Are Modern Fruit Production Systems Sustainable?

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The quality, diversity, and availability of fruits is greater today than at any time in recorded history. Relative wholesale values of most fruits have been stable or declining for decades, higher crop yields are produced on decreasing acreage, and postharvest storage and quality have improved as new technologies have been developed (NRC, 1989). Americans now spend only 12% of their personal income on food—the lowest proportional expenditure of any industrialized nation. Contemporary fruit growers are more likely to worry about excess production and consequent depression of wholesale prices than crop failures or insufficient supply. Surprisingly, amidst these achievements, there are also increasing doubts about our ability to sustain current production and availability of fruits and other crops. “Sustainability” has emerged as a new paradigm by which fruit production systems and practices are judged (York, 1991). Federal and private funding agencies are reallocating millions of dollars from traditional research into new programs assessing environmental impacts, food safety, and other aspects of agricultural sustainability.

Are these recent trends an over-reaction to subjective and misinformed public attitudes toward a successful and sustainable agriculture, or are modern fruit production systems flawed and nonsustainable? We try to answer these questions here by discussing sustainability in the context of perennial crops, estimating the present and future availability of essential resources for fruit production, and surveying trends that are likely to affect future fruit crop production.
Criteria for sustainability. The recent emphasis on sustainability originated within international development agencies as a criterion for evaluating the progress and performance of socioeconomic development programs. It was extended subsequently to agriculture in the developed nations, and a myriad of different and often contradictory definitions of sustainability have since been proposed (Crews et al., 1992). Most agree that sustainable farming systems all share certain attributes. First, they conserve and protect the essential agroecosystem resource bases (e.g., soils, water, genetic diversity). Second, they provide adequate quantity and quality of the food and fiber to meet present and future requirements. Third, they optimize crop output per unit of capital, labor, land, or energy input. Finally, they are profitable enough to provide farmers with adequate living standards and support viable rural communities. Beyond these four basic attributes, there is little agreement about the best definition of sustainability, and we do not intend to contribute further to that controversy.

Fruit production systems

Traditional fruit growing and gathering system. At first glance, traditional fruit production systems appear to provide excellent models of sustainability. They were developed with minimal external inputs, and obviously they have endured for very long periods of time. There are groves where avocado, cashew, olive, apple, grapes, and other perennial fruits have been harvested continuously for many centuries (Simmonds, 1976). A substantial portion of the world’s production of several commercially important tropical fruits (e.g., Brazil nuts) still is harvested from semidomesticated, old forest stands (Smith et al., 1992). Many more fruits gathered in these agroforestry systems are not commercially marketed, but provide an essential part of the dietary needs of subsistence farmers and indigenous peoples. These traditional fruit production systems are certainly sustainable on their own merits. Nonetheless, rampant deforestation of large tracts for timber, grazing, and conversion to export cash crops threatens these forests, the local people who depend on them for food and income, and the invaluable diversity of flora and fauna that they harbor. In addition, these gathering systems often do not meet the food demands of increasing human populations.

If the clear cutting and conversion of tropical forests to pasture or field crops is necessary to provide adequate food for the people of Third-world countries, then traditional forest agroecosystems are nonsustainable. However, several studies have indicated that the long-term food and income yields of tropical forests used by low-impact gathering of fruits, nuts, latex, and other resources could surpass the short-term yields of timber or slash-and-burn crops that usually motivate deforestations (Smith et al., 1992).

In such cases, it is perhaps the underlying socioeconomic systems that are nonsustainable, not the fruit production systems themselves. This fundamental distinction is often ignored. In many instances, farming systems are faulted for shortcomings that are caused not by the internal dynamics or integrity of the agroecosystem, but by external socioeconomic forces resulting from national policies. It is difficult for farmers to sacrifice voluntarily short-term gains for the sake of intangible future benefits when the cultural, commercial, and political systems in which they must survive are rewarding short-term profits and economies of scale.

Traditional fruit and nut gathering systems—however intrinsically sustainable they may be—are threatened and losing ground everywhere because of external factors unrelated to the agroecological integrity of these venerable systems. Without changes in human population dynamics and local/global economic systems, it appears unlikely that many traditional fruit-growing systems can be sustainable.

Traditional family farm fruit production. The orchards, vineyards, and berry plantings of 75 years ago were usually just one component of diversified family operated farms. Diversified farms provided some important advantages to growers, insulating them from occasional crop failures and commodity price fluctuations. Smaller plantings and larger families reduced the need for hired help. Integrating livestock with field and fruit crop systems minimized certain off-farm inputs. Organic manures were readily available, and pest-infested fruit could be used for animal feed. On the other hand, the productivity of traditional orchards was generally low, and production/replacement cycles were considerably longer than they are today. Expertise, equipment, and technical support often were limiting. Fruit plantings consisted of many genotypes and were not grafted on clonal rootstocks, resulting in nonuniform crop stands that were difficult to manage. Nursery stock was propagated without regard for virus status, and diseased stock severely limited the production of many fruit crops. Pest controls included heavy-metal derivatives such as lead arsenate, or genetic sources of resistance (if they existed). The minor portion of each fruit harvest suitable for fresh consumption was bartered or marketed locally, was relatively expensive, and

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