75% and 59.50%. Plant height, stem diameter, number of branches, number of leaves and plant spread were recorded monthly up to 240 days. Leaves and shoots were analysed for N, P, K, Na, Ca, Mg and chlorophyll, and roots were examined at the end of the experiment. Growth was adversely affected by increasing Na content, and they further reported that at 30.25% Na, growth reduction was not marked, but no plant survived at 59.50%. Leaf N and Na concentrations increased and leaf P, K, Ca, Mg and chlorophyll concentrations decreased with increasing Na content. Abdul *et al.* (2001) invested on the different pruning intensities (75, 100, 125 and 150 cm above from the ground level) as Factor A and various pruning dates (22 December, 07 January, 23 January and 08 February) as Factor-B on the production of phalsa. They further reported that pruning levels significantly affected the days taken to

sprouting, flowering, fruit setting, number of branches/plant, and length of branches, number of fruit clusters / plant and weight of clusters. Among different pruning intensities, 100 cm pruning gave the maximum number of cluster/ plant 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 cluster/ plant and the highest yield/plant (18.17 kg).

3. Materials and Methods

The present investigation entitled "Studies on flowering, fruiting and yield attributing characters of phalsa (*Grewia subinaequalis* D.C.) fruits" was carried out at Main Experiment Station, Department of Horticulture, Narendra Deva University of Agriculture and Technology, Kumarganj, Faizabad (U.P.) during the year 2012-13 on 20 years old phalsa plants already established in the field. The plants were pruned in last week of February at zero level and the new emerging 3 shoots of current season were marked treatment wise on each plant for investigation. The experimental site is located on the Faizabad, Rae Bareli road at the distance of 42 km away from Faizabad district head quarter. Geographically it is situated at 26-47 ^{0}N latitude, 82.12 ^{0}E longitude and altitude of 113 meter from mean sea level. The site is located in typical saline-alkaline belt of indigenous plains of eastern Uttar Pradesh. The observation were recorded for length of current season shoot, number of leaves per shoot, number of leaves per shoot bearing axillary flower buds, number of flower buds per shoot, number of flower buds open, fruit setting (Nos. /shoot), fruit weight, fruit volume and specific gravity. The date of observations was started on 17 March 2013 using Randomized Block Design (R.B.D.) with three replications at 8 days intervals till the end of experiment. The data were analyzed at 8 days intervals average fruit. Data recorded in respect to parameters were subjected to statistical analysis (Panse and Sukhatme, 1985).

4. Results and Discussions

Data recorded on changes in attributes of phalsa plants in length of current season shoot are furnished in Table-1. The length of current season shoots was increased continuously during the entire period of observation from March 17, 2013 to May 16, 2013. The changes were statistically significant. The flowers initiated up, till the shoots attained 127.53 cm height. Similar to other fruits bearing on current season shoots, the phalsa shoot also increases with flowering. The results are close conformity with the investigation of Abdul *et al.* (2001) on different pruning intensity in phalsa plant. Kumar and Ram (2009) also reported such result in ber plants. Whereas, the number of leaves per shoot was continuously increased (Table-1.) during entire period of study from starting of observation to the end of observation and the change was significant. This increase The shoot was bearing 5 leaves on 17.03.2013 when observation was initiated and increased to 24 leaves on 16.05.2013 when experiment was ended thus it may be concluded that current season shoots of phalsa bear flower and fruits with 24 leaves, in number of leaves with shoot growth was due to species characteristic of the phalsa. Intrieri *et al.* (2009) find such result during the investigation on changes in leaf area, fruit setting, yield and bunch morphology of grape vine made by microvinification and Yadav *et al.* (2009) reported maximum number of shoots leaves and intermodal length of shoots in phalsa with the soil application of urea+ MOP + FYM + Azotobactor and PSB. Number of leaves bearing axillary flower buds increased gradually (Table-1.) since the observation started during mid of March to end of April thereafter initiation of leaves bearing axillary flower stopped and during the same period number of flower buds increase continuously. The findings are in agreement with Meena *et al.* (2013) in phalsa that flower bud per shoot was increased significantly till end of April during flowering and fruiting. It indicates that under North Indian agro climatic conditions phalsa flowers from mid of March to end of April which might be due to agro climatic effect of Northern India. Flower buds opening were started about one week later when flower buds appear in the axill of leaves and opening were continue till first week of May. Thus middle of the April is the peak flowering period of phalsa in North India. Ram *et al.* (2010) reported similar result with phalsa where peak flowering took place in April. Rathore (2010) also reported same results. Data recorded on changes in attributes of phalsa plants during flowering and fruiting on fruit setting are furnished in Table-1. The fruits setting was started in first week of April and continued up till first week of May; however the number of fruits setting was higher during second and third week of April. The fruit setting increased continuously and statistically significant. It may be concluded from the data that maximum fruits setting take place during second and third week of April in phalsa. This also could be due to species characteristics and agro climatic effects on the phalsa plants. The results are also close conformity with the study of Pratibha and Lal (2012) in fruit quality of guava and Prakash *et al.* (2012) also reported that the summer pruning of spring flushed bearing shoot of current season was effective in increasing the production of superior quality fruits in winter guava. Data recorded on changes during growth in fruit weight of phalsa are presented in Table-2. Average fruit weight of phalsa continuously increased with periods and the changes were significant. Increase in weight of fruits was recorded till day of ripening. There was 0.75 g weight of a ripe fruit. Whereas observed showed on changes in fruit volume during growth and development shown in Table-2. Data showed that the volume of fruits continued to increase from 0.12 cm^3 on the stage of first day of observation to 0.65 cm^3 on 32nd day of observation then volume of fruits was become constant till 40 days as fruits ripen. The increase in volume was statistically significant up till 32 days after fruit setting. During the initial period of fruit growth the both weight and volume increased rapidly. The increase in weight and volume indicates the accumulation of metabolites and cell elongation in fruits during the period at rapid rate. The continuous increased in both weight and volume of fruit have also been reported in other fruit crops like guava Patidar *et al.* (2012), citrus (Zhorg *et al.* 1991), ber (Pandey *et al.* 1990) and four sour cherry Mika *et al.* (2011). It is clear from the data of Table-2 that the specific gravity of fruits during growth and development was continuously increased up till 32 days after fruit setting however during first fortnight specific gravity less than one after that was

increased to 1.03 when fruits ripened. The increasing in specific gravity might be due to accumulation of more metabolites resulting higher weight at faster rate than increase in the volume. The continuous increase in specific gravity of fruit has also been noted in guava Singh (2012) and in ber fruits Kumar and Ram (2009).

5. Conclusion

Hence it can be concluded form the first experiment conducted to study the flowering and fruiting behaviours of phalsa plants that phalsa bears on the current season shoots, shoots length as well as number of leaves on shoots increases during flowering and fruiting. Under Northern Indian conditions phalsa flowering starts from mid of March and completed at end of April and middle of April is the peak flowering time whereas fruit setting take place between 1st week of April to 1st week of May and 2nd and 3rd weeks of April are the peak fruit setting periods.

6. Future Scope

Fruit growing is one of the important and age old practices, practiced in India since ancient times. Cultivation of fruit crops plays an important role in overall status of the mankind and the nation. The standard of living of the people of a country is depending upon the production and per capita consumption of fruits. Fruit growing have more economic advantages.

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Table 1: Changes in phalsa plants during flowering and fruiting

Date of observation	*Length of current season shoot (cm)*	*Number of leaves per shoot*	*Number of leaves per shoot bearing axillary flower buds*	*Number of flower buds per shoot*	*Number of flower buds open*	*Fruit setting (Nos/ shoot)*
17.03.2013	42.21	5.00	4.00	12.00	0.00 (0.71)	0.00 (0.71)
24.03.2013	68.57	9.00	8.00	28.00	10.00	0.00 (0.71)
01.04.2013	74.40	11.00	10.00	39.00	16.00	9.00
07.04.2013	84.22	13.00	12.00	81.00	31.00	42.00
14.04.2013	94.75	15.00	13.00	157.00	55.00	126.00
22.04.2013	121.68	20.00	16.00	171.00	39.00	163.00
30.04.2013	127.53	22.00	17.00	172.00	14.00	166.00
08.05.2013	131.88	23.00	0.00 (0.71)	0.00 (0.71)	4.00	168.00
16.05.2013	134.40	24.00	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)
SEm±	**3.578**	**0.490**	**0.116**	**0.239**	**0.162**	**0.240**
CD at 5%	**10.726**	**1.470**	**0.349**	**0.716**	**0.485**	**0.720**

Note- In Paranthesis transformed data (Y√X+½)

Table 2: Showing the result of yield attributes in phalsa fruits

Interval (Days)	*Average fruit weight (g)*	*Volume of fruit (cm^3)*	*Specific gravity*
1	0.11	0.12	0.91
8	0.25	0.27	0.92
16	0.45	0.46	0.97
24	0.57	0.56	1.01
32	0.67	0.65	1.03
40	0.75	0.65	1.15
SEm±	0.018	0.024	0.027
CD at 5%	0.058	0.076	0.085