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GOOD FRUIT GROWER

Good Point - Stephen Young

Tree fruits as annual crops?

Orchard systems have gone through dynamic changes over the past 50 years. High-density plantings and dwarfing rootstocks have allowed growers to make changes in production practices more quickly as markets have expanded and become more volatile. Will these changes in woody perennial crops in the past five decades be equaled or surpassed in the next?

In central Washington, near the Columbia River, apple orchards on V-trellis and slender spindle systems are planted adjacent to large fields of irrigated corn, potatoes, and alfalfa. Several miles downstream, where the river divides Washington and Oregon, large acreages of tree fruit orchards are now being converted to wine grapes. Similar to the apple orchards upstream, the new vineyards are intermixed with large fields that contain rotational crops of corn, carrots, peas, potatoes, and alfalfa. In these two examples and numerous others, the concept of integrating woody perennial crops into an annual crop rotation is obvious, yet highly unlikely and almost completely out of the question— or is it?

An historical account, by C.D. Walker (1980), on the development of intensive orchards in England, reveals initial plantings in the mid-1500s were standard trees grafted onto seedling crab rootstocks planted in grass that was grazed by livestock. By 1900, the bush orchard with small trees on Paradise rootstocks was being used with densities of 300 to 600 trees per hectare (121-242 trees per acre). In 1912, research on rootstocks began in earnest at the East Malling Research Station in an effort to identify and classify existing stocks. This research produced the Malling 1, M.2, M.9, and later the MM.106, and more recently, the extremely dwarfing M.27 rootstocks. The intensive systems of the late 1920s were predominantly apple trees on M.2 rootstocks at 6,000 trees per hectare (2,420 trees per acre). These first attempts were unsuccessful, primarily because of the much-too-vigorous M.2 rootstock. Since then, the proportion of intensive orchard systems being planted has steadily increased, and M.9 (for densities of around 1,200 trees per hectare/485 trees per acre) or MM.106 (for 500 trees per hectare/200 trees per acre) have been the more commonly used rootstocks, according to Walker's account.

From this research, it is clear that with breeding and genetics, intensive orchard systems can come into full production at a faster rate than those of the pre-twentieth century era. Future research will provide clues as to how even faster production capacity can be achieved by woody perennial crops, including pears, cherries and grapes, which would be ideal for rotating with herbaceous annuals and short-lived perennials.

Rotations are widely used in herbaceous annual crops (e.g., corn, potatoes, wheat), and a high rate of cultivar turnover has long been accepted by growers of herbaceous short-lived perennials (e.g., strawberry). However, other industries that rely on fruit production from traditionally grown woody perennials (e.g. apple, grape), which require a longer period to realize a return on

the investment, are reluctant to change cultivars, let alone rotate with another crop. The use of existing stock to graft new cultivars and even different species is a common practice in progressive orchard systems, which allows for a quick change with little disturbance and minimal capital investment. While incorporating woody perennial crops into annual cropping systems may seem impossible today, the rapid advancements in technology and research could allow for future highly diversified systems that include rotations of both short-lived perennials and long-lived annuals, crops that are traditionally annuals but might in the future be grown for more than one year.

Similar to woody perennial crop production, annual cropping systems have gone through recent changes, with more to come. For example, herbicide resistance, perennial production, and - computer-based management—once thought to have been impossible in annual cropping systems—are either currently available or in various phases of research. The production of herbicide-resistant crops (e.g., Roundup Ready) was unheard of until the mid-1990s and is an example of molecular biotechnology being successfully applied to improve the production efficiency of conventional cropping systems.

Research on extending the longevity of wheat is progressing and could soon yield a viable alternative to annual wheat that would help reduce soil erosion, degradation, and production costs. Although estimates put production several years away, the thought of perennial wheat 20 years ago was just that—a thought. In the area of sensor technology and automation, recent advancements are occurring at a rapid pace, especially in the United Kingdom, where machine guidance and vision systems are being researched for weed control in organic crop production systems.

In woody perennials, the advent of dwarfing rootstocks and high-density plantings, as previously mentioned, have reduced the time required for a tree to enter into fruit bearing. The emphasis on precocity over the past 40 years has been a major development in orchard systems, partly in response to the need for more rapid turnover of cultivars. Today's consumer is constantly looking for something new, grown without chemicals, and of high quality. In New Zealand, the apple industry has found that the profitable introductory phase is shorter with each new cultivar, according to a 1999 report by John Palmer of HortResearch, New Zealand.

One way fruit growers have adapted to the pressure to be first with new varieties is by extremely rapid orchard turnover. When a variety becomes established on the market, new ones quickly replace it. Growers have been known to begin top working one-year-old trees that are young, vigorous, and properly spaced. In some cases, trees are removed and the block is replanted. This type of response—in this case market-driven—can provide the stimulus needed to bring change in ideas, methodologies, and practices.

Disadvantages

In the future, when woody perennials are seriously considered for use in annual cropping systems, discussions will have taken place on the advantages and disadvantages. At this point, the primary disadvantages or limitations are:

- Costs and site disturbance associated with planting and removal
- Length of time to fruit bearing
- Integration of two highly diverse cropping systems

Research is being done to find ways to shorten the time to reach full production and, with the help of advanced technology, research projects could be initiated to address the other primary limitations.

Advantages

Currently, there are several advantages for rotating woody perennials into an annual cropping system:

First, the effects from market volatility are reduced because growers can rotate parts of their acreage between several different crop types (e.g., high value, low value, annual, and perennial). This allows for an operation to be vertically integrated and better able to withstand changes in the marketplace.

Second, rotations that include a wider range of crops will lower the build-up of pest pressure. The potential to reduce inputs for controlling weeds, insects, and disease is increased with a highly diversified crop production system.

Third, rotating between deep- and shallow-rooted crops allows for more uniform nutrient cycling within the soil profile. In addition, roots of woody perennials create hydrologic and biologic channels beneath the soil surface, which can be a direct benefit for annual crops.

The use of woody perennials as viable additions to annual cropping systems is a long way off. Much is unknown along the pathway to these extremely diverse systems, but to explore the possibilities is part of the process of advancing the industry and doing the impossible.

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