A New Philosophy For Peach Rootstock Development

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Peach production has existed in this country for well over 100 years. During this span, considerable and remarkable progress has been made in cultivar development. Professional peach workers can recommend cultivars which will fit the climate, season of maturity and market use with assurance of product quality.

When it comes to rootstocks, however, we cannot make equivalent recommendations for climate, soil adaptability or scion performance with any degree of confidence.

It is certain that a measure of our difficulty to achieve high peach production levels and to maintain them through an adequate time period is related to the tree's rootstock. One has only to consult the review by Yadava and Doud (9) to appreciate the problem of rootstocks, particularly those of the peach.

The prevailing philosophy has been to use peach rootstocks for peach scions. A new attitude is now timely. The intent of this essay is to stimulate thinking about using Prunus species other than *P. persica* or in combination with them in the development of clonal peach rootstocks. The approach is specifically through interspecific hybridization. Concommitant with this new philosophy is the acceptance of the clonal rootstock concept. While this philosophy starts with the research, it must be converted to activity among nurserymen and growers.

This philosophy is presented not to ignore the attempt to produce peaches on their own roots such as the studies of Erez in Israel and Couvillion in Georgia (1). In their approach, the meadow or throw away orchard, the root system needs little adaptability as it is only required to sustain the tree for 1 to 4 production cycles.

A similar approach is that being pursued by Dr. Nicotra of Italy (6) who is actively breeding peach cultivars with desirable rooting capacity and rootstock characteristics.

At a 1979 S-97 Regional Peach Rootstock Committee meeting, a group of researchers compiled a tentative list of peach rootstock characteristics, those qualities of a rootstock for which we would like specific information and upon which recommendations could be made. It is not surprising that under the broad headings of nursery factors, breeding and genetics, and horticultural requirements over 50 points were listed. If one weighs this long list of what we would like to know about a rootstock, say Lovell or Siberian-C, against what we do know about them, it is apparent that vast gaps exist in our current knowledge. Furthermore, as we summarize the complexity of factors which cause our rootstock problems and look to their solution within *P. persica* we severely limit our problem solving ability.

For example, what gene pools would you go to if a rootstock required resistance to crown gall, armillaria, alkaline soil, peach tree borers and low temp stress while keeping in mind compatibility and rooting requirements?

Thus, to find the attributes necessary to build peach rootstocks, I suggest that we move out of the *P. persica* gene pool.

To a certain extent this has been done by using seedlings or selections

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from other *Prunus* species where a multitude of genetic material exists (2, 3, 7). For the most part this was done to solve only one problem, *i.e.* the use of plum stocks for adaptability to wet soil or the use of *P. besseyi* for dwarfing. This single problem solving technique neglected the fact that seldom does only one problem exist. This is exemplified by the Nemaguard rootstock (a *P. davidiana* × *P. persica* hybrid) which failed in North Carolina and Arkansas due to lack of hardiness, although it solved the nematode problem. A more disciplined approach would be to incorporate through interspecific hybridization various attributes which would result in a rootstock clone.

In the interspecific hybridization approach two fundamental requirements must be met in a clonal stock: 1) compatibility and 2) rootability. Compatibility with peach is a devious trait in *Prunus* species other than *P. persica* with respect to scion proficiency; thus, it would seem reasonable to have some *persica* genes present in future rootstocks for this characteristic alone. Success in vegetative propagation of a clone is prerequisite to commercial use. Thus, rootability, whether in the field, mist bed or test tube, must be present. Nursery characters share in importance with orchard performance in developing a rootstock.

The term "new philosophy" is really somewhat of a misnomer and is used in this essay to stimulate a new interest in this concept among peach breeders and researchers. The use of other *Prunus* species, particularly the plum species, as rootstocks is an old art; one that has been overlooked and one which should now be carried forward (4). When breeders move into the arena of interspecific hybridization to pick up particular characteristics progress will be made in rootstock development.

The French have over 25 years of experience in developing interspecific clones and in finding suitable selections from other species. I have had some exposure to this work started by Dr. R. Bernhard and now carried forward by Drs. Grasselly and Salesses. Their results are solving their rootstock problems and their clones are being used in commercial plantings. The problem of excess soil moisture and alkaline soil is solved in the GF 677 rootstock, a peach × almond hybrid. In 1968, 3% of the peach area in France utilized GF 677 stocks while in 1978, 23% of the peach area was planted using GF 677. The rootstock is now under commercial tissue culture propagation in Italy. Another interesting French stock now undergoing improvement is Damas 1869 (Damas de Toulouse) which is a natural hybrid between *P. domestica* and *P. spinosa*, a native species in France. The selection has been around for over 200 years. It is considered as a good wet soil rootstock, but has a bad rootsuckering problem. GF 106.4 is another natural *spinosa* hybrid that does not sucker, but lacks anchorage. Salesses (8) at the INRA station at Bordeaux has synthesized the pentaploid plum *P. domestica* × *P. spinosa*, from which 1869 originated, in looking for a genomic non suckering copy of Damas 1869. I observed over 1400 of these hybrids at a research station at Bouran and noted a vast array of genetic diversity. The French are now working at building multiple resistance in their current generation of rootstock hybrids.

The replant problem exists in France as it does in the US. I visited one site near Mirande that has been used solely for peach since 1920. The 4th replant showed a uniform stand of healthy trees. At each replant a different and more vigorous rootstock is used.

The rootstock work of Professor Holub in Prague, Czechoslovakia is interesting (5). He is looking for frost hardiness and drought resistance. He is using *P. davidiana* in his crossing program, but also employed *P. fergamensis* and *P. mira,* the latter for dwarfing and acid soil tolerance.

The rootstock approach through interspecific hybridization has a modest effort in North America. Dr. Lane at Harrow, Canada, is trying *P. persica* × *P. besseyi* crosses looking for dwarfing, hardiness and improved compatibility.

At Byron, GA, Dr. Dick Okie is experimenting with *P. persica* × *P. mira,* while Dr. Wayne Sherman in Florida is trying *P. texanna* × *P. persica* crosses to establish a bridge for further interspecific crossing. David Ramming at Fresno, California, has some almond × peach, plum × peach, plum × almond and plum × apricot hybrids. At Arkansas we have been collecting species material for hybridization. In one of our progenies, a *P. davidiana* × Boone County hybrid, we have found an almost pure *davidiana* type with a late bloom characteristic. Another cross, Hahn almond × Chui Lum Tao appears to be of interest.

Exemplary in the interspecific hybrid approach is the work of Floyd Zaiger in California. One of his most interesting rootstocks is a *P. muni* (Japanese flowering apricot) × *P. cerasus* which resulted in *P. belerina* which he has crossed with *P. amygdalus.* This progeny is crossed with Nemaguard × Rutgers Red Leaf. The resulting rootstock should be crown gall resistant, nematode resistant, have good anchorage, controlled vigor and good rooting from hardwood cuttings.

So some work is in progress.

This so-called "new philosophy" must start with the breeder. It then can be converted to an attitude among nurserymen and growers. Eventually it will become a fact of life in peach production. The approach ties in well with the possibilities of genetic engineering through protoplast fusion. Ancillary to the program is tissue culture techniques to advance the multiplication of selected clones.

For years peach breeders have looked at fruit size, color and season of maturity. Now it is time for them to get down to earth and develop rootstocks for their impressive spectrum of cultivars.

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