EFFECT OF DATE OF GRAFTING ON SURVIVAL IN DOUGLAS-FIR

by

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ABSTRACT

A field study of 1,300 grafts in western Oregon indicated that 90-percent or higher survival was obtained when Douglas-Fir was grafted from early spring to mid-May. Fall grafting in September and October was especially unfavorable.

INTRODUCTION

Orchardists find it necessary to make hundreds of grafts each year to establish and maintain Douglas-Fir seed orchards. It is usually most economical to complete grafting an orchard in as few years as possible. Each month the propagators try to anticipate when or if grafting success is likely to be too low to justify production costs. Results of the following study should help seed orchard managers select the correct termination date of grafting. Survival of grafts made each month from April to October is documented.

METHODS

Field grafting was done in 1968 and 1969 near Corvallis, Oregon. One hundred top-cleft grafts were made each year during the first week of every month, April through September in 1968, and April through October in 1969. Each month, scions from four clones were top-cleft-grafted on twenty-five 9- to 12-year-old rootstocks. Scions from the same four clones were grafted both years. One experienced grader did all the grafting, using uniform techniques throughout the study. No polyethylene bags or protective coverings were placed over the scions.
after grafting. Survival was recorded in June following the year of grafting.

Scions for grafting in 1968 were collected on March 28, divided into six groups, and stored at 35° F. until time of grafting. Scions for grafting in 1969 were collected on March 28 and August 4 and 24. The March 1969 collection was handled as the 1968 collection, except that only enough scions were stored for 4 months' grafting. Scions for 3 additional months were collected in August. Scions collected on August 4 were grafted the same day, and scions collected on August 24 were divided into two lots and stored at 35° F. until grafted in September and October.

RESULTS AND DISCUSSION

Propagators in the Pacific Northwest usually begin grafting in March. Survival of March grafts is normally 90 percent or higher. Results of the present study (table 1) indicate that 90-percent or higher graft survival can be expected until mid-May. Thus, in western Oregon there is a 2½-month interval, March to mid-May, when 90-percent or higher graft survival can be obtained by an experienced grafter. Grafting after that time resulted, with exception of July 1969, in progressively lower survival.

Table 1.--Graft survival, maximum temperature, precipitation, and evaporation during the month of grafting

<table>
<thead>
<tr>
<th>Month of grafting</th>
<th>Graft survival</th>
<th>Average maximum temperature</th>
<th>Total monthly precipitation</th>
<th>Total monthly evaporation</th>
</tr>
</thead>
<tbody>
<tr>
<td>April</td>
<td>97</td>
<td>97</td>
<td>58.9</td>
<td>58.8</td>
</tr>
<tr>
<td>May</td>
<td>94</td>
<td>96</td>
<td>64.8</td>
<td>70.1</td>
</tr>
<tr>
<td>June</td>
<td>80</td>
<td>67</td>
<td>72.8</td>
<td>74.5</td>
</tr>
<tr>
<td>July</td>
<td>52</td>
<td>7</td>
<td>81.4</td>
<td>78.9</td>
</tr>
<tr>
<td>August</td>
<td>35</td>
<td>19</td>
<td>76.2</td>
<td>79.0</td>
</tr>
<tr>
<td>September</td>
<td>23</td>
<td>13</td>
<td>72.7</td>
<td>74.8</td>
</tr>
<tr>
<td>October</td>
<td>--</td>
<td>--</td>
<td>60.4</td>
<td>--</td>
</tr>
</tbody>
</table>


2/ Survival was recorded in June following the year of grafting.
Long-term storage had no apparent influence on initial graft survival, but one undesirable consequence was discovered. The vernalization requirements had already been satisfied so vegetative buds of scions collected and stored in March 1968 flushed 30 to 40 days after grafting. Thus, scions grafted in August and September flushed buds in September to October or October to November, respectively. These late growth flushes produced succulent shoots which were not adequately hardened off to protect them from severe frost damage. In order to overcome the frost problem in 1969, scions for grafting in August, September, and October were collected in August from the 1969 new growth. Buds from these unchilled scions did not flush until the following spring—thus no frost damage was visible. Time of scion collection is not considered the cause of lower graft survival in August and September 1969 than in the same months in 1968 because lower survival from June and July 1969 grafts indicated a poorer summer for grafting.

This study was designed to discover what percent of graft survival could be obtained by grafting at 1-month intervals and not specifically to explore causes of reduced survival. But it is logical to compare survival results with weather data in order to find leads which might be useful in extending the grafting season or in determining the favorable grafting period for areas with slightly dissimilar climates. Weather records were checked to determine the relationship between graft survival and precipitation, maximum temperature, and evaporation. An inverse correlation between graft survival and average maximum temperature and total evaporation was found. High graft survival (94 to 97 percent) was obtained during the cool months of April and May (table 1). Grafts made in June showed reduced survival (67 to 80 percent), and even lower survival resulted when grafting was done during the hot, dry days of July and August (7 to 52 percent).

It should be noted that moderately successful summer grafting (58 to 70 percent survival) was achieved in other studies when protective bags were placed over the grafts. Unfortunately, this type of grafting is slow and thus results in high production costs; therefore, the method is not used for normal orchard establishment.

A third factor, length of favorable growing season after grafting, was evident in grafts made in September and October. Grafts made during those 2 months had lower average survival than that obtained in other months (4 to 23 percent). This was somewhat unexpected because temperature and precipitation were much more favorable than in July and August. The hypothesis is that union formation in September and October grafts was not completed before growth ceased and that the scions were more subject to winter injury than were grafts made earlier.

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1/ Personal communication from Joe Wheat, Industrial Forestry Association, Olympia, Wash.
in the growing season. This was especially noticeable in October grafts, of which only 4 percent survived.

A survey of six seed orchardists from Oregon, Washington, and British Columbia revealed that five in Oregon and Washington had poor results with fall grafting. The one positive report came from British Columbia, where an average of about 80 percent of the fall grafts survived.2/

All environmental factors which lead to water stress conditions in the scion and rootstock probably have a combined effect which is detrimental to graft survival. Lack of precise fit of graft survival with temperature, precipitation, or evaporation data suggests that no single weather factor can be used to explain all survival variation. This was evident in the precipitation and the daily maximum temperature data; high temperatures and low precipitation in July 1968 and 1969 did not result in comparably low survival (52 vs. 7 percent) (table 1). This difference between years is significant at the 99-percent level.

2/ Personal communication from Chris Heaman, Research Division, British Columbia Forest Service, Victoria, B.C.