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Suggested guidelines to aid small farmer crop selection : the case of peaches in Tennessee

Mark B. Follis

To the Graduate Council:

I am submitting herewith a thesis written by Mark B. Follis entitled "Suggested guidelines to aid small farmer crop selection : the case of peaches in Tennessee." I have examined the final electronic copy of this thesis for form and content and recommend that it be accepted in partial fulfillment of the requirements for the degree of Master of Science, with a major in Agricultural Economics.

John R. Brooker, Major Professor

We have read this thesis and recommend its acceptance:

Accepted for the Council:
Carolyn R. Hodges

Vice Provost and Dean of the Graduate School

(Original signatures are on file with official student records.)

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Robert P. Jenkins

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Accepted for the Council:

L. Evans Roth

Vice Chancellor
Graduate Studies and Research

4

SUGGESTED GUIDELINES TO AID SMALL FARMER CROP SELECTION: THE CASE OF PEACHES IN TENNESSEE

A Thesis

Presented for the

Master of Science

Degree

The University of Tennessee, Knoxville

Mark B. Follis

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ABSTRACT

Small farmers world-wide have historically suffered from a lack of advice and information from governmental and marketing institutions pertinent to their particular situation. This has been a source of much uncertainty and the subsequent reluctance of small farmers to produce nontraditional, more profitable specialty crops. This uncertainty might be diminished by a procedure with which a small farmer could answer for himself, given a set of opportunities and constraints, the two primary questions of (1) What crops can be successfully grown? and (2) Where and by what means can these crops be sold in a profitable manner? As its first objective, this study suggests such a small farmer self-evaluation procedure which examines historical, natural resource, management, cost and return, and marketing considerations.

The second objective of this study, an example of the implementation of this procedure, is conducted by examining the feasibility of small farmer participation in an expansion of the Tennessee commercial peach industry. It is determined that while physical production of peaches is feasible in large areas of Tennessee, crop damaging spring frosts are not uncommon and market outlets are limited, particularly for small farmers. Peaches would appear, however, to be an attractive side enterprise for small farmers provided the presence of direct marketing opportunities.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER I

INTRODUCTION

Many small farmers in Tennessee suffer from problems of low productivity and income. Factors responsible for this include the limited availability of productive land, high input costs, labor shortages, and the high costs of equipment and other fixed expense items. This situation is not unlike that facing small farmers in many other parts of the world, particularly in the developing nations. Small farmer agriculture in both Tennessee and abroad can be defined as that situation where:

> (1) The bulk of the labor force, management, and capital comes from the same household, (2) production is either consumed on the farm and/or traded in local markets, (3) the decision-making process is hampered by limited access to marketing and political institutions, and (4) the farmers do not live much above the culturally determined subsistence level. (14, p. 34)

In the past, agricultural development has focused primarily on those factors that seemed most crucial to large-scale crop production (15, pp. 3-5). As a result, most production increases occurred in those areas where resource constraints to production were relatively light. Although substantial advances have been made, world food production has only barely kept in step with population growth.

The continuing need for increased world food production is drawing new attention to small farmers. There is also interest in the development of small farm resources in order to provide expanded employment opportunities in rural areas. Success in this could help

reverse the historical trend of rural-to-urban migration which in turn might relieve some of the population pressure currently facing large metropolitan centers in both the United States and abroad.

Problem

As mentioned in the previous section, agricultural research has often been directed towards very large farms, plantations, state farms and smaller farms organized into estates and cooperatives. This has been particularly true in the developing countries of the world (23, p. 271). Small farmers not involved in such units have often been ignored and left to make their own production and marketing decisions. As a result, they have suffered not only from shortages of land, labor and capital but also from a lack of information and advice pertinent to the specific horticultural and economic conditions that they face.

This lack of information has been the cause of much uncertainty and confusion in the minds of small farmers (4, p. 34). A poor harvest or market failure in a given year could be far more devastating to the small farmer at the subsistence level than to the larger farmer with greater financial reserves and credit. This has compelled the small farmer to choose familiar agricultural activities rather than potentially more profitable alternatives with which he has little or no experience.

A small farmer might relieve such uncertainty by using guidelines which are specifically designed to help him determine the feasibility of producing and marketing a new crop given his particular situation.

He might then be more inclined towards the production of nontraditional crops which could improve his income and well-being. Such a program would need to address both the physical production of a crop and its subsequent sale through marketing channels. This is extremely important because a crop might thrive in a certain physical environment but would be of little benefit to the producer if markets were not available.

Objectives

This study has two objectives. The first is to develop and suggest a set of guidelines which can enable small farms and people working with them to self-evaluate the feasibility of producing and marketing a potentially higher income specialty crop. The second objective is to illustrate the implementation of the guidelines through a specific example.

Procedure

In order to achieve the first objective of the study, Chapter II will examine those areas which most affect the physical production of crops and the disposal of the harvest through marketing channels. Included will be an examination of the natural physical factors most critical to crop production. The principal managerial skills necessary for success in such agricultural enterprises will also be identified. Finally, a discussion of important economic and marketing considerations will be included. The special problems inherent to small farmer agriculture will be particularly kept in mind in all these matters.

The second objective of this study--an illustration of the guidelines developed in Chapter II--will be discussed in Chapter III. This chapter will examine the feasibility of small farmer participation in an expansion of Tennessee's commercial peach industry.

Chapter IV will summarize the findings and implications of Chapters II and III. This chapter will also address the applicability of the study to the situations facing small farmers elsewhere in the world. This is pertinent because this study is part of the Title XII Strengthening Program in which both The University of Tennessee and the Agency for International Development are participating. This program is directed toward improving the problems of small farmers in both Tennessee and in developing nations with the purpose of increasing their productivity and material well-being.

It should be noted that, while the guidelines to be developed in this study are aimed at small farmers primarily, many others in agriculture might benefit from such an exercise. These could include medium and larger sized farmers, extension personnel, individuals employed in agribusiness, governmental advisors and project planners.

CHAPTER II

FACTORS AFFECTING THE VIABILITY OF AGRICULTURAL ENTERPRISES

A small farmer wishing to enter or expand an agricultural enterprise needs to examine his particular situation carefully before committing limited time and resources. He needs to consider his unique combination of production and marketing constraints and opportunities.

> The cost of using a resource is sometimes best measured not directly in money or hours, but in terms of what was given up in order to undertake another choice. The significance here is that each unit of land, labor, and capital should be used where it will add most to income. This is extremely important in choosing enterprises.
>
> It means putting to use those resources which are not idle part of the year and making more use of those already employed. This, in fact, is a key problem in under developed countries, especially under- or unutilized land, labor, and capital resources are widespread. (9, p. 13)

Theoretically, there is a universal set of all possible agricultural enterprises in which a small farmer might enter. In reality, however, he will be limited to those opportunities which are available to him by many constraints. These constraints include the natural resources which he may or may not possess, his managerial ability, labor availability and the amount of capital and credit to which he has access (Figure 1). Other constraints which he may face are municipal zoning ordinances, governmental policy, environmental regulations, the pressure or absence of agricultural subsidies and the availability of supportive services.

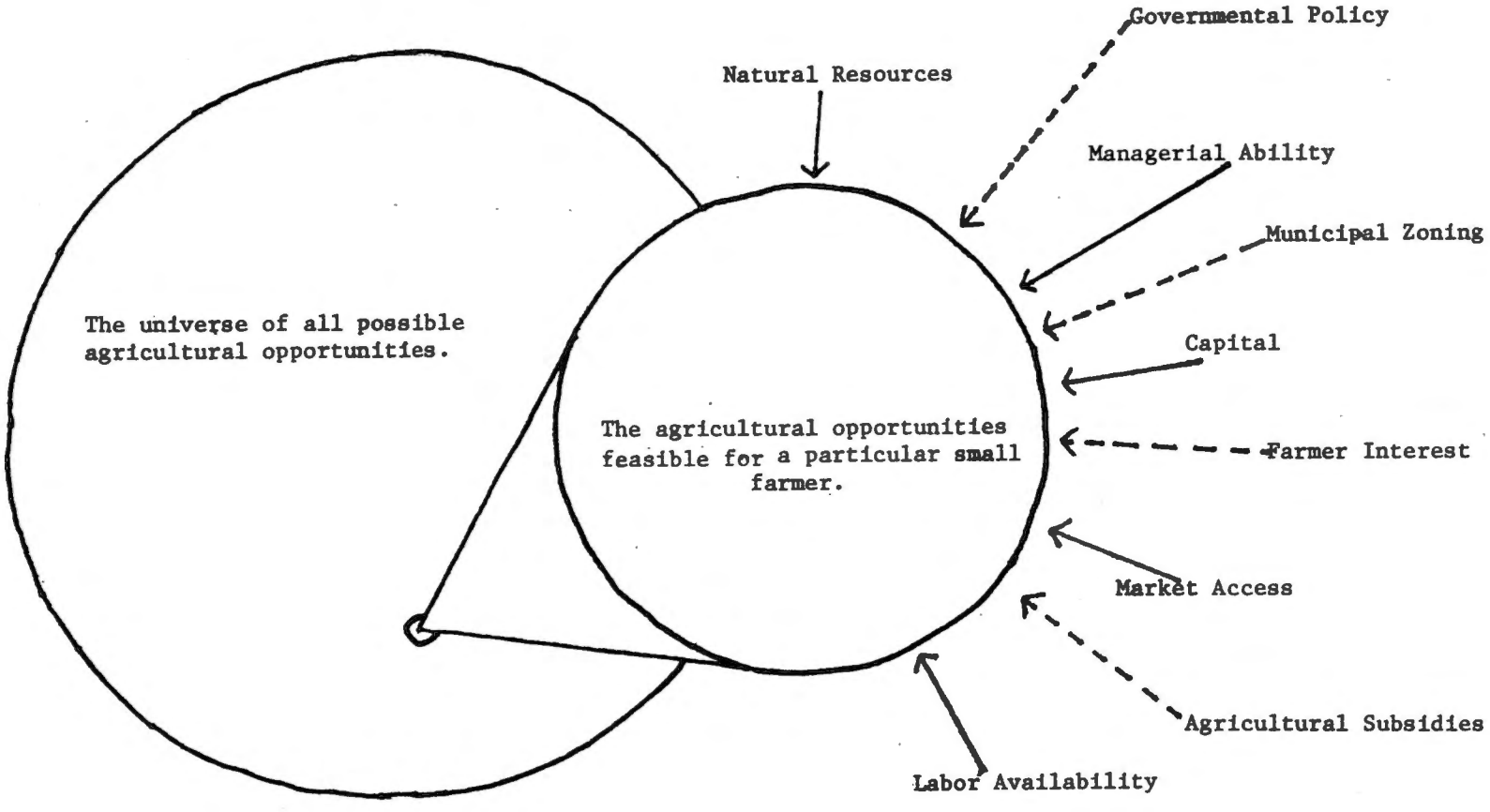


Figure 1. The agricultural opportunities feasible for the small farmer are determined by the set of constraints that he faces.

A small farmer has little or no control over such constraints as zoning, governmental policy and subsidies. He can, however, given his natural resources, managerial skill, capital and market accessibility, select and produce crops which could maximize his productivity and economic well-being. Two important economic concepts which he might find useful to keep in mind are competitive and comparative advantage.

Small farmers should look for agricultural activities in which their region might have a competitive advantage. This occurs when an individual or region can produce, process, and transport a product to a given market at a lower price than can the competition (20, p. 8). Comparative advantage is more complicated and harder to identify. In fact, the determination of comparative advantage would probably only be useful to individuals involved with the macro level such as governmental planners and policy developers. This is because comparative advantage is more concerned with improving the overall productivity of an entire region or nation than it is with the individual welfare of particular farmers. As an example of a comparative advantage, suppose a region produces and consumes both X and Y. If it is relatively more efficient at producing X than Y compared to another region, it may be to its advantage to devote most or all of its resources to the production of X and in turn buy the Y that it needs from a region that is most proficient at producing Y. Both regions have benefitted because each is maximizing the productivity of its resources.

The identification of the above concepts is made more complicated by the fact that different individuals and areas do not always maintain

the same economic relationships with each other. Several factors can alter the situation. Some of the more important are: (1) the adoption of new techniques, varieties and technologies; (2) changes in market demand and structure; and (3) changes in transportation costs and processing facilities (9, p. 10).

As mentioned earlier, while farmers may have little or no control over zoning or governmental policy, they can elect to produce those crops which will maximize the productivity of the resources they do possess. Figure 2 illustrates the procedure suggested in this chapter to improve small farmer crop selection--the preproduction examination of historical records, natural resource requirements, managerial ability, expected costs and returns and market accessibility.

These guidelines should aid small farmers in choosing optimal opportunities in three ways. First, they should help eliminate horticulturally and economically unsound activities from consideration. Secondly, they should help the farmer select which crop or crops to produce from the set of feasible alternatives. Finally, the guidelines should provide a schedule for proceeding with the decision to produce and market a particular crop.

Historical Considerations

A good first step for a small farmer to take is to obtain histories of the particular agricultural industry in which he is interested. These may be obtainable from extension sources, public libraries, agricultural schools, and so forth. From these the

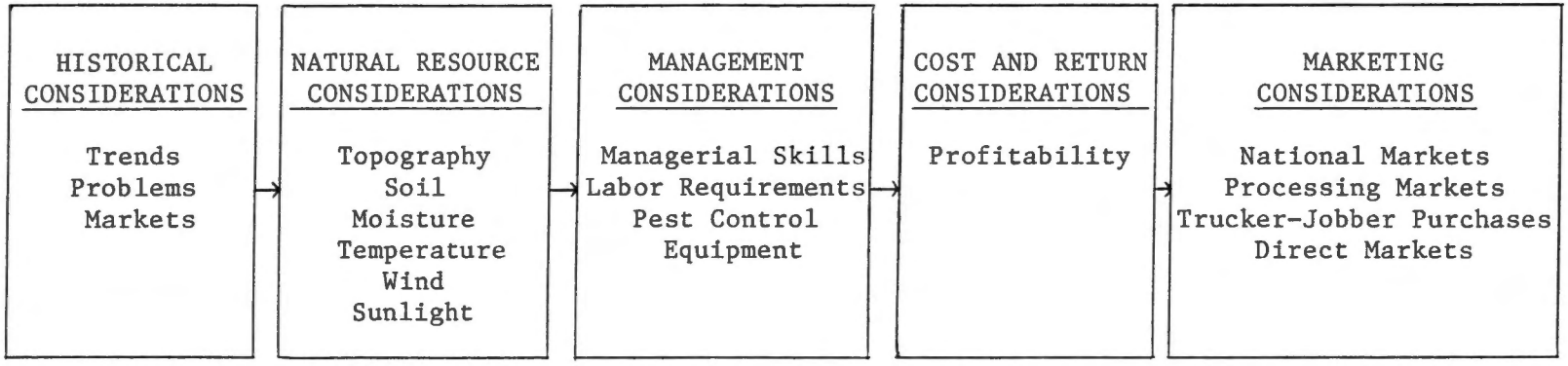


Figure 2. A suggested procedure for small farmer evaluation of the feasibility of producing and marketing a nontraditional specialty crop.

potential producer may gain an insight into several areas including: (1) geographic regions in which a crop has been and is presently produced; (2) past and present markets; and (3) historical trends in production and their causes. All of this information can provide useful "clues" as to the viability of producing a specific crop.

Natural Resource Considerations

The set of natural resources which are available to a farmer will determine whether or not his own farm is favorable for the production of a certain crop. Topography and soil type are two important natural physical factors that influence plant growth while four important climatic factors are moisture, temperature, wind and sunlight. Considerations warranting particular examination with regard to these climatic factors are the means and extremes, and the frequency of departure from the means in a certain locality (3, p. 47).

Topography

Topography is important in crop selection for several reasons. It can influence the amount of water that is available for crop production. In severe cases, certain soils in elevated areas may be too dry to effectively support vegetation while low areas may be too damp and waterlogged for proper crop growth. Topography can affect crops because of the temperature modifying effects of air drainage. Some slopes will tend to be warmer or cooler than land sloping in other directions. In areas with steep topographies there may be the potential for severe erosion. Finally, the production of many crops

performed at considerably less cost on level or rolling sites than on those which are rough or sloping.

Soil

The soil requirements of most crops will usually be met if a soil is well aerated, near neutral in reaction, low in salinity, and if it supplies sufficient available water and nutrients (10, p. 23). Farmers should determine the specific soil requirements for any cropping enterprise they are interested in entering. If there is doubt as to soil suitability, they may be able to check with local extension personnel or local soil survey maps. Such information may be very limited or even nonexistent in some less developed countries.

With regard to crop selection, it is important that a farmer pursue those agricultural activities that will maintain the productivity of his soil as a fertile field may yield up to twice as much for the same area as an unfertile field. He needs to choose crops by which he can minimize soil erosion, protect his water supply, and either maintain or improve the soil fertility.

Moisture

Moisture requirements vary from crop to crop. In most areas soil moisture is provided primarily through rainfall (30, pp. 21-25). Too much moisture can cause soil waterlogging which may make plants particularly vulnerable to rot and disease. Too little moisture will result in the wilting or death of a plant.

Rainfall will vary widely from region to region. Long-term weather records can be useful for determining the availability of moisture for cropping operations. Important considerations include average total rainfall and seasonal distribution.

Temperature

Temperature is critical for the germination of seeds and the active growth of plants. The yield and quality of fruits and vegetables can be affected by temperatures which are either too hot or too cold. This is because of the reduced photosynthetic activity which occurs at these temperatures. Temperature also affects the length of the growing season. The length of time required for a crop to mature will usually be longer in localities where summer temperatures are relatively cool. There might be too little time for the plant, flower, and fruit or vegetable to mature between the last frost in the spring and the first killing frost of the fall. For these reasons the potential producer should compare the ideal and critical temperatures required of a crop with those actually observed and recorded over time in his particular area.

Wind

In some localities wind can be an important factor in crop selection. This is primarily because of the correlation between wind and transpiration. Excessive winds can also cause physical damage to plants and crops.

Sunlight

Sunlight is essential for the growth of plants. In some maritime and mountainous regions excessive cloud cover may reduce the amount of light reaching a crop to the point that yields are reduced to an uneconomic level.

Management Considerations

Managerial Requirements

Along with horticultural skills a farmer needs to possess sound managerial judgment. The specific amount will vary with the crop. High value crops can demand particularly meticulous care in both production and marketing (12, p. 66). For this reason it is important that a farmer thoroughly acquaint himself with the cultural and marketing practices required of a particular crop before production begins. He needs to determine whether he is capable if implementing those practices that will: (1) provide high yields per acre; (2) provide an adequate financial reserve throughout the year; (3) make the maximum productive use of available acreage; (4) provide enough capital for the continued development and improvement of the farm; and (5) provide for necessary purchases with a maximum return on sales (4, p. 19).

Labor Requirements

Labor availability can impose severe restrictions on the types and quantities of crops that can be produced. Labor requirements will differ depending on the specific crops grown and the production and

harvesting methods selected. The small farmer needs to determine whether or not for any crop he produces he can: (1) procure the required labor when it is needed; (2) pay for this labor; and (3) properly manage and keep hired labor involved in productive work.

Labor problems can be particularly severe when two or more crops are grown simultaneously (6, p. 165). If different crops require attention at the same time, limited labor resources may be further strained. Labor requirements will usually peak during the planting and harvesting seasons. These peaks will often be the principal factor limiting the size and scope of a farming operation.

Cost and Return Considerations

There are usually a number of crop alternatives which are agronomically feasible for a given farm and its resources. Potential profits can be estimated by consulting published crop budgets. Crop budgets can also be useful in determining the cultivation practices, inputs, and equipment required to raise the crop and when they will be needed (22, p. 495). In addition, the farmer may be able to determine when labor requirements will peak at different times during the growing season.

A limitation with crop and farm budgets is that they are usually constructed by using a number of observations or results obtained on controlled experiment station plots. In reality there will be a wide range in the cost of producing a particular crop due to such variables as managerial ability, climate and soil fertility. Another problem is

the volatile nature of input costs and prices received which are used in a budget.

There are several methods which can be used to adjust to this latter problem. Unit quantities employed in budgets usually will remain constant from one year to the next. New production costs can be derived by multiplying these quantities by updated costs. The estimation of probable yields and prices will represent a more difficult problem. A farmer will have to rely on either his own or experiences of others to accomplish this (17, p. 234). Studies from other states or regions may be useful when a crop is new to an area. Whatever method is used, the farmer should be somewhat conservative in the estimation of his probable yield. It will usually require two or three years to become familiar with the crop production techniques when a grower has no prior experience.

Marketing Considerations

It is very important that a small farmer knows where and in what manner he will sell his crops before he begins production. He needs to examine the supply, the transportation system, the demand and the buyer requirements for the crops in which he is interested.

If a producer has access to an unsaturated market with reasonable transportation costs he should not encounter many marketing problems if he conforms to the wishes of buyers concerning packaging, grading and frequency of delivery (25, p. 67). Historically, small farmers have experienced marketing problems when: (1) no well-developed markets

existed for their products; (2) problems arose in the transportation of their crops to market; (3) they could or would not meet the grading and sizing specifications of certain markets; and (4) they could not find or pay for an adequate number of experienced harvesters (24, p. 34).

Transportation is a particularly important aspect of marketing. Crops will need to be moved from where they are produced to those areas where they will be either processed or consumed. This access between the farm and the market will need to be suitable to that particular agricultural enterprise (7, p. 45). The lack of such transportation facilities can be particularly severe in many of the developing countries.

Other marketing considerations requiring examination prior to beginning production include: (1) the minimum start-up volume; (2) which off-farm services will be required; and (3) what degree of technological sophistication will be required for successful production and marketing (25, p. 72). Investments may have to be made in local crop collection, transportation, processing, and storage facilities in order to market a new crop. These investments may or may not be practical depending on the expected volume and scale of production. A new enterprise may in some circumstances, however, improve the utilization of existing facilities.

A potential producer should be aware of the potential of market saturation. If a new producer is economically successful and other farmers begin producing and marketing the same crop, the market may quickly become so saturated that the excess supply drives prices

received by all producers below the profitable level. This problem usually does not occur in the first two or three years of production but it can become very serious over a more extended period.

Small farmers who grow traditional products within their local area are severely restricted as to possible marketing alternatives. They are usually confronted with very limited bargaining strength because of the low volume and the undependable supply they produce (18, p. 22). The production of nontraditional products also has its marketing problems. The small producer will usually not be able to attract a volume buyer because of his limited quantity. Therefore, he may have to develop his own markets. Final decisions concerning marketing will be dependent upon the products sold, the existing markets, and the amount of time the farmer is able to devote to marketing (4, p. 383).

National Markets

Before marketing became highly developed it was common for individual small farmers to ship their produce directly to city dealers (39, p. 29). This is, for the most part, no longer practical. Likewise, the individual farmer does not produce the necessary volume for participation in large national markets. Rising transportation costs may, however, present the small farmer with a competitive advantage, particularly if principal suppliers are located a long distance from a specific national market.

Processing Markets

Commercial processing markets are usually not accessible to the small farmer unless a processing capability already exists in the area (31, p. 48). In most cases processors demand a very specialized product for their plants which are usually only located in areas where a crop has been traditionally grown in large volumes. They will usually either produce their own crops or give out short-term contracts to a limited number of large producers.

Trucker-Jobber Purchases

Sales to small truckers may present a viable marketing outlet, provided the small farmer can supply a large enough volume to interest a trucker. A problem with this approach is that the largest financial gains to small farmers have occurred when he has been able to remove the middleman from his activities (24, p. 123).

Direct Marketing

Roadside stands, pick-your-own operations, and farmers' markets are increasingly popular outlets for small farmer crops and specialty items. In order for these marketing strategies to be successful, it is usually necessary that large populations be located nearby. The maintenance of quality and freshness is also critical to the success of these operations (12, p. 200).

CHAPTER III

AN ANALYSIS OF SMALL FARMER PARTICIPATION IN AN EXPANSION OF THE TENNESSEE PEACH INDUSTRY

This chapter will illustrate an actual implementation of the guidelines presented in Chapter II. In a real life situation a farmer would examine natural resource, managerial and capital requirements for a certain crop in light of his own particular farm. Since this study does not have a given farm with which to evaluate, it is necessarily of a more general nature. This chapter will examine the prospect of small farmer participation in general in an expansion of the Tennessee peach industry.

The goal of this study is not meant to endorse peach production by small farmers. Peaches are only used as an example of a crop feasibility evaluation. In an actual situation a small farmer using these guidelines would compare the profitability of producing and marketing several different crops. He could then better choose that alternative most conducive to improving his financial and material well-being.

The History of Peach Production

The first step, as outlined in the previous chapter, is to examine the history of peach production both in the United States and abroad. This may give some useful insights into the feasibility of small farmer production.

The peach was originally cultivated in Eastern Asia and later spread to Persia, Greece, Italy and other temperate areas of Europe (8, pp. 1-2). Today Europe and North America account for 50 percent of the world's peach production. By country, the United States is the single largest producer followed by France and Italy. Collectively, these three account for 50 percent of all production. South Africa, Argentina, Japan, Turkey, and Greece are other major producers.

The Spaniards first introduced the peach into the Western Hemisphere. Early French and English settlers also brought peach pits from Europe. The Indians later planted peaches across a wide area. Many trees escaped cultivation and pits from wild trees are still gathered for use as seedling rootstocks.

Until the early 20th century, most peach varieties grown in the United States originated as chance seedlings and were white-fleshed. These were later crossed with yellow-fleshed peaches from Mexico. All the commercial varieties now in production in the United States have been developed from crosses conducted at agricultural experiment stations and by private breeders.

Commercial peach production developed rapidly after 1800. Prior to this data peaches were grown almost entirely for on-farm consumption. Commercial shipments began gradually between 1870 and 1890. The industry continued to expand during the early 1900's, particularly in Georgia, South Carolina, Arkansas, Texas, and California. Beginning in the late 1920's thousands of acres of peach orchards were abandoned primarily due to falling prices.

Peaches are now one of the most important fruit crops in the nation. Among noncitrus fruits peach production ranks third in volume, being ahead of pears but behind that of grapes and apples. Production in the United States has generally increased since 1910 despite the fact that the number of trees has declined drastically. There were 25 million peach trees in the country in 1974 compared to 136 million trees nationwide in 1910 (26, p. 3). The upward trend in production has been attributed primarily to: (1) improved soil and site selection; (2) the introduction of hardier peach varieties; (3) increased marketing at orchards and roadside stands; and (4) improvements in transportation facilities primarily through the use of refrigerated trucks and railroad cars (5, p. 328).

Principal Production Areas in the United States

The commercial cultivation of peaches is geographically more widespread in the United States than that of any other fruit (8, pp. 2-4). In California the San Joaquin and Sacramento River valleys have proven exceptionally favorable for commercial peach production for several reasons including the availability of irrigation, good soils and frost-free conditions. These two areas alone account for almost two-thirds of all the peaches grown in the United States. The Southeastern United States is another important area. It produces about one-fifth of the nation's crop. Production in this region can be quite variable, however, because of weather conditions. The most important producing states in this region are South Carolina and

Georgia. In the East, Maryland, Pennsylvania, Virginia, and West Virginia are important producers. New York, Ohio and Michigan also have large crops because of the weather modifying effects of the Great Lakes. Washington and New Jersey are other large producers.

Peach production in the eastern half of the country has been plagued with problems. This has been primarily because of the selection of orchard site particularly susceptible to spring frosts and winter freezes. Other problems have been associated with drought, insufficient winter cold, disease and pests. Despite these problems, peach production has remained an important fruit enterprise in the East ranking second only to the apple in terms of production and value.

Peach Production in Tennessee

In 1980 Tennessee produced 4200 tons of peaches out of a national total of 1,536,800 tons (33, p. 23). The farm value of Tennessee's peach production in this year was $1,495,200 to a national value of nearly $397,000,000. Tennessee ranked 24th among the states in production during the 1977 to 1979 period (Table 1). The state's average annual production over this longer period was 8.3 million pounds. This represents about 0.3 percent of the total national production of 2892 million pounds.

A survey conducted in 1978 by the Tennessee Crop Reporting Service reported 50 commercial orchards (an orchard containing 100 or more trees) in the state containing about 94,000 trees (32, p. 3). Seventy percent of these peach trees were of bearing age (four years or more).

Table 1. Average Quantity of Fresh and Processed Peaches Produced Annually in the United States by State, 1978-1980

State	Quantity Produced (million pounds)	Share of Total National Production (percent)
California (clingstone)	1375	47.5
California (freestone)	444	15.3
South Carolina	340	11.7
Georgia	125	4.3
New Jersey	92	3.1
Pennsylvania	85	2.9
North Carolina	47	1.6
Michigan	45	1.5
Arkansas	34	1.2
Washington	33	1.2
Virginia	33	1.2
West Virginia	23	0.6
Maryland	21	0.6
Texas	20	0.6
Illinois	18	0.5
Alabama	17	0.5
Oregon	14	0.4
Kentucky	13	0.4
Colorado	13	0.4
New York	12	0.3
Utah	11	0.3
Idaho	11	0.3
Oklahoma	9	0.3
TENNESSEE	8	0.3
Ohio	7	0.2
Louisiana	6	0.2
Indiana	6	0.2
Kansas	5	0.2
Connecticut	3	0.1
Mississippi	3	0.1
Massachusetts	2	0.1
Delaware	2	0.1
Total	2892	100.0

Source: "Agricultural Statistics, 1981," United States Department of Agriculture, Washington, D.C., 1981, p. 234.

The high percentage of trees under four years of age (30 percent) suggested the possibility that an expansion of the industry was under way. More recent information has confirmed this. In an unpublished survey the Tennessee Agricultural Extension Service estimated that in 1980 there were 150,000 peach trees in Tennessee being grown on 1500 acres.

Production Areas

Although peach trees are found throughout the state, commercial production is concentrated on the western Appalachian slope, along the southern border of the state and in the Mississippi Valley. Table 2 lists the counties which collectively account for two-thirds of the total state production. Figure 3 illustrates the geographic distribution of peach acreage in Tennessee.

Varieties

The 1978 Tennessee Crop Reporting Service survey reported more than 12 different varieties of peaches being produced in the state. Redhaven was the most popular variety in terms of numbers of trees followed by Georgia Belle and Elberta. More detail on varieties appears in Table 3.

Natural Resource Requirements

Topography, soil, temperature, moisture and possibly wind and sunlight are all factors in the natural environment that the potential peach producer should investigate before commencing production.

Table 2. Principal Peach Producing Counties in Tennessee, 1980

County	Acreage	Percentage of State Total
Obion	500	33.3
Shelby	175	11.7
Hardeman	125	8.3
Bradley	102	6.8
Lawrence	100	6.6
Rutherford	81	5.4
All Others	417	27.8
Total	1500	100.0

Source: Unpublished Tennessee Agricultural Extension Service survey, 1980.

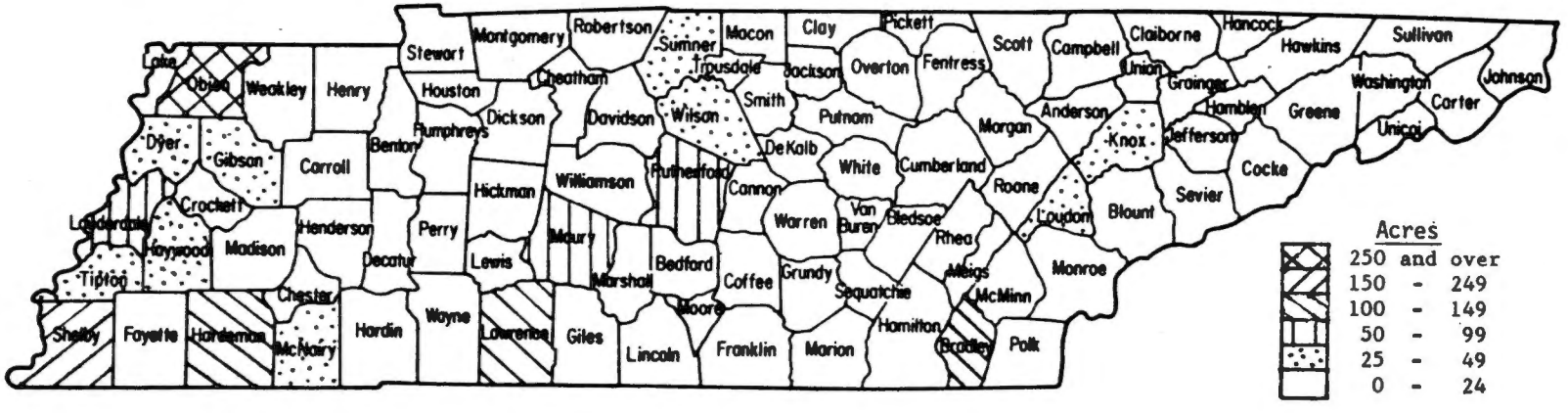


Figure 3. Geographical distribution of peach acreage in Tennessee, 1980.

Source: Unpublished Tennessee Agricultural Extension Service survey.

Table 3. Number of Commercial Peach Trees by Variety in Tennessee, 1978

Variety	Thousands of Trees	Percentage
Redhaven	23.9	25.4
Georgia Belle	13.8	14.6
Elberta	12.9	13.6
Redskin	5.4	5.7
Rio-Oso-Gem	3.1	3.2
Loring	2.8	2.9
Dixired	2.7	2.8
Halehaven	2.6	2.7
Sunhigh	2.5	2.6
Sunhaven	2.3	2.5
Harkin	1.9	2.0
Madison	1.3	1.3
Other Varieties	18.9	20.0
Total	94.3	100.0

Source: "Commercial Fruit Tree Survey," Tennessee Crop Reporting Service, Nashville, 1979.

Topography

Tennessee has numerous sites topographically suitable for growing peaches. Satisfactory sites are found on both hilly and level land. The better situations usually occur on land which is elevated above its surroundings and which is also free from obstructions to air movement. This is important because of the role that air drainage plays in protecting peach blooms from frost damage.

> Cold air, which is heavier than warm air, tends to settle into low spots. On still, frosty nights the temperature in valleys or depressions surrounded on all sides by higher land may be several degrees colder than land in more elevated regions. Under such conditions a difference of 100 feet in elevation may make a difference of 2 to 10°F in the minimum temperature encountered. In many seasons such differences would mean the difference between a full crop and a failure. (34, p. 2)

The direction in which land slopes can also affect peach production. Land sloping towards the south or southeast facing the sun tends to be warmer than land which slopes in other directions. Trees grown on these slopes will begin growth earlier in the season because of these higher temperatures. Even though early fruit may bring higher prices, the fruit grown on these slopes will be more susceptible to damage from late frosts. Northeastern slopes have an advantage in that trees on these slopes break dormancy later in the season thereby reducing the potential for frost damage. Another advantage of northeastern slopes is that the morning sun will dry trees early in the day thus reducing the possibility of disease problems. One final topographical consideration is that steep lands, though possibly less expensive, may have higher requirements for labor as well as a greater

potential for severe erosion. Handling equipment on steep or rough slopes will also be more hazardous.

Soil

Suitable soils for peach production can be found all across Tennessee. Peach trees grow well in many soils ranging from coarse sand to fine textured clay-loam (8, p. 6). The idea, however, that soils which are unfit for any other agricultural purpose will still be satisfactory for fruit orchards has been costly for many growers. Investments should not be made on a soil that is not certain to be satisfactory.

An ideal soil for producing peaches is a sandy loam overlain by clay. This type of soil is capable of the retention and storage of rainfall. On the other hand, finely textured and impervious subsoils become waterlogged during rainy periods which can prevent the roots from obtaining adequate oxygen. Similarly, the submergence of the root system in warm water during the summer can result in the death of the tree.

Peach trees require a readily available water supply. The amount of water that a soil can hold will depend upon its composition. Although coarse textured soils usually have better drainage and aeration, they have a lower moisture retaining capacity. This can be a serious problem in localities where summer droughts are frequent and irrigation is not available.

> Trees will grow in shallow soil in the humid regions where the rainfall averages four to five inches a month

> during the growing season, or where trees are irrigated. In regions where rainfall may be deficient for periods of four to six weeks in the summer or where there is not irrigation, shallow, coarse soils cannot store enough water to meet the needs of the tree. (8, p. 6)

Soil fertility, though important, is not as critical to peach production as are a soil's drainage, aeration, and water-holding capacity. Most producers rely on commercial fertilizers when fertility deficiencies are present (5, p. 358). Nitrogen usually gives the most notable response.

Temperature

The viability of growing peaches in a particular area may be more dependent on temperature than on any other single factor.

> Regions that have grown peaches successfully for a period of ten or more years may be considered adaptable to this fruit as far as the climate is concerned. Regions that have been unsafe for commercial peach growing are those in which protracted warm periods occur during the winter and those in which winter temperatures of well below 0°F are common occurrences. (29, p. 12)

Few sites in the Southeastern United States have winter temperatures cold enough (-10°F or colder) to kill the dormant buds on a peach tree. Damage can and does occur, however, because of late frosts which occur during blooming. Peach trees in blossom can tolerate a light frost but not a heavy freeze. For this reason regions in which severe spring frosts occur relatively often are most likely not suitable for peach orchards.

An area's elevation has a large influence on its temperature. The temperature will generally decrease by 3°F for every 1000 ft. increase in elevation (11, p. 2). According to data published by the National

Oceanic and Atmospheric Administration there is an 11 percent chance of a temperature of 28°F occurring in the first week of April at Crossville which has an elevation of 1810 feet (11, p. 11). This temperature, depending upon its duration, could completely destroy a peach crop which is in bloom. At Jackson on the other hand, which has an elevation of only 400 feet, the chance of a 28°F temperature is only 3 percent.

Because of low elevations, many areas in Middle and West Tennessee contain suitable sites for growing peaches provided that advantage is taken of temperature modifying topographic features. Rolling hills with elevations of 350-800 feet present the best situations (27, p. 15). Elevations of over 1000 feet are usually, however, a poor risk for growing peaches. High elevations will rule out many sites in East Tennessee, most notably the Cumberland Plateau and the Appalachian region. Figure 4 illustrates those areas in Tennessee lying at 1000 or more feet in elevation which are most probably unsuitable for peach production.

It should be mentioned that irrigation of the fruit buds with water during a frost can provide some protection from damage but it can induce tree breakage from the weight of ice. Irrigation can be particularly effective if temperatures are within a few degrees of the freezing mark.

Rainfall

Peach trees require about 40 to 45 inches of rain which should be evenly distributed throughout the year (8, p. 6). The rainfall in

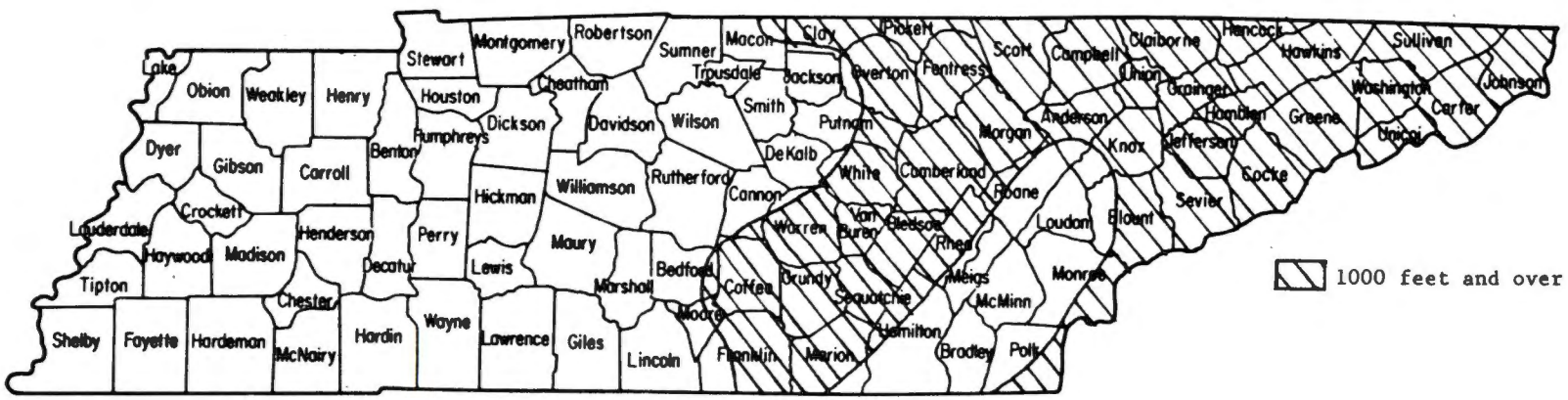


Figure 4. Geographical areas of Tennessee exceeding 1000 feet in elevation.

Source: "Tennessee: Facts about Soil, Climate, and Rainfall," Tennessee Department of Agriculture, Nashville, 1914.

Tennessee appears to be adequate provided that soils with a sufficient water-holding capacity are present (see Table 4).

Table 4. Average Tennessee Precipitation in Inches, 1941-1970

Division	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Annual
Eastern	6.6	4.4	4.6	5.4	6.7	3.8	8.7	3.5	4.8	2.4	5.9	2.1	58.7
Middle	7.8	4.2	8.0	8.4	7.7	3.7	5.5	5.5	9.9	3.3	7.1	4.5	75.7
Western	5.6	5.7	6.3	9.1	8.0	3.6	5.0	4.0	6.4	2.3	7.9	4.7	68.4

Source: "Tennessee Weather and Crops," Tennessee Crop Reporting Service, Nashville, 1980.

Wind

Damage can occur if a hilltop location exposes trees to cold winds during the winter. High winds can also cause problems if trees are not firmly rooted in the soil. Proper pruning will lessen tree susceptibility to wind damage.

Sunlight

Sunlight is important to peach trees for normal growth and particularly for the ripening and coloring of fruit. Insufficient sunlight should not be a problem in Tennessee as excessive cloudiness usually occurs only in maritime regions. Proper pruning and tree spacing can help assure that peach trees receive adequate sunlight.

Managerial Skills

The prospective peach grower should examine the managerial skills required for the successful operation of a peach orchard. He needs to

be capable of making many different decisions concerning such topics as orchard size, variety selection, cultivation, and disease and pest control. Critical harvesting and marketing decisions will also be required of him. The management of a commercially sized peach orchard is a full time job.

> The man who engages in peach growing on a commercial scale must be a specialist. This means that after his orchard comes into bearing he must confine his efforts largely to this one crop. Growers who have attempted large acreages in cotton or tobacco together with peaches find that not one of the crops can be given sufficient attention and labor at the critical stages to make them profitable. (29, p. 17)

Orchard Size

A potential grower needs to determine what size orchard he can expect to properly manage depending on his land, labor, and capital constraints. Managerial, equipment, and labor requirements will vary depending upon the size of his operation.

Growers supplying large markets may have orchards of from 100 to 200 acres or more. The volume generated by such an orchard will enable the grower to sell in truck loads. This is advantageous because quantities of this size will usually receive more interest from large volume buyers than will smaller quantities. In fact, the trend in the South has been away from orchards which contain less than 40 acres. This is because small orchards have historically not generated the returns necessary to support an average sized family unless special marketing opportunities existed (29, p. 18).

Variety Selection

Once a potential grower has determined a site to be suitable for peach production he needs to select those varieties that will suit his production and marketing strategies. Important considerations will include whether or not there is: (1) a satisfactory yield, (2) an appropriate dormancy period, (3) safe blooming and ripening with regard to customary freezes and killing frosts, (4) resistance to locally encountered disease and pest problems, and (5) acceptability in potential market outlets (28, p. 400). Ripening dates are a particularly important aspect of variety selection. Varieties should be selected so that an orchard provides a supply of marketable fruit over the longest period practical. Varieties can also be selected by ripening dates in order to avoid competition from other growing areas.

> Some districts owe their prominence and importance as growing centers principally to the fact that some of the favorite market varieties ripen in those districts at a time when relatively little fruit is marketed from other districts. (29, p. 23)

Peach varieties are primarily classified as either freestone or clingstone.

> In freestone varieties, the fruit can easily be separated from the stone or the pit. In clingstones, as implied by the name, the flesh adheres tightly to the pit. Both varieties have yellow-fleshed and white-fleshed varieties. The yellow-fleshed varieties are most common and are generally preferred for both processing and fresh market uses. Clingstones are usually considered to have a less desirable flavor than freestones. However, clingstones are firmer, smoother, and hold their shape well. For this reason, processors prefer clingstones for canning. (36, p. 7)

Comments concerning the ten most commonly grown peach varieties in Tennessee are presented in Table 5. All the varieties listed are freestone with the exception of the Dixired (cling) and the Sunhaven (semi-free). The Georgia Belle is the only white-fleshed variety appearing in the list.

Site Preparation

Proper soil preparation before planting can have marked effects on subsequent tree growth and development (31, p. 84). The soil can be plowed and disked in order to assure seedlings of a soft, loose bed in which to grow. Infertile soils may benefit from a green manure crop grown prior to planting. Herbicides also may be applied at this time to limit weed infestation.

Orchard Design

Peach trees are usually set out in rectangular patterns. This is so that tillage and other cultivation can be performed in several directions. A square is commonly used on flat land. Whatever shape the orchard, peach trees are most often set at about 20' by 20' which allows from 100 to 110 trees per acre. If irrigation systems are to be used, the orchard design will need to fit the system.

> Time spent in carrying out the necessary orchard operations will be made more efficient if long rows are used as opposed to short rows. With fewer rows, less time will be wasted in turnings at the ends of the orchard. In addition, complete rows made up of a single variety make a more efficient, more easily managed orchard than where two or more varieties are found in each row. This is due to the fact that different varieties often require different spraying schedules and have different ripening times for the fruit. (19, p. 1)

Table 5. Recommended Peach Varieties for Tennessee

Variety	Blossom Time*	Ripening Time*	Comments
Redhaven	-4	+28	Nonbrowning flesh, resistant to bacterial leaf spot, considered to be the best peach for its season, consistently productive, may cling unless fully ripe.
Georgia Belle	+2	+3	Difficult to handle, ripens uniformly, good for local market.
Elberta	Midseason	Late Midseason	Fruit large, resistant to brown rot, may drop badly approaching maturity, not resistant to flesh browning.
Redskin	+1	+2	Firm, keeps well, nonbrowning flesh, resistant to bacterial leaf spot, sets fruit well under adverse conditions.
Rio-Oso-Gem	-2	-6	Weak trees, fruit ripens uniformly.
Loring	-1	+12	Firm, good size, resistant to bacterial leaf spot, tree is not cold hardy.
Dixired	-5	+41	Some resistance to leaf curl, usually needs heavy thinning, fruit is highly colored.
Halehaven	-2	+14	Fruit too small some seasons, browns moderately, ripens uniformly.
Sunhigh	-1	+14	Firm, fruit sizes well, very susceptible to bacterial leaf spot.
Sunhaven	-5	+38	Consistently productive, too soft for commercial plantings, sizes well even with large crop.

*Days before (-) or after (+) the Elberta.

Source: "Tree Fruit and Small Fruit Cultivar Recommendations for Tennessee," Publication 746, Agricultural Extension Service, The University of Tennessee, 1979.

It is a good practice to employ contour planting and terracing where soil erosion is likely to be a problem. Terraces can slow the flow of water downhill and allow much of it to percolate into the soil. Terraces should be planned before the orchard is planted.

Seedling Acquisition and Planting

Good nursery stock is usually the cheapest investment (14, p. 16). It is unwise to plant inferior or low-grade trees. If possible, the seedlings should be purchased from a nursery near the orchard in order to reduce transportation costs and allow prepurchase inspection.

In the Southern United States, planting usually occurs in late fall or early winter so that the young trees can already be established when spring growth begins. Seedlings should be planted in holes which have been dug large enough so that the roots can be planted with a natural spread. The covering soil should not be packed too tightly.

> Sizes recommended for planting range between five-sixteenths inch to eleven-sixteenth inch in diameter. A one year-old tree is generally more satisfactory and easy to manage. Trees two to three years-old should not be considered for commercial planting. (28, p. 405)

If trees cannot be planted on the day in which they are received they should be placed in a trench so that all of the roots can be kept covered with moist soil. This will keep them from drying out (29, pp. 26-27). Another method is to cover the seedlings roots with wet sacks.

Fertilization

The area around young peach trees needs to be kept clean so that they do not have to compete with weeds and other plants for water and

nutrients (28, p. 411). Fertilizer requirements for peach trees vary depending upon the composition, type, and natural fertility of the soil as well as the age of the orchard. Nitrogen and potassium are the two fertilizers most often required for peach orchards. If there are any doubts about a soil's suitability, soil tests should be conducted.

Pruning

Peach trees require extensive pruning throughout their lives and particularly during the first three years of growth.

> Peaches are pruned in order to (1) build up a strong framework for the tree, (2) to admit sunlight for coloring the fruit, (3) to thin the fruit by cutting out part of the branches, and (4) to limit the length and spread of the tree so as to make spraying and harvesting the fruit easier and therefore more economical. (29, p. 52)

Peach trees are usually first pruned at planting. This involves removing limbs and trimming the stem to a height of between 20 and 30 inches. Once scaffold limbs have been selected trees are usually then only lightly pruned until fruiting begins. The branches are then thinned and headed back in order to promote outward growing lateral shoots.

Disease and Pest Control

Disease and pests can cause extensive damage to peach orchards. All parts of the tree can be affected. In fact, some diseases and pests will destroy an entire orchard in a short amount of time if not controlled. Peach orchards will require a series of annual sprayings and treatments in order to prevent this from happening.

Insect pests most likely to cause damage in the South are the Oriental Fruit Moth, the Peach Tree Borer, San Jose Scale, the Plum Curculio and various nematodes (29, pp. 69-82). Fungi and viruses can also be problemsome for Tennessee growers. Brown Rot, a fungus, is particularly worrisome. Peach Leaf Curl and Scab are other diseases to be watched for. In some areas rodents may be a problem and will have to be controlled.

Harvesting

Peaches are best harvested while they are still firm. In this state they are least likely to be damaged by picking, transporting and packing activities. Peaches which are intended for the fresh market are most often picked by hand because bruised peaches are of little value in the fresh market.

> Unskilled labor may be used for picking peaches. An experienced foreman can direct from 20 to 30 pickers and see that they pick the peaches at the proper stage of ripeness. It requires about 25 pickers to pick 65 acres of peaches every three days. (29, p. 83)

After being picked, peaches are usually transported to markets and packing houses in either pallets or one-bushel baskets. Most peaches are sold wholesale in 3/4 bushel cardboard containers. Peaches in a near-ripe stage will ripen in a few days when kept at room temperature (26, p. 9).

Equipment

A grower will need to own or have access to certain equipment in order to properly maintain his orchard. According to The University of

Tennessee Agricultural Extension Service crop planning budgets, during the first year a peach producer will need a digger for planting, a tractor, a rotary mower for controlling grasses and weeds, and an air-blast sprayer for controlling pests and diseases, pruning implements and a fertilizer spreader. All of these same items will be required in subsequent years with the addition of some type of conveyance after the third year for transporting fruit (38, pp. 58-62). Large producers may be able to substitute hand labor for such items as differs and fertilizer spreaders.

Labor

According to the same budget, the labor requirement in the first year is estimated to be 26 man-hours per acre, 13 during the second year, 68 during the third year, and 135 hours per acre in the fourth and following years. The principal activities accounting for the greatly increased labor requirements after the second year are pruning, thinning, harvesting and marketing.

Costs and Returns

It is important that the prospective peach grower estimate his costs and returns. This is particularly true since the grower will face a period of three or more years in which no revenue is produced. This is because peach trees do not begin to bear fruit until the third year and usually do not reach peak production until the sixth year.

A peach production budget published by the Tennessee Agricultural Extension Service is presented in Table 6. Yields in this budget have

Table 6. Annual Revenues and Expenses per Acre for a Tennessee Peach Orchard

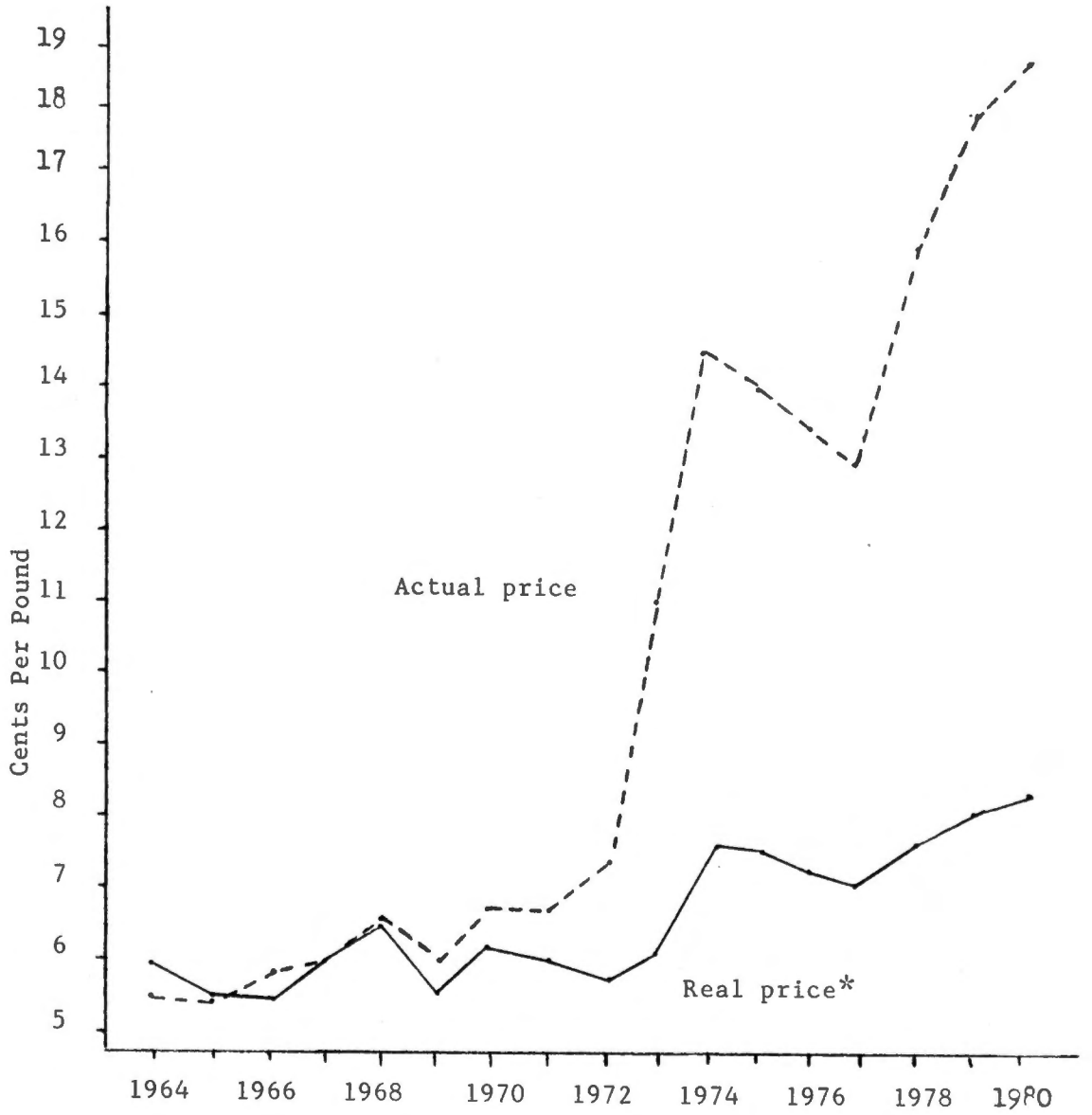
Year	Revenue Bushels Sold	Value	Annual Production Expenses Variable	Total	Annual Return Other Variable Expenses	Cumulative Return Over Total Cost
1	-	-	$224.44	$257.95	-	$ -257.95
2	-	-	109.27	137.45	-	-395.40
3	55	$ 550	315.08	376.53	$ 234.92	-221.93
4	110	1100	478.72	542.54	621.28	335.53
5	165	1650	588.72	652.54	1061.28	1332.99
6	220	2200	698.72	762.54	1501.28	2770.45
*	*	*	*	*	*	*
*	*	*	*	*	*	*
*	*	*	*	*	*	*
17	220	$2200	$698.72	$762.54	$1501.28	$18,582.51

Source: "Planning Budgets for Fruits and Vegetables: A Supplement to the Farm Planning Manual," Agricultural Extension Service, The University of Tennessee, 1980. p. 59.

been specified to be 0.5, 1.0, 1.5, and 2.0 bushels per tree in the third, fourth, fifth and subsequent years, respectively, of the orchard's life. The budget also assumes a population of 110 trees per acre.

According to this budget, given a price of $10.00 per bushel, a peach orchard would not show a profit until the third year. In that year, the return from 55 bushels would be $234.92 more than production expenses. The cumulative return, however, would not be positive until the fourth year when it would be $335.53. During a life span of 17 years an orchard operator could expect a total cumulative return, according to this budget, of $18,582.51 per acre.

Yields and prices received will vary from grower to grower and orchard to orchard for a variety of reasons. In recent years, the average real price paid to Tennessee peach producers has been increasing, though not as rapidly as the actual price rate. Figure 5 illustrates real and actual prices paid to Tennessee producers in cents per pound from 1964 to 1980. During 1981 Tennessee peach growers received an average price of $9.00 per bushel (48-50 lbs.), which is less than the figure used in the budget (35, p. 12). Table 7 illustrates the effects of varying yields and prices on net returns to land, labor, capital and management per acre for the life of an orchard. Thus, if a grower's average yield during the life span of his orchard was two bushels per tree (3267 total bushels per acre over 15 bearing years) at an average price of $8.00 per bushel he could expect a total net return of $14,722 per acre. On the other hand, at an average price



*Actual prices adjusted by the Index of 1967 = 100.

Figure 5. Actual and real prices paid to Tennessee fresh peach producers, 1964-1980.

Source: Agricultural Statistics, 1964-1980, United States Department of Agricultures.

Table 7. Effects of Varying Rates of Production and Prices on Net Return to Land, Labor, Capital, and Management, Years 6 through 16

Rate of Production	Total Expenses per Acre	Price per Bushel				
		$8.00	$9.00	$10.00	$11.00	$12.00
2376 bu.	$10,523	$ 8,485	$10,861	$13,237	$15,613	$17,989
2673 bu.	10,820	10,564	13,237	15,910	18,583	21,256
2970 bu.	11,117	12,643	15,613	18,583	21,553	24,523
3267 bu.	11,414	14,722	17,989	21,256	24,523	27,790
3564 bu.	11.711	16,801	20,365	23,929	27,493	31,057

Source: "Planning Budgets for Fruits and Vegetables: A Supplement to the Farm Planning Manual," Agricultural Extension Service, The University of Tennessee, 1980, p. 62.

of $12.00 per bushel he could expect a net return of $27,790 per acre on the same production.

The total expense per acre in Table 7 includes all total and variable expenses, excluding interest on operating capital, ownership expenses, and the value of labor. Total expenses vary with yield since the fruit baskets cost $1.00 each.

Marketing

A favorable physical environment for the production of peaches does not guarantee financial success. In order for his enterprise to be financially successful a farmer must be able to sell his peaches at an adequate price. This implies adequate demand.

National Trends in Fresh Peach Consumption

Literature published by the USDA has revealed a decline in fresh peach consumption (37, p. 27). United States population and peach utilization data from the Department of Agriculture was used in this study to determine the national trend in fresh peach consumption from 1964 to 1978. A simple regression model $Y = a + bX$ was used where: Y = per capita consumption of fresh peaches in pounds and X = time in years. The trend line that was derived to fit the data is represented by the equation $Y = 13.113 - 0.106X$. This line along with annual per capita consumption for the same period appears in Figure 6. The negative slope of this line confirms the long-term decline in per capita fresh peach consumption. This has been primarily due to the

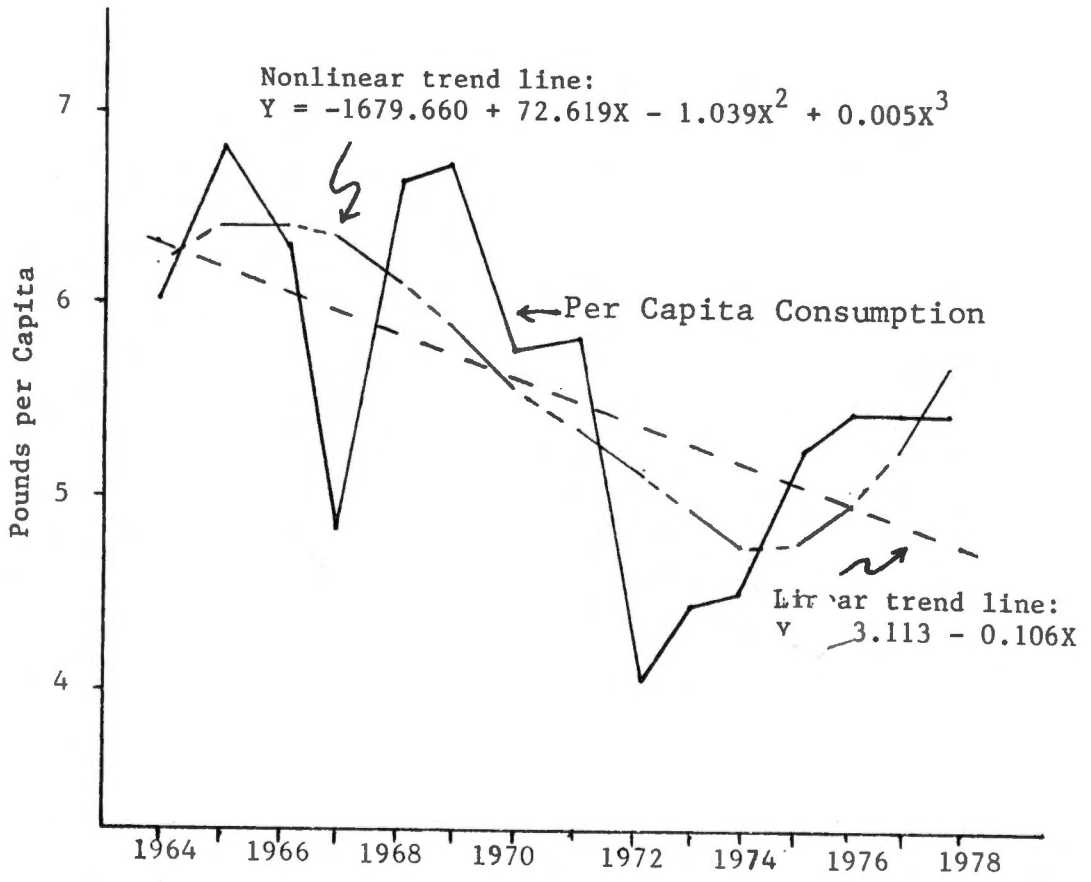


Figure 6. Linear and nonlinear trend lines for U.S. fresh peach consumption per capita, 1964-1978.

Source: Agricultural Statistics 1979, United States Department of Agriculture.

convenience and year around availability of processed peach products (35, p. 27).

A second regression model (polynomial) was then generated in order to improve the "goodness" of fit over the first. Y and X were again specified as in the previous model. This gave the nonlinear trend line $Y = 1679.660 + 72.619X - 1.039X^2 + 0.005X^3$. This model reconfirmed the long-term decline in per capita consumption but also reflected the upward trend in consumption of fresh peaches since 1974. This line also appears in Figure 6.

Tennessee Markets

Almost all of the peaches grown in Tennessee are marketed locally (1, p. 21). Local outlets include roadside stands, farmers' markets, pick-your-own operations, and independent retail stores. There are no commercial peach processors or peach packinghouses in the state at the present time. Potential market outlets for new Tennessee peach growers might include sales to: (1) national fresh markets; (2) processors; (3) trucker-jobbers; and (4) final consumers (direct marketing).

National Fresh Markets

Peach growers participating in major national markets may be required to perform several presale services. These include (1) assemblage of fruit at local packing and shipping points; (2) grading and standardizing; (3) transporting to final markets; (4) storage and warehousing; (5) selling at wholesale and terminal markets; and (6) financing and assuming risks (5, p. 278).

Peaches are usually transported from the orchard on trailers and in bins pulled by tractors or on narrow-bed pickups and trucks (21, p. 6). They are then transferred to larger trucks when more than short distance hauling to packinghouses is involved. Grading, sizing, and packaging are important activities performed at these packinghouses (26, p. 15). At this time graders classify peaches according to quality and color and also cull bruised or diseased peaches. Sizing machines are required when fruit is packed according to specified diameters. From the packinghouse, peaches are usually shipped in one-half and three-quarter containers, which when filled will weigh 25 to 38 pounds, respectively.

Peaches, depending upon the nature and distance of the market, can be shipped by either large, refrigerated trucks and railroad cars or by small trucks. In the Eastern United States almost all peaches are shipped by truck. Air freight is sometimes used when tight supplies and high prices make it advantageous.

Tennessee peach producers do not presently participate in national markets. Peach production data published by the Tennessee, South Carolina, and California Agricultural Extension Services was examined for this study to determine if Tennessee producers might have a competitive advantage over producers in these two other states. This is because of the relatively small distances between Tennessee and a few selected major consumption centers.

Production costs for peaches grown in Tennessee, South Carolina, and California are presented in Table 8. Because the crop budgets used

Table 8. Estimated Yields and Production, Harvesting, and Packing Costs per Acre for Producing Peaches in Tennessee, South Carolina, and California, 1980[a]

Item	State		
	Tennessee	South Carolina	California
Yield (bushels)	220	253	396
Cultural Costs (per acre)	$653[b]	$823	$548
Picking and Packing Costs ($4.64/bushel)	$1021	$1174	$1818
Total Cost (per acre)	$1684	$1997	$2366
Total Cost (per cwt.)	$15.20	$15.80	$12.00

[a]Costs adjusted to 1980 levels by Prices Paid, Interest, Taxes, and Farm Wage Rates indices for 1975, 1978 and 1980.

[b]The actual cost appearing in the 1980 budget is $762.54 which includes $110.00 for fruit baskets in the sixth year. For this study, it has been deducted since this cost is included in the picking and packing cost.

Sources: "Costs of Producing Peaches in South Carolina," South Carolina Agricultural Experiment Station, Clemson University, 1978, p. 16; "Orchard Development Costs," Division of Agricultural Sciences, University of California, 1975, p. 14; "Planning Budgets for Fruit and Vegetables: A Supplement to the Farm Planning Manual," Agricultural Extension Service, The University of Tennessee, 1980, p. 59.

to compile the figures were published over a five-year period, they have been adjusted to January, 1980, using indices published by the United States Department of Agriculture. The only picking and packing cost data available were from the South Carolina budget, these were therefore used for all three states. Costs of land, equipment, trees and interest on capital were not included. A final qualification was that both the South Carolina and California figures included a cost for irrigation while Tennessee's did not. All figures are for the sixth year of an orchard's operation and assume a population of 110 trees per acre. Yields given for Tennessee, South Carolina, and California were 2.0, 2.3, and 3.6 bushels per tree, respectively. (The large California yield reflects the widespread use of irrigation in that state.)

Truck transportation costs from Nashville, Tennessee; Spartanburg, South Carolina; and Modesto, California to Cincinnati, Ohio, Louisville, Kentucky, and Baltimore/Washington, D.C., are shown in Table 9. These figures were obtained from fresh produce shipping brokers in Knoxville, Tennessee who were personally contacted in order to obtain representative transportation rates for this study. It should be noted that, because fruit shipping rates are unregulated, the food stuff rate for carlot volumes has been used.

Tennessee's 1980 cost of production, $15.20 per cwt., was roughly equivalent to South Carolina's, $15.80 per cwt., and was much higher than that of California's, $12.00 per cwt. Tennessee has had, however, with the exception of the Spartanburg-Baltimore/Washington, D.C.,

Table 9. Transportation Costs of Shipping Fresh Peaches from Three Production Areas to Selected National Markets, 1981

Destination	Origin of Shipment		
	Nashville, TN	Spartanburg, S.C.	Modesto, CA
		---per cwt.---	
Cincinnati, Ohio	$1.34	$1.70	$5.77
Louisville, Kentucky	.95	1.66	5.66
Baltimore/ Washington, D.C.	2.28	1.89	6.89

Source: Unpublished graduate student survey by author.

connection, the lowest transportation costs to the three national markets. When production and transportation costs are combined, Tennessee compares very favorably with both South Carolina and California. Combined production and transportation costs to the three selected markets from all three states are presented in Table 10.

Total costs for fresh Tennessee peaches to Cincinnati, Ohio, are estimated at $16.54 per cwt. in 1981, while South Carolina's total cost to this same market was $17.50 per cwt. and California's is $17.77 per cwt. Total costs to Baltimore/Washington, D.C., for the three states were $17.48, $17.69, and $18.89, respectively. Louisville, because of the close proximity, is the market in which Tennessee's cost is most competitive in 1981 at $16.15 compared to $17.46 and $17.66 for South Carolina and California.

Most Tennessee peaches are harvested during the months of June and July. Unload data from the United States Department of Agriculture have been used to determine the sales of fresh peaches from California and South Carolina in five national markets during these two months. This information is presented in Tables 11 and 12. Memphis and Nashville have been included because of the obvious transportation advantage Tennessee producers would have in these two markets. Large national markets such as Atlanta and Birmingham have been excluded because of the presence of sizeable peach industries in their respective states (Table 1, p. 23).

Total shipments from the two states to the five destinations averaged 60,000 cwts. or about 120,000 bushels during the two months

Table 10. Total Costs of Producing and Transporting Fresh Peaches from Three Production Areas to Selected National Markets, 1981

Destination	Origin of Shipment		
	Nashville, TN	Spartanburg, S.C.	Modesto, CA
		---per cwt.---	
Cincinnati, Ohio	$16.54	$17.50	$17.77
Louisville, Kentucky	16.25	17.46	17.66
Baltimore/ Washington, D.C.	17.48	17.69	18.89

Table 11. Peach Unloads in Selected National Markets Originating from South Carolina during June and July, 1976-1979

Destination	1976	1977	1978	1979	Average
	1,000 cwts.				
Cincinnati	13	24	14	18	17
Louisville	17	16	11	14	15
Baltimore/ Washington, D.C.	11	12	12	13	12
Memphis	1	-	-	2	1
Nashville	7	7	4	3	5
Total	49	59	41	50	50

Source: United States Department of Agriculture unload data.

Table 12. Peach Unloads in Selected National Markets Originating from California during June and July, 1976-1979

Destination	1976	1977	1978	1979	Average
	1,000 cwts.				
Cincinnati	3	4	5	2	4
Louisville	1	2	2	2	2
Baltimore/ Washington, D.C.	1	3	4	1	2
Memphis	-	-	-	2	1
Nashville	-	-	-	2	1
Total	5	10	13	9	10

Source: United States Department of Agriculture unload data.

over the four-year period. If Tennessee producers could capture 80 percent of the South Carolina and California supply to these markets, it would amount to 96,000 bushels of peaches. With a 50 percent capture of the unloads in these five markets, the quantity would be 60,000 bushels, while a 20 percent capture would require 24,000 bushels. This market, however, could be easily saturated if many Tennessee growers tried to enter. Assuming a yield of 220 bushels per acre (2 bushels per tree and 110 trees per acre), it would only take 273 acres to produce 60,000 bushels.

Processing Markets

Traditionally, clingstone peaches, which are the type of peach required for processing, have not been grown in the southeastern United States. This is primarily because of the relatively inferior quality of clingstone peaches which have been produced in this area. Research is now under way, however, to develop firm-flesh clingstone varieties which would be suitable to conditions in the Southeast (37, pp. 21-22). Efforts are also being conducted to improve production and harvesting techniques in this region.

Recent studies by the United States Department of Agriculture have indicated that the Southeast could play a much larger role in the processed peach industry (37, p. 27). According to these studies, it could supply processing markets more economically than any other producing area except those processors located in the far West. The Southeast's competitive advantage is primarily because of relatively

lower land and labor costs, coupled with a closer proximity to major consuming centers.

This is of particular interest because of the long-term trend toward the consumption of canned and processed peaches and away from fresh. This is due primarily to the convenience and year-round availability of processed peach products. Other segments of the fresh peach industry are interested in the processing market because of the increasing cost of producing and marketing fresh peaches.

Trucker-Jobber Markets

Sales to trucker-jobbers can represent a market outlet for Tennessee peach growers if they can provide sufficient volume. Several factors will determine the quantity that will interest a trucker-jobber. These include the distance from the orchard to a consumption center and the price that the trucker can expect to receive. Another important factor will be his opportunity costs with regard to other marketable crops. If typical peach producers in an area are small, this type of marketing will probably only be practical where a number of growers can consolidate their production.

Direct Markets

Direct marketing involves the selling of produce by the farmer directly to the consumer. The principal advantage is that it can often provide higher prices to the producer than can the wholesale market. In the Tennessee peach industry this is a very important market and is perhaps the only one that is open to the small producer. Although the

large producer can and does participate in this type of marketing, he will usually need to sell the bulk of this crop through wholesale channels.

The three most common forms of direct marketing are: (1) roadside stands; (2) pick-your-own operations; and (3) farmers' markets. Well travelled roads and highways can present good opportunities for marketing peaches. This is particularly so if there are large population centers located nearby. As an example, one Midwestern producer has been able to market 90 percent of this fruit from 120 acres of peaches and applies through roadside stands (14, p. 79).

An advantage with roadside marketing is that several of the costs inherent with conventional wholesale marketing can either be reduced, eliminated, or absorbed by the consumer. These include some of the costs for assemblage, grading, and packaging as well as costs for transportation and shipping. Roadside marketing does, however, entail some additional expenses not incurred by sales through wholesale buyers. These may include costs for sales help, construction and maintenance of the stand, and consumer items such as sacks, baskets, and boxes. Advertising may also be required. The extent of these costs will depend upon the volume of business and on the elaborateness of the facility (16, p. 3).

With pick-your-own operations consumers typically go to the orchard themselves and pick the peaches that they wish to purchase. One Northeastern grower has been able to market 15 percent of his production in this manner (14, p. 25). Some specific advantages with

pick-your-own marketing for the farmer are: (1) payment for his crop is received immediately upon sale; (2) middlemen are eliminated; (3) the labor and expense required to pick and pack his fruit is eliminated; (4) transportation expenses are reduced; and (5) customer loyalty can be developed. On the other hand pick-your-own operations can entail problems unique to this type of marketing. These include: (1) the possibility of personal injury to customers; (2) the need for constant monitoring in order to prevent theft and damage to trees; (3) the possibility of drastic reductions in sales because of adverse weather conditions; and (4) the loss of crop due to inadequate customer response.

A final form of direct marketing feasible for small farmers is participation in farmers' market. As an example, the Baltimore Farmers' Market is open every Sunday from July to December with an average of 80 to 100 growers participating on any one day. Customers, averaging more than 5000 each Sunday, mention fair prices, high quality, freshness, and atmosphere as reasons for their interest in this type of marketing (2, p. 9). It is very important that the small farmer engaged in this type of marketing maintains a high standard of freshness and quality.

CHAPTER IV

CONCLUSIONS AND IMPLICATIONS

The guidelines developed in Chapter II were designed to help small farmers answer the two primary questions of (1) What crops can be successfully grown? and (2) Where and how can they be sold in a profitable manner? Emphasized were: (1) The usefulness of crop histories with regard to past and present production areas, problems, markets and trends; (2) the importance of comparing the agronomic, geographic and climatic requirements of a potential cropping enterprise with those actually present in a specific locality; (3) the necessity for the small farmer to determine whether or not the managerial ability required for the production of the particular crop is available; (4) the need to estimate expected costs and returns in order to determine the financial feasibility of an agricultural activity; and (5) the importance of determining where and how a crop will be marketed before production commences.

Chapter III illustrated a general application of the procedure. This exercise discussed the physical and economic feasibilities of small farmer participation in an expansion of the Tennessee peach industry. It was found that large areas of Tennessee are physically suitable for the production of peaches. There are many sites with a rolling topography conducive to good air drainage and frost protection, particularly in the centeral portion of the state. Suitable soils for peach production may be found across Tennessee. Rainfall is sufficient

and is well distributed throughout the summer months and excessive winds and a lack of sunlight are not problems.

The one major natural constraint to peach production in Tennessee is temperature. Although extremely low winter temperatures which cause damage to wood tissue are rare, spring frosts which can destroy budding peach blossoms are not. Those areas in Tennessee at or above 1000 feet in elevation are particularly vulnerable to frosts. Even producers at lower, safer elevations would have to expect an occasional partial or total crop loss.

Many small farmers might possess suitable land and the necessary managerial skill to produce peaches on a commercial scale but might not be able to pay the labor necessary to operate a commercially-sized orchard of 40 or more acres. Another problem facing the small peach producer would be the procurement of necessary equipment. Commercial orchards require substantial investments in expensive machinery. An air blast sprayer necessary for disease and pest control cost approximately $8000 in 1981 while a sprinkler irrigation system, necessary during period of freezing temperatures, cost $14,000 (38, pp. 5-7). Major investments would also be required for such items as tractors, mowers and fertilizer spreaders.

The problem of high input costs is further compounded by the fact that an orchard it totally an expense for the first three or four years. Because of this cash flow problem, small farmers with limited capital and credit would be forced to raise other income producing crops during this period. This distraction would further decrease the size of the orchard a small farmer could hope to properly manage.

The size of orchard a small farmer could properly manage would not produce sufficient volume to allow his participation in national markets. In fact, as seen in Chapter III, even large Tennessee producers would face serious obstacles in entering such markets. Tennessee growers are essentially out of processing markets because of the underdeveloped state of that industry in the Southeast. Purchases by trucker-jobbers might provide an outlet for the small farmer provided he either alone or in cooperation with others could supply a large enough volume. The most promising market outlet for the small farmer's limited production would appear to be direct marketing. Tennessee farmers located near well traveled roads and highways could market their produce in roadside stands or on-farm-markets. This would be particularly attractive for farmers located near roads connecting major population centers such as Memphis, Nashville, Knoxville and Chattanooga or smaller cities such as Jackson and Clarksville. Pick-your-own operations might prove profitable for growers located within 11 to 25 miles of these or other metropolitan areas. Finally, small peach producers might find suitable outlets for their crops in farmers' markets located in communities across the state.

To summarize, by using the guidelines suggested in Chapter II, it has been determined that: (1) there are large areas of Tennessee that have sites physically suitable for commercial peach production; and (2) that potential markets, though limited, do exist for the small farmer. Peach production would appear to be a viable source of extra income with the presence of direct marketing opportunities. It would

not, however, appear to be a feasible primary crop for the small farmer. This is primarily because of high input costs, the required large capital investments, limited market accessibility and the relatively high risk of partial or total loss of crop because of bad weather.

Small farmers in less developed countries may also be able to use this type of procedure in similar crop feasibility evaluations. As mentioned in the introduction, they face basically the same agronomical, climatic and financial constraints that small farmers face in this country. One difference would probably be in the more limited information and extension advice which would be available in a less developed nation. A small farmer in this situation would be forced to rely more on his own judgment and experience. Another difference is that small farmers in developing countries might be more subject to governmental policy and subsidy constraints. This would be particularly true in those countries with a centrally planned government.

LIST OF REFERENCES

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1. American Fruit Grower, Vol. 97, No. 2, February, 1977.

2. American Fruit Grower, "Farmers' Markets Pack 'Em In," Vol. 100, No. 8, August, 1980.

3. Brown, Maxwell L. Farm Budgets. Baltimore: The John Hopkins University Press, 1979.

4. Chapman, Paul. Efficient Farm Management. Atlanta: Turner E. Smith and Company, 1948.

5. Childers, Norman F. Modern Fruit Science. New Brunswick, New Jersey: Horticultural Publications, 1961.

6. Degraff, Herrell and Ladd Haystead. The Business of Farming. Norman: The University of Oklahoma Press, 1948.

7. Ellison, R. M. "General Review of Overall National Planning in Agriculture." Development Research Digest, Vol. 2, No. 3, January, 1964.

8. Fogle, H. W. "Peach Production East of the Rocky Mountains." Agricultural Handbook No. 280, Agricultural Research Service, United States Department of Agriculture, Washington, D.C., April, 1965.

9. Food and Agriculture Organization. "Report on the Fourth Development Centre on Farm Management for Asia and the Far East." Report No. 1092, Rome, 1959.

10. Foth, Henry D. Fundamentals of Soil Science. New York: John Wiley and Sons, 1978.

11. Fribourg, H. "Probability of Low and High Temperatures in Tennessee." Environmental Data Service, National Oceanic and Atmospheric Administration, Washington, D.C., March, 1978.

12. Graham, E. The Profitable Small Farm. London: Perton Davies, 1931.

13. Haines, C. William, Jr. "The Challenge of Direct Marketing." Proceedings, National Peach Council, 1977.

14. Harrison, K., and K. Shwedel. "Marketing Problems Associated with Small Farmer Agriculture." Seminar Report No. 5, The Agricultural Development Council, New York, 1974.

15. Harwood, Richard R. Small Farm Development. Boulder: Westview Press, 1979.

16. Henderson, Peter L., and Harold R. Linstrom. "Farmer to Consumer Direct Marketing in Six States." Agricultural Bulletin No. 36, Economic, Statistics and Cooperatives Service, United States Department of Agriculture, Washington, D.C., July, 1980.

17. Hopkins, John A., and William G. Murray. Elements of Farm Management. New York: Prentice-Hall, Inc., 1953.

18. Horne, James E. Small Farms: A Review of Characteristics, Constraints, and Policy Implications. Starkville, Mississippi: Southern Rural Development Center, 1979.

19. Lockwood, Gary. "Orchard Design." The University of Tennessee, 1977.

20. Mathia, Gene A., and John R. Brooker. "Vine-Ripe Tomato Production and Marketing in North Carolina and Tennessee." Bulletin No. 230, Southern Cooperative Series, June, 1978.

21. Morrison, W. W. "Preparing Peaches for Market." Marketing Bulletin No. 9, United States Department of Agriculture, Washington, D.C., August, 1960.

22. Moorhouse, L. A. The Management of the Farm. New York: D. Appleton and Company, 1925.

23. Morgan, W. B. Agriculture in the Third World. Boulder: Westview Press, 1978.

24. Morss, Elliot R., Donald Mickelwaite, John K. Hatch, and Charles F. Sweet. Strategies for Small Farm Development: A Review of 36 Development Projects. Boulder: Westview Press, 1976.

25. Mosher, Arthur. Getting Agriculture Moving. New York: Frederick A. Praeger Company, 1966.

26. Rasmussen, Gary D. "How Fresh Peaches Are Marketed." Marketing Bulletin No. 64, United States Department of AGriculture, Washington, D.C., August, 1978.

27. Rom, Roy C. "Peach Production in Arkansas." Proceedings, National Peach Council, 1975.

28. Scheer, Arnold H., and Elwood M. Juergenson. Approved Practices in Fruit Production. Danville, Illinois: The Interstate Printers and Publishers, 1964.

29. Stuckey, H. P. Southern Horticulture. Atlanta: Turner E. Smith and Company, 1944.

30. Symons, Leslie. Agricultural Geography. New York: Frederick A. Praeger, 1967.

31. Talbert, Thomas Jesse. Growing Fruit and Vegetable Crops. Philadelphia: Lea S. Febiger, 1953.

32. Tennessee Crop Reporting Service. "Commercial Fruit Tree Survey." Nashville, 1979.

33. United States Department of Agriculture. "Agricultural Statistics." Washington, D.C., 1981.

34. _____. "Establishing and Managing Young Apple Orchards." Farmers Bulletin No. 1897, Washington, D.C., December, 1976.

35. _____. "Fruit Situation." Economics, Statistics and Cooperatives Service, Washington, D.C., July, 1980.

36. _____. "U.S. Peach Industry, Part I: Structures, Trends, and Consumption Projections to 1980." Agricultural Economic Report No. 200, AGricultural Research Service and Economic Research Service, Washington, D.C., March, 1971.

37. _____. "U.S. Peach Industry, Part II: An Interregional Competitive Model." Agricultural Economic Report No. 230, Agricultural Research Service and Economic Research Service, Washington, D.C., February, 1973.

38. Walch, Herbert N., Robert M. Ray, and Alvin D. Rutledge. "Planning Budgets for Fruits and Vegetables." Agricultural Extension Service, The University of Tennessee, January, 1980.

39. Weld, L. D. The Marketing of Farm Products. New York: The Macmillan Company, 1920.

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