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Effect of rootstock and interstock on plant vigour of pear

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ABSTRACT

The present investigations on the effect of rootstock and interstock on plant vigour of pear were carried out at the experimental orchard of Department of Pomology, Dr YS Parmar University of Horticulture and Forestry, Nauni, Solan, HP during 2004 and 2005. It was randomized and quardately replicated with four rootstocks namely Kainth, Quince A, Quince C and BA-29 which were grafted on five scions namely Flemish Beauty, Max Red Bartlett, Conference, Red Bartlett and Starkrimson with or without interstock (Beurre Hardy) thus making 40 combinations in all. The rooted suckers of rootstocks (Quince A, BA-29 and Quince-C and seedling Kainth) were transplanted in the nursery beds during the second week of January 2004 and the observations were recorded during 2004 and 2005. The effect of different graft combinations on the plant height (Table 1) was almost similar during both the years. Scion Red Bartlett resulted in significant higher plant height (0.77 and 0.90 m) and Conference the least (0.71 and 0.82 m) during 2004 and 2005 respectively. The interaction studies between scion x rootstock revealed that treatment combination Red Bartlett x Kainth exhibited higher height of 0.96 and 1.09 m in 2004 and 2005 respectively as compared to other combinations. In the rootstocks and interstocks interaction studies Kainth x without interstock exhibited higher height (1.01 and 1.19 m) and was statistically significant as compared to other treatments whereas least plant height was recorded under Quince A and BA-29 x without interstock (0.63 m each) in 2004 and (0.71m each) in 2005. The interaction among scion x rootstock x interstock revealed that Red Bartlett x Kainth x without interstock gave significantly more height (1.09 and 1.29 m) as compared to other combinations whereas the least increase in height was recorded under Conference x Quince-A and BA 29 without interstock (0.58 m) during 2004 and Conference x Quince-A/BA-29 x without interstock (0.65 m each) in 2005.

Keywords: Pear, rootstock, interstock, plant height

INTRODUCTION

Pear has long been considered a highly treasured fruit both in East and West. It is an important fruit crop after apple among temperate fruits in the world. China produces nearly 60 per cent of the world's pear (Anon 2006). In India scattered

plantations of pears are found growing right from cold dry temperate hilly regions to warm humid sub-tropical plains. However the major pear production area is confined to North Western Himalayan region comprising the states of Jammu and Kashmir, Himachal Pradesh and Uttaranchal. The low chilling cultivars of pear are also grown considerably in the plains of Northern India and the hills of Nilgiris in Southern India. Selection of rootstock is an important consideration in pear production (Lambard and Westwood 1986, 1987, Reil 1990) since correct rootstock can determine the short and long term health of the trees.

Seedlings of Kainth (Pyrus pashia Buck and Ham) have been the main rootstocks for both European and Asian pears. At present more plantations are being raised on Quince-A rootstocks where interstems of Old Home and Beurre Hardy are used to overcome incompatibility problems arising in many commercial cultivars of pear with these clonal rootstocks. Although clonal rootstocks have been used for many decades in temperate fruit growing and the practical, economical and scientific importance of stionic effects on tree growth and fruit production have been recognized there is a scanty information on the effect of rootstocks and interstocks on plant vigour. While several theories have been put forth as possible explanations for the interactions between rootstock, scion and interstock the fundamental mechanisms of control is not well understood (Singh 2001).

Very few studies have been carried out on the effect of rootstocks and interstocks on the pear trees especially those cultivars which are being grown commercially in India. The present investigations on the effect of rootstock and interstock on plant vigour of pear were undertaken which were carried out at the experimental orchard of Department of Pomology, Dr YS Parmar University of Horticulture and Forestry, Nauni, Solan, HP during 2004 and 2005.

MATERIAL AND METHODS

The experiment was conducted with a view to find out the reciprocal influences of the rootstock and scion on each other. It was randomized and quardately replicated with four rootstocks namely Kainth, Quince A, Quince C and BA-29 and were grafted on five scions namely Flemish Beauty, Max. Red Bartlett, Conference, Red Bartlett and Starkrimson with or without interstock (Beurre Hardy) thus making 40 combinations in all.

The experiment was conducted to study the comparative influence of rootstocks and interstocks on the scion cultivar grafted on them. In this experiment the plant material used was Flemish Beauty, Max Red Bartlett, Conference, Red Bartlett and Starkrimson as scions; Quince A, BA-

29, Quince C and Kainth as rootstocks, and Beurre Hardy as interstock for all the combinations.

The interstock of 10 cm length was grafted at 7.5 cm height from ground level. For comparison stionic combination were also made without the use of interstock. One year old seedlings of different rootstocks were used for grafting and the operations were carried out simultaneously for rootstocks, interstock and interstock-scion grafting during third week of February 2004. The grafted plants were given uniform cultural treatments and observations on different parameters were recorded during the years 2004 and 2005.

The plants were selected randomly in each treatment/replication and were marked permanently with paint for recording the observations on plant height during growth cessation in the month of December 2004 and 2005. The shoot length and plant height were measured with the help of a measuring tape from grafted point to the tip of the main axis whereas the total plant height was measured from the ground level to the tip of the main axis and data were expressed in cm.

RESULTS

The effect of different graft combinations on the plant height (Table 1) was almost similar during both the years. Scion Red Bartlett resulted in significant higher plant height (0.77 and 0.90 m) and Conference the least (0.71 and 0.82 m) during 2004 and 2005 respectively. In case of rootstocks Kainth exhibited higher plant height (0.89 and 1.02 m) as compared to BA-29 which had the least (0.65 and 0.77 m) during both the years of study. The effect of interstock was also significant during 2004 only. Treatment without interstock exhibited more height (0.75 m) as compared to with interstock treatment which depicted the minimum height (0.73 m) during 2004. The results were non-significant during 2005.

The interaction studies between scion x rootstock reveal that treatment combination Red Bartlett x Kainth exhibited higher height (0.96 and 1.09 m) in 2004 and 2005 as compared to other combinations respectively. However the least plant height was under Conference x Quince A and BA29 (0.61 m each) and of Starkrimson x Quince-A (0.70 m) in 2004 and 2005 respectively. In case of interaction between scion x interstock combination Red Bartlett x without interstock expressed higher height 0.78 m and minimum by Conference x with interstock (0.70 m) in 2004 whereas in 2005 treatment combination Red Bartlett x with interstock exhibited maximum plant height (0.90 m) and minimum by Conference x without interstock combination (0.81 m).

In the rootstocks and interstocks interaction studies (Table 2) Kainth x

Table 1. Effect of different grafting combinations on the plant height (m) of pear

Scion/Rootstock	Quince-A	BA-29	Quince-C	Kainth	Mean	Without inter stock	With inter stock
2004							
Flemish Beauty	0.68	0.66	0.77	0.84	0.74	0.74	0.74
Max Red Bartlett	0.71	0.63	0.74	0.82	0.75	0.75	0.74
Conference	0.61	0.61	0.73	0.88	0.71	0.71	0.70
Red Bartlett	0.66	0.68	0.77	0.96	0.77	0.78	0.75
Starkrimson	0.63	0.67	0.79	0.88	0.75	0.77	0.73
Mean	0.66	0.65	0.76	0.89	—	0.75	0.73
2005							
Flemish Beauty	0.77	0.78	0.88	1.00	0.86	0.87	0.85
Max Red Bartlett	0.82	0.75	0.86	1.03	0.87	0.86	0.88
Conference	0.74	0.73	0.85	0.99	0.82	0.81	0.84
Red Bartlett	0.80	0.80	0.90	1.09	0.90	0.89	0.90
Starkrimson	0.70	0.79	0.93	1.00	0.87	0.88	0.86
Mean	0.78	0.77	0.88	1.02	—	0.86	0.87

$CD_{0.05}$	**2004**	**2005**		**2004**	**2005**
Scion:	0.01	0.01	Scion x Rootstock:	0.02	0.03
Rootstock:	0.01	0.01	Scion x Interstock:	0.01	0.02
Interstock:	0.01	NS			

Table 2. Effect of different grafting combinations (with and without interstocks) on the plant height (m) of pear

Roostock/With/ Without Interstock	2004 Without Interstock	2004 With Interstock	2004 Mean	2005 Without Interstock	2005 With Interstock	2005 Mean
Quince-A	0.63	0.69	0.66	0.71	0.85	0.78
BA-29	0.63	0.67	0.65	0.71	0.83	0.77
Quince-C	0.74	0.78	0.76	0.83	0.93	0.88
Kainth	1.01	0.78	0.89	1.19	0.86	1.02

$CD_{0.05}$	**2004**	**2005**
Rootstock x Interstock :	0.01	0.02

without interstock exhibited higher height of 1.01 and 1.19 m and was statistically significant as compared to other treatments whereas least plant height was recorded under Quince A and BA-29 x without interstock (0.63 m each) in 2004 and (0.71m each) in 2005.

The interaction among scion x rootstock x interstock revealed (Table 3) that Red Bartlett x Kainth x without interstock gave significantly more height (1.09 and 1.29 m) as compared to other combinations whereas the least increase in height was recorded under Conference x Quince-A and BA 29 without interstock (0.58 m) during 2004 and Conference x Quince-A/BA-29 x without interstock (0.65 m each) in 2005.

DISCUSSION

The plant height of pear was observed to be influenced by the characteristics of scion cultivars and rootstocks. The use of interstock could not influence the vigour of pear plants in the present studies however the use of interstock neither influenced the scion or rootstock nor created its own influence in the propagation technique of pear plants. The vigour was superior without interstock treatment under the present studies. The maximum plant height was obtained when

Table 3. Effect of interactions of scion, rootstocks, and interstocks on the plant height (m) of pear

Scion/Rootstock	Quince-A		BA-29		Quince-C		Kainth	
	Without Interstock	With Interstock	Without Interstock	With Interstock	Without Interstock	With Interstock	Without Interstock	With Interstock
2004								
Flemish Beauty	0.62	0.73	0.64	0.68	0.76	0.78	0.92	0.72
Max Red Bartlett	0.68	0.74	0.60	0.65	0.72	0.75	1.00	0.83
Conference	0.58	0.63	0.58	0.64	0.72	0.74	0.97	0.79
Red Bartlett	0.64	0.69	0.65	0.70	0.75	0.79	1.09	0.82
Starkrimson	0.62	0.65	0.66	0.68	0.76	0.82	1.02	0.74
2005								
Flemish Beauty	0.73	0.81	0.73	0.83	0.86	0.89	1.15	0.85
Max Red Bartlett	0.74	0.91	0.68	0.82	0.82	0.90	1.19	0.87
Conference	0.65	0.82	0.65	0.80	0.80	0.90	1.12	0.86
Red Bartlett	0.72	0.88	0.73	0.87	0.83	0.96	1.29	0.84
Starkrimson	0.70	0.81	0.76	0.83	0.87	1.00	1.18	0.82

$CD_{0.05}$	**2004**	**2005**
Scion x Rootstock x Interstock :	0.03	0.04

Red Bartlett scion was worked on Kainth rootstock without employing the interstock whereas minimum plant height was recorded in Conference scion grafted on to Quince-A rootstock. The increase or decrease in the height of scion cultivars grafted on different rootstocks was according to vigour potential of scions or rootstocks. These observations are in conformity with the findings of Vyvyan (1955) and Nauriyal and Kanwar (1969), Bajwa et al (1972 and 1974), Carlson and Oh (1975), Sharma et al (1979), Tubbs (1980), Parry (1981) and Ugolik and Kantorowicz (1993) etc who reported that both scion and rootstock exert influence on the vigour of a composite plant however McKenzie (1956) and Roger and Beakbane (1957) reported that the influence of a given clone on tree vigour was greater when used as rootstock than as a scion. Nauriyal and Kanwar (1969) studied the behaviour of pear plants in nursery when grafted on Kainth and Patharnakh rootstocks. They reported that LeConte and Bagugosha on Kainth and Smith scion on Patharnakh made significantly more growth whereas Kieffer scion was of almost equal magnitude on both the rootstocks viz Kainth and Patharnakh. Similar observations were put forth by Bajwa et al (1972, 1974) and Sharma et al (1979). Carlson and Oh (1975) were of the view that the length of interstem exhibited a direct influence on shoot growth (longer the interstem, lesser the annual growth) and are in line with the present studies.

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