Influence of ROOTSTOCK *on bloom period of* BARTLETT PEAR *after a mild winter*

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After a mild winter, Bartlett on Old Home rootstock bloomed earlier and more uniformly than Bartlett on other rootstocks or own-rooted Bartlett trees. Normal blossoming time of the rootstock appeared to be unrelated to its influence on the bloom period of the Bartlett scion. Also, differences in time of bloom apparently were not associated with tree vigor. This research indicates that Old Home rootstock may be valuable in areas where production of Bartlett is limited by insufficient chilling.

CHILLING TEMPERATURES (at or below 45°F) occurring in California's major pear districts from September 1 through March 1 range from 1,400 to 1,900 hours. In most years the amount of chilling in each district is adequate for normal bud opening of Bartlett and other common varieties of *Pyrus communis* L. Good chilling during both December and January is especially critical. Differences in time of flowering and foliation among pear species and varieties have been correlated with differences in the number of chilling hours required to break the rest period. Following winters that fail to provide sufficient chilling, pear trees —as well as other deciduous fruit trees —may have delayed and prolonged bloom periods, dead flower buds, fewer flowers per inflorescence, delayed foliation, and reduced vigor.

Records of bloom dates of pear trees in University of California rootstock plots have indicated that the type of rootstock had little or no influence on the bloom periods of pear trees under the usual range of chilling conditions characteristic of California's principal pear-producing areas.

Differences in bloom did occur, however, among Bartlett trees with different rootstocks at the Deciduous Fruit Station in the Santa Clara Valley at San Jose, following the extremely mild winter of 1969–70. The experimental plot consisted of a replicated planting made in February 1964, of 200 Bartlett trees, 20 with each of nine different kinds of rootstocks, as well as own-rooted Bartlett trees (see table). Records at the San Jose station for 1949–50 through 1968–69 indicate that the average winter (September 1 through March 1) provided 934 hours of chilling temperatures, with 584 hours accumulated during December and January. These averages are considerably lower than those recorded at the station from 1929–30 through 1948–49 (1,423 hours of chilling temperatures, with 717 hours accumulated during December and January). The reduction in the amount of chilling is considered to be caused by the urbanization of the entire area surrounding the 17-acre experiment station.

The satisfactory development of pear leaf and flower buds following most winters in the Santa Clara Valley is considered to be due to clouds, fog, and marine winds which hold down the daytime temperature of the buds. In the September 1, 1969–March 1, 1970 chilling period, only 540 hours at or below 45°F were recorded at the San Jose station. Of these, only 247 hours accumulated during the December–January period. Based on previous results of controlled chilling studies with young pear trees, more killing of flower buds, and a greater delay in bloom, foliation, and shoot growth was expected than actually occurred. The application of the standard 4% dormant oil spray February 5, 1970 most likely assisted in breaking the dormancy of the buds.

The status of bloom was rated on April 2. Each tree was given a score of 1, 2, or 3 (see table), the highest score indicating the most advanced stage of bloom. A one-unit difference in rating was equivalent to a difference of three to four days in stage of bloom.

The trees were routinely inspected for infection caused by the pear blight organism *Erwinia amylovora* (Burr.). The blighted shoots were counted and removed. Length of annual shoot growth by these trees was determined each fall

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by measuring 10 upright terminals, 6 to 10 feet above ground, around the periphery of each tree.

The trees with Old Home rootstock bloomed earlier and were more uniform in their stage of bloom than were trees with the other rootstocks (see table), indicating that Bartlett on Old Home rootstock had a lower chilling requirement than Bartlett on the other stocks, or own-rooted Bartlett. This is interesting, as non-topgrafted Old Home trees normally bloom with Bartlett at Davis, and evidently have about the same chilling requirements. Non-topgrafted *P. calleryana* Decne. and *P. betulaefolia* Bunge trees, in contrast, require less chilling than does Bartlett, and reach full bloom 21 and eight days, respectively, before Bartlett at Davis. Consequently, if the stock influences the chilling requirement of the scion, Bartlett on one of these oriental stocks would be expected to bloom before Bartlett on Old Home (contrary to what was observed).

The portion of the tree that consisted of Old Home wood did not influence the chilling requirement of the Bartlett buds, as there were no appreciable differences in stage of bloom between Bartlett trees developed by topgrafting Old Home 1 ft above the ground in 1964 and those developed by topgrafting Old Home 3 to 5 ft above the ground in 1965 (table), to give them a blight-resistant scaffold system.

Blight infection

The weather during the latter part of the Bartlett bloom period and throughout most of April, 1970 was favorable for infection by the pear blight organism, *Erwinia amylovora*. Blight infections in current-season shoots became apparent April 7, and lasted throughout April and May. A high negative correlation ($r = -0.90$) existed between stage of bloom and number of blight infections for trees with different types of rootstock (see table). Correlations between these factors were not significant within each group of trees with the same type rootstock, however.

Bartlett trees with Old Home stocks had the fewest blight infections (table). Although the Old Home tissue is blight-resistant, apparently it does not confer any resistant qualities to the varieties topgrafted upon it. As the blight bacterium usually enters the tree through the flowers, it is probable that the reduced number of infections in Bartlett on Old Home was due to the earlier and more uniform bloom. Evidently, most of the flowers on these trees were past their most susceptible stage before conditions became favorable for infection.

Tree vigor

In seeking an explanation for the differences in bloom between trees with different rootstocks, tree vigor, as indicated by shoot growth in 1969, was correlated with stage of bloom in 1970. Lack of significant correlation coefficients indicated no consistent relationship between tree vigor and time of bloom. The bloom stage of trees with *P. betulaefolia* seedling rootstocks, which were most vigorous, was about the same as that recorded for the least vigorous trees, those with Angers quince rootstock (see table).

In view of previous reports from Mississippi and California, the trees that bloomed earliest were expected to make the most shoot growth, as their chilling requirements were assumed to have been more adequately fulfilled than those of trees that bloomed later. Despite the poor chilling winter of 1969–70 (540 chilling hours, with 247 occurring in December and January) as compared with 1968–69 (813 chilling hours, with 589 occurring in December and January) all types of trees made about the same, or slightly more, shoot growth in 1970 than they did in 1969 (see table). The amount of shoot growth made in 1970 by own-rooted Bartlett trees, which bloomed last, was not significantly different from that made by Bartlett on Old Home, which bloomed first. For each type of tree, stage of bloom was correlated with amount of shoot growth made in 1970, but none of the correlation coefficients were significant. Thus, the differences in time of bloom apparently were not associated with tree vigor, and any reduction in chilling requirement effected by the rootstock was too subtle to be manifested in the amount of subsequent shoot growth.

The earlier and more uniform bloom of Bartlett on Old Home rootstock following the extremely mild winter indicates that this stock may be valuable in certain areas where production of Bartlett pears is limited by insufficient chilling.

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INFLUENCE OF ROOTSTOCK ON BLOOM PERIOD OF BARTLETT PEAR TREES AT SAN JOSE, CALIFORNIA FOLLOWING THE MILD WINTER OF 1969–70

Tree constitution—Bartlett scion grafted on:	Average length of growth per shoot		Stage of bloom April 2, 1970	Blight infections per tree by June 18, 1970
	1969	1970		
rootstock	cm	cm	rating*	av. no.
Old Home† (grafted 1 ft above ground level)	59.1 cd‡	59.9 cd	3.0 d	0.8 ab
Old Home† (top-grafted 3 to 5 ft above ground)	51.1 bc	52.8 bc	3.0 d	0.7 a
Bartlett seedlings	41.1 b	43.7 b	2.6 c	1.4 bc
Provence quince† with Old Home interstock	48.4 b	49.5 b	2.5 bc	1.3 ab
Kirschensaller seedlings§	56.4 bc	55.9 bc	2.3 bc	1.2 ab
Winter Nelis seedlings	48.9 bc	51.0 bc	2.3 bc	1.7 cd
Pyrus betulaefolia seedlings	83.6 e	84.1 e	2.2 b	1.6 cd
Pyrus calleryana seedlings	68.8 d	67.1 d	2.1 b	2.2 d
Angers quince† with Hardy interstock	28.6 a	28.7 a	2.1 b	1.8 cd
CONTROL				
Own-rooted Bartlett trees developed from cuttings	49.7 bc	51.6 bc	1.7 a	2.0 cd

* Stage of bloom rating: 1 = 1 – 10% of the flowers open with 0 – 1 leaf per cluster; 2 = 30 – 50% of the flowers open with 1 – 3 leaves per cluster; 3 = full bloom with 3 – 6 leaves per cluster.

† Own-rooted stocks developed from cuttings.

‡ Values in columns followed by the same letter are not significantly different at the 5% level.

§ A strain of Pyrus communis.