Selection for freedom from bud failure

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PRINCIPLE CONTROL MEASURES for BF include standardization of nursery stock for low BF potential in susceptible varieties like Nonpareil or selection of varieties with no BF potential. Avoidance of susceptible varieties in localities with prolonged high summer temperature may be required, as better information on relative susceptibility is obtained.

Standardization of nursery stock requires selection of suitable sources for low BF potential, maintenance of these sources under conditions that preserve the low potential, and a distribution scheme to furnish this stock to orchardists. Progress in standardizing nursery stock for low BF potential is being made.

A clean stock program has been in operation for a number of years to identify propagation sources of important grape and fruit tree varieties that are true-to-type and free of known harmful viruses. When identified, the indexed "mother tree" is registered with the State Nursery Service and maintained in an isolated foundation planting, to prevent reinfection. Propagation material is made available to cooperating propagators to establish increase blocks and scion orchards from which buds are taken to produce stock. Certification is possible if the mother plant is from indexed stock and the nursery production system is monitored by nursery inspectors under regulations prescribed by the State Nursery Service. Certification programs have been developed primarily to combat virus diseases and have relied on *visual inspection of source trees* and *indexing to a prescribed range of virus indicators* to accomplish this purpose. The Farnham Nonpareil was selected on this basis; it was symptomless for BF and free of known almond viruses.

Selection for low BF potential, however, requires additional new procedures, not yet completely elucidated. Such procedures will include a method to identify BF potential in the variety source and may include a provision to locate the bud source blocks in areas with moderate temperatures. Selection for low BF potential must utilize indirect methods based, not on the source plant, but on the performance of trees propagated from it. Because no direct indicators exist to measure BF potential in the absence of visual symptoms, performance tests must be made in a high temperature area to induce symptoms to develop. Performance testing requires time and is an indication, not a positive proof, of absence of BF potential.

Performance test information on the BF potential of new single-tree candidate selections is being obtained on candidates for registration and certification. Candidates have originated from various sources through cooperative efforts of horticulturists, plant pathologists, and commercial nurserymen. These candidates have a history of low BF potential, have met standards for visual inspection and virus indexing, and are currently being performance-tested for BF incidence in the southern San Joaquin Valley. Only one of these, designated IR-2 Nonpareil, is currently available for distribution through the Foundation Plant Material Service, University of California at Davis. Performance tests have shown no BF in three years, whereas 50% of the Farnham Nonpareil trees in the same test have BF after the first year. While this looks promising, it is too soon to know just how low the BF potential is in IR-2 Nonpareil.

Information is available from many commercial nurseries on the BF performance of their nursery stock and should be requested by orchardists when trees are obtained. Such plants may meet standards of visual inspection and limited virus indexing based on the Shirofugen cherry test for *Prunus* ringspot virus. Information on performance may be available from selection records and orchard tests similar to those used for testing registered stock, or may be available by monitoring commercial orchards established from the commercial line.

Recent research implies that the bud source trees of low BF potential should be maintained in a low temperature area to minimize gradual increase in BF potential over time. With current methods, such an increase would be undetected until symptoms began to appear in progeny trees. Despite the fact that all trees of Nonpareil and certain other varieties may be affected, BF potential appears to vary widely in the variety. Perhaps low temperature for maintaining a stock block may apply only to specific highly susceptible propagation lines. The question of bud source location has not been resolved, and its answer requires more information than is now available. The environment of the propagation source block as a factor in establishing foundation orchards, scion orchards, and increase blocks is a new concept.

Inheritance studies have indicated that Nonpareil not only acquired the BF potential at the time of seed formation but that it has transmitted the condition to offspring varieties, such as Jordanolo, Merced, Harpareil, Jubilee, and numerous unnamed selections. Many new varieties developed by individuals in California may have BF potential although it may not become evident until large numbers of trees have been grown.

Although BF potential may be inherited in almond × almond crosses, a long period of time may be required for identification. Therefore, information is being obtained on transmission of a BF factor to seedling progeny from almond when crossed with peach. In such progeny, it was found that a proportion of the offspring affected by BF can be identified at the end of one year.

These studies indicate a genetic explanation for BF, but the possibility of an unknown pathogen is not ruled out, and research is continuing on some pathological aspects of the problem.

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