A Sweet Cherry Scion/Interstock/Rootstock Experiment[1]

Fenton E. Larson[2]

In 1964, 486 sweet cherry trees consisting of two scion cultivars, four interstocks, and four rootstocks, in all possible combinations, were planted at the Washington State University Royal Slope Research Farm in the Columbia Basin of Washington. The primary purpose of this experiment was to observe size and growth characteristics of the various combinations. The scion cultivars used were Bing and Chinook. Interstocks (about 12 inches in length) were the sour cherry cultivars, Kansas Sweet, Northstar, Montmorency, and Redrich. Rootstocks were F/12/1 Mazzard, New York Mazzard, Mahaleb 4, and Mahaleb 900. F/12/1 is an East Malling clonally propagated rootstock. New York Mazzard is a common seedling rootstock. The two mahaleb stocks are seedling stocks selected by Dr. Earle Blodgett at Prosser, Washington.

Tree spacing was 12.5 ft. x 25 ft., with 5 trees per plot in a split plot design with two replications. Two trees in each plot were considered filler trees, should thinning become necessary. The trees were clean cultivated for the first two seasons. In 1966, S-143 orchard grass was seeded between the rows. A grass- and weed-free strip has been maintained in the row with chemicals. Under-tree sprinkler irrigation was used.

No significant crop of fruit was produced during the first 5 years. A crop would have been produced in 1968, but most blossoms were killed by spring frost at bloom.

The purpose of this report is to present information on present tree size and characteristics, as influenced by the various scion/interstock/rootstock combinations, and to give data on fruit bud survival following 1968-69 low mid-winter temperatures.

Measurements of interstock and scion diameters have been made annually in December. Interstocks were measured midway between both unions, and scions were measured within foot of the scion/interstock union above any bulge that might be present. Only those figures for December, 1968 are given.

A single composite sample from each plot of at least 100 fruit buds was examined in March, 1969, to determine bud survival following low mid-winter temperatures. Separate samples were not taken from each tree, because of a general scarcity of buds on trees of some plots. Buds were forced and examined in the laboratory and were considered live if one or more blossoms were alive.

Results and Discussion

Tables 1 and 2 contain the data for tree growth as influenced by different scion/interstock/rootstock combinations. Scion diameter was significantly influenced by both rootstock and interstock (Table 1). Interstock diameters (Table 2) not only differed significantly, but were also influenced by scion and rootstock. There was a significant scion diameter—interstock

[1]Scientific paper No. 3434. College of Agriculture, Washington State University. Work was conducted under project 1639.
The interstock/rootstock portions of the trees for this study were provided by Carlton Nurseries, Forest Grove, Oregon, through an arrangement with Dr. Earle Blodgett of the Washington State Dept. of Agriculture. Scion varieties were budded on by Murit Aichele, of the Wash. State Dept. of Agr.
[2]Associate Professor, Dept. of Horticulture., Wash. State Univ., Pullman.

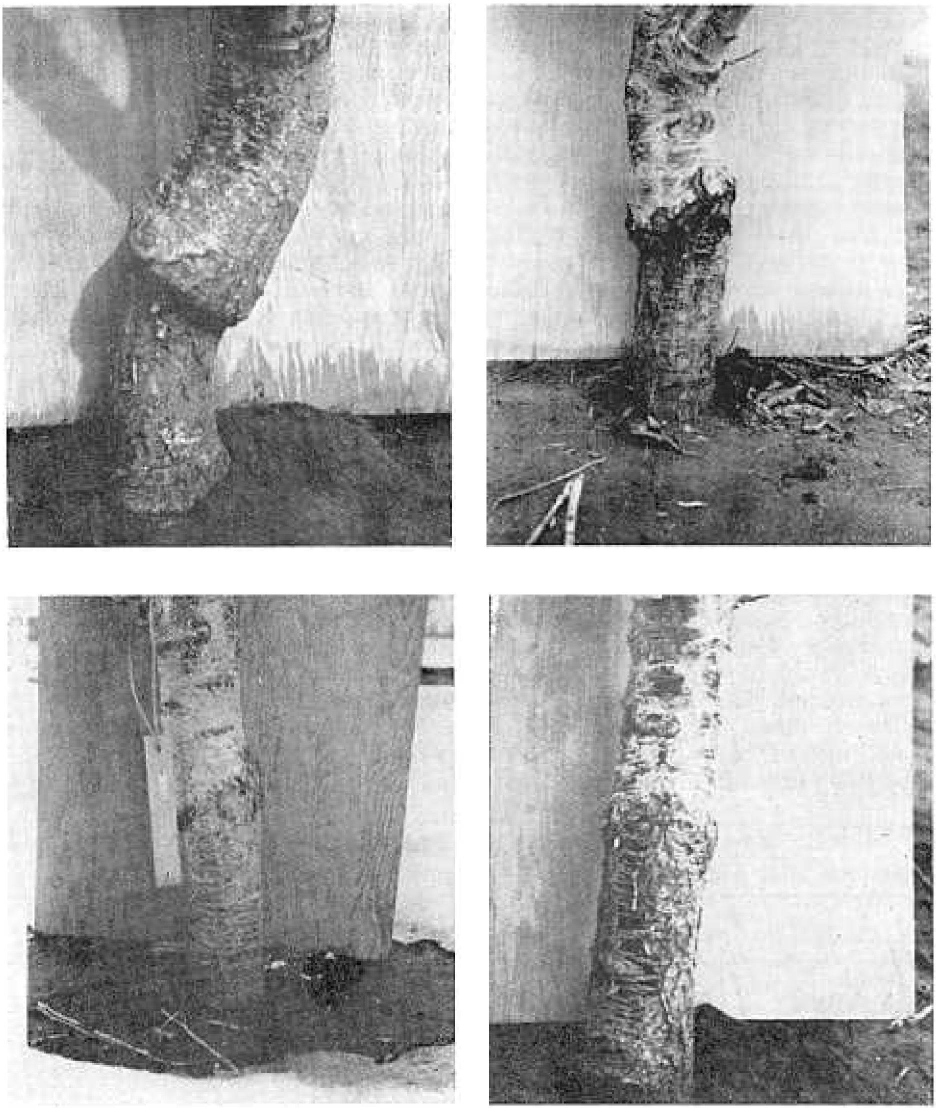

Fig. 1. Representative examples of good (lower photos) and poor (upper photos) sweet cherry scion—interstock combinations. Upper left: 'Chinook'/'Redrich'; Upper right: 'Bing'/'Montmorency'; Lower left: 'Bing'/'Kansas Sweet' Lower right: 'Chinook'/ 'Northstar'.

interaction and a significant interstock diameter rootstock interaction, which indicates that the growth of the tree is a function of the component parts, as one would suspect.

When interstocks are considered independently of rootstocks, Redrich interstocks produced the smallest trees (diameter and height). When rootstocks are considered independently of interstocks, smallest diameter scions were on New York Mazzard roots. The most satisfactory interstocks for uniformity of diameter between scion and rootstock and for freedom from apparent defects were Kansas Sweet and Northstar. Redrich interstocks were generally smallest in diameter compared to other interstocks and were always considerably smaller in diameter than the scions. It appears that most trees on this interstock will be very prone to breakage when the trees become larger in size and have a full crop of fruit.

With Montmorency interstocks there was often a lack of bark continuity at the scion/interstock union resulting in a distinct break in the external bark at this point. This was first noticed in 1968, and occurred only with Bing scions. Examination of the bark disclosed that all tissue at the union except the current season growth was dead. This resulted in a ring of dead bark tissue at the union which could not expand with increased trunk diameter. Consequently, when other tissues expanded, a break in the bark occurred. Even though an external break had not developed on some trees, the dead bark ring was present and presumably a break will eventually occur. The xylem tissue appeared normal with no apparent abnormalities at the union. Some cases of apparent Bing/Montmorency incompatibility, which have resulted in tree losses, have been noted by Washington fruit growers. While no tree losses of this combination have occurred in this planting, there appears to be a question about long term compatibility.

Figure 1 shows the usual smooth transition between scion, interstock and rootstock when Kansas Sweet and Northstar interstocks were used. Also shown are the overgrowths present with Redrich interstocks and the type of bark separation usually present with Bing/Montmorency combinations.

The low temperatures for the period December 27, 1968, to January 2, 1969, were + 15, – 2, – 12, – 20, – 8, – 2, and + 4° F, respectively. High temperatures were + 20, 0, – 6, – 10 + 14, + 15, and + 15° F. During this period, temperatures dropped to as low as – 50° F. in some parts of the

Table 1. Main cherry scion diameter (cm) as influenced by rootstock and interstock after 5 growing seasons—December, 1968.

	Scion		
	Chinook	Bing	Mean[1]
Rootstock			
Mahaleb 4	13.89	12.80	13.34 a
F/12/1 Mazzard	13.67	12.65	13.16 a b
Mahaleb 900	13.02	12.34	12.67 b c
New York Mazzard	12.50	11.68	12.09 c
Interstock			
Kansas Sweet	13.21	13.34	13.27 a
Montmorency	14.20	12.12	13.16 a
Northstar	12.47	12.40	12.43 b
Redrich	12.76	11.65	12.20 b
Scion Mean[2]	13.22 a	12.37 b	

[1]Figures are means of measurements of 48 trees from two replications.

[2]Figures are means of measurements of 96 trees from two replications.

Means not followed by a common letter are significantly different at the 1% level. Comparisons should be made only between rootstocks means, between interstock means, or between scion means, and not across means of different categories.

state, and considerable damage was done to fruit trees. Fruit bud survival as observed in March 1969, was 20.9% on Bing and 31.2% on Chinook (Table 3). There was a significant difference in fruit bud survival between rootstocks as well as between scion varieties, but no statistically significant difference between interstocks. It appears, however, that if sufficient fruit buds had been available to allow more extensive sampling a greater degree of statistical separation could have been achieved. It is of interest to note that there was no consistent relationship between fruit bud survival and tree size (vigor) except in the case of scion height as influenced by rootstock. Scion height was negatively correlated with fruit bud survival. Also of interest although not statistically significant, is that fewest live fruit buds (22.4%) were found on trees with Redrich interstocks. Fruit bud survival with other interstocks were: Montmorency 27.8%, Northstar 26.4%, Kansas Sweet 25.6%.

Carrick (1) reported that mahaleb stock is hardier than mazzard stock. This does not necessarily mean that the scion growing on these stocks will be hardier. However, Edgerton and Parker (2) showed evidence that Montmorency cherry twigs were hardier on mahaleb than on mazzard. Although further work is desirable to substantiate the findings of this study, it also appears that sweet cherry fruit buds are hardier on mahaleb stocks. As in this work, Toyama and Barnard (3) found that 'Chinook' cherry fruit buds are hardier than Bing.

This planting needs further evaluation to observe growth, fruitfulness, and fruit quality as influenced by interstock and rootstock. When in full bearing, differences of more commercial significance may appear in tree size. More time will be required to observe possible incompatibility with the Bing/Montmorency combination. It appears at this point that the Redrich interstock can be ruled out because of the probability of structural weakness. It would be particularly desirable to use artificial freezing tests to obtain substantiating evidence on the influence of rootstock and interstock on fruit bud hardiness.

Table 2. Mean cherry interstock diameter (cm) in relation to rootstock and scion after 5 growing seasons—December, 1968.

	Interstock				
	Northstar	Kansas Sweet	Montmorency	Redrich	Mean
Rootstock					
F/12/1 Mazzard	13.74	13.54	12.57	11.30	12.78 a[1]
Mahaleb 4	12.73	11.67	11.73	12.80	12.23 b[1]
Mahaleb 900	12.40	12.88	11.53	9.91	11.68 c[1]
New York Mazzard	12.42	12.34	10.80	11.02	11.64 c[1]
Scion					
Chinook	12.73	12.47	12.24	11.43	12.21 a[2]
Bing	12.60	12.27	11.00	10.85	11.73 b[2]
Interstock mean[1]	12.74 a	12.54 a	11.64 b	11.20 c	

[1]Figures are means of measurements of 48 trees from two replications.

[2]Figures are means of measurements of 96 trees from two replications.

Means not followed by a common letter are significantly different at the 5% level. Comparisons should be made only between rootstock means, between interstock means, or between scion means and not across means of different categories.

Table 3. Mean percent[1] cherry fruit bud survival as influenced by scion and rootstock—March, 1969.

Rootstock	Scion: Chinook	Scion: Bing	Rootstock Mean[2]
Mahaleb 900	33.2	25.2	29.2 a
Mahaleb 4	34.6	21.0	27.8 a b
New York Mazzard	30.1	20.1	25.1 a b
F/12/1 Mazzard	27.2	17.5	22.4 b
Scion Mean[3]	31.2 a	20.9 b	

[1]Figures are from composite samples of at least 100 buds from plots having 3 record trees.

[2]Rootstock means represent 16 samples each. Means not followed by a common letter are significantly different at the 5% level.

[3]Scion means represent 32 samples each. Means not followed by a common letter are significantly different at the 1% level.

Literature Cited

1. Carrick, D. B. 1920. Resistance of the roots of some fruit species to low temperature. *Cornell University, Agr. Expt. Sta. Mem.* 36:609-661.
2. Edgerton, L. J. and K. G. Parker. 1958. Effect of nematode infestation and rootstock on cold hardiness of 'Montmorency' cherry trees. *Proc. Amer. Soc. Hort. Sci.* 72:134-138.
3. Toyama, T. K. and G. E. Barnard. 1965. The effect of the December, 1964, freeze on some stone fruit varieties and selections. *Proc. Wash. State Hort. Assoc.* 61:51-53.

The Badgerbelle Strawberry

F. A. GILBERT*

The Badgerbelle strawberry was released by the University of Wisconsin in 1967. This variety (tested as Wis. 5827) originated from a cross of Robinson x Jerseybelle and was selected at the Peninsular Experiment Station, Sturgeon Bay, Wisconsin.

The fruit of Badgerbelle is large, attractive, moderately firm (in more northerly latitudes), medium red, colors uniformly, has a large calyx, and the fresh fruit quality is fair.

The plants are very vigorous, prolific (runners root easily), and they are moderately susceptible to leaf scorch.

It is assumed that Badgerbelle would not have any resistance to Red Stele as both parents are susceptible. Since Robinson has some degree of field resistance to Verticillium Wilt it is possible that Badgerbelle might be classified as an intermediate. However, there is only limited evidence of these diseases in Wisconsin and no reports have been received regarding infection under field conditions.

The yields of Badgerbelle have been quite consistent (Table 1).

Field reports with regard to winter hardiness have been very favorable and the variety trials at the Experiment Station have born out this fact as shown by the yield figures in 1965 (Table 1). The lower yields of the other varieties in the table reflect various degrees of plant loss and injury due to a rather open winter.

The large fruits which maintain there size through several harvests

*Professor of Horticulture, University of Wisconsin, Madison, Wisconsin.