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Scion/Rootstock Influence on Bloom Date and Early Fruit Production of Asian Pears in Washington State[1, 2]

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Abstract

Time of bloom and fruit production for the third and fourth growing seasons (1987 and 1988) of a planting of 10 Asian pear cultivars ('20th Century,' 'Chojuro,' 'Hosui,' 'Kikusui,' 'Niitaka,' 'Okusankichi,' 'Seigyoku,' 'Shinko,' 'Shinseiki' and ' Tsu Li') on 6 rootstocks (Old Home x Farmingdale (OHF) 51, OHF 97, OHF 282, OHF 217, OHF 333, and Provence quince) are reported. There was little consistent effect of rootstock on time of bloom. 'Shinko,' 'Niitaka,' and 'Tsu Li' bloomed earliest and 'Hosui,' 'Kikusui,' and 'Okusankichi' bloomed latest. Generally, later-blooming cultivars had a shorter bloom period. A significant scion/rootstock interaction influenced fruit production, but generally, 'Shinko' and '20th Century' on OHF rootstocks had the greatest fruit numbers, and 'Kikusui' and 'Okusankichi' had the least. 'Tsu Li' was barren except on Provence quince in 1987 and produced very few fruit in 1988.

Introduction

Grower interest in Asian pears has increased dramatically in the Pacific Northwest, but there is very limited information on cultivars and rootstocks for this region. Asian pears represent an alternative crop for Washington fruit growers, being especially attractive because of precocious fruit production (1) and current high prices. An early return on investment is very important. Early production can be enhanced by use of precocious scion/rootstock combinations. Bloom dates must also be considered, as little is gained from a good producer that does not bloom synchronously with pollinizers.

This paper reports the influence of scion and rootstock on bloom date and fruit production of Asian pears during the third and fourth growing seasons of an experimental planting in Washington State.

Materials and Methods

A planting of 10 Asian pear cultivars on 6 rootstocks was established in the spring of 1985 at Washington State University's Royal Slope Research Unit near Othello, Washington. Scion cultivars were '20th Century,' 'Chojuro,' 'Hosui,' 'Kikusui,' 'Niitaka,' 'Okusankichi,' 'Seigyoku,' 'Shinko,' 'Shinseiki,' and 'Tsu Li.' Rootstocks were Old Home x Farmingdale (OHF) 51, OHF 97 OHF 217 OHF 282, OHF 333, and Provence quince. 'Hosui'/OHF 97 was unavailable at planting, and shortages occurred with Provence quince due to apparent incompatibility. Of 20 trees originally budded in the nursery for each scion on Provence quince, only 4, 5, 6, 3, and 9 trees were available on 'Chojuro,' 'Seigyoku,' ' Shinko,' 'Shinseiki,' and 'Tsu Li,' respectively, for orchard planting. When budding on quince, there was a low percentage take, and later others broke at the union when handled. Further details of this planting were reported previously (2). The experiment was established as a split plot in a randomized complete block with 4 blocks and with each scion/rootstock combination having 3 trees per block. Scion cultivars were the main plots and rootstocks were the sub-plots. The trees were pruned to a central leader. Overhead sprinklers were available for frost

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[2]Trees for this study were provided by Carlton Nursery, Dayton, Oregon.

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control but were not needed in 1987. Frost damaged some of the earliest flowers in 1988. Many trees produced flowers in the second growing season (1986), but all flowers were removed at anthesis.

Bloom data were collected on 8 April 1987 when the first trees were in full bloom, and again on 12, 16, and 21 April, after which nearly all trees were past full bloom. In 1988, we began data collection on 7 April when the first flowers opened, and we continued collection on 10, 13, 17, 19, and 23 April, when all trees were past full bloom. On each date, each tree (except replacement trees) was placed into one of 4 bloom categories (Fig. 1). Since analysis of categorical data is unreliable when sample sizes are low (5), bloom results were based on simple inspection of the mean bloom categories over time.

During June, 1987 and 1988, fruit were thinned to one per inflorescence, and all fruit were removed from the central leader above the second tier of lateral branches. Additional fruit were removed if the crop was too large for the tree to support. Relative to the other cultivars, 'Shinko' was thinned more heavily in 1988 due to poor size in 1987. Immediately after thinning, total fruit were counted on each tree. Tree height was measured 16 July 1987 for use as a covariate in the analysis, with the hope of removing variation in fruit number due to tree size. Since height had no influence on fruit number, it was not measured in 1988.

We used only trees that had a history of normal growth. This excluded some trees (2), and along with poor availability of some scion/rootstock combinations already noted, created numerous missing cells in the intended design. Therefore, most of the fruit production data reported here were analyzed as an 8 X 5 factorial experiment in a completely randomized design. Rootstock effects on fruit production of 'Tsu-Li' and 'Hosui,' and scion effects on Provence quince, were analyzed separately since 'Tsu-Li,' 'Hosui,' and Provence quince were not sufficiently well-represented to be included in the factorial arrangement. All means reported were adjusted for unequal sample sizes, and they represent the sum of fruit production for 1987 and 1988 for each sample tree.

Results

Bloom timing

Within the 10 scion cultivars, time of bloom appeared to be independent of OHF rootstock, although the influence of scion cultivar was dramatic (Fig. 1c, d). 'Hosui,' 'Kikusui,' and 'Okusankichi' trees had few flowers open at the time 'Niitaka' and 'Tsu Li' were at or near full bloom, a difference of 4 to 6 days. 'Tsu Li'/OHF was first to reach full bloom in both years. However, in 1987, only 2 trees bloomed, each of which produced only one inflorescence. 'Seigyoku' was one of the last cultivars to begin flowering, yet it was the median cultivar to reach full bloom. By 21 April, in both years, nearly all trees, even later-blooming cultivars, were past full bloom (Fig. 1c, d). 'Hosui,' 'Kikusui,' and 'Okusankichi' were all in full bloom for less time than other cultivars on OHF rootstocks.

On Provence quince, 'Seigyoku' flowering was delayed relative to the other cultivars in both years, and it was apparently in full bloom for a relatively short period of time (Fig. 1a, b). While 'Tsu Li' was one of the first cultivars to commence bloom on Provence quince in 1987, it was one of the latest in 1988, while the reverse can be said of 'Chojuro.'

Fruit production

No trees of 'Hosui' were available on Provence quince or OHF 97 rootstocks, but 'Hosui' produced about 50 fruits per tree on the remaining OHF

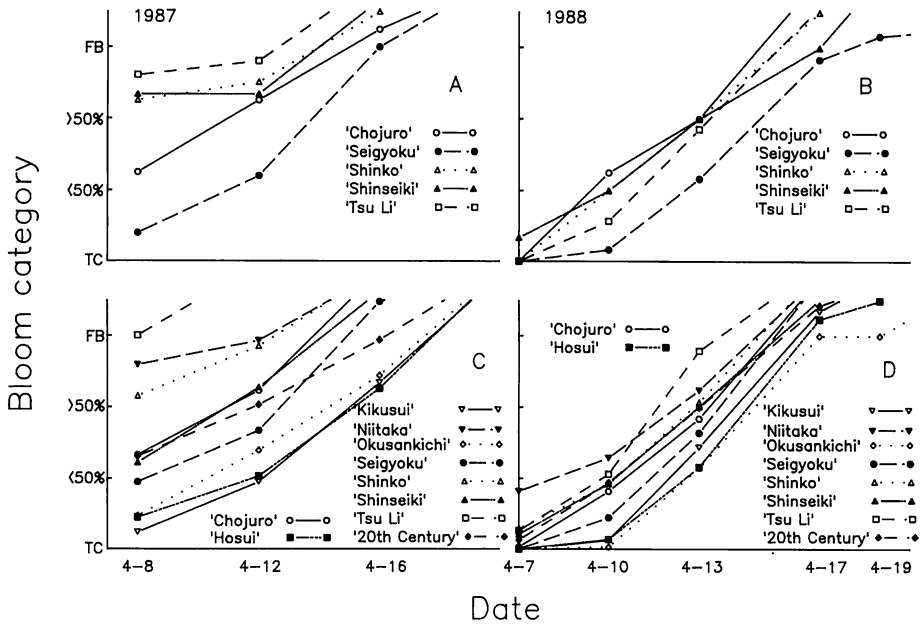

Figure 1. Bloom sequence for selected Asian pear cultivars on Provence quince (panels A and B) and on several Old Home x Farmingdale (OHF) (panels C and D) rootstocks in 1987 and 1988 in central Washington. Bloom categories are, TC = tight cluster (no open flowers), <50% = at least one flower open but not more than half of the flowers open, >50% = at least half of the flowers open, FB = full bloom.

rootstocks (Table 1). 'Tsu Li' was not available on OHF 51, and had poor production regardless of rootstock (Table 1).

On Provence quince rootstock, none of the available cultivars were particularly productive (Table 2). The most productive cultivar, 'Chojuro,' produced only 16.5 fruit per tree, which was significantly more productive than only 'Seigyoku,' which produced one-third of a fruit per tree in two years (Table 2).

For all cultivars (not including the trees in Tables 1 and 2), production in 1988 was much greater than in 1987 (Fig. 2). A significant interaction between scion and rootstock ($P \leq 0.001$) indicated that the effect of rootstock on cumulative fruit production differed among scion cultivars (Fig. 2). For example, OHF 282 was the least productive rootstock for 'Shinko,' but it was one of the most productive for 'Chojuro' and '20th Century.' Also, rootstock had a significant effect only on the more productive cultivars, 'Shinko,' '20th Century,' and 'Chojuro.'

'Kikusui' and 'Okusankichi' produced more fruit than 'Tsu Li,' but fewer

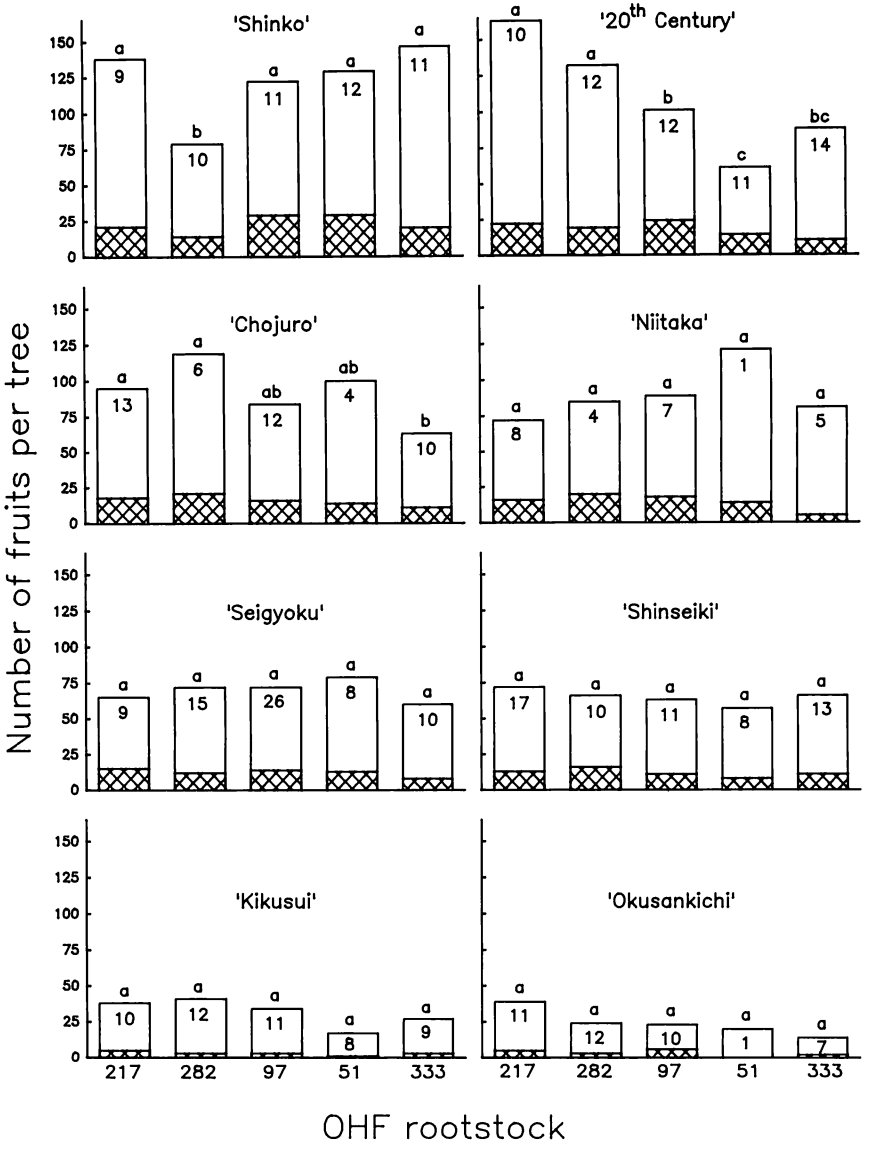

Figure 2. Cumulative fruit number per tree for selected Asian pear cultivars on Old Home x Farmingdale (OHF) rootstocks. Cross-hatched areas indicate 1987 fruit production, with the remaining area being 1988 production. Letters above the bars indicate significant differences among rootstocks within scion cultivars. Like letters indicate no significant difference ($P \leq 0.05$). Numbers within the bars indicate the sample size (tree number). Numbers below the horizontal axes are the numeric portion of the OHF rootstock designations, e.g., 333 = OHF 333.

Table 1. Mean cumulative fruit number per tree of 'Hosui' and 'Tsu Li' Asian pears from 1987 to 1988.

Rootstock	'Hosui' n	'Hosui' Fruit number (tree^{-1})	'Tsu Li' n	'Tsu Li' Fruit number (tree^{-1})
Provence quince	0	—	1	1.0a
OHF 51	8	50.6a[z]	0	—
OHF 97	0	—	4	12.3a
OHF 217	10	55.6a	8	12.6a
OHF 282	2	45.5a	3	16.7a
OHF 333	9	51.1a	1	8.0a

[z]ANOVA indicated that means within cultivars were not significantly different

fruits than the other cultivars, including 'Hosui' (cf. Fig. 2 and Table 1).

Graft compatability

While this study was not designed to test this factor, the low percentages of trees surviving the budding process and nursery and field handling prior to planting suggest that compatability of Asian pear on Provence quince is low (<50%).

Discussion

Two factors are important in assessing the bloom response of Asian pears on OHF and Provence quince rootstocks, 1) the timing of a particular bloom stage and, 2) the length of time trees are in a particular stage. Ideally, trees would be in full bloom late enough to avoid frost injury and long enough to ensure complete pollination. This requires that pollinizers bloom concurrently with the desired crop cultivar. Among the cultivars we studied, only 'Shinseiki' is reasonably self-fruitful (3). '20th Century' and 'Shinseiki' are good pollinizers for most Asian pears, with the notable exceptions of 'Seigyoku' and 'Tsu Li' (3). Fortunately, these two pollinizers flowered at an intermediate time (Fig. 1). Also, 'Shinseiki' was at or near full bloom for several days (Fig. 1).

'Niitaka' is pollen sterile (1), and it was one of the earliest flowering varieties, being past full bloom before most of the others. Sterility and early bloom could cause poor fruit set in 'Niitaka,' although it had reasonably good fruit production in our orchard. 'Shinseiki' does not pollinate 'Seigyoku' and is a relatively poor pollinizer for 'Tsu Li' (3). Generally, our data show that cultivars which bloomed the latest ('Hosui,' 'Kikusui,' and 'Okusankichi') were in full bloom for the shortest period of time. Examination of maximum daily temperatures (data not shown) indicated that this shorter bloom period was not due to warmer temperatures later in the month.

Among the scion/rootstock combinations that could be arranged factorially, 'Chojuro,' 'Niitaka,' ' Shinko,' and '20th Century' all produced at least 100 fruits per tree on at least one OHF rootstock. Conversely neither 'Kikusui' nor 'Okusankichi' produced even 50 fruit per tree regardless of rootstock. Analogous groupings cannot be made regarding the rootstocks.

'Tsu Li' was the only cultivar tested that, except when budded onto Provence quince, lacked production in the third growing season (1987). Production of 'Tsu Li' in 1988 was only one-half that of the next lowest yielding cultivar, 'Okusankichi.'

Table 2. Mean cumulative fruit number per tree of Asian pears on Provence quince rootstock from 1987 to 1988.

Scion	n	Fruit number (tree^{-1})
'Chojuro'	4	16.5a[z]
'Shinko'	4	15.3ab
'Shinseiki'	3	7.7ab
'Tsu Li'	1	1.0ab
'Seigyoku'	3	0.3b

[z]Mean separation by Protected LSD on least squares means

Early production appeared not to be correlated with expected rootstock vigor. OHF 51 and OHF 333, which are expected to produce smaller trees (6), tended to be the most productive rootstocks for some scions and the least productive for others. However, in this young orchard, tree height did not affect production in the first producing year of our study (third growing season). We expect differences in yield efficiency to emerge as the orchard matures.

The poor early production of 'Kikusui' and 'Okusankichi' may be overcome as the trees age. Griggs and Iwakiri (4) report these cultivars as "very productive" and "productive," respectively. However, their characterization of 'Tsu Li' as "moderately productive" suggests that its poor showing in this study may persist with age.

'20th Century' has become a popular Asian pear in the Pacific Northwest. Its early production was among the highest we measured when budded to relatively vigorous rootstocks. '20th Century' also flowered over a longer period of time. Although 'Shinko' flowered and was past full bloom earlier than many of the other Asian pears, including '20th Century,' it was more productive than most cultivars.

This study is an indication of early production that might be expected, and by extension, the potential for an early return on money invested for Asian pears in the Pacific Northwest. However, considerably more information is required on these and other parameters, including quality characteristics and consumer preferences.

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Comments on 'Gala'

ROBERT A. NORTON

Possibly the most heavily planted new variety worldwide. Planted extensively in New Zealand, South America, southern Europe, and Washington. Strong points — sweet, crisp texture, hangs well, stores well with good shelf life. Weak point — fruit size.

Almost all of the plantings are of one red strain or the other—'Royal,' 'Imperial,' 'Scarlet,' 'Regal,' 'Spur Galagored.'

Some are blushed, some striped, some claim larger size and spur-type habit. The tree is similar in habit to one of its parents, 'Golden Delicious.'

Late blooming, incompatible with 'Golden' but compatible with 'Delicious.'

Picked in early September before 'Jonathan' and 'McIntosh.' Management costs may be slightly higher due to heavy set and need far more careful thinning.