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Tennessee Agriculture - Projections to 1990

University of Tennessee Agricultural Experiment Station

Department of Agricultural Economics and Rural Sociology

Extension Agricultural Economics and Resource Development

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**Department of Agricultural Economics and
Rural Sociology
and
Extension Agricultural Economics and
Resource Development**



**Department of Agricultural Economics
and
Rural Sociology**

TENNESSEE AGRICULTURE -- PROJECTIONS TO 1990*

Introduction

This report is an update of a report prepared in 1970 entitled, "Tennessee Agriculture -- Possibilities For 1985." This report contains projections of trends for agriculture in the state for the decade ahead. The purpose of this report, like the earlier one, is to provide general guidelines for planning agricultural research and extension programs for the state. The projection of trends should not be viewed as prediction or prophecy of what will happen in the future. Rather, the intent is to project the possible and most likely directions of growth and change in many characteristics of Tennessee agriculture. The projections are based on a careful assessment of problems and potentials faced by farmers. The upper limits of the agricultural production capacity of the state, which is set by the quality of the resource base and the highest possible level of technology and management that could be applied, is not of immediate concern. The objective here is to arrive at an informed judgement of how the land resources of the state will be used over the next ten years and how much improvement can reasonably be expected in farmers' adoption of technology and better management practices on farms. It is known that the adoption of improved techniques and management may be brought about by education. It is also known that the economic and social environment within which farmers find themselves affects farm operators' decisions. What the economic and social environment will be over the next decade is largely a matter of speculation. It is assumed that inflation will remain a problem shaping farmers'

*This report has been prepared by the staff of the Department of Agricultural Economics and Rural Sociology, and Extension Agricultural Economics and Resource Development. Assistance and helpful suggestions were contributed by other Institute of Agriculture staff.

decisions. A social force which will also likely affect Tennessee agriculture significantly in the years ahead is the public attitude toward soil conservation. It is assumed that the trends which are apparent now in land use and cultural practices to reduce erosion on the loess soils of West Tennessee will gain wider acceptance and application by farmers.

The relationship between agriculture and other sectors of the state's economy is recognized. In the narrative that follows, attention is given to projected changes in population, the farm supply and services sector, and marketing system. Primary emphasis, however, is placed on the farm sector.

The basis for much of this report includes information contained in the 1978 Census of Agriculture, the annual updates of the 1970 Census of Population and data published by the Tennessee Crop Reporting Service for 1970-79. The following general guidelines were used in developing this report:

1. Constant prices, at the 1979 level, are used for agricultural products. Thus, any change in gross farm sales estimates are based on changes in physical volume. (During the decade of the 1970's, approximately 11 percent of the increase in cash farm marketings in Tennessee was due to increased volume of production and 89 percent to price increases.)
2. Growth in the total market for agricultural products -- domestic and export -- will be about like it was in the decade of the 1970's.
3. The 1990 projections are based on producing the same crops and livestock. No allowance has been made for shifts to new crop or livestock enterprises.

Population

The total population of Tennessee is estimated to increase by 690,000 between 1980 and 1990. This assumes a growth of 15% over the decade compared with about a 17% growth between 1970 and 1980.

The major shift in population is projected to be the continuing growth in rural non-farm and urban areas and a continuing decline in rural farm population (Table 1).

Table 1.

Estimated Urban, Rural Non-Farm, Rural Farm, And
Total Population, Tennessee, 1980 And 1990

Item	1980	1990	Projected Percent Change 1980 to 1990
	----thousands----		
Urban	2,600	2,900	+ 11.5
Rural Non-Farm	1,760	2,180	+ 23.9
Rural Farm	230	200	- 13.0
Total Population	4,590	5,280	+ 15.0

The rural farm population is expected to decline from 5.0 percent of Tennessee's population in 1980 to 3.8 percent in 1990. The rural non-farm population is expected to increase 420,000 between 1980 and 1990. The desire to "live in the country" is expected to continue; however, there will likely be counterpressure from rising energy costs to reduce miles driven to work and thus, the rate of growth in the rural non-farm sector may be slowed. However, the total population living in rural areas of the state is expected to increase by 390,000 people during the next ten years.

Supplies and Services

The availability and price of agricultural inputs has been greatly influenced by worldwide events during the seventies. Inventory shortages and spiraling prices indicate the availability of agricultural inputs should no longer be taken for granted. During this period, expenditures by Tennessee farmers for all supplies and services have nearly tripled. Expenditures for fuel, pesticides, seeds, feed and fertilizers increased relatively more than the other operating expenses. During the past decade, capital expenditures comprised 37 percent of total expenditures. Most of the increase in capital expenditures resulted from larger investments in land, buildings and equipment. Credit is a major source of capital. Total farm debt in Tennessee stood at 2.6 billion dollars on January 1, 1979. Since 1970, indebtedness has nearly tripled in Tennessee. However, assets have increased more than debts. The agricultural industry continues to have a favorable debt-to-asset ratio of about 19 percent. However, substantial variation exists between farms.

Interest on farm mortgage debt accounts for 7 percent of total production expenses as contrasted to 5 percent ten years ago. Total interest on farm debts has increased by an average of approximately 29 percent per year during the 10 year period. It is expected that total production expenses will rise from approximately 1.7 billion in 1979 to approximately 2 billion by 1990 (in 1979 dollars).

Supplies and services must be obtained as economically as possible for Tennessee farmers to remain competitive with other areas. The total credit needs for farming will increase dramatically as will the needs for each individual farmer.

Rising Total Capital Requirements

In 1979 the investment per farm in Tennessee was over \$127,000. Real estate assets accounted for approximately 70 percent while non-real estate assets accounted for 30 percent of the total investment. Average land values per acre have increased approximately 15 percent per year for the past ten years. The trend is toward real estate assets constituting a higher proportion of total assets. By 1990 average investments will likely be two to three times greater than the 1979 level. Some economically efficient family farms in 1990 will have farm investments in excess of \$1 million in 1979 dollars.

Rising capital requirements will make entry for an individual desiring a commercial sized operation more difficult. Innovative financial instruments such as the graduated mortgage will likely become more common. The trend will continue toward more part-owner commercial farms and less fully owned operations. At the same time, there will be a trend toward an increased percentage of part-time farmers who have nonfarm employment as a major source of income.

Inflating prices of land and other inputs along with fluctuating product prices will cause cash flow problems of greater intensity for farmers who wish to expand through debt financing. These same pressures will magnify problems of entry into farming by young farmers who are not fortunate enough to inherit a commercial farm business.

Agricultural Marketing in 1990

Several factors contributed to a basic change in agricultural marketing, especially of grains, during the 1970's. Farmers were given more freedom to plant crops of their choice and reduction of government stocks introduced

more variability into farm prices for grains and soybeans. This, in turn, had an influence on livestock producers through feed supplies and prices. These changes placed a much higher premium on producer knowledge of marketing. This premium is expected to increase during the 1980's.

The marketing system that is in operation may not differ greatly from the one in existence in 1979 however there will be several significant trends underway.

The following general trends are expected to continue or increase in the 1980's and be evident in 1990.

1. The marketing system in 1990 should be more efficient than the one existing today. One primary reason will be due to improved market price information. Farmers will be better informed concerning prices over space and time.
2. Producers in 1990 will be much more inclined to develop a marketing plan, program or strategy for their operation with risk management as a key ingredient. Lending agencies will begin to require a marketing plan to accompany a farm plan and cash flow projection. Producers will make greater use of forward pricing tools such as contracts or direct use of the futures market.
3. There will be an increasing use of electronic marketing especially in the livestock industry. Electronic marketing may exist in several different forms but the objective of reducing the total cost of marketing will be the same for all. Although not necessarily related to the development of electronic marketing, there will likely be a reduction in the number of livestock auction markets.

4. The volume of direct sales from producer to consumer or next user will increase. Producers of fruits and vegetables, cattle, swine and fire-cured tobacco will all participate in direct sales.
5. Market packages for some commodities, especially burley tobacco, will change. Some type of loose-leaf burley package will be widely used in 1990.
6. There will be an increase in the proportion of farm production for which the market is known through integration, contracting or other means of coordination prior to the start of the production process.

THE FARM SECTOR

The farming sector in Tennessee includes farms and farm operators with widely varying characteristics. In 1978 on about one-third of the 97,000 farms, farm product sales totaled less than \$2,500 while 75 percent had sales of less than \$10,000. Only 7 percent of the farms sold \$40,000 or more of farm products. On the other hand, over half of the total product sales came from farms with sales of \$40,000 or more. Over one-half of the farm operators worked off the farm 100 days or more.

In 1978, farm size averaged 135 acres for all farms, 56 acres for farms with sales of less than \$2,500 and 177 acres for farms with sales of \$2,500 or more. Total land in farms in 1978 was slightly over 13 million acres, about the same as 1974 acreage but over 2 million acres less than reported in 1964. About 60 percent of the land used for farming was classified as cropland in 1978 and slightly over one-fourth of the total acreage was utilized for row crops, primarily soybeans, cotton, corn and tobacco. About 26 percent of farmland acreage was wooded (some of this was pasture).

Nearly two-thirds of the farms with sales of \$2,500 or more in 1978 were classified as full owners while 27 percent were part owners (operated both owned and rented land). Nine percent of the farms were operated by tenants. Eighty-seven percent of the farms were individual or family operations. Twelve percent were organized as partnerships and only one percent were corporations.

1990 Projections:

Projections of farm acreage, farm numbers, tenure characteristics and farm income from Tennessee farms in 1990 were based on the assumptions that the farm definition would not change and that demand for agricultural products, especially export demand, will continue to be relatively strong over the next few years. Since the census definition of a farm is income based, inflation tends to result in more units being classified as farms and to move some existing farms into the commercial farm classification (over \$2,500 sales). A strong demand for farm products and resulting relatively high prices for farm commodities will tend to dampen or offset past tendencies for reduction in number of farms and the farmland base.

The major changes projected in the farming sector are as follows:

1. Stabilization of the acres used for farms. Acreage in farms in Tennessee was approximately 13 million in both 1974 and 1978, slightly less than 50 percent of the total land base of the state. While some farmland will likely be diverted to nonfarm uses by 1990, strong demand for farm products, particularly soybeans, wheat and cotton, will likely attract additional acres into farm production. (Table 2)

2. Continued decline in number of farms and increase in farm size. Total number of farms is projected to decline to about 85,000--about 12

Table 2.

Characteristics of All Farms in 1978 With Projected 1990

<u>Characteristics</u>	<u>1978</u>	<u>1990</u>	<u>Percent Change 1978 to 1990</u>
Number of Farms	96,792	85,000	- 12
Total Acres in Farms	13,092,015	13,000,000	- 1
Total Acres Cropland	8,007,336	8,000,000	0
Total Acres Cropland Harvested	4,476,645	4,490,000	+ 7
Average Acres Per Farm	135	153	+ 13
Average Sales Per Farm	\$14,745	\$25,354	+ 72

percent less than reported in the 1978 Census of Agriculture. With no change in land base, farm size is estimated to increase from 135 acres to 153 acres.

3. Expansion in number of commercial farms (sales of \$2,500 or more) and a reduction in number of farms with sales less than \$2,500. In 1978, over 33,000 farms (nearly one-third) had sales of less than \$2,500. This number is projected to decline to 15,000 by 1990 due to inflation and consequent movement into the commercial classification and due to expansion and farm consolidation as operators strive to achieve the operating efficiency of larger units. A net increase is expected in the number of farms with sales of \$2,500 or more. The number of farms in this category is likely to increase due to inflation and to expansion of farm size. This will be offset to some extent by a tendency for consolidation and size expansion of farms currently in this classification.

4. Substantial increase in acreage used for row crop production. With strong demand and favorable farm prices for soybeans, wheat, and cotton, an incentive will exist to expand row crop acreage on existing farms and/or to

rent acreage not presently being used for farm production. On the other hand, increased emphasis on soil conservation and meeting soil loss tolerance guidelines will tend to favor fewer acres for row crops and more small grain, hay and pasture. Efforts to meet soil loss guidelines are likely to result in expanded use of minimum tillage cropping systems and to increased acreage of wheat, particularly as a double crop with soybeans. (Table 3 and Table 5)

Table 3.

Land Use in Tennessee in 1978 With Estimated 1990

Land Use	1978	1990
	(thousands acres)	
<u>Cropland</u>		
Row-crops and small grain	3,411	4,140
Hay and Pasture	4,196	3,660
Idle	400	200
Total Cropland	8,007	8,000
<u>Other land</u>		
Other Pastureland	913	1,330
Woodland	3,500	3,000
Roads, lots, wasteland, etc.	672	670
Total Other Land	5,085	5,000
Total Land in Farms	13,092	13,000
Total Land Not In Farms	13,358	13,450
Total Land in Tennessee	26,450	26,450

5. Minor shifts in tenure and organizational structure of farms. In 1990, about two-thirds of the farm operators are expected to be classified as full owners and to use about 50 percent of the farm acreage. Part owners are expected to operate 27 percent of the farms and 44 percent of the acreage. A slight reduction in proportion of farms operated by tenants is projected. A slight increase is projected in the proportion of farms operated as partnerships and corporations. By 1990, corporations are expected to operate 2 percent of the farms and 4 percent of the acreage.

GROSS CASH RECEIPTS - \$2.3 BILLION

Cash receipts account for about 85 percent of total gross farm income. Other components of gross income such as home consumption, value of housing, recreation, custom work and government payments, while important, have not been included in the projection.

Total cash receipts in 1979 were \$1,779.5 million with livestock and livestock products accounting for 54 percent. Cash farm marketings can be boosted to about \$2.3 billion (1979 prices) by 1990 through intensive and cooperative efforts of farmers, marketing, service and supply firms and agencies and through research and education.

Total livestock and livestock product sales are projected to increase from \$955 million in 1979 to \$1,082 million in 1990. Total crop sales are projected to increase from \$904 million to \$1,256 million during the same time period. It is estimated that total farm marketings can increase from the \$1,779 million in 1979 to \$2,339 in 1990 (Table 4).

Table 4.

Comparison of Gross Farm Receipts in 1979 With
Estimated Receipts in 1990, Tennessee

Item	Actual 1979	Estimated 1990	Change 1979 to 1990
	Thousands	Dollars	Percent
Cattle and calves	411,598	476,000	16
Dairy products	245,284	260,000	6
Hogs	187,515	213,000	14
Poultry and poultry products	102,691	125,000	21
Other livestock and products	<u>8,352</u>	<u>8,300</u>	<u>- 1</u>
Total livestock and products	955,440	1,082,300	13
Soybeans	431,731	545,000	26
Tobacco	156,006	160,000	3
Cotton	58,113	116,000	100
Fruits and vegetables	30,664	46,000	50
Greenhouse and nursery	115,000	185,000	60
Corn for grain	52,491	61,000	16
Wheat for grain	30,370	108,000	260
Forest products	17,087	23,000	35
Other field crops and hay	<u>12,881</u>	<u>12,800</u>	<u>- 1</u>
Total Crops	904,343	1,256,800	39
TOTAL FARM MARKETINGS	1,859,783	2,339,100	26

FARM MARKETING POSSIBILITIES BY ENTERPRISE

This section of the report discusses the principal commodities produced in Tennessee, the 1990 potential and some general problems to achieving the 1990 estimates.

Grains and Soybeans

Situation: Soybeans, wheat, corn and other feed grains (oats, barley and sorghum) provide a major contribution to total cash farm receipts in Tennessee. The value of cash receipts in 1979 from these crops totaled about

\$515 million, a 442 percent increase from the \$95 million in 1970. Soybeans accounted for about 84 percent of the value of total cash receipts from the combination of all grains and soybeans.

Soybeans has been the leading cash crop since 1973 and should hold the top position for the foreseeable future. Cash receipts from soybean sales jumped from \$73 million in 1970 to \$432 million in 1979. The share of crop cash receipts provided by soybeans jumped from 27 percent in 1970 to 52 percent in 1979.

Acreage devoted to soybean production has also risen sharply during the 1970's. In 1970, soybeans (as beans) were harvested from 1.15 million acres. In 1979, harvested acreage totaled 2.62 million acres, or more than double the level of 9 years earlier. Acreage expansion has come from pasture and hay land, shifting from other crops (especially cotton), from land clearing, and from drainage.

Corn produced for grain continues to be an important crop in Tennessee. Cash receipts rose from \$16 million in 1970 to \$52 million in 1979. The value of the crop to producers is not fully reflected by total cash receipts since only 40-45 percent of the crop is sold as grain. The remainder is fed to livestock on the farm where it is grown. Corn acreage harvested as grain averaged 615,000 acres over the 1970-79 period. Acreage ranged from a low of 480,000 in 1972 to a high of 730,000 acres in 1977. From 1970 to 1979, acreage showed no definite trend.

Wheat is a significant cash crop in many Tennessee counties. Annual cash receipts in the 1975-79 period averaged \$23 million. Acreage in the 1975-79 period has fluctuated between 220,000 and 300,000 acres.

1990 Potential: Soybean acreage is projected to expand to 2.8 million acres by 1990 (Table 5). Per-acre yield averaged 23.7 bushels over the 1970-79 period. Yields should improve somewhat to 30 bushels per acre by 1990. Total production should thus reach 84 million bushels in 1990.

Corn acreage for grain is expected to stand at 600,000 acres in 1990. Yields per acre should average near 84 bushels. About one-half of the corn will probably be sold off the farm with the remainder fed to livestock on farms where it is produced.

Wheat acreage harvested as grain may increase to about 950,000 in 1990. The emphasis on erosion control and wheat's adaptability to double-cropping with soybeans in West Tennessee will account for most of the acreage increase. Yields may average 40 bushels per acre by 1990. Total annual production would total 38 million bushels.

Impediments: Continuing efforts are needed to improve varieties and production technology and encourage growers to adopt a "package" of proven practices. Soybean and grain yields have been increasing rather slowly over the past few years. In the case of soybeans, acreage expansion has come from less productive soils, which has tended to keep average yields from rising. The problem of soybean cyst nematodes will keep pressure on plant breeders as continuous soybean production may permit nematodes to break down resistance in the nematode-resistant varieties. Without resistant varieties, growers would be forced to rotate to other crops, apply expensive nematicides, or suffer greatly reduced yields. Lower yields in many cases would make other crops more profitable and lead to reduced soybean acreage.

Another major yield impediment for grains involves the extent to which rising petroleum prices will affect tillage practices and fertilizer application

Table 5.
Harvested Acreage of Principal Crops in Tennessee,
1979 and 1990

Crop	1979 (thousands of acres)	1990
Soybeans	2,620	2,800
Corn (grain)	620	600
Corn (silage)	116	125
Cotton	230	350
Tobacco	59	65
Wheat (grain)	295	950
Fruits, vegetables and nursery	55	60
Other small grain and sorghum	70	65
Total	4,065	5,015 ^a

^aAn estimated 750,000 acres would represent double cropping.

rates, especially nitrogen. The combining of field operations and the increased use of limited tillage practices should not reduce yields under good management. Rapidly rising nitrogen prices could lead to reduced application rates and lower yields, especially in corn production. Wheat yields would suffer to a lesser extent.

The possibility of federal anti-erosion legislation is another potentially serious impediment to the expansion or perhaps even the maintenance of current cropland acreage. Legislation of this type would be a special problem in the case of soybeans. Strict enforcement of water quality standards which would restrict production of soybeans and other crops using conventional tillage practices on steeper slopes would have the effect of encouraging the rapid

adoption of limited tillage practices and/or shifting land from soybean production to pasture and hay production.

Tobacco

Situation: Four types of tobacco are produced in Tennessee: eastern dark-fired, western dark-fired, dark air-cured, and burley. Burley was grown on about 46,000 acres in 71 counties in East and Middle Tennessee in 1979. Farm cash receipts from burley account for about 80 percent of the total farm cash receipts from tobacco. Dark air-cured was grown on 1,600 acres in 1979, mostly in the 10 northern counties of Middle and northeastern West Tennessee. Eastern dark-fired was produced on about 11,800 acres in nine counties in northern Middle Tennessee, while western dark-fired was grown on 690 acres in two northern counties in West Tennessee in 1979.

Total tobacco acreage has trended downward since the 1920's. The annual average tobacco acreage of 65,976 acres during 1975-79, was about 40 percent of the peak acreage in 1930. Tobacco has consistently ranked among the highest income-producing farm enterprises in the state.

Tobacco is produced and marketed under a production control-price support program. The crop is very labor intensive (over 315 hours of labor per acre), especially in the harvesting and market preparation stages where mechanization and other labor-saving practices are the least developed. Experimentation with different market packages that reduce labor requirements has led to about 10 percent of burley being sold as loose-leaf. The proportion is expected to increase. The bulk of tobacco production occurs on farms of small acreages with a substantial proportion of the crop produced by part-time farmers. For example, tobacco was grown on over 37,500 Tennessee farms and required over 21 million hours of labor in 1978. Both

gross and net returns per acre are high when compared to most other crops.

Annual cash receipts from the crop have accounted for 8.0 to 17.5 percent of the annual total farm cash receipts in the state since 1960; however, less than two percent of the harvested cropland in the state is used for tobacco.

1990 Potential: With current trends in technology and government policies and present industry structure assumed to prevail in 1990, the aggregate market for tobacco produced in Tennessee, as measured by real farm cash receipts (1979 prices) will increase slightly to about \$160 million by 1990. Uncertainties associated with the smoking and health issue and market trends in consumption products made from tobacco, continued high costs of production and low production volume per farm, increased foreign competition, and certain provisions of the present tobacco program will all tend to dampen individual producer and industry enthusiasm for expansion.

Impediments: There is a continued need to develop new, higher quality, higher yielding, disease and pest resistant tobacco varieties. New or improved pest management systems that enhance net returns while meeting environmental and health standards are needed. Mechanization progress and altered marketing practices are impeded by (1) small poundage quotas per farm, (2) limited lease and transfer provisions for quota, (3) custom and traditions favoring the present industry structure and marketing system, and (4) relatively high capital requirements.

Cotton

Situation: The combined value of lint and cottonseed produced in Tennessee in 1979 was \$60 million. This was more than \$10 million less than the average value of lint and seed over the 1974-79 period. Acreage harvested at 230,000 in 1979 was identical to 1978 acreage, but still below the average of 326,000 acres during 1974-79, and well below the average

of 435,000 acres during 1970-73. Several factors have contributed to this sharp decline in acreage since 1974. Examination of the major factors should provide insights into expectations regarding Tennessee's cotton industry in 1990.

A major factor behind the cotton acreage decline has been a low yield problem. Per-acre yields have slipped from an average of 524 pounds per acre during the 1970-73 period to 363 pounds over the period 1974-79. In two years, 1974 and 1976, the state average yield declined to under 300 pounds per acre. These low yields have resulted in financial losses to growers and reduced acreage which has led to gin closings and financial setbacks for warehousemen. The average cotton producer did not recover full production costs during the 1974-79 years. Low yields and the resulting income problems has contributed to the shifting of cotton land to soybeans, which requires less production capital and is an easier crop to produce.

1990 Potential: Cotton as an alternative enterprise is needed as a rotation crop mainly with soybeans and, in some cases, corn. In addition, cotton provides considerably more total economic benefits to the Tennessee economy per acre than soybeans. Memphis is still the largest spot cotton market in the world. Ginning and storage capacity is still quite adequate. Tennessee gins and warehouses are also close to cotton mills.

The overall future of U. S. cotton appears bright. Demand should remain strong over the next 10 years, especially the export market. In addition, cotton will be hurt less by rising petrochemical prices than will man-made fibers. If the uncertainty regarding yield can be reduced, growers should be able to combine better yields with sound marketing programs to help Tennessee share in the optimistic outlook for U. S. Cotton.

Assuming that the yield situation of Tennessee cotton producers can be stabilized with at least 450 pounds per acre and that the price per pound remains at the 1979 level of 62 cents per pound for lint and \$135 per ton for seed, a reasonable expectation would be 350,000 acres of cotton in 1990. Total returns would thus be \$97.6 million for 328,125 bales of lint and \$17.7 million for 131,250 tons of seed.

Impediments: The key to the future of cotton in Tennessee appears to be dependent upon some improvement in per acre yields as well as a reduction in yield variability and uncertainty. Acreage is up slightly in 1980, but this increase does not necessarily represent a return of grower confidence in the crop. Instead, growers probably shifted from soybeans to cotton in response to a cotton/soybean price ratio during the spring planting season which strongly favored cotton. This situation will not likely prevail each year. Rather, if the cotton industry is to stabilize or perhaps make a comeback, an infusion of confidence from two or three years of consistently higher yields is needed. If yield increases are not forthcoming, acreage will remain steady at best or more likely decline and precipitate additional gin closings.

Fruits and Vegetables

Situation: Total cash receipts from Tennessee fruits and vegetables were almost \$31 million in 1979. The major vegetable product was snap beans, with an estimated 11,500 harvested acres in 1979. Next in descending order of acreage were Irish potatoes, tomatoes, sweet potatoes, and cabbage with 4,300, 3,000, 2,800, and 650 acres, respectively. Apples and peaches were the major fruit crops, producing 10 million, and 8.5 million pounds, respectively, in 1979.

The Tennessee market for processing vegetables continues to remain strong, primarily due to three large processors - two in East Tennessee and one in West Tennessee. All three processors engage in considerable contracting with producers. The number of producers growing vegetables for these processors has declined over the past decade, partially due to increased purchases from growers in other states and increased production of vegetables by the processors.

Snap bean production has declined since 1973 when 18,200 acres were harvested. However, the acreage in 1973 was an unusual situation because the acreage has otherwise ranged from 12,200 to 16,800 over the past 10 years. The market for snap beans consists of two processors in East Tennessee, along with a processor in Arkansas. This market will probably remain strong and even expand over the next 10 years if the yields per acre can be improved.

Irish potatoes and sweet potatoes are primarily produced for fresh market outlets. Acreage of both of these vegetables has remained fairly steady over the past 10 years. Greater potential for expansion seems to be with sweet potatoes, as several adjoining states have engaged in rigorous efforts to develop cultivars for improved production and campaigns to increase consumer acceptance and demand for sweet potatoes.

Tomato production has been expanding over the past few years. The 3,000 acres harvested in 1979 is the largest total in over 20 years. Potential for further expansion of fresh market tomato production appears excellent. The producers and packers of tomatoes in East Tennessee have reached the point in maturity where group action to improve and protect markets for Tennessee tomatoes is possible. Recent research has revealed that East Tennessee has better potential for expanding production of vine-ripe tomatoes than its nearest competitor, Western North Carolina.

Production of cabbage, bell pepper, and pimiento pepper for processing continues to be important vegetable products for growers interested in contract production. The level of activity for these products is not expected to change much over the next decade.

Fruit production, namely apples and peaches, has remained fairly stable over the past 10 years. Potential for both fruits appears to be good but growth is directly linked to improved quality and market outlets. Market access is the major obstacle confronted by many of Tennessee's fruit and vegetable producers. For instance, production of peaches and strawberries has expanded in areas where pick-your-own operations are feasible. There is also interest in blueberries and grapes.

1990 Potential: Total cash receipts in 1990 should be about \$46 million, an increase of \$15 million over the 1979 level.

Impediments: In general, expansion of fruit and vegetable production for fresh market outlets depends upon improved marketing opportunities. Small growers need direct type outlets or a means of aggregating supplies for commercial outlets. Neighboring states, namely North Carolina and Georgia, have experienced excellent development of infant industries. Much of this development is attributable to state participation in the establishment of fruit and vegetable marketing facilities. But in Tennessee, the major obstacle to expanded fruit and vegetable production continues to be the lack of adequate marketing opportunities.

Nursery and Greenhouse

Situation: Tennessee's estimated nursery sales of over \$90 million in 1979 from 22,000 acres places it ninth in the nation. Over 730 certified nurseries reflect a gradual increase during the past 10 years. The majority of production is sold wholesale, out-of-state.

Greenhouse production is increasing in Tennessee and much interest is evident because the mild winters reduce heating costs, compared to traditional northern production areas. Also, local sources of winter produce are attractive because transportation costs from distant production areas are becoming prohibitive. Since more people are growing gardens, the opportunities for growing vegetable plants in greenhouses are also increasing. Flower production is also favored in Tennessee because energy costs for shipping from western areas is increasing.

1990 Potential: Expansion of the nursery industry is controlled by demand for plants, availability of suitable land, competition from other states, profit margins and mastery of the production technology. Flower greenhouses appeal primarily to florists who market flowers for special occasions, and also to firms and individuals who desire a ready source of flowers throughout the year. Vegetable growers produce for a high quality, premium priced market during the time when weather prevents outside production. Production of bedding plants and house plants offer growth potential for the future.

If growth in sales continues at about the rate which occurred in the 1975-79 period, sales from nurseries and greenhouses should reach \$185 million by 1990 at constant prices.

Impediments: A continuing erosion in the purchasing power of families might restrict growth in the ornamental industry. Although a trend toward smaller homes on less land seems likely in the future, landscaping expenditures may actually increase. The best and most expensive landscaping is usually on smaller lots. High interest rates, which reduce housing starts, could reduce total demand. No problems from the supply side are evident now except the increasing cost of suitable land and the cost of multi-year financial commitments required to produce quality trees and shrubs. Some greenhouse

growers face extremely high energy costs. Also competition from field-grown crops in warm areas of this country and abroad is intense. Labor requirements are heavy in greenhouses. This could be a problem in some areas.

Farm Forestry

Situation: The reported sales of farm forest products have ranged from approximately \$6.0 million to \$15.5 million during the 1970's. The composition of income from these sales has been changing. The sale of pulpwood has been increasing over the last two decades relative to sales for other uses. This is due partly to the increased demand for paper and paper products. Until the mid-1970's, there was a substitution of electricity and petroleum products for wood as a source of heat. However, during the latter 1970's, the increased cost of petroleum and electricity has caused a significant increase in the demand for wood as a source of heating fuel. One impact from this will be rising incomes from fuelwood sales and such incomes may be two-to-five times the levels observed in the 1970's.

In the last three decades, the amount of forest land owned by farmers decreased by about 17 percent. Some of this decrease results from conversion to non-forest uses but much of it has been due to forest land sales to non-farmers. This trend is expected to continue.

In general, the quality of the growing timber stands are poor. The best quality trees have been cut in the past while cull and low-grade trees remain. As a result, many timber sites are producing low-quality products. In addition to the low-quality problem, much of the acreage is understocked. As pulpwood and especially fuelwood demand increases, markets may strengthen, thus allowing an economical outlet for the removal of such poor quality timber. Furthermore, an opportunity to thereby economically upgrade the stand on many sites may develop.

1990 Potential: By 1990 the sales of forest products from farms are likely to reach \$23 million. This increase is expected due to expanding markets for timber (especially fuelwood and pulpwood) and farmers needing to increase their cash flow. The quality of the producing stands may change since the main increases in markets are for lower quality products. This may ultimately increase the quality of sawtimber. However, if selective logging is not practiced, little change in quality is likely.

Impediments: The life span of the individual appears to be too short for sustained quality timber production on individually owned timber tracts unless new incentives are provided. Payment of taxes each year rather than at harvest of the timber influences the amount of resources devoted to timber production. Reorientation and redirection of the tax structure could be such that taxation would concur with income. Feasible taxation alternatives need to be developed and evaluated. Many individual owners lack financial, physical, and technological resources to practice improved forest management. However, the expected increase in pulpwood and fuelwood will offer some economic incentives to improve forest conditions.

New and improved methods for marketing and utilizing low-quality timber are needed. Also ways to use timber slash economically would aid in obtaining a cellulose base for products from timber resources. Developments of new harvesting methods and techniques would permit more commercial timber production on the less desirable land sites.

Genetic improvements in the various species are needed in order to shorten the production cycle or to produce higher value. Impediments to improved forest management as perceived by forest owners need to be ascertained. This information would give guidance for present and future public forest programs.

The economics of reclamation and species selection for reclamation work for strip mining, roads, and right-of-way need to be ascertained. Also, pricing structure, conduct, and performance for the forest and forest products industry need to be investigated and evaluated.

Hay, Pasture and Silage

Situation: Sales of forages either as baled hay or silage are limited due to the bulkiness of the product. However, forages provide a major share of the feed requirements for the beef and dairy enterprises and are extremely important crops. The 1978 Census of Agriculture reported a total of 3 million acres of cropland used for pasture, 1.2 million acres harvested for hay, 900,000 acres of non-cropland utilized for pasture and 151,000 acres used for corn or sorghum silage. So, over 30 percent of the agricultural land in the state is being utilized for these crops.

While total forage producing acres have been decreasing, the acres used for hay production have been increasing slightly. Since 1970, the acres of land devoted to alfalfa production have increased at a rate of about 8.5% per year. During 1978 there were 105,000 acres utilized in alfalfa production and about 252,000 tons were produced.

Another trend occurring on Tennessee farms is that more forage is being harvested as wilted hay-crop silage. This practice saves harvesting labor and also usually results in a higher quality feed than hay since the time between cutting and storing is reduced and therefore the danger of rain damage is reduced.

1990 Potential: Acreage used for hay, pasture and silage will probably decrease from the present level. However, with the share of acres used for alfalfa production increasing and the overall quality of the forages also

increasing, the value of production should increase by 1990. Total value produced from hay and silage should reach \$200 million. Due to decreasing acreage, pasture may be fertilized heavier than in the past and production per acre should rise.

Impediments: To achieve this goal, emphasis will need to be placed on the educational efforts directed toward both the production of hay silage and pasture and the early harvest, handling, storage and feeding of forages. Emphasis will need to be placed on the development and testing of varieties and species best suited to Tennessee conditions. Probably the most important area is the continuing emphasis on improved pasture production and management. A large portion of the forages is still harvested by livestock and this is the area where most progress can be made.

Cattle and Calves

Situation: The number of all cattle on farms January 1 increased from 2 million head in 1970 to 3 million in 1975, and then declined to 2.4 million in 1979. All cows that had calved increased from 1,238,000 head in 1970 to 1,566,000 in 1975, and then decreased to 1,260,000 in 1979. The numbers of beef cows that calved for the same three years were 942,000, 1,349,000 and 1,050,000 head, respectively. These changes reflect in great measure the recurring cycle in beef cattle numbers and marketings.

For the years 1970, 1975 and 1979 cash receipts from farm marketings of cattle and calves were \$187, \$255 and \$412 million, respectively. These receipts were 26, 23 and 24 percent, respectively, of cash receipts from marketings of all farm commodities in Tennessee.

Changes continue to occur in channels through which packers in Tennessee obtain slaughter cattle. In 1970, 56 percent of all cattle bought by packers

in the state moved direct from producers or through country dealers. This percentage fell to 39 in 1975 and rose back up to 43 percent in 1978. During 1978, only 9 percent of all cattle bought by Tennessee packers moved through terminal markets, while 48 percent were bought at auctions.

The number of cattle and calves fed for or by packers varied during the 1970's, from 15,800 head in 1970, to 21,500 in 1972, 4,800 in 1975, 2,700 in 1976, and 4,900 in 1977, the last year for which data are available. Finally, total cattle and calves on feed on January 1 went from 26,000 head in 1970 to 10,000 in 1975, and up to 27,000 in 1979, and then sharply down to 15,000 in 1980.

1990 Potential: The most important factor affecting the supply of cattle produced in Tennessee in 1990 will be the historical cycle in cattle numbers. This cycle is about 10 years in length, with low points in cattle numbers coming at the end of one decade and the beginning of another. Thus, given the pattern which has existed up to now, 1990 cattle numbers will be at the low point of the cycle. However, with the notable exception of the cycle ending in 1979-80, each successive cycle since the 1920's has ended at a larger number of cattle than the previous cycle. This implies a long-term upward trend in cattle production in addition to the usual 10-year cycles. It is assumed this trend will continue to 1990, even allowing for the influence of the much greater than usual herd liquidations that occurred in 1975-79.

In addition to the cattle cycle mentioned above, the estimates are based on these assumptions: 1) continuation of current U. S. population growth; 2) a 10 percent increase in per capita beef consumption between 1980 and 1990; 3) continuation of calving and culling rates and slaughter weights currently typical in Tennessee; 4) continuation of 1979 relative prices of beef

and its substitutes; 5) availability of pasture required for herd expansions during the current cycle; 6) continuation of the current regional patterns of cattle raising and feeding; and 7) continuation of current basic consumption patterns for block, fabricated, and processed beef and for beef substitutes.

The beef and dairy cow breeding herd in 1990 is estimated to number about 1.4 million head. This number of cows should produce about 964,000 beef and dairy calves for sale as feeder or stocker animals. An estimated 40,000 head of these feeder animals will be retained and fed to slaughter weight in Tennessee. In addition, approximately 225,000 cull cows from the breeding herd will be available for slaughter. Sales of these feeder, stocker, slaughter, and cull animals should generate about \$476 million in cash receipts at 1979 price levels.

Impediments: Rising energy costs will tend to result in lower feeder cattle prices. Increased fuel costs will cause higher trucking costs which, in turn, will be deducted from prices paid for feeder cattle to be shipped.

Reproductive efficiency continues to be a problem in the cow-calf industry. The problem seems to be related to failure to adopt known management practices rather than to lack of knowledge. Adoption of a regular breeding and calving season and elimination of nonbreeders would result in much improved reproductive efficiency.

There are substantial numbers of auction markets in the state with low sales volume. Low volume markets tend to have higher costs and result in few buyers and prices at less than competitive levels. The halt in cattle slaughter operations at four plants in the 1970's has discouraged many producers from finishing slaughter cattle. In the past when feeder cattle prices were depressed, finishing to slaughter weight was a viable option. The decline in

number of slaughter plants will also result in less competition for cull beef and dairy animals and subsequently lower prices and returns.

Rising land values will tend to limit the number of new producers entering the cow-calf business. High interest costs and changes in loan repayment procedures will also create hardship during the next period of low cattle prices.

Dairy

Situation: Milk cow numbers decreased from 477,000 in 1960 to 211,000 in 1979, a 56 percent decline over the 19-year period. Average herd size for those farms selling milk to processors increased from 25 head in 1974 to 43 head in 1978, a 72 percent increase. In 1974, slightly more than 27 percent of the dairy farms marketed Grade A milk. This increased to about 50 percent in 1979.

Total milk production within the state stayed relatively constant between 1960 and 1979 at about 2,150 million pounds annually, while production per cow increased from 4,600 pounds per year in 1960 to 10,000 pounds per year in 1979, an increase of 117 percent. Cash receipts from milk sales increased from \$111 million in 1970 to \$244 million in 1979. The dairy industry accounts for about 14 percent of total agricultural cash receipts.

1990 Potential: The total number of milk cows in Tennessee will continue to decline to about 170,000 cows by 1990. The number of dairy farms will also decline, but those farmers remaining will likely increase their herd size to more than 100 cows. Dairy farmers will continue to shift to Grade A production and by 1990 almost all milk marketed will be Grade A. Output per cow will increase to about 13,000 pounds of milk annually and total annual production for Tennessee will increase slightly to 2,200 million pounds. Annual total cash receipts for the sale of milk should reach \$260 million (based on 1979

dollars) by 1990. Milk sale's share of total Tennessee agricultural output is expected to remain fairly constant at about 14 percent.

Impediments: The key to the dairy farm adjustments required in the 1980's is the development of the managerial ability required to operate the larger dairy farms. Particularly critical will be increasing herd output. Good record systems and management effort will be needed to properly cull and replace cows in order to increase per cow output. The number of cows enrolled in the Dairy Herd Improvement Program (DHIA) nearly doubled during the decade of the 1970's. Interest in this type of record keeping program will continue to grow. One-half of Tennessee's dairy cows will be enrolled in one of the organized record keeping programs by 1990. Alternative feed rations and methods of constructing the feed rations will also be important so that the maximum amount of milk is derived from every feed dollar. Capital and proper management of that capital will also be important in order to provide the modern efficient facilities necessary for farm and output expansion. Management of labor and product quality control will also become more critical as dairy farms enlarge and shift to Grade A production.

Marketing developments may result in some changes in the milk marketing system in Tennessee during the 1980's. Rapidly declining supplies of manufacturing grade milk in Minnesota and Wisconsin calls into question the use of the Minnesota-Wisconsin manufacturing milk price as a price mover, and suggests a new pricing mechanism may need to be developed. The marketing of new, imitation products and alternatives to dairy products may require some adjustment and competitive effort on the part of the milk industry in order to maintain market share. If government stocks of dairy products continue to build in the 1980's as they have in the late 1970's, some adjustment in

the Federal price support program may also take place, changing the structure of milk marketing considerably.

Hogs

Situation: The number of hogs marketed in the state rose 28 percent between 1970 and 1979 from 1,672,000 to 2,137,000 head. Cash receipts rose from \$70.3 million in 1970 to \$187.5 million in 1979. The total number of farm operations with hogs has been gradually declining and totaled 32,000 in 1979. The national trend has been toward more farms with 500 or more hogs. The same trend is believed to be true for Tennessee and is expected to continue in the future.

Hog numbers peaked in Tennessee in 1971. Inventory reached a low in 1975 and peaked again in 1979. From the low in 1975 to the peak in 1979 there was a 59 percent increase in the inventory.

Records of Tennessee feeder pig sales during the 1970's emphasize the continued importance of this enterprise. In 1970, 385 sales were held at 21 market locations through which 633,526 head were sold for \$11.1 million. In 1979, 439 sales were held at 14 locations through which 1,007,515 head were sold for \$31.2 million.

Commercial hog slaughter in Tennessee in 1979 was 2.7 million head, slightly lower than the 2.9 million head in 1970. This slaughter is composed of hogs from Tennessee and surrounding states. Likewise, some hogs finished in Tennessee are shipped out of state to be slaughtered.

1990 Potential: A substantial increase in returns from swine production in 1990 can be obtained by: 1) increasing total swine production; 2) improving feed efficiency; 3) improving the quality of both feeder pigs and market hogs; 4) expanding the production of finished hogs; 5) and the

adoption of known technology in the swine industry. If Tennessee producers continue to produce according to trends established from 1965 through 1980, a total of 159,000 sows will farrow in 1990 producing approximately 2.3 million pigs. Assuming 60 percent of the hogs will be produced in farrow-to-finish operations and 40 percent will be sold as feeder pigs, cash receipts of \$213 million will be generated by the swine industry based on 1979 prices.

The greatest opportunity for increasing cash receipts from swine production is by increasing the number of hogs fed to market weight rather than by expanding feeder pig production. If an additional 20 percent of total swine production is shifted to finishing, total revenues to swine will be increased to \$226 million. This shift could come through a switch from feeder pig production to farrow-to-finish operations or from an increase in finishing of purchased pigs.

Impediments: Rising energy costs will result in lower prices for feeder pigs. This will result from higher transportation costs and higher priced feed grains. Tennessee has 18,000 - 20,000 feeder pig producers who market 900,000 to 1,000,000 head per year. High energy costs, especially electricity, will result in greater production costs for swine producers. Research in lower cost heating, cooling or ventilation and waste handling methods should be pursued to help solve this problem.

Both production and management continue to be problems for feeder pig and market hog producers. Reproductive efficiency is a key factor in reducing costs of production per head and thus increasing returns.

There is a need for more research on confinement rearing, environmental stress, waste disposal, facilities and equipment and protection from disease. In particular, there is a need for research on health management practices

for purchased pigs coming from comingled, graded sales. These pigs suffer nearly twice the death loss as that which occurs in farrow-to-finish operations. The possibility of FDA banning the use of nitrite in pork remains an issue of unknown impact on the industry.

High investment requirements and high interest rates will continue to restrict entry of producers and expansion of swine production.

Poultry Meat

Situation: Per capita consumption of dressed chicken in the U. S. fluctuated between 40 and 41 pounds annually for several years in the early 1970's. Then, between 1975 and 1978 it increased from 40.6 to 47.7 pounds. Although U. S. per capita consumption of dressed chicken will likely increase in the future, the 1975-78 rate of increase will not likely be sustained over an extended period.

The number of broilers produced in the U. S. increased about 29 percent between 1970 and 1979. However, the increase in pounds of liveweight broilers produced was 39 percent during the same period because of a trend toward marketing birds at heavier weights--3.9 pounds in 1979 compared to 3.6 pounds in 1970.

There has been a gradual long-run increase in the number of broilers produced in Tennessee over the last 20 years. However, the number of broilers produced in Tennessee has been cyclical in response to factors such as feed costs and prices of substitute meats such as beef and pork.

1990 Potential: Broiler production in Tennessee in 1990 will likely exceed 70 million. In addition, 3 million other chickens will probably be sold by Tennessee farmers for dressed consumption in 1990.

The farm equivalent value of broiler production in Tennessee in 1990 should be about \$73 million. The sale of other farm chickens in Tennessee should generate cash farm receipts of about \$2 million in 1990 making the total value of chicken production in the state about \$75 million.

Impediments: The more important production and marketing problems which will affect the 1990 potential of Tennessee's broiler industry grows out of the rather weak competitive position that producers face as a result of being located on the fringe of a geographic area of concentration of broiler production. Within the areas of heavy concentration of broiler production, efficiency is more easily achieved by producers because of the presence of an infrastructure of institutions which provide necessary off-farm services at lower cost. The institutions provide producers the services of financing, marketing, management, and other input needs. The efficiency to be gained by producers through the availability of low cost production and marketing services is primarily related to volume of production in a given area. The solution of this problem can most easily be achieved by growth in demand for broilers which allows for expansion of production in the low volume areas which in turn leads to the development of an efficient infrastructure to serve the producers' needs.

Eggs

Situation: Egg production in Tennessee has been influenced by several factors during the 1970's which have resulted in a decrease in both the size of the laying flock and the farm price of eggs measured in constant dollars. Total egg consumption by the U. S. civilian population declined almost 2.4 billion between 1970 and 1978. The growth in the total U. S. civilian population during that period, which averaged less than one percent per year,

failed to offset the decline in per capita consumption of eggs which fell from 309 in 1970 to 283 in 1979. Although U. S. per capita egg consumption increased slightly in both 1978 and 1979, it is uncertain at this time whether the trend toward declining per capita consumption has been reversed.

At the same time total U. S. egg consumption was declining during the 1970's, U. S. egg production per layer increased steadily from less than 220 eggs per layer in 1970 to 240 eggs per layer in 1979 and is projected to increase to 270 eggs per layer in 1990. Egg producers in both the U. S. and Tennessee adjusted to the changes in egg consumption and output per layer by reducing the number of birds in their laying flocks. Even with the reduction in layer numbers, egg prices at the farm level measured in 1979 dollars declined from just over 80¢ per dozen in 1970 to 58.6¢ per dozen in 1979 as a result of the egg consumption and production changes.

1990 Potential: The number of layers on Tennessee farms in 1990 is expected to decline to about 3.8 million. The total number of eggs sold by Tennessee producers in 1990 will be slightly greater because of increases in the rate of lay. The value of egg sales by Tennessee producers in 1990 will be about \$50 million measured in 1979 dollars--slightly more than egg sales of \$48 million in 1979.

Impediments: The more important production and marketing problems relating to eggs needing research include: (1) costs and returns in egg production, (2) effects of pollution control and other regulations, (3) improving physical and economic efficiency in firms producing and marketing eggs, (4) factors affecting per capita consumption of eggs and (5) competitive position of egg production in Tennessee related to other locations.

Sheep

Situation: Sheep and lamb numbers on farms January 1 continued a marked decline during the 1970's--from 50,000 head in 1970 to 13,000 in 1979. Cash receipts from farm marketings fell from \$625,000 in 1970 to \$419,000 in 1979.

1990 Potential: Sharp declines have occurred in commercial sheep and lamb slaughter in Tennessee--from 22,100 head in 1970 to 1,400 head in 1979. The potential for increases appears extremely limited.

Impediments: Civilian per capita consumption of lamb and mutton in the U. S. has been on a steady decline--from 4.3 pounds annually in 1960 to 1.4 pounds in 1979. Consumption rates in the South have been even lower--about 40 percent of the national average. Unless consumer preference patterns in Tennessee and elsewhere change markedly, there will be no market incentives for increased sheep and lamb production. On the supply side, effective programs to control predatory animals are needed if sheep and lamb production is to be increased.