An Expert System for Selecting Peach and Nectarine Cultivars

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Hundreds of peach cultivars are available for commercial growers. Consumers usually cannot distinguish among these various cultivars. Therefore, the grower most often selects cultivars based on such factors as particular marketing needs, geographic location, disease susceptibility, flower hardness, tree hardness, and/or, in southern regions, chilling requirements.

A computer-technology expert system (ES) has been used to assist fruit growers, county agents, and private consultants in making better decisions by addressing the complex horticultural and pathological problems involved in peach cultivar selection in Pennsylvania (Sullivan et al., 1989). As described previously (Crassweller et al., 1989), this single module is part of an overall program designed originally for apple production management and now expanded for peach production management.

There are several published compilations of peach cultivar characteristics from which many of the cultivar descriptions were gleaned (Frecon, 1988; Ritter and Peterson, 1988; Savage and Prince, 1972, 1977). Often, however, the compilations are specific to a region. The advantage of this module is that a companion program was developed that allows a nontechnical person to update or add cultivars or alter characteristics as they pertain to a particular region. The ability to update without reprogramming creates a flexible system while eliminating the need for major

revisions by a technically trained computer programmer.

The program develops the recommendations based on nine characteristics: harvest date (before or after a benchmark cultivar); flesh color (white or yellow); flower hardness (hardy, medium hardy, or tender); pit freeness (cling, semicling, semifree, or free); average fruit size (<2.25 inches, <57 mm; 2.25–2.75 inches, 57–70 mm; >2.75 inches, >70 mm); and susceptibility to brown rot, bacterial spot, leaf curl, and winter injury (resistant, moderately resistant, or susceptible). Where possible, cultivars were ranked for each of the characteristics based on comparison to 'Redhaven' as grown in the fruit-producing areas of the mid-Atlantic region of the United States and on previously published literature (Frecon, 1988; Ritter and Peterson, 1988). Where observational data were not available, a consensus ranking by research and extension personnel was used. Any or all of these characteristics may be chosen in narrowing down the list of cultivars.

In selecting the harvest date, the user may choose either 'Redhaven' or 'Elberta' as a standard reference point. To allow for seasonal variations, a ± 5 -day window is used on either side of the desired ripening date for the benchmark cultivar. For example, a user desiring to find those cultivars that ripen 10 days after 'Redhaven' will be shown ones that ripen 5 to 15 days after 'Redhaven'.

The companion program was developed to allow extension or research personnel to alter or add cultivars based on their region and growing conditions. This program permits easy modification of the cultivar selection program without the need for involved computer language changes. The ES also features a help option. The user may ask the system to explain the reason for asking particular questions or to define terms in the questions.

An example of the operation of the system might include the following approach. First, the user desires a peach cultivar that ripens 10 days after 'Redhaven'. The system selects all those cultivars within ± 5 days of the 10-day choice, producing a potential list of 26 peach and six nectarine cultivars. The second characteristic desired may be a high degree of flower bud hardness, narrowing the previous list down to 12 peach and two nectarine cultivars. Based on previous research and knowledge of growing conditions, only eight peach cultivars and one nectarine cultivar from this list are recommended for planting in this region and are so denoted by an asterisk next to the cultivar name.

The listing of cultivars that match the user's requirements is presented on the last display screen. The user may then select from the list to determine the exact characteristics of a particular cultivar. A review option also allows the user to retrace steps followed in the program. Currently, there are 153 peach and 30 nectarine cultivars accessible within the program as used in Pennsylvania. The software is written in a frame-based ES shell, PennShell, that generates compiled C-code for enhanced portability among different microcomputers. The program currently is only available for Macintosh systems but should be available soon for IBM and compatibles. Copies of the program for trial examination are available by contacting R.M.C.

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