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Studies on Fruit Setting and Bearing Pattern of *Pyrus pashia* Grafted with Scion of *Pyrus communis* Var. Bartlett

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Abstract

Present study deals with the effect of grafting on fruit setting and bearing pattern of *Pyrus pashia* grafted with *Pyrus communis* var. Bartlett. The rootstock exert a pronounced effect on nutrient uptake, growth, longevity, productivity and fruit quality of the cultivars grafted on them. 5.0 and 7.5 cm girth size rootstocks of *Pyrus pashia* were grafted with the scion of *Pyrus communis* var bartlett having four buds. During first and second year of study no fruit setting was observed in either root stocks while maximum fruit setting was recorded to be 66.00 and 63.15% in 5.0 cm. and 7.5 cm girth size rootstock respectively. During third year, the fruit bearing was recorded to be 44 and 47% in 5.0 cm and 7.5 cm girth size rootstocks respectively.

Keywords : Rootstocks, Wild pear (*Pyrus pashia*), Grafting, Scion, Pear *(Pyrus communis*),Var.Bartlett, Fruit Setting, Bearing Pattern

Introduction

The pears (*Pyrus communis*) is one of the few fruit crops that are adaptable to a wide range of agro-climatic conditions. Like other temperate fruits, the pear is propagated by grafting and the rootstocks exert a pronounced effect on nutrient uptake, growth, longevity, precocity, productivity and fruit quality of the cultivars grafted on them (Sandhu *et al*.1983). Therefore, use of appropriate rootstocks can help a great deal not only in improving cropping and quality of fruits, but also in making fruit plantations successful under unfavorable conditions (Bajwa et al. 1974). Tsyngalev (1996) studied the grafts of plums cv. Stakhanovka on 27 clonal rootstocks based on cherry plums, planted in 1989 – 90 at spacing of 5 x 2 m and found that the rootstocks regulated the growth rate and development of the trees and affecting their precocity and productivity. Brar *et al*. (1999) reported that scion wood used for tongue grafting in peaches normally has 5 – 6 buds but only 2 – 3 of these sprouts due to apical dominance. The effect of using scions of peach cv shan – 1 punjab with 2, 3, 4, 5 or 6 buds for grafting on Sabarmati rootstock in January were examined by them. Sprouting percentage in April was found highest when scion had four bud. During the present study the wild pear *(Pyrus pashia)* was used as for Pyrus communis varieties to study its effect on fruit bearing.

Aim of the Study

The aim of the present study was to evaluate the flowering, fruiting, bearing and size of the fruits on scions grafted on Pyrus pashia growing wildly in middle Himalayan region. The results will provide future resource for horticulture to utilize wild root stock for fruit tree development.

Review of Literature

During the recent years, certain grafting and budding techniques used in the propagation of temperate fruits, are gaining commercial popularity. Nauriyal and Kanwar (1969) reported that scions of Le conte, kieffer and bagugosha on kainth made significantly more radial growth that those on patharnakh rootstock. Bajwa et al. (1972) reported that the trees on kainth rootstock were having larger scion girth than the trees on patharnakh rootstock, while the stock girth was greater in kainth rootstock than patharnakh with le conte, kieffer and bagugosha as scion cultivars. Haq et al. (1972) reported that the differential rootstock effects on date of flowering and fruit set were slight. Rud and Kaimakan (1976) reported that the type of rootstock and the degree of compatibility had an effect on pollination and fruit set, and that self-pollination and fruit set in clapp's favourite and saint germain were successful only in trees on wild pear

rootstocks,where as no fruit set occurred in trees on wild pear rootstocks. Oosten and Baarrends (1975), however, observed that flowering of in beurre hardy and doyenne du Comice pear cultivars was the most profuse on quince adams, but the fruit set was the best on quince C rootstock. However, in apple, flowering started and terminated earlier on clonal rootstocks than on seedling rootstocks (Logvinenko, 1975). Vorob (1986) reported those clonal rootstocks, especially of the dwarfing group, B-9 and 62-396, advanced flower bud initiation and flowering in the apple scion cultivars. Larsen and Higgins (1989) reported that there was little consistent effect of rootstock on time of bloom in Asian pears in Washington State.

Materials and Methods

The present study area was undertaken at agricultural wasteland of Satpuli district Pauri Garhwal of Garhwal Himalaya. Geographically, it is located in south of Pauri Garhwal at 29^0 33^0 North latitude and 78^0 45^0 East longitude. The altitude of the study area ranged between 700-800 m above sea level. The climate of the study area was sub-tropical. Two girth sizes rootstock i.e. 5.0 and 7.5cm were grafted with grafts of *P.communis* var. Bartlett having 4 buds each. The grafting materials scion of Pyrus communis var. Bartlett was collected from Kullu (H.P). The rootstock *Pyrus pashia* were cut at 20cm above the ground level for grafting. Tongue grafting method was applied during first week of Febuary, 1999 and observations were recorded during 1999, 2000, 2001. Out of 100 grafted plants, 40 plants were selected for recording observations (20 each from two girth size). Date were recorded on following parameters.

Time and Duration of Flowering

Total period for opening first bud to last bud was recorded. The time of flowering was recorded by observing the dates of opening of the first bud (start) and of the last bud (termination) in a combination and duration of flowering was worked out by calculating the total number of days from opening the bud to the opening of the last bud in combinations, on marked plants.

Fruit Set

Fruit set was recorded two months after petal fall on each marked tree. Branches were tagged for recording date of fruit set. This was carried out on grafted plants selected for recording observations (20 each from two girth sizes).

Fruit Size (cm^2/fruit)

Ten fruits were selected at random from each combinations for determining the fruit size. Size of fruits was determined by measuring the length and diameter of the fruits with the help of digital Vernier caliper and the result were expressed in cm^2 per fruit.

Fruit Weight (g)

Average of weight of ten fruits from each combination was taken for calculating fruits weight.

Fruit Volume

The volume of fruit was recorded by water displacement method. The results were expressed as ml per fruit.

Results

Flower Bud Setting

The date of flower bud setting on grafted scion are presented in table 1. It is evident from the data that time of bud initiation and termination was not affected by the girth size of rootstock but number of flower bud was found affected by the size of root stock.

The rate of bud setting was also found increased in the each period of plantation during first two year flower bud setting initiated by 15th March during 2001. It propend to 28th Feb. on 5.0 cm girth size root stock tree was 2 to 5 bud setting in 1999, 7 to 21 in 2000, 4 to 26 in 2001 whereas on 7.5cm girth size rootstock the number was 3 to 7 in 1999, 11 to 20 in 2000 and 7 to 25 in 2001.

Flower opening was not found affected by rootstock size. It started by 30th March during first year and 15th march during 2nd and 3rd year but after 15th April no flowers were added. The number of flowers was not affected by the rootstock size. The maximum number of flower was found present

Table No.1 :- Flower Bud Setting and Total Number of Flower in Per Plant (Scion), Both Size of Girth Rootstock 5.0 and 7.5 Cm.

Year and date		Flower Bud Setting		Total Number of Flower Per Scion	
Year	Date	5.0 cm	7.5 cm	5.0 cm	7.5 cm
	15/2	-	-	-	-
	28/2	-	-	-	-
1999	15/3	2±0.19	3±0.63	-	-
	30/3	5±0.27	7±0.41	7±1.07	6±2.31
	15/4	5±0.81	7±0.89	11±1.23	12±7.80
	30/4	5±1.01	7±0.89	-	-
	15/2	-	-	-	-
	29/2	-	-	-	-
2000	15/3	7±1.05	11±0.93	18±4.39	13±3.10
	30/3	17±5.21	18±3.71	49±6.41	46±21.32
	15/4	21±7.21	20±8.01	43±9.17	40±13.09
	30/4	21±7.21	20±8.01	-	-
	15/2	-	-	-	-
	28/2	4±0.53	7±0.81	-	-
2001	15/3	14±3.11	19±8.21	21±6.31	26±12.66

	30/3	20±9.1	22±7.64	59±14.01	63±17.23
	15/4	26±11.39	24±7.82	50±11.42	56±14.21
	30/4	26±11.41	25±8.92	-	-

during 1999, 2000 and 2001 and amounting to 11, 49 and 59 respectively on 5.0 cm rootstock and 12, 46 and 63 respectively on 7.5 cm rootstock.

Table 2 shows the data of fruit setting and fruit bearing percentage.It is evident from the data that fruit setting percentage was 66.0 and 63.15 in 5.0 and 7.5 cm girth size rootstock respectively. After 30th April the fruit setting percentage were constant in both sizes of scion. It is evident from the data that the number fruit setting was started during first two year. The fruit setting and fruit bearing percentage was not affected by the girth size of rootstock. Fruit setting was initiated by 15th April in both the sizes of scion. However the fruit setting was slightly less in 7.5cm girth scion. The fruit bearing was also not affected by rootstock size. The fruit bearing percentage was counted from the consistence after fruit setting. Fruit bearing was recorded on 15th May and 15th June respectively in the 5.0 girth size and found 44%, where as the 50, 49.7 and 49.3% respectively was recorded in 7.5cm girth size.

Table No. 2 Fruit Setting and Fruit Bearing Percentage of Grafted Scion of 5.0 and 7.5cm Girth Size Rootstock.

Year and Date		Fruit Setting		Fruit Bearing	
Year	Date	5.0 cm	7.5cm	5.0cm	7.5cm
1999	15/4	-	-	-	-
	30/4	-	-	-	-
	15/4	-	-	-	-
	30/4	-	-	-	-
	15/5	-	-	-	-
2000	30/6	-	-	-	-
	15/6	-	-	-	-
	30/6	-	-	-	-
	15/4	67%	64	-	-
	30/4	66%	63.15	-	-
	15/5	66%	63.15	45.7%	50%
	30/5	-	-	45.7%	49.7%
2001	15/6	-	-	44.0%	49.3%
	30/6	-	-	44.0%	47.0%
	15/7	-	-	44.0%	47.0%
	30/7	-	-	44.0%	47.0%

The data in table 3 showed the fruit size of *Pyrus communis* var. Bartlett. It was measured in terms of length and diameter. The value of fruit length was measured after 50 days of anthesis and amounted 2.05±0.80cm. This value was found to increase in subsequent stage and maximum was recorded after 90 days stage and amounted 4.38±1.44cm.

The diameter of the fruit was found minimum at initial stage after 50 days of anthesis and measured to 1.34±0.44 cm whereas the maximum was reported after 90 days and reported 98±0.96cm (Table 3).

Table-3 Size of Fruit, Weight and Volume of Fruit *P.communis* var. Bartlett grafted on *P.pashia*.

Day After Anthesis	Size of fruit		Weight of Fruit (g)	Volume of Fruit (ml/Fruit)
	Length (cm)	Dia. (cm)		
50	2.05±0.80	1.34±0.44	30±4.50	0.26±0.08
60	2.60±0.95	2.04±0.44	54±6.70	0.64±0.11
70	3.51±0.86	2.9±0.67	85±8.70	0.83±0.19
80	4.07±1.24	3.57±0.86	114.05±11.61	1.01±0.22
90	4.38±1.44	3.98±0.96	130.0±14.5	1.09±0.29

The initial value of fruit weight was recorded after 50 days of anthesis and measured 30±50g. This value was found to increase linearly after each 10 days interval and the maximum was noted after 90 days of anthesis when it was 130.0±14.5g. It is evident from the result that initial volume of fruit was observed 0.26±0.08 ml/fruit after 50 days of anthesis. The value was found to increase up to 90 days of anthesis and amounted 1.05±0.29 ml/fruit.

Discussion

The present study was under taken to evaluate the rootstock graft interaction of *Pyrus pashia* and *Pyrus communis* Var. Bartlett on flower bud setting, fruit set and fruit bearing capacity. The incompatibility of stock and scion even though they are of same species is a problem that has arisen in connection with large scale seed orchard grafting. Graft incompatibility, long recognized as a problem in horticultural work, has been fully discussed by Mosse (1962).Webb (1961) recognized the possibility of

stock scion incompatibility and selected a number of parent trees for studies of grafting techniques.

In the present study, *Pyrus pashia* was taken as rootstock in 5.0 and 7.5cm girth size at 20cm above the ground surface. Sharma et al. (1988) reported that growth was greatest on D-4 rootstock for both the cultivars and on *Pyrus pyrifolia* suckers and quince A. Similar result were also obtained by Kahlon et al. (1993) and Ratanpal et al. (1996). They reported D-4 rootstock imparted maximum tree vigour in both the pear cultivars, but not with *Pyrus pashia*.

The temperature and other factors condition have pronounced effect on cambium activity (Eams, 1961). The climate in the present study may be one of the factors for non response of *Pyrus communis* var. Bartlett cultivar as bud sprouting of need a particular temperature in particular time period. These finding are in agreement with those of Blondel (1951), Thaper (1961) and Sharawat (1967).

Flower bud setting was found maximum after three years of grafting. Higher number of flowers was reported in 5 cm girth rootstock in 2nd and 3rd year. Maximum flowering was observed in March and April of the year. Haq et al. (1972) found no or slight effects of rootstocks on flowering and fruit set. Larsen and Higgins (1989) reported that there was little consistent effect of rootstock on time of bloom in Asian pear in America. In apple, flowering was found earlier on clonal rootstock reported by Logvinenko (1975).

The largest size of fruit of Bartlett variety was reported on rootstock quince A and C by Sorensen (1953). Koleva (1983) reported increase in fruit size of Bartlett when grafted on quince B12. Lambard and Westwood (1976) also reported better fruit size when grafted with *Pyrus calleryana* and *beutilaefolia* rootstock. In the present study fruit size was found medium when compared with results of Kappel and Quamme (1988) and Gersbuch (1976). In the present study, length of fruits was found in the range 2.05 ± 0.80 – 4.38 ± 1.44 cm. The diameter of fruits was reported in the range of 1.34 ± 0.44 – 3.98 ± 0.96 cm. Sharma et al. (1985) reported the fruit length in the range of 6.43- 7.16 cm and diameter in the range 6.00 -7.22 in patharnakh variety of pears. Farooqui and Happa (1990) reported fruit length and diameter 4.39 and 3.98 cm in William pear (Bartlett). In marry red Bartlett they reported fruit length and diameter 10.15 and 7.50 cm respectively. The results of present study thus find support from the above work and are in conformity with Farooqui and Happa (1990).

Seth and Kukshal (1981) reported 30 - 40% fruit setting in Bartlett pear at Almora. Roud and Kaimakan (1976) reported that fruit set and pollination was found affected by type of rootstock and degree of compatibility. Ooysten and Barrends (1975) observed that flowering and fruiting was not affected by girth size of rootstock but gets affected with the variety of rootstock.

In the present study, yield of fruits was found slightly affected by girth size of rootstock. In 5.0 cm girth of rootstock total yield of fruits after three years of grafting was found 12.3 kg per plant whereas plants grafted 7.5 cm girth rootstock it was observed 14.65 kg per plant. Aubrst (1949) reported that Bartlett tree produce double fruiting if grafted on quince. Chrirstensen (1959) also reported the similar results.

Conclusion

Pyrus pashia (Mehal) is growing wildly and abundantly in hilly places of Uttarakhand. If this species is grafted with *Pyrus communis* Var. Bartlett, will provide better income to the farmers maintaining the plants. The fruit set and yield of *Pyrus communis* Var. Bartlett shows promising results and will provide good economy.

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