# Sweetpotatoes: An Economic Assessment of the Feasibility of Providing Multiple-Peril Crop Insurance

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## Executive Summary

U.S. growers harvested 11.1 million cwt of sweetpotatoes from 80,000 acres in 1993. North Carolina and Louisiana, the top two sweetpotato producing states, accounted for 57 percent of the 1993 output. California, Texas, Alabama, and Mississippi ranked third through fifth in production.

U.S. sweetpotato production has been decreasing since 1970. During 1989-93, production averaged 11.6 million cwt--7 percent below the average for 1970-74. Higher yields since the 1940's have partly offset a decline in acreage. While harvested area has declined by half since the mid-1960's, average yield has risen 48 percent, due to higher yield varieties and expanded irrigation use.

According to the 1987 Census of Agriculture, most farms growing sweetpotatoes were small operations, with 57 percent having total crops sales of less than $25,000. Only 19 percent of U.S. farms growing sweetpotatoes reported crop sales of $100,000 or more.

Although we do not have statistics on enterprise diversification on farms growing sweetpotatoes, industry contacts indicate that sweetpotatoes are usually grown as part of a vegetable and field crop enterprise mix. In North Carolina, the largest sweetpotato state, several of the largest sweetpotato growers are primarily tobacco producers. In Louisiana, sweetpotato farms also frequently produce cotton, soybeans, and rice.

About 60 to 65 percent of sweetpotatoes sold for human consumption are to the fresh market; 35 to 40 percent are destined to the processed market. Canned sweetpotato products account for the largest share of the processed market. Following World War II, per capita use of sweetpotatoes began a slow downward trend which lasted through the early 1980's. Since then, per capita use has stabilized at about 4 pounds, fresh weight.

The marketing season price pattern for sweetpotatoes is stable compared with prices of highly perishable vegetables, such as lettuce and celery. Prices for the new marketing year, beginning September 1, become established during September and October when production prospects become clearer. They remain relatively flat or rise slowly through May or June. Prices sometimes rise sharply during July and August as storage stocks become depleted. Growers in some areas try to harvest a portion of their crop early to benefit from the high prices in July and August.

Sweetpotatoes are a tropical and subtropical crop that grows best in sandy or well-drained loamy soils. They thrive on high daytime temperatures for top growth. Root formation is best when the soil temperature is above 65° F at the time of transplanting. Small, immature plants tolerate mildly cool temperatures, but their vigor is reduced if exposed to low temperatures early in the season. Freezing at the time of harvest may damage the leaves but will not usually harm the roots, unless soil temperatures drop below 55° F.

Sweetpotato plants are grown from slips (transplants) that are produced from vegetative seed stock or from cuttings taken from field-planted slips. Most growers purchase vegetative seed in sufficient quantity to produce their own transplant material. Sweetpotatoes are planted at 10-12 inches between plants, and 40-44 inches between rows.

Sweetpotatoes are typically planted in late spring and harvested in late summer and early fall. Growers usually plant sweetpotatoes over a period of weeks to spread labor and equipment use. The time between planting and harvest ranges from 70-150 days, depending on the variety, soil type, moisture, and temperature conditions. A 3-5 year rotation is recommended for sweetpotatoes in order to alleviate problems of insects and diseases, particularly soil-borne diseases, and nematode attacks.

Sweetpotatoes are generally harvested by hand after the roots have been exposed by disk diggers, plows, or bed diggers. Although it results in more damage to the roots than hand harvesting, mechanical harvesting is becoming more widely adopted because of labor-cost savings. Harvesting and marketing costs typically amount to 40-60 percent of total production costs.

The weather-related peril most likely to result in indemnity payments under a sweetpotato crop insurance policy is excessive rainfall. Excessive soil moisture causes "souring" or asphyxiation of the roots and can result in complete crop losses. Drought, frost, and extended cold temperatures are also perils. Soil-borne diseases usually cause greater economic losses than foliar and stem diseases. Insects problems can generally be controlled.

Ad hoc disaster data can be used to indicate which sweetpotato-producing areas received large payments relative to their acreage. NASS does not collect data on Arkansas sweetpotato acreage, but that state received 4.2 percent of ad hoc sweetpotato payments over the 1988-93 period. Similarly, North Carolina accounted for 40 percent of U.S. sweetpotato acreage between 1988 and 1993, and received nearly 47 percent of the payments made for that crop. In contrast, California and Louisiana collected smaller shares of ad hoc payments relative to their acreage.

These data suggest that, under a potential sweetpotato policy, the probability of yield losses for sweetpotatoes in the North Carolina area may be somewhat greater than in California and Louisiana.

Insurance issues addressed in this report include the setting of reference prices, estimating "appraised production," moral hazard, and the demand for insurance. Our research suggests that the demand for a sweetpotato policy would likely be higher in the southern and eastern states than in California.

## Introduction

The sweetpotato is a tropical vegetable belonging to the Convolvulaceae (morning glory) family. It is a perennial plant, but is grown as an annual in commercial production. The parts used for human food are enlarged tuberous roots. The roots are harvested each year and new plants are planted for the following crop. The average number of enlarged roots ranges from four to ten per plant. The flesh color of sweetpotatoes may be red, orange, salmon orange, yellowish orange, or white.

There are two basic types of sweetpotatoes grown in the United States. One has a seemingly dry flesh which remains firm when cooked, while the flesh of the second appears moist and turns soft when cooked. The "soft-fleshed" varieties, also known as "moist types," are of greater commercial importance than the "dry-flesh" varieties. The moist type is often called "yam" in the trade. However, the true yam is a different genus and is not grown commercially in the United States (Charney).

Sweetpotatoes are grown commercially throughout the South (as far north as New Jersey) and in California. North Carolina, Louisiana, and California account for the lion's share of commercial production (Table 1).

This report examines those aspects of the sweetpotato industry that relate to the demand for crop insurance and the feasibility of developing a sweetpotato policy.

## The Sweetpotato Market

### Supply

U.S. sweetpotato production has been declining since 1970. During the 1989-93 period, production averaged 11.6 million cwt--7 percent below the average for 1970-74 (Table 2). Higher average yields since the 1940's have partly offset the effect of declining acreage on production. While harvested area has declined by half since the mid-1960's, the average yield has risen 48 percent, due to the introduction of higher-yielding varieties and because an increased share of total acreage is irrigated.

U.S. growers harvested 80 thousand acres and produced a crop of 11.1 million cwt in 1993. Acreage is expected to rise 2 percent in 1994 accompanied by a small gain in production. U.S. sweetpotatoes are produced for use in both the fresh and processing markets.[1]

The USDA reports sweetpotato acreage and production for 11 States (USDA, NASS), while the 1987 Census of Agriculture reported small acreages in an additional 15 States. Except for California, the U.S. sweetpotato industry is largely concentrated among the southeastern states. North Carolina and

[1] Data are no longer available to determine the proportion of the sweetpotato crop sold for fresh use and the amount for processed use. As a result, the following discussion centers on total production and use.

Table 1--U.S. sweetpotato acreage and production, 1988-93

| State | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 |
|---|---|---|---|---|---|---|
| | | | Acres harvested | | | |
| Alabama | 4,100 | 3,900 | 4,900 | 4,700 | 4,900 | 4,400 |
| California | 7,100 | 8,300 | 8,300 | 8,200 | 9,000 | 8,300 |
| Georgia | 4,500 | 4,800 | 4,500 | 3,800 | 3,200 | 3,000 |
| Louisiana | 17,000 | 18,000 | 21,000 | 16,000 | 16,000 | 16,500 |
| Maryland | 900 | 500 | 600 | 300 | 300 | 300 |
| Mississippi | 3,500 | 3,000 | 3,500 | 3,500 | 4,000 | 5,500 |
| New Jersey | 2,300 | 2,100 | 2,100 | 1,900 | 1,900 | 1,400 |
| North Carolina | 34,000 | 34,000 | 34,000 | 30,000 | 35,000 | 32,000 |
| South Carolina | 3,000 | 3,000 | 3,400 | 2,900 | 2,000 | 2,200 |
| Tennessee | 800 | 600 | [1] | [1] | [1] | [1] |
| Texas | 7,400 | 7,000 | 6,200 | 5,500 | 5,500 | 6,000 |
| Virginia | 900 | 800 | 1,000 | 1,000 | 600 | 600 |
| U.S. | 85,500 | 86,000 | 89,500 | 77,800 | 82,400 | 80,200 |
| | | | Production | | | |
| | | | 1,000 cwt | | | |
| Alabama | 472 | 468 | 588 | 682 | 809 | 704 |
| California | 1,207 | 1,453 | 1,453 | 1,517 | 1,845 | 1,743 |
| Georgia | 720 | 816 | 585 | 589 | 576 | 390 |
| Louisiana | 2,465 | 2,880 | 3,360 | 2,400 | 2,720 | 2,063 |
| Maryland | 135 | 80 | 84 | 36 | 24 | 30 |
| Mississippi | 350 | 285 | 420 | 490 | 520 | 660 |
| New Jersey | 173 | 168 | 273 | 228 | 247 | 147 |
| North Carolina | 4,420 | 4,080 | 4,930 | 4,050 | 4,200 | 4,160 |
| South Carolina | 300 | 330 | 374 | 276 | 210 | 187 |
| Tennessee | 72 | 60 | [1] | [1] | [1] | [1] |
| Texas | 518 | 630 | 372 | 770 | 770 | 900 |
| Virginia | 113 | 108 | 155 | 165 | 84 | 69 |
| U.S. | 10,945 | 11,358 | 12,594 | 11,203 | 12,005 | 11,053 |

[1] Discontinued.

Source: USDA, NASS.

Table 2--U.S. sweetpotatoes: Supply, utilization, and price, farm weight, 1970-94

| Year | Supply | | | | Utilization | | | | | | Season average price 8/ | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Produc-tion | Imports | Beginning canned stocks | Total | Exports | Ending canned stocks | Seed use | Feed use, shrink, & loss | Total use | Per capita use | Current dollars | Constant 1987 dollars |
| | 1/ | 2/ | 3/ | | 3/ | 4/ | 5/ | 6/ | | | | |
| | Million pounds | | | | | | | | | Pounds | $/cwt | |
| 1970 | 1,316 | -- | -- | 1,316.0 | -- | -- | 68.5 | 137.6 | 1,109.9 | 5.4 | 4.38 | 12.48 |
| 1971 | 1,149 | -- | 158.6 | 1,308.0 | -- | 105.5 | 68.0 | 111.5 | 1,023.0 | 4.9 | 5.22 | 14.11 |
| 1972 | 1,217 | -- | 105.5 | 1,322.5 | -- | 141.3 | 70.7 | 91.4 | 1,019.1 | 4.9 | 5.73 | 14.73 |
| 1973 | 1,216 | -- | 141.3 | 1,356.9 | -- | 114.4 | 80.5 | 95.6 | 1,066.4 | 5.0 | 7.32 | 17.72 |
| 1974 | 1,334 | -- | 114.4 | 1,448.3 | -- | 219.7 | 79.2 | 102.1 | 1,047.3 | 4.9 | 7.34 | 16.35 |
| 1975 | 1,289 | -- | 219.7 | 1,508.8 | -- | 166.5 | 87.6 | 95.9 | 1,158.8 | 5.4 | 8.59 | 17.46 |
| 1976 | 1,327 | -- | 166.5 | 1,493.8 | -- | 129.1 | 76.9 | 114.1 | 1,173.7 | 5.4 | 7.50 | 14.34 |
| 1977 | 1,189 | -- | 129.1 | 1,317.6 | -- | 92.4 | 91.6 | 95.1 | 1,038.5 | 4.7 | 10.50 | 18.78 |
| 1978 | 1,312 | 14.2 | 92.4 | 1,418.1 | 17.5 | 131.2 | 101.7 | 76.4 | 1,091.3 | 4.9 | 10.60 | 17.58 |
| 1979 | 1,337 | 13.1 | 131.2 | 1,481.3 | 19.4 | 147.9 | 92.5 | 81.2 | 1,140.3 | 5.1 | 8.92 | 13.60 |
| 1980 | 1,095 | 12.8 | 147.9 | 1,256.0 | 17.4 | 69.2 | 92.4 | 67.8 | 1,009.2 | 4.4 | 13.60 | 18.97 |
| 1981 | 1,280 | 17.9 | 69.2 | 1,367.0 | 19.8 | 91.5 | 110.8 | 60.6 | 1,084.3 | 4.7 | 13.60 | 17.24 |
| 1982 | 1,483 | 26.8 | 91.5 | 1,601.6 | 13.6 | 112.9 | 98.9 | 107.6 | 1,268.6 | 5.5 | 8.03 | 9.58 |
| 1983 | 1,208 | 35.5 | 112.9 | 1,356.7 | 14.7 | 87.4 | 104.7 | 80.2 | 1,069.7 | 4.6 | 13.60 | 15.60 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 1984 | 1,290 | 39.9 | 87.4 | 1,417.5 | 16.7 | 60.0 | 105.0 | 71.3 | 1,164.5 |
| 4.9 | 14.00 | 15.38 | | | | | | | |
| 1985 | 1,457 | 46.7 | 60.0 | 1,564.0 | 18.2 | 89.4 | 103.9 | 72.9 | 1,279.6 |
| 5.4 | 8.81 | 9.33 | | | | | | | |
| 1986 | 1,237 | 48.5 | 89.4 | 1,374.7 | 19.4 | 136.2 | 100.2 | 61.8 | 1,057.1 |
| 4.4 | 10.90 | 11.25 | | | | | | | |
| 1987 | 1,161 | 50.4 | 136.2 | 1,347.7 | 17.1 | 97.1 | 98.8 | 58.1 | 1,076.7 |
| 4.4 | 11.60 | 11.60 | | | | | | | |
| 1988 | 1,095 | 54.4 | 97.1 | 1,246.0 | 14.7 | 82.1 | 95.3 | 54.7 | 999.2 |
| 4.1 | 12.90 | 12.42 | | | | | | | |
| 1989 | 1,136 | 60.4 | 82.1 | 1,278.3 | 13.9 | 100.0 | 96.7 | 56.8 | 1,011.0 |
| 4.1 | 16.40 | 15.12 | | | | | | | |
| 1990 | 1,259 | 59.0 | -- | 1,318.4 | 14.7 | -- | 100.5 | 63.0 | 1,140.3 |
| 4.6 | 9.70 | 8.56 | | | | | | | |
| 1991 | 1,120 | 51.3 | -- | 1,171.6 | 16.1 | -- | 85.3 | 56.0 | 1,014.2 |
| 4.0 | 13.30 | 11.30 | | | | | | | |
| 1992 | 1,201 | 61.8 | -- | 1,262.3 | 19.3 | -- | 91.6 | 60.0 | 1,091.4 |
| 4.3 | 12.20 | 10.07 | | | | | | | |
| 1993 | 1,105 | 63.7 | -- | 1,169.0 | 23.0 | -- | 88.3 | 55.3 | 1,002.4 |
| 3.9 | 13.40 | 10.79 | | | | | | | |
| 1994f | 1,162 | 60.0 | -- | 1,221.6 | 20.0 | -- | 89.8 | 58.1 | 1,053.7 |
| 4.0 | -- | -- | | | | | | | |

-- = Not available. f = forecast.

1/ Production includes fresh, processed, feed, seed, on farm use, and shrink and loss. 2/ Includes imports of yams. 3/ Export data for 1978-89 is from Statistics Canada and represents only exports to Canada. U.S. trade data had no code for sweetpotatoes.

4/ January 1 stocks are for canned sweetpotatoes as reported by the National Food Processors Association. Fresh stocks data are no longer available. 5/ Beginning with 1985, calculated as the product of acres planted and seeding rate per acre.

6/ Beginning with 1985, feed, shrink and loss is estimated as 5 percent of production. 6/ Source: National Agricultural Statistics Service, USDA. 7/ Converted to a fresh-weight basis using a factor of 1.292. 8/ Constant dollar prices were computed using the GDP implicit price deflator, 1987=100.

Louisiana are the top two producing states and usually account for about 57 percent of U.S. production. California (15 percent), Texas (7 percent), Alabama (6 percent), and Mississippi (5 percent) round out the top 5 states.

International trade has never been a significant factor in U.S. sweetpotato supply and utilization. Although the U.S. currently imports about 6 percent of its sweetpotato consumption, most imports are shipments to Puerto Rico from Caribbean countries, such a the Dominican Republic. Very few sweetpotatoes are imported into the continental Unite States. The United States exports less than 2 percent of its total sweetpotato production. The major foreign market for U.S. sweetpotatoes is Canada.

Both yield and acreage variation cause year-to-year changes in sweetpotato production. The average absolute year-to-year change in production during 1983-93 was 8.7 percent. One of the biggest year-to-year variations occurred between 1985 and 1986 when U.S. production declined 15 percent.

**Demand**

Following World War II, per capita use of sweetpotatoes began a slow downward trend which lasted through the early 1980's. Since the mid-1980's, however, use appears to have stabilized at about 4 pounds per person, fresh-weight basis (Table 2). Total sweetpotato use averaged 1.04 billion pounds during 1991-93, about the same as for 1970 72. Surveys indicate sweetpotatoes are most popular in southern States among people 60 years of age and older ("Fresh Trends, 1988").

On average, about three-quarters of the U.S. sweetpotato production is sold for human consumption. Nonfood uses include seed (7 to 9 percent) and shrinkage, loss, and anima feed (4 to 6 percent) The amount used for livestock feed is declining. Farm household use likely accounts for about 2 to 3 percent of total production.

Approximately 60-65 percent of the sweetpotatoes sold for human consumption are to the fresh market and 35-40 percent are destined for processing. Canned products account fo the largest share of processed sweetpotatoes, while frozen and dehydrated products account for the remainder.

Sweetpotatoes are processed into a wide variety of products. These include: frozen whole, sliced, diced, candied, and french-fried sweetpotatoes; dehydrated flakes; twice baked, pattied, ripple-sliced, canned candied (in syrup), and canned mashed sweetpotatoes; canned baby food; and pie fillings. Sweetpotatoes are also used to make bread products, custards, cookies, and cakes. There are several types of sweetpotato chips produced from the sliced or dehydrated raw product.

Although there are no price or income support programs for sweetpotatoes, USDA has regularly purchased canned sweetpotato products for use in school lunch and other feeding programs. During the 1992/93 crop year, USDA purchased the fresh-weight equivalent of about 11 million pounds of canned mashed and candied sweetpotatoes. This represented about 6 percent of the estimated total U.S. pack of canned sweetpotatoes an 1 percent of overall U.S. production. USDA generally does not purchase any fresh, frozen, or dehydrated sweetpotatoes.

Although the volume of sweetpotatoes marketed varies widely from month to month, demand is relatively predictable. The periods of greatest demand for sweetpotatoes occur around holiday seasons. About 22 percent of fresh sweetpotato shipments occur in November just prior to Thanksgiving, 13 percent in December around Christmas and the Jewish holidays, and 10 percent in March or April (depending on when Easter falls).

Because sweetpotatoes are a traditional part of the holiday meal, many consumers are reluctant to forego their purchase of sweetpotatoes for a holiday meal even when supplies are short and prices relatively high. Consequently, small changes in the quantity of sweetpotatoes result in relatively large changes in price. Large year-to-year changes in prices are associated with relatively small changes in the available supply. This type of price and quantity relationship is referred to as an inelastic demand. One widely quoted study of the demand for food commodities in the United States estimates that each 0.5 percent rise (decline) in the quantity of fresh sweetpotatoes demanded is associated with a one percent decline (increase) in the farm price (George and King).

**Prices**

Compared with prices for some of the more perishable vegetables, such as celery and lettuce, sweetpotato prices are relatively stable from month to month within the marketing season (Figure 1). Because sweetpotatoes are storable and demand peaks occur at known points (the holidays), within-season prices tend to follow a predictable pattern.

Prices for the new marketing year (beginning September 1) become established during September and October when production prospects become clearer and then remain relatively flat or rise slowly through May or June (Table 3 and Figure 2). Sometimes prices rise sharply during July and August as storage stocks become depleted. Growers in some areas try to harvest a portion of their crop early in order to benefit from hig prices during July and August.

With demand being fairly predictable, domestic production is the major determinant of prices. The amount of acreage for harvest and extremes in weather, such as widespread drought or excessive rains, cause most of the year-to-year variation in prices.

Sweetpotato production and prices tend to follow counter-cyclical patterns in which years with large production and low prices alternate with years of smaller production and higher prices. Growers tend to cut acreage following years with very low prices while maintaining or raising acreage slightly following years with higher prices. Production tends to rise during years when acreage remains relatively unchanged because of the output-increasing effect of rising average yields.

Table 3--Sweetpotatoes: U.S. f.o.b. prices, monthly averages, 1989-93

| Month | 1989 | 1990 | 1991 | 1992 | 1993 |
|---|---|---|---|---|---|
| | --------Dollars per 40-pound carton-------- | | | | |
| January | 11.55 | 13.16 | 6.59 | 12.33 | 7.80 |
| February | 12.11 | 14.34 | 6.52 | 11.27 | 7.62 |
| March | 12.42 | 13.26 | 6.55 | 11.42 | 7.58 |
| April | 12.98 | 13.01 | 6.94 | 11.66 | 7.39 |
| May | 15.77 | 12.70 | 7.82 | 11.50 | 7.34 |
| June | NR | 11.76 | 9.02 | 12.08 | 7.16 |
| July | 22.00 | 9.96 | 10.19 | 13.62 | 7.34 |
| August | 19.24 | 9.95 | 14.36 | 12.47 | 11.92 |
| September | 11.56 | 8.09 | 11.63 | 9.94 | 11.33 |
| October | 11.24 | 7.23 | 10.65 | 8.48 | 10.23 |
| November | 12.47 | 7.09 | 11.20 | 8.00 | 12.35 |
| December | 13.26 | 6.92 | 11.50 | 8.07 | 13.25 |

NR = Not reported.

Source: Computed from USDA, AMS.

## Industry Characteristics

Those characteristics of the sweetpotato industry which hold particular significance with respect to determining the potential demand for crop insurance are: 1) limited diversification between farm and off-farm employment, 2) limited use of irrigation as a protection against drought, and 3) substantial enterprise diversification with other crops. The primary source of available information on farms producing sweetpotatoes is the 1987 Census of Agriculture.[2]

### Sweetpotato Farms

The U.S. Census of Agriculture reported 3,164 farms with sweetpotato sales in 1987, dow nearly 50 percent from 1982 (Appendix table 1). However, the acreage of sweetpotatoes harvested declined only 23 percent between 1982 and 1987. In 1987, North Carolina had just over a quarter of U.S. sweetpotato farms and nearly half the harvested acreage and production. When combined, Alabama, California, Georgia, Louisiana, New Jersey, South Carolina, and Texas accounted for about one-third of the farms, about 40 percent of the acreage harvested, and 38 percent of the production.

Most farms growing sweetpotatoes in 1987 were small operations, with 57 percent (1,812 farms) having total crop sales of less than $25,000 (Appendix table 2). Only 19 percen of U.S. farms with sweetpotatoes reported crop sales of $100,000 or more. However, in California, 55 percent of the farms harvesting sweetpotatoes had crop sales of $100,000 or more.

The most common type of ownership of farms (86 percent) growing sweetpotatoes in 1987 was individual or family ownership (Appendix table 3). Farms operated under corporate arrangements (either family-held or other) tended to have the highest total value of crop sales. Nearly 75 percent of the farms with corporate ownership arrangements reported crop sales of $100,000 or more in 1987. In contrast, only about one-third of the farms with partnership ownership arrangements and 15 percent of individual or family-owned operations reported total crop sales valued at $100,000 or more.

### Income Diversification on Sweetpotato Farms

About three-fourths of the operators on all farms growing sweetpotatoes reported that farming was their main occupation in 1987 (Appendix table 4). Farming was the main occupation of 90 percent of the sweetpotato producers with crop sales of $25,000 or more, compared to 61 percent of the producers with less than $25,000 of sales. About 3 percent of the operators of farms growing sweetpotatoes worked off the farm at least 1 day during 1987.

We did not locate statistics to document the amount of enterprise diversification on farms growing sweetpotatoes. However, contacts in the industry indicate that sweetpotatoes usually are grown as part of an enterprise mix consisting of vegetables and other field crops. In North Carolina, the biggest sweetpotato state, a number of the largest sweetpotato growers are primarily tobacco producers who also grow

[2] Results for the 1992 Census of Agriculture were not available for all states at the time this report was prepared.

sweetpotatoes, vegetables, and field crops. In Alabama, some sweetpotato producers als grow white potatoes. A number also grow field crops such as corn and soybeans and some have poultry operations. In Louisiana, diversification is with other field crops such as cotton, soybeans, and rice.

## Cultivation and Management Practices

Recommended cultivation and management practices provide background information about growing conditions and production techniques needed to achieve commercial sweetpotato yields. Sweetpotatoes have complex care requirements, providing an indicator of the potential for moral hazard as a problem in offering insurance. A crop that requires numerous timely judgement-based decisions creates more opportunities for neglect-induce losses than a crop requiring fewer decisions and decisions which are less dependent on timely expert judgement.

The ideal conditions for sweetpotatoes--tropical to subtropical temperatures, sandy or well-drained loamy soils, and a long growing season--are present in Louisiana, North Carolina, Georgia, Texas, and California. Although sweetpotatoes are grown in other states, few locations have conditions that are as ideal as in North Carolina, Louisiana and California.

### Climate

The sweetpotato is a tropical/subtropical crop that grows best in sandy or well-drained loamy soils and with high day-time temperatures. Sweetpotato production is confined worldwide to the range of latitudes 40º North to 40º South. The sweetpotato thrives on high day-time temperatures for top growth. Root formation is optimum when the soil temperature is above 65º F at the time of transplanting. Top growth increases with day length and light intensities.

Small, immature sweetpotato plants tolerate mildly cool temperatures, but their vigor i reduced if exposed to low (but above-freezing) temperatures early in the season. Freezing at the time of harvest may damage the leaves but will not usually harm the roots unless soil temperatures drop below 55º F. Sweetpotato plantings in areas with well-drained, sandy soils and few heavy late-summer rains usually yield more than those grown in areas with frequent heavy late-summer rains and moisture-retaining soils.

### Soils

The ideal soil for sweetpotatoes is a fertile, well-drained sandy loam with an acidity ranging from Ph 5.8 to Ph 6.2. Because harvested sweetpotatoes are roots, clay or othe dense soils will retard proper size and shape development. During extended dry weather sweetpotatoes grown on well-drained soils will benefit from irrigation. During periods of wet weather, potassium and, especially, nitrogen will leach and more fertilizer will be required to produce commercial yields. Soils high in organic matter tend to produce rough or cracked roots. Heavy soils that do not drain well are susceptible to causing anaerobic respiration in the sweetpotato root, which leads to "souring" in storage.

### Cultural Practices

Several varieties of sweetpotatoes account for most of the U.S. crop, although new varieties are being developed. The most important commercial varieties include Jewel, N.C. Puerto Rico 198, and Sweet Red, all developed in North Carolina; Beauregard, developed in Louisiana; and Cordner, developed in Texas. The Jewel variety is a moist type grown in the South, and is the leading variety produced in the United States. The Garnet variety is also a moist type, and is produced in California. Other popular varieties include Centennial, Hanna, Travis, and Yellow Jersey.

Plant production. Sweetpotato plants are grown from slips (transplants) which are produced from vegetative seed stock or from cuttings taken from field- planted slips. The term "vegetative seed stock" refers to sweetpotato roots which are planted in a see bed for commercial production of sweetpotato slips. Slips are the sprouts which grow from the seed stock in the seed bed. Cuttings may be taken from field-planted slips which have grown to sufficient length. Seed-stock sweetpotatoes are usually grown from cuttings to avoid transmitting soil-borne diseases which may be carried forward to the new generation when using slips. Reproductive sweetpotato seeds (seeds borne from flowers) are used only in breeding new varieties.

Certified, vegetative seed stock, the root material from which slips are produced, is purchased from seed dealers, seed foundations, or from other growers who raise seed stock as a part of their commercial operation. Producers of certified vegetative seed stock must be careful to select "true to type" plants, because sweetpotatoes mutate readily to produce unwanted characteristics such as variable skin and flesh coloring. Vegetative seed certification is an important practice to insure the quality of seed stock sold to growers.

Most growers purchase vegetative seed in sufficient quantity to produce their own transplant material. Thorough sanitation of seed stock storage rooms and production equipment is required to maintain seed stock productivity. Uncontrolled pathogen infestation will reduce yields and quality of the final crop. The amount of seed stock needed to produce the slips to plant an acre of sweetpotatoes in the Southeast ranges from 600 to 1200 pounds, depending on the desired plant population and the average size of the seed stock roots (Wilson). In California, about 500 pounds of seed stock sweetpotatoes are required to produced the slips to plant an acre of sweetpotatoes (Yagi).

Sweetpotatoes are planted at 10 to 12 inches between plants, and 40 to 44 inches betwee rows. Different row spacings may be necessary to accommodate limitations in planting and harvesting equipment. The recommended planting density is 12-15,000 plants per acr in the Southeast (Wilson).

The size of the sweetpotatoes produced is controlled more by spacing within the row tha between rows. Uniformity of plant spacings is important for the development of uniform sized sweetpotatoes. Irregular spacing will produce variable sizes of the roots and require more sorting after harvest.

Some varieties, such as Jewel, develop misshapen roots if the soil is too cold during the early development of the roots. Other varieties, such as Centennial, develop misshapen, unmarketable roots if planted too late in the season. The proper shape is a important criteria in meeting market expectations. A high degree of uniformity in root shape lowers the cost of sorting to meet grade requirements.

Planting Dates. Planting dates are usually used as reference points in specifying insurance sign-up dates and policy closing dates. Sweetpotatoes are typically planted in late spring and harvested in late summer and early fall (Table 4). Growers usually plant sweetpotatoes over a period of weeks to spread labor and equipment needs for planting and harvesting more uniformly. The time from planting to harvest ranges from 7 to 150 days depending on the variety and soil type, moisture, and temperature condition during the growing period.

Fertilization. Sweetpotatoes require nitrogen, phosphate, and potash fertilization, bu the proper amounts depend on the nutrients available in the soil. Under average soil and weather conditions in North Carolina, 90 to 100 pounds of nitrogen, 60 pounds of phosphate, and 150 pounds of potash per acre are recommended for producing commercial sweetpotato yields (Wilson and Averre). Rates may vary in other states and for various soil types.

Nitrogen and potash are applied as a preplant, a sidedressing at the last cultivation, and a topdressing about 1 month after the sidedressing application. Sidedressing refer to application to the soil beside the plant. Topdressing includes application to the plant and soil, mainly because the plant is large and covers the soil area. Phosphate is applied only as a preplant. Twenty percent of the potash is applied preplant, 80 percent sidedressing. Nitrogen is applied in roughly equal proportions in all 3 applications.

A physiological disorder, called blister, can arise if boron is deficient in sweetpotatoes. Blister develops more frequently on the roots of the Jewel variety than on other varieties. Blister is not evident at harvest, but develops in storage and resembles scurf, a disease caused by fungi (see later discussion). Boron can be added to the preplant fertilizer to control blister.

Weed control. Weed management is essential in both plant beds (raising slips) and in the field. Weeds are a serious problem in sweetpotato culture because of competition for water, nutrients, and sunlight. Also, several common weeds are alternate hosts of various sweetpotato insects and diseases. Both herbicides and mechanical cultivation are used to control weeds.

Table 4--Usual planting and harvesting dates for sweetpotatoes

| State | Planting date | Usual harvest date | | |
|---|---|---|---|---|
| | | Begin | Most active | End |
| Alabama | Mar. 15-June 30 | June 15 | Aug. 1-Nov. 15 | Nov. 30 |
| Arkansas | Apr. 20-June 10 | Aug. 10 | Sep. 1-Oct. 31 | Nov. 15 |
| California | See Table in California state analysis section. | | | |
| Georgia | Mar. 20-May 31 | July 10 | Aug. 25-Nov. 15 | Nov. 30 |
| Louisiana | Apr. 15-June 15 | July 10 | Aug. 15-Nov. 15 | Nov. 30 |
| Maryland | May 15-June 25 | Aug. 15 | Aug. 25-Oct. 15 | Oct. 31 |
| Mississippi | Apr.1-Jun. 30 | July 1 | Aug. 10-Nov. 10 | Nov. 30 |
| New Jersey | May 5-May 31 | Aug. 25 | Sep. 15-Oct. 25 | Nov. 5 |
| N. Carolina | Apr. 20-June 30 | July 20 | Sep. 15-Nov. 10 | Nov. 15 |
| S. Carolina | Apr. 15-June 30 | Aug. 1 | Sep. 15-Oct. 31 | Nov. 30 |
| Tennessee | May 1-June 15 | Aug. 20 | Sep. 15-Oct. 25 | Nov. 10 |
| Texas | Apr. 15-May 31 | July 20 | Aug. 15-Oct. 15 | Nov. 15 |
| Virginia | Apr. 20-July 15 | Aug. 1 | Sep. 1-Oct. 31 | Nov. 15 |

Source: USDA, Statistical Reporting Service.

Note: Dates reported in this table may differ slightly from those reported in the "State Analyses" section. Dates in that section largely reflect personal communication with extension specialists and ASCS county executive directors and may be more location specific than the dates in this table.

Irrigation. Although moderately tolerant of dry conditions, sweetpotatoes produce the highest-quality roots and largest yields if they have an even distribution of water during the growing cycle. Twenty-three percent of the U.S. harvested area was on irrigated land in 1987 (Appendix table 1). The proportions of area irrigated in the major sweetpotato-producing States were: California, 100 percent; Louisiana, 12 percent North Carolina, 10 percent; and Texas, 7 percent.

Crop Rotation. Sweetpotatoes are optimally grown in warm (or hot) and humid conditions -the same conditions that foster heavy weed growth and a multiplicity of insects and diseases, particularly soil-borne diseases. Crop rotations between sweetpotato plantings help alleviate these problems as will soil fumigation or chemical pest contro (Nonnecke). In addition, sweetpotatoes are vulnerable to nematode attacks, which are minimized through crop rotation. A 3-5 year rotation is recommended for sweetpotatoes. Residual herbicides used for previous crops need to be checked to assure they are not toxic to sweetpotatoes.

## Harvesting and Packing

The sweetpotato root will continue to grow as long as the above-ground tops are green. Therefore, the decision to harvest sweetpotatoes rests on attaining the desired root size and yield. Sweetpotatoes reach harvestable quality in varying lengths of time depending on the variety and growing conditions. North Carolina growers expect a norma crop of Jewel or Centennial varieties to produce 65 percent fresh market No. 1's, 5 percent "jumbos", and 30 percent "canners", No.2's, and culls after 120-150 days from transplanting. Sweetpotatoes are normally harvested before frosts kill the tops but at least before soil temperatures decrease to below 55° F. Root damage occurs at temperatures below 55° F. Roots chilled below 40° F overnight may develop internal breakdown in storage. In North Carolina, harvest needs to be completed by late October or early November to avoid undue risk of cold damage to the roots.

Sweetpotato roots are "cured" in storage for up to one week at 85° F to allow the skin to develop disease resistance and to improve cooking quality. Roots dug on sunny days with temperatures above 90° F must be removed from the field within 2 hours to avoid excessive drying and damage to the skin.

Sweetpotatoes are generally harvested by hand after the roots have been exposed by disk diggers, plows, or bed diggers. Hand harvesting usually results in less physical damag to the roots than mechanical harvesting. However, mechanical harvesting is becoming more widely adopted because of labor-cost savings. The use of harvesting aids, such as vine cutters and field-packing machinery is common among the larger commercial operations.

A typical harvest operation begins with a large disk digger cutting the vines along the row and exposing the roots. Laborers then pick up and field grade sweetpotatoes into boxes. Workers often use gloves to protect against scarring the sweetpotatoes and may use sizers to help measure length and diameter. Wirebound boxes of 1-1/8 bushels are used to carry 60 to 65 pounds of sweetpotatoes and are used mainly for storage. Increasingly sweetpotatoes are being harvested into bulk bins for handling and storage.

Several problems at harvest and during postharvest handling may reduce the saleable yield of sweetpotatoes. Chilling to temperatures below 55° F for more than 24 hours will cause a hardened core upon cooking. Temperatures approaching freezing for short periods or soil temperatures below 55° F for long durations increase chilling injury. Chilling injury may increase the incidence of rot in storage.

Improper ventilation during curing and storage will lead to anaerobic respiration in th root and cause "souring" (see later discussion). During curing, ventilation of two or three air exchanges per day is sufficient; during storage one air exchange per day is sufficient.

Rots which occur during storage have usually begun in the field or at harvest. Very few, if any, new infections occur after curing. Rots are best controlled by minimizing harvesting and handling injuries, and properly curing the roots within a hour of digging. After curing, sweetpotatoes are best stored at 55° F to 60° F and 90 percent relative humidity.

Standard practice in preparing sweetpotatoes for marketing requires washing, sorting, and grading. Waxing is performed usually only if requested by the buyer. Treatment with dicloran and chlorine during the grading process to prevent decay during marketing is a recommended practice. Most sweetpotatoes are shipped to market in 40-pound corrugated fiberboard boxes.

## Marketing

Marketing considerations are important for insurance because the lack of a profitable market can increase the incentive for moral hazard. Although uncertainty as to the availability of a buyer does not appear to be a major issue for sweetpotatoes, low prices at times, in combination with low yields, may cause growers to abandon a portion of their crop prior to harvesting.

Most sweetpotatoes are grown for the fresh market with the culls (those too small or to large or too misshapen for the fresh market) being sold for processing. USDA does not report fresh and processed use separately. Industry sources, however, indicate that about 2/3 of the production in North Carolina is sold in the fresh market and 40-50 percent of those grown in Louisiana.

Many growers have their own storage facilities and do their own packing and selling. I California, however, a number of growers sell the crop to a packer-shipper.

## Cost of Production

Cost of production information is pertinent in assessing the feasibility of crop insurance because the timing of expenditures provides an indication of the magnitude of losses associated with an insurable event occurring at different stages in the production cycle.

By the time sweetpotatoes are planted, growers have incurred a substantial amount of th preharvest expenses. Some of the preharvest expenses for operations such as pest control, supplemental fertilization, and other cultural practices, however, may not be incurred if an insurable event occurs before the crop reaches the harvestable stage.

Harvesting and marketing expenses typically amount to 40 to 60 percent of total production costs (Table 5)[3]. A grower would not incur harvesting and marketing expenses, however, if an insurable loss occurred before the crop is harvested. In orde to avoid providing a moral hazard incentive, an indemnity for an in-field loss should cover only expenses actually incurred. The in-field value of sweetpotatoes would not include the value of harvesting and marketing expenses.

Cost of production budgets were not located for California. One 400-acre farm, however reported total variable costs of about $1,000 per acre. This total included all variable expenses, including harvesting and hauling to storage. Of this $1,000, preharvest costs accounted for about 60 percent and harvesting costs about 40 percent.

## Production Perils

The weather-related perils that would be most likely to result in indemnities under a sweetpotato crop insurance policy are excessive rainfall and drought. Extended cold temperatures, frosts and freezes, excessive wind, and hail also occasionally cause yiel losses.

Insects can cause considerable losses in the field during the growing season and after harvesting by feeding on the sweetpotato roots. Foliar insects, however, rarely cause problems. Growers generally report they can cope with insect perils by following prudent management practices.

### Excessive Moisture

Excessive soil moisture causes "souring" or asphyxiation of the roots and can result in complete crop losses (see the "Physiological Disorders" section). Sweetpotato roots do not develop well under wet conditions. The plants can develop excessive vine growth which interferes with field operations. Excessive moisture is more likely to damage sweetpotatoes than drought, and is the source of most sweetpotato losses in Alabama (Tunnell).

[3] Detailed budgets are presented in Appendix table 6.

Table 5--Sweetpotatoes: Production cost allocations, selected states [1]

| Item | North Carolina | Louisiana | Georgia | Alabama |
|---|---|---|---|---|
| | ----------Bushels/acre---------- | | | |
| Yield [2] | 290 | 350 | 450 | 350 |
| | ----------$/acre---------- | | | |
| Pre-harvest | 938 (62) | 420 (35) | 976 (45) | 961 (46) |
| Harvesting and marketing | 584 (38) | 789 (65) | 1,217 (55) | 1,147 (54) |
| Total | 1,522 (100) | 1,209 (100) | 2,193 (100) | 2,108 (100) |

( ) indicates percent of total.

[1] Costs may not be comparable among states because budgets may be for different seasons and may not include the same cost items. Some costs were allocated 65% preharvest and 35% harvest.

[2] A bushel weighs 50 pounds.

Sources: Wilson and Averre, 1989; Mizelle, 1994b; Hinson, 1994; Williams and Dangler, 1992.

**Drought**

Growers in several states, particularly in the Southeast, indicate that drought is a major production peril. Drought can prevent plants from becoming well-established, and can also retard root development and lower yields. Because sweetpotatoes are fairly drought-tolerant, however, it is not generally as severe a peril as excess moisture. Industry contacts indicate that an uneven distribution of rainfall--drought at certain times, excess moisture a few weeks later--has been the cause of many losses in recent years.

**Cold Weather**

A late spring frost can kill newly-planted sweetpotatoes. In addition, if young plants are exposed to extended cold (above freezing) temperatures, their vigor is reduced, yields usually will be below average, and the percentage of very short, chunky, and less-desirable sweetpotatoes will be high (Wilson). This problem can usually be avoide by planting after an "earliest recommended planting date" for each production area.

Although an early fall frost will not usually hurt the sweetpotato roots (unless soil temperatures fall below 55$^{o}$ F for several hours), it will kill the vines of unharvested plants and "hurry-up" the harvesting of the remaining crop. Early frost may on occasio reduce yields of late-planted varieties which have to be harvested before the roots reach the desired size. Problems with late frosts can usually be avoided by planting before a "latest recommended planting date" for the production area.

**Excessive Wind**

Wind damage is not a common production peril, but disaster assistance payments were mad in California during the 1988 season for wind damage. (See the "California" state discussion for more detail.)

**Physiological Disorders**

The principal physiological disorders for sweetpotatoes are blister, growth cracks, and souring. Blister normally develops during storage and is caused by a boron deficiency. It is characterized by a root surface that becomes brown or black and small raised bump or "blisters" on the surface. Blister can be controlled by adding boron to the preplan fertilizer at the rate of 1/2 pound per acre.

Growth cracks result from uneven growth in the enlarging root and the buildup of internal stress. Cracking can be minimized by ensuring favorable environmental conditions, including: the absence of root diseases; assurance of a uniform supply of moisture during the growing season (by irrigation if necessary); proper fertilization; and avoidance of varieties susceptible to cracking.

Souring is a physiological condition caused by anaerobic respiration of the sweetpotato root. Sweetpotato roots respire, even after harvest, and require a relatively uninterrupted exchange of oxygen and carbon dioxide. Soured roots are more susceptible to rotting microorganisms, especially Rhizopus, and attract large numbers of fruit flies, which create a nuisance. Souring can occur in the field under conditions of hig soil moisture or in curing and storage with inadequate ventilation. During a period of drought in well-drained soils, the sweetpotato root develops high gas exchange needs. If a heavy rain ensues, souring in the field becomes more likely.

Souring can be diagnosed by experienced fieldmen who detect an odor of alcohol, a byproduct of anaerobic respiration. Upon cutting, the root interior appears dull and latex does not flow from the root. Souring can be minimized by selecting well-drained fields that are not drought-prone.

**Diseases**

The sweetpotato can be attacked by a number of diseases, but soil-borne diseases usuall cause more economic losses than foliar and stem diseases. Three major sweetpotato diseases in the United States, ranked in order of their probable economic importance, are scurf, fusarium, and bacterial soft rot. Other diseases include black rot, streptomyces root rot, and soft rot.

Scurf. Scurf is a seed- and plant-borne disease that causes brown-to-black skin coloring. Scurf damage is largely cosmetic, affecting only the sweetpotato skin, but nevertheless renders the sweetpotato unmarketable for fresh use. Scurf does not cause decay.

The scurf organism has a narrow host range, which reduces the measures necessary for control. The scurf organism can survive in soil for up to 1 year, even in the absence of a sweetpotato planting. A 3-year rotation is recommended for satisfactory control. The use of cut plants or vine cuttings (not pulled plants), coupled with a good grower seed program and a suitable rotation pattern, can effectively contain scurf.

Fusarium. Fusarium may cause surface rots or penetrate deeper into the stored root. F oxysporum causes fusarium surface rot and can be controlled by minimizing harvesting an handling injuries, by harvesting when soils are dry, and by placing roots under curing conditions within 1 hour of digging. F. solani causes fusarium root and stem rot and penetrates into the fleshy root. This organism causes firm and dark tan lines, easily distinguished from neighboring healthy root tissue. F. solani is systemic and is transmitted in infected transplants. Control measures include 2-year or longer rotations as well as fungicide treatments of the transplant cuttings.

Bacterial Soft Rot. Bacterial soft rot, caused by Rhizopus fungi, causes extremely wet and mushy root tissue. The seed-borne pathogen may cause symptoms at the onset of hot weather. These symptoms may include yellowish tops (noticeable especially on the older foliage), which occur randomly in the field. On close inspection, the lower stem may have a black, shiny rot.

At other times, detection of bacterial soft rot is difficult. Affected tissue may appear similar to healthy tissue. In later stages, the rotted tissue blackens at the

interior of the root. Unfortunately, many roots that appear normal harbor the bacteria in internal tissues, which may have extensive interior decay.

The bacterial soft rot organism survives poorly in the soil. Good sanitation and seed management practices are necessary for control. The packing and grading structures and equipment must be thoroughly cleaned, washed, and rinsed in chlorinated water. Plantin material should be taken only from fields that have no bacterial soft rot.

**Insects**

Sweetpotatoes can be attacked by insects both on the leaves and on the roots. Insects attacking the leaves include leafhoppers, aphids, grasshoppers, banded cucumber beetles argus tortoise beetles, sweetpotato flea beetles, cabbage loopers, southern armyworms, sweetpotato leaf rollers, corn earworms, and sweetpotato hornworms. Generally, insects attacking the leaves do not cause damage sufficient to warrant treatment, unless the attack is in bedding material. Transplants should be free from insect infestation before they are moved to the field.

Because insects that attack the sweetpotato root may reduce marketable quality, they ma warrant the expense of treatment. The life cycle of beetles and weevils includes the grub or larvae, which live in the soil and feed on plant leaves and roots. Certain weevil adults also feed extensively on the leaves. The larvae of sweetpotato flea beetles feed on roots, where they produce pin-sized holes or more extensive mining and "writing" on the root surface. Wireworms may cause small, irregular, shallow or deep holes on the surface of the sweetpotato root. To minimize wireworm control costs, fields which have been idle one or more years under grass cover should be avoided. If necessary, chemical treatments for wireworms may be necessary.

The sweetpotato weevil, although feared widely as a sweetpotato pest, is not currently widespread problem in most U.S. sweetpotato production regions. If the sweetpotato weevil is found, quarantine measures may be instituted to contain the pest.

**Nematodes**

Nematodes reduce the yield and quality of sweetpotatoes. Nematodes are usually present in sandy soils (which is the optimum soil type for sweetpotato growing) and can cause losses even on resistant varieties. A field of sweetpotatoes infested with nematodes will show patchy and uneven growth. The sweetpotato root will show cracking and a partially-decayed surface.

To minimize nematode problems, growers can choose resistant varieties, such as Jewel, and treat the soil in the transplant bed. Failure to control nematodes in the seed bed will assure damage in the field. Most varieties offer only partial nematode resistance Varieties may show varying degrees of resistance among different species of nematode.

Soil treatment may include fumigation with or application of a nematicide. Most transplant beds are fumigated. Fumigating fields is less common; but when it is performed, it should be done at least two weeks before planting. Application of granular or liquid nematicide may be done closer to planting, depending on label recommendations.

## State Analyses

The following section describes those aspects of sweetpotato production in the major sweetpotato-growing states which pertain to the feasibility of offering crop insurance.

### Alabama

Alabama accounted for about 6 percent of U.S. sweetpotato production in 1993. The largest number of growers and the largest acreage is located in Cullman county (north central Alabama) and in Baldwin county (southern Alabama). A substantial amount of white (Irish) potatoes are also grown in both of these counties.

The Census of Agriculture reported 74 farms growing sweetpotatoes in Cullman county in 1987, and the County Extension Farm Advisor judges there is about the same number in 1994 (Boswell). Most of the sweetpotato-growing operations are less than 10 acres. Th County Farm Advisor estimated that there were only 3 or 4 farms with operations of 50 o more acres of sweetpotatoes, and that about "a half dozen" had 10-50 acres.

The annual production cycle begins in February or March when growers place seed stock into plant beds. Field planting begins in May and continues through June. Harvesting begins in late summer and continues through October. Growers may do their own marketing, finding a buyer and negotiating prices. Some growers use the services of a broker to sell their sweetpotatoes.

#### Production Perils

Excessive rain is the biggest production peril in growing sweetpotatoes in Alabama. To much soil moisture causes excessive vine growth, and the sweetpotato roots "size up" poorly. Wet conditions also can interfere with field operations. Rain prevented timel planting and lowered yields in 1988.

#### Demand for Insurance

Our contacts reported varied opinions about Alabama growers' interest in sweetpotato crop insurance. One person said he thought growers would be more interested in insurance if the situation arose where they knew ad hoc disaster payments would not be available in the future (Boozer). He said there were large ad hoc payments to Alabama growers in 1988, 1990, and 1993. Actually, payments of over $100,000 were made every year from 1988 through 1993.

Another contact, who is chairman for the winter meeting of the National Sweetpotato Growers Association, indicated he would like to have an FCIC representative speak about crop insurance at their January 1995 meeting in Point Clear, Alabama (Tunnell). He sai he did not know how much interest there would be in crop insurance among Alabama growers.

A third contact indicated that she thought that Alabama growers would welcome crop insurance for sweetpotatoes (Kelley). She said there were $300,000 in disaster payment to sweetpotato growers in 1989 as a result of too much rain. She thought there were yield losses every year due to weather-related causes, as well as storage losses due to insects and storage rot.

Sources of Information

There is no grower organization involved in the marketing or promotion of sweetpotatoes in Alabama. There is a state sweetpotato growers organization (see list of contacts at end of this report).

**Georgia**

Georgia produced about 3.5 percent of U.S. sweetpotato output in 1993, on 3,000 harvested acres (Table 2). The Census reported 158 growers in 1987, with most reportin a total value of crop sales of less than $25,000. There are about a half dozen specialized grower-shipper operations with 100 acres or more of sweetpotatoes, and a larger number of farms with small acreages. Sweetpotato production is spread over a wide area of central and southwest Georgia. Growers in Colquitt and Jeff counties received the largest disaster assistance payments for Georgia sweetpotatoes during the 1988 through 1993 period, although these counties do not necessarily have the largest acreages.

Because of their southern location, Georgia growers have sweetpotatoes ready for harves before growers in North Carolina. Growers transplant plants in the field during April and May and the first harvest begins as early as late July. Most of Georgia's sweetpotato crop is harvested in late September, but the harvest may continue until the first frost, usually mid-November.

Most Georgia growers try to harvest part of their crop for the early market (in August) in the hopes of receiving a premium price. In years when North Carolina shippers have depleted their inventory of sweetpotatoes held in storage, prices may be relatively hig for sweetpotatoes marketed early in the season. If the inventory of "old" sweetpotatoe is relatively large the price premium for early sweetpotatoes may not compensate for th lower yields associated with early harvesting.

Sweetpotatoes in Georgia are grown with the intention of selling in the fresh market. There are no processing plants in Georgia, and very few of Georgia's sweetpotatoes, consequently, go for processing. Shippers try to sell a large part of their supply in the high-volume Thanksgiving and Christmas markets (Mizelle 1994a).

Production Perils

The most serious production perils for sweetpotatoes in Georgia are excessive rain and severe drought. Excessive rain is especially damaging if it occurs at harvest. It can cause souring and increased incidence of rot damage in storage. Some years sweetpotatoes may be damaged by drought during a part of the growing season and by excessive rain during another part of the season.

Although a number of growers irrigate, severe drought remains a major production peril for sweetpotatoes in Georgia. Irrigation is intended as a supplement to natural rainfall and during periods of extended drought, water supplies become depleted and cro losses occur despite the supplemental irrigation. Disaster assistance payments were made for sweetpotatoes in Georgia in all years from 1988 through 1993. In 1990 and 1993, payments were made for losses resulting from drought. Disaster assistance

payments were made in 1992 for losses due to excessive rain. Payments were made in 199 for both drought and excessive rain (Glow, Forbes, Walters).

Early fall frost can kill the vines and "hurry-up" harvesting, but this is not likely t result in substantial yield loss among unharvested sweetpotatoes. Losses could result if the frost occurred after the sweetpotatoes had been dug, but before they had been placed in storage. Usually this situation would only involve a small part of a grower' crop and would occur only among smaller growers. Growers with larger acreages typicall dig and bin in one operation and their sweetpotatoes, consequently, are not exposed to cold overnight temperatures.

The sweetpotato weevil has been a production peril in some of the minor-producing counties in Georgia in the past. When an infestation is discovered, the Georgia Department of Agriculture quarantines the immediate area (generally a 1 or 2 mile radius), which places certain restrictions on how sweetpotatoes can be marketed. Consequently, if a grower falls within the quarantined area, he may have restrictions placed on how he sells his crop, which may increase his costs, reduce receipts, or both Crop loss due to the sweetpotato weevil quarantine is not covered by disaster assistanc in Georgia.

Demand for Insurance

An extension agricultural economist indicated that he thought growers would purchase crop insurance if they were convinced that no ad hoc disaster payments would be available, if the only program were an area-triggered disaster assistance program, and if the insurance program were sufficiently advertised (Mizelle, 1994a). The fact that Georgia growers collected $1.17 million in sweetpotato disaster assistance payments between 1988 and 1993 indicates that growers face a significant incidence of crop losses. Disaster assistance payments amounted to 2.7 percent of the value of Georgia sweetpotatoes marketed over the 1988-93 period.

Sources of Yield Information

It may be possible to construct yield histories for some sweetpotato growers in Georgia from data collected in the operation of a state sweetpotato promotion program and through the use of county-level crop acreage data maintained by the Agricultural Stabilization and Conservation Service (ASCS).

The Georgia Sweetpotato Commission has a check-off for funding research and promotion based on each grower's production. Production histories for individual growers may be available from records kept by the Commodities Promotion Division of the Georgia Department of Agriculture for those growers who contribute to the program. Although al growers are supposed to participate in the funding program, reporting is voluntary and records may not be available for growers who did not report.

County ASCS offices are a potential source of acreage histories for growers who participate in the farm programs. Farmers are encouraged to report the acreage of all crops (Walters).

**New Jersey**

New Jersey produced 147,000 cwt of sweetpotatoes in 1993, just 1.3 percent of U.S. tota output. The Census of Agriculture reported 127 New Jersey farms with sweetpotato sales in 1987. Most of New Jersey's sweetpotato enterprises are small operations. The largest may have up to 150 acres of sweetpotatoes.
Atlantic county usually accounts for about 40 percent of New Jersey's sweetpotato production. The New Jersey Department of Agriculture reported 800 acres of sweetpotatoes planted and 700 acres harvested in Atlantic county in 1991 (New Jersey Agricultural Statistics Service). Sweetpotatoes in Atlantic county are usually grown a part of a diversified farm plan including other horticultural crops, such as blueberries, cucumbers, and other vegetables (VanVranken).

New Jersey growers usually cure, store, and pack their own sweetpotatoes. A portion of New Jersey's sweetpotato production consists of specialty varieties, such as Jersey Yellow, Jersey Red, and White Yam, which may sell for a premium price. Consequently, the average grower price for New Jersey sometimes is substantially higher than for othe states.

In New Jersey, sweetpotatoes are transplanted in the field between mid-May and mid-June Harvest begins in early September and continues to the end of October or until frost kills the vines. Growers frequently have irrigation facilities available, but sweetpotatoes may not be their highest priority crop for irrigation.

Most of New Jersey's sweetpotatoes are sold in the fresh market. They are sold both green (uncured) and cured. The cured sweetpotatoes are usually stored for a period of time before being sold. Most of the sweetpotatoes what are culled in grading and packing are shipped to a canner in Maryland.

Production Perils

Drought and excessive rains are the two major perils in sweetpotato production in New Jersey. Excessive moisture in August or September may cause losses due to splitting of the sweetpotato roots. Flooding sometimes leads to souring, which also causes crop losses. There were over $400,000 in disaster assistance payments made for sweetpotatoe in Atlantic county in 1988 alone. The cause of these losses was reported as drought an excessive heat by the county ASCS office (Riley); a period of heavy rains after the drought and heat compounded losses.

**North Carolina**

North Carolina accounts for more than a third of the U.S. sweetpotato crop and about a third of the farms growing sweetpotatoes. The state has consistently been the leading producer of sweetpotatoes since 1970. North Carolina produced 4.2 million cwt of sweetpotatoes in 1993, 38 percent of the U.S. total (Table 1). North Carolina sweetpotatoes had a farm gate value of $39 million in 1993.

Most North Carolina sweetpotato acreage is located in the southcentral part of the Stat (Central Coastal and Southern Coastal agricultural statistics districts), a region important in the production of flue-cured tobacco and vegetable crops. The leading counties in sweetpotato production are Johnston, Sampson, Nash, Wilson, Wayne, Harnett, Columbus, Cumberland, Duplin, and Edgecombe (North Carolina Agricultural Statistics Service).

The Census of Agriculture reported 1,017 farms growing sweetpotatoes in North Carolina in 1987, and extension specialists estimate that there are about 900 to 1,000 farms today (Schultheis). There are a range of farm sizes, but the number of farms with 500 acres or more is increasing. A farm with 100 acres of sweetpotatoes or less is considered a small operation in North Carolina. Most growers with 200 acres or more ar grower-shippers, and have curing and storage facilities. Often, grower-shippers also buy sweetpotatoes from smaller growers.

Sweetpotato growers frequently also produce tobacco and vegetables, such as pickling cucumbers, lettuce, greens, and white (Irish) potatoes. Labor requirements for these crops tend to complement one another so that the grower can provide continuous employment over a number of weeks or months.

Planting in seed beds begins in March and April and plants are set in the field during May and June. Although some sweetpotatoes may be harvested during August for the early market, most harvesting occurs during September and October.

Approximately two-thirds of the state's output is sold in the fresh market with the remainder processed (largely canned) or used as seed. North Carolina markets fresh sweetpotatoes throughout the eastern and central parts of the country with the largest volume moving to New York, Baltimore, and Chicago.

Production Perils

The most serious peril in sweetpotato growing in North Carolina is too much rain. Too much rain late in the season can be especially damaging. Excessive soil moisture in

August results in increased incidence of root rot and poor sizing of the sweetpotato roots. After the roots have sized up (enlarged), excessive moisture increases the incidence of cracking, which severely reduces the market value of the crop. Excessive soil moisture in October, especially if accompanied by cool weather, may cause souring.

Drought can cause yield losses to sweetpotatoes in North Carolina, but has not been as serious a peril as excessive moisture. The sweetpotato plant is relatively drought tolerant. Nevertheless, dry conditions early in the season prevent plants from becomin well established. Although a poorly established field could be replanted, this is not common practice because a late-planted field has an increased risk of loss at harvest-time due to wet conditions or early frost. Drought during the growing period retards root development and lowers yields.

The effects of drought can be exacerbated if dry weather is followed by excessive rain. In this situation, the sweetpotato plant develops fewer higher-value "number 1" size roots and more extra large ("jumbo") and extra small ("number 2") roots than if the plant had a continuous supply of moisture during the growing season. The jumbos and number 2 potatoes sell for a lower price than the number 1's.

Not very many North Carolina growers irrigate their sweetpotatoes. The Census reported 10.5 percent of North Carolina sweetpotato acreage irrigated in 1987.
Early fall frost can cause losses by killing the vines before the roots have sized up. This is usually a problem only for sweetpotatoes that are planted after July 1 (Bateman). A sweetpotato insurance policy should require a cut-off date by which sweetpotatoes would need to be planted in order to be insured.

Hail can be a production peril for sweetpotatoes in North Carolina, but yield losses ar rare (Faircloth, Bateman).

Demand for Insurance

North Carolina growers collected $10.3 million in disaster assistance payments during 1988-93. This amounted to about 3.4 percent of the value of the North Carolina's sweetpotato crops during this 6-year period.

The Executive Director of the North Carolina Sweet Potato Commission indicated that the North Carolina industry did not want crop insurance for sweetpotatoes as long as ad hoc disaster assistance is available (Yeargin). He said the reason was that "they did not want growers planting sweetpotatoes and then neglecting them and collecting government payments because of a crop failure." However, he indicated that if ad hoc disaster assistance were phased out, and an area-triggered disaster plan were in place instead, the industry would likely be much more interested in crop insurance.

Sources of Data

It may be possible to construct yield histories for some sweetpotato growers in North Carolina from production data reported to the North Carolina Sweetpotato Commission and through the use of acreage data reported to county ASCS offices. The North Carolina Sweet Potato Commission collects an assessment from growers on the basis of the quantit of sweetpotatoes packed and processed.

Acreage data from county ASCS offices could be used in combination with total productio data from the Sweetpotato Commission to compute a yield per acre. Growers who participate in one of the Federal programs, mostly tobacco and feed grains in North Carolina, are requested to report the acreage of each crop each year, including the acreage of horticultural crops such as sweetpotatoes.

**Louisiana**

Louisiana is the second leading producer of sweetpotatoes, accounting for about a fifth of the U.S. crop. Louisiana reported 16,500 harvested acres of sweetpotatoes in 1993 (Table 1). The value of the Louisiana crop in 1993 was $38.4 million.

The Census reported 213 sweetpotato growers in Louisiana in 1987. However, the extension horticulturalist at Louisiana State University indicated that the Census number seems low to him. He estimates that there are about 400 sweetpotato growers in Louisiana and that about 250 of them are "serious" commercial producers (Cannon.) The greatest concentration of sweetpotato acreage is in West Carrol and Franklin parishes i northeast Louisiana, and in Avoyelles, Evangeline, and St. Landry parishes in southcentral Louisiana.

Sweetpotato operations in Louisiana range in size from 1 to 800 acres. The average operation is about 40 acres. There are about 50 growers with 100-300 acres and about 1 who grow 300 acres or more (Cannon). Thirty to forty grower-packers account for about half of the sweetpotato acreage.

Selling is handled by sweetpotato brokers. There are about 5 brokers in the state. Only two or three grower-packers do their own selling. Louisiana has a long growing season, so planting and harvesting are spread over a relatively long period of time.

The growing cycle in Louisiana begins when the seed sweetpotatoes are placed in beds, usually during March. Transplanting begins by the end of April and continues to mid-July. The earliest harvesting begins in late July and extends through November. The peak harvest occurs during September and October.

Three important sweetpotato varieties in Louisiana are Beauregard, Jewel, and Travis. Beauregard and Travis are relatively short-season varieties (90 days from transplanting to harvest) and Jewel is a relatively long-season variety (120 days from transplanting to harvest).

Most sweetpotatoes in Louisiana are planted with the intention of selling to the fresh market, although some growers produce exclusively for the processing market. Typically the packer grades out the number 1 sweetpotatoes for sale to the fresh market and sells the jumbo and number 2's to a processor. About half of the crop was marketed for fresh use and half for processing in 1993 (Duplechain). The percentage going for fresh use has increased in the past several years because newer varieties pack out a higher percentage of number 1 sweetpotatoes.

There are two sweetpotato processors in the State. In addition to buying sweetpotatoe culled from the fresh packing lines in Louisiana, processors buy some sweetpotatoes fro other states.

Production Perils

The most significant peril for sweetpotato production in Louisiana is too much rain. Louisiana is prone to being hit with hurricanes in the summer and fall which can deluge sweetpotato fields with water. Excessive moisture associated with hurricanes and tropical storms can cause heavy losses to sweetpotatoes.

Drought is a second major peril. Although drought may not result in a complete crop loss, yields are reduced and the quality is lowered. Sweetpotatoes grown under drought conditions grade out a lower percentage of number 1's and more number 2's.

Frost can result in reduced yields for sweetpotatoes harvested late in the season. The cut-off date for prudent planting is about July 1. Sweetpotatoes planted after that date run a relatively high risk of loss due to frost in the fall. In 1994, an estimate 89 percent of the states sweetpotato acreage was planted by July 1. Some growers plant through the middle of July and usually make a crop--especially with the Beauregard variety--but they run an increased risk of cold damage.

Hail damage can cause crop losses, but serious damage occurs relatively infrequently.

Sweetpotato weevils, cucumber beetles, white grubs, white fringe beetles, soil rot, and storage rot are common production problems. Some areas at times have sweetpotato weevi infestations. Sweetpotato acreage in these areas may be quarantined for a period of time until the weevil infestation is under control.

Occasionally, growers will abandon their sweetpotato crop because of a combination of low prices and poor production. If current market prices are low and the outlook is fo relatively low prices for the remainder of the marketing season, the grower may calculate that he can not cover his costs for harvesting, storing, and marketing. In such a situation, the grower may minimize his losses by abandoning the crop. The decision to abandon is more likely to be made if adverse conditions have lowered the expected yield.

Sources of Data

The Louisiana Sweetpotato Commission collects 8 cents a bushel for research and promotion on all sweetpotatoes sold for either fresh use or processing. Although the assessment is based on the amount marketed, the quantity is measured at the shipper level and can not necessarily be traced to individual growers because the shipper may b handling sweetpotatoes for several growers.

Demand for Crop Insurance

Although none of the persons contacted for this study reported an opinion about the demand for crop insurance on the part of Louisiana sweetpotato growers, there may be less demand than in some other southern states. The reason for this judgment is that Louisiana seems to have a lower incidence of crop loss than most other major sweetpotat states (excluding California). Disaster payments for sweetpotatoes in Louisiana averaged only 1.1 percent of the crop value during the years 1988-91, versus 3.4 percen in North Carolina and an average of 2.2 percent for eleven sweetpotato states (see the "Ad Hoc Disaster Assistance for Sweetpotatoes" section).

**Texas**

Texas produced 900,000 cwt of sweetpotatoes in 1993, 8 percent of total U.S. output. The farm value of the Texas crop was $15 million. USDA reported 6,000 harvested acres of sweetpotatoes in Texas in 1993.

The Census of Agriculture reported 184 sweetpotato growers in Texas in 1987, with most of the acreage located in Van Zandt and Wood counties in northeast Texas. An estimated 30 to 40 growers account for most of Texas' production, but there are a number of producers with very small operations (less than 5 acres of sweetpotatoes).

Larger growers or groups of growers have their own grading and packing equipment and storage sheds. The fresh market is the principal use for most of Texas' sweetpotatoes. Packers grade out the sweetpotatoes that do not meet fresh market standards and sell them to canners in Louisiana.

Some growers raise only sweetpotatoes, but most also produce watermelons and vegetables Growers tend to produce sweetpotatoes on rented land that has not had sweetpotatoes grown on it for several years.

Transplanting into the field usually begins in early May and extends to early July. Th ASCS county committees in Wood and Van Zandt counties set July 1 as the latest planting date for sweetpotatoes to qualify for disaster assistance payments. Sweetpotatoes planted after this date have an increased probability of being damaged by frost at harvest-time. Most harvesting occurs in September and October.

Harvesting usually involves two operations. In the first, the soil is turned over exposing the sweetpotatoes. Then, harvesting crews gather the exposed roots and place them on conveyors attached to a mobile harvesting-grading unit. Grading according to fresh market and processing quality is done on the mobile harvester, sometimes called a "bat-wing" or "bird-wing" harvester because of the conveyors extending from either side

Production Perils

The greatest production peril in the northeast Texas area is extreme drought. Growers do not irrigate sweetpotatoes in this area. However, the area can be subject to extended periods of hot and dry weather which retards root development and lowers yields.

The combination of excessive moisture and cool weather in the spring can be a problem for sweetpotatoes because the new plants may not become established. Excessive moistur also can be a problem at harvest-time, leading to the onset of storage rot and souring.

Early frost occasionally causes some damage to late-harvested sweetpotatoes in the Texa area if the roots are exposed. After the sweetpotatoes are dug, they may lay in the field for a day or two before being harvested. If they are exposed to freezing temperatures during this period, quality will be reduced and storage losses rise. Fros is not considered a serious production risk in Texas for sweetpotatoes planted before the recommended "latest-planting date."

Hail occasionally causes losses to sweetpotato plants in Texas, but is not generally considered a serious production peril.

**California**

California is the third leading producing state for U.S. sweetpotatoes, accounting for 10 percent of U.S. harvested acreage in 1993 and 16 percent of total production. The vast majority of the California crop is located in Merced, Fresno, and Stanislaus counties in the San Joaquin Valley (see county production statistics in Appendix table 5).

The Livingston-Atwater area in Merced county accounts for three-fourths of the state's output. Sweetpotatoes are produced on about 80 farms in the state with 40-60 of these in the Livingston-Atwater area (Post, Alvernaz). Fifty-five percent of farms with sweetpotatoes in California had $100,000 or more in agricultural sales in 1987 (Appendi table 2).

Seed stock are placed in sweetpotato beds in late February or early March and the young plants transplanted into the field in late April or early May. Harvest starts around September 15, and continues until early November. Usually 2.5-3.0 acre feet of irrigation water are used per acre during the growing cycle in California, with water being applied once a week.

A number of sweetpotato growers also grow almonds and peaches. Merced, Fresno, and Stanislaus counties are major peach producing counties. Stanislaus and Merced countie also are major almond growing counties.

California sweetpotato production is marketed primarily in fresh market outlets. Less than 10 percent of total production is used for processing (Post). A cannery in the Livingston area is the only processing outlet in California. The major fresh markets for California sweetpotatoes are Los Angeles, San Francisco, and Seattle.

Production Perils

California growers generally do not consider natural perils such as drought, excessive moisture, wind, hail, extreme temperatures, and earthquakes as a serious risk in sweetpotato production. Nevertheless, $87,000 in disaster assistance were paid for crop losses due to wind damage in Merced county in 1993. Reportedly, wind-driven sand "sheered" the sweetpotato plants.

Freezes or unusually cold temperatures, although infrequent among California sweetpotatoes, can be a source of crop loss. Sweetpotatoes, especially the young plants, are vulnerable to cold damage in early-planted fields. Occasionally, growers will plant part of their acreage before recommended planting dates in hopes of harvesting early and receiving a premium price on the early market. When sweetpotatoes are planted within normal planting dates the risks of cold weather damage are minimal (Alvernaz).

Planting and Harvesting Dates

The following are generally accepted normal planting and harvesting dates for the Livingston area (Merced county):

| | Bed preparation | Transplanting | Harvesting |
|---|---|---|---|
| Normal | Feb. 22-Mar.20 | Apr. 22-Jun. 1 | Sept. 15-Nov. 5 |
| Early Starting | Early Feb. | Apr. 7- Jun. 1 | early July-Nov. 5 |

Source: Yagi; Alvernaz; Scheuerman; USDA, ARS.

Planting in Fresno county can usually start several days earlier than in Merced county because the Fresno county sweetpotato area is located about 90 miles south of the Merce area.

Grower Organizations

There are two principal grower organizations for California sweetpotatoes, which may provide a source for individual yield data. The California Sweet Potato Growers Association is a producer cooperative with 5 members who are growers and shippers. The Sweet Potato Council of California is a grower-shipper organization which directs product promotion and research. Funding is through per acre assessments on growers and per carton assessments on shippers. Participation is voluntary.

## Ad Hoc Disaster Assistance for Sweetpotatoes

Ad hoc disaster assistance legislation was made available for losses of commercially-grown crops in each of the years 1988-93. Ad hoc payments provide an indication of high-loss areas during that period, and may indicate states and counties that would face relatively high risk under a potential FCIC sweetpotato policy. These data may also suggest the areas where the demand for a sweetpotato crop insurance policy would be relatively high.

Under the 1988-93 legislation, payments were made under the categories of participating program crops, nonparticipating program crops, sugar, tobacco, peanuts, soybeans, sunflowers, nonprogram crops, ornamentals, and at times, aquaculture. Producers without crop insurance--the case for sweetpotatoes--were eligible for payments for losses greater than 40 percent of expected production. If a producer had no individual yield data to use in calculating "expected production," county-level or other data were used as a proxy. Payment rates for sweetpotatoes were based on 65 percent of a 5-year average price, dropping the high and low years.

Disaster assistance payments for sweetpotatoes (fresh and processed) totalled nearly $22 million over the 1988-93 period. Payments for fresh sweetpotatoes accounted for 96 percent of the total; payments for processed sweetpotatoes accounted for 4 percent. Payments for total sweetpotato losses peaked at $6.4 million in 1988, and were over $3 million in 1989 and 1993. Ad hoc payments made for sweetpotatoes accounted for about 0.6 percent of all ad hoc payments for non-program crops (that is, non-price and income support crops) over the 1988-93 period, but far less than 1 percent of total payments (program and non-program crops).

Ad hoc disaster payments for sweetpotatoes were scattered over a geographically broad area (Figures 3 and 4). For fresh sweetpotatoes, 32 states received payments in at least one of the 6 years, with 17 states collecting payments in all years. Further, payments for fresh sweetpotatoes were reported in a variety of states for which neither NASS nor the Census collects data on sweetpotatoes--including Nebraska, West Virginia, and Hawaii. For processed sweetpotatoes, 7 states collected payments in one of the 6 years, with Louisiana the only state receiving payments in all years.

In an ordering of counties, Sampson county, North Carolina was ranked first in payments, receiving over $3.3 million over the 6-year period. The North

Carolina counties of Columbus, Johnston, and Duplin ranked second through fourth, with over $1 million in payments between 1988 and 1993. Among the top-10 recipient counties, seven were in North Carolina, and one each were located in Texas, Alabama, and New Jersey.

Ad hoc disaster data can be used to indicate which sweetpotato-producing areas received large payments relative to their acreage (Table 6). NASS does not collect data on Arkansas sweetpotato acreage, but that state received 4.2 percent of ad hoc sweetpotato payments over the 1988-93 period. Similarly, North Carolina accounted for 40 percent of U.S. sweetpotato acreage between 1988 and 1993, and received nearly 47 percent of the payments made for that crop. New Jersey also received a disproportionately large share of payments.

In contrast, California and Louisiana collected smaller shares of ad hoc payments relative to their acreage. California accounted for 10 percent of sweetpotato acreage and less than 1 percent of payments, while Louisiana accounted for 21 percent of U.S. acreage and 9 percent of payments.

Disaster payments for the eleven NASS sweetpotato states averaged 2.2 percent of the total crop value over the six years (Table 7). Disaster payments as a percent of crop value were highest in New Jersey and lowest in California and Louisiana. The low payments in California reflect the relative absence of weather-related production perils. All of California's sweetpotatoes are irrigated so drought, consequently, is not a production peril. California's climate during the summer and fall is predictable, and the absence of rainfall during the growing and harvesting period essentially eliminates excessive moisture as a production peril.

Disaster assistance payments in Louisiana are relatively low when compared with North Carolina and other southeastern states. Horticulturalists in Louisiana and North Carolina suggest three possible explanations for the difference. First, the Beauregard variety, widely grown in Louisiana, is more resistant to souring than the Jewel variety, which is widely grown in North Carolina. Consequently, losses resulting from flooding in Louisiana are lower than in North Carolina. Second, the sweetpotato soils in North Carolina are more drought-prone than the soils in Louisiana. Sweetpotatoes are grown primarily on deep sandy soils in North Carolina, which dry out more quickly than the clay loam soils on which Louisiana sweetpotatoes are grown. Third, Louisiana may have a more uniform rainfall during the growing season than in North Carolina (Cannon, Wilson).

## Sweetpotato Insurance Implementation Issues

### Setting Reference Prices

FCIC provides a reference price (price election) for the insured crop which becomes the basis for assigning value to yield losses. The insured grower elects a price guarantee, normally between 30 and 100 percent of the reference price. The reference price needs to be high enough to provide reasonable protection for insuring farmers, but not so high that it provides an incentive for crop failure (moral hazard).

Table 6--Disaster assistance payments for sweetpotatoes (fresh and processed), 1988-93

| State | Average sweetpotato harvested acreage, 1988-93 | Share of U.S. acreage | Total sweetpotato disaster payments, 1988-93 | Share of U.S. sweetpotato disaster payments |
|---|---|---|---|---|
| | --Acres-- | --Percent-- | Million --Dollars-- | --Percent-- |
| Alabama | 4,483 | 5.4 | 1.219 | 5.6 |
| Arkansas | NR | NR | 0.930 | 4.2 |
| California | 8,217 | 9.9 | 0.087 | 0.8 |
| Georgia | 3,967 | 4.8 | 1.173 | 5.4 |
| Louisiana | 17,417 | 20.9 | 1.949 | 8.9 |
| Mississippi | 3,833 | 4.6 | 0.981 | 4.5 |
| New Jersey | 1,950 | 2.3 | 1.581 | 7.2 |
| North Carolina | 33,000 | 39.6 | 10.285 | 46.9 |
| South Carolina | 2,683 | 3.2 | 0.805 | 3.7 |
| Tennessee | 700 | 0.8 | 0.352 | 1.6 |
| Texas | 6,267 | 7.5 | 1.883 | 8.6 |
| U.S. | 83,350 | 100 | 21.926 | 100 |

NR = not reported.

Sources: USDA, NASS and ASCS data files, compiled by the General Accounting Office.

Table 7-- Sweetpotatoes: Crop value and disaster assistance, selected states, 1988-93

| State | Total crop value | Total disaster payments | Disaster payments, percent of crop value |
|---|---|---|---|
| | --------$1,000------ | | --Percent-- |
| Alabama | 50,296 | 1,219 | 2.4 |
| California | 186,204 | 87 | 0.0 [1] |
| Georgia | 44,250 | 1,173 | 2.7 |
| Louisiana | 170,656 | 1,949 | 1.1 |
| Maryland | 6,535 | 110 | 1.7 |
| Mississippi | 31,594 | 981 | 3.1 |
| New Jersey | 19,501 | 1,581 | 8.1 |
| North Carolina | 301,477 | 10,285 | 3.4 |
| South Carolina | 21,130 | 805 | 3.8 |
| Texas | 63,986 | 1,883 | 2.9 |
| Virginia | 5,640 | 47 | 0.8 |
| Eleven states | 901,269 | 20,120 | 2.2 |

[1] Less than 0.05 percent.

Sources: USDA, NASS and ASCS data files, compiled by the General Accounting Office.

Indemnity payments should be computed in a way that equitably compensates growers for the larger financial injury associated with a crop loss that becomes apparent only after the sweetpotatoes were placed in storage while not overcompensating growers for the smaller injury from a loss occurring prior to harvest. Because of harvesting expenses, a grower's financial loss for sweetpotatoes held in storage is likely to be larger than for a crop failure occurring prior to harvest. One way to accomplish this dual objective may be to provide for both an "in-field" price election for losses occurring prior to harvest and a "harvested" price election for losses occurring after harvest. The in-field price is similar to the "on-tree" prices which are used as a reference price for crop insurance for tree crops.

The in-field price election would apply when a crop failure became apparent prior to harvest and the marketable yield was so low as to not justify harvesting. In such situations, the grower does not incur harvesting expenses and the financial injury is smaller than if a loss occurs after harvesting costs have been incurred. Variable harvesting and storage expenses account for a relatively large share of total costs (perhaps as much as 50 percent). Computing an indemnity for a preharvest loss on a postharvest price election could provide a payment larger than an actual financial loss.

There are two approaches to arrive at an "in-field" reference price. One is to deduct the estimated harvesting costs from a market price. The second is to estimate cost of production for growing the crop. The market price here refers to the grower price and not the retail price. The market price approach calculates the loss based on the potential market loss while the cost of production approach is based on the actual dollar amount spent on production.

**Actual Production History**

The actual production history (APH) for insured farmers is established from their production records over the past 4-10 years. Previous production records may provide a better basis for establishing a production history for sweetpotatoes than for perishable commodities such as lettuce and celery. With lettuce and celery, a grower may salvage a larger yield per acre during periods of higher market prices than during periods of lower prices. With sweetpotatoes, on the other hand, a grower usually harvests the entire field regardless of the level of current prices.

In some instances, a grower may abandon a field of sweetpotatoes. This occurs when the expected value of the crop is less than the variable harvesting and marketing costs. Such a situation may occur due to a combination of a low expected price and a poor yield.

**Estimating "Appraised Production"**

Appraised production for sweetpotatoes could be estimated in a similar manner to that used by the USDA in its objective yield survey for potatoes (USDA, NASS). The procedure consists of harvesting a sample of small plots within the field and expanding the yield obtained therefrom to a per-acre equivalent.

**Insuring Price Risks**

There is less intra-seasonal market price variability for sweetpotatoes than for more perishable commodities such as lettuce and celery. With the more perishable vegetables, the market quantity depends on current production and small changes in current supplies cause wide price swings resulting in substantial price variability within the season. Sweetpotatoes, on the other hand, can be stored for a number of months, and the effects of production variability are spread throughout the season to a much greater degree than with perishable commodities.

Nevertheless, market prices were cited as the primary source of risk in sweetpotato growing by a number of sources. Growers, especially in California where the predictable summer climate and the universal use of irrigation minimize weather-related risks, report they can manage production risks by following prudent management practices and that market risk is their greatest concern. To make crop insurance attractive to sweetpotato growers, especially in California where natural risks are at a minimum, a policy may have to contain an element of protection against the risks of low market prices. A revenue insurance plan may provide such protection.

With a revenue insurance plan, sweetpotato growers could insure against income falling below some guaranteed minimum, regardless of whether the cause was low yields, low prices, or a combination of both.

**Moral Hazard**

There are a number of opportunities for a sweetpotato grower to follow management practices that increase the risk of incurring a crop loss. Sometimes, growers transplant sweetpotatoes into the field before a prudent "earliest planting date" in the hope of harvesting a part of the crop in time to receive a premium price which frequently accompanies the summer market. Planting early, however, increases the risk that a late frost or cold snap will damage the new plants. In a similar manner, growers may plant after the latest recommended planting date for an area, increasing the chances of damage to the sweetpotato crop from an early fall freeze.

**Demand for Insurance**

FCIC has received fourteen requests for a sweetpotato policy since 1989--many of which were from varied production areas. FCIC has received four requests for a sweetpotato policy from growers in California, five from North Carolina, three from Texas, and two from Tennessee. However, our assessment is that the demand for a potential sweetpotato policy is likely greater in the South and East (Alabama, North Carolina, Louisiana, etc.) than in California.

## References


Alvernaz, Joe. California Sweet Potato Growers Association. Livingston, California. Personal Communication. July 1994.

Bateman, Kenneth. Director. Johnson County Cooperative Extension Service. Johnson County, North Carolina. Personal Communication. July 1994.

Boozer, Bobbie. Cooperative Extension Service. Chilton County, Alabama. Personal Communication. June 1994.

Boswell, William. Cooperative Extension Service. Cullman County, Alabama. Personal Communication. June 1994.

California Department of Food and Agriculture. *California Agriculture Statistical Review, 1992*. Sacramento, California. July 1993.

California Agriculture Statistics Service. *County Agricultural Commissioners' Annual Reports*. 1980-1992. Department of Food and Agriculture. Sacramento, California.

Charney, Patricia and R.S. Seelig. *Fruit & Vegetable Pointers--Sweetpotatoes*. United Fresh Fruit and Vegetable Association. Washington D.C. February 1967.

Cannon, J.M. Extension Horticulturalist. Louisiana Cooperative Extension Service. Personal Communication. June 1994.

Duplechain, L.J. Executive Secretary. Louisiana Sweetpotato Commission. Personal Communication. July 1994.

Faircloth, Hilda. Program Assistant. North Carolina Agricultural Stabilization and Conservation Service. Samson County, North Carolina. Personal Communication. July 1994.

Forbes, David. Assistant Chief. Georgia Agricultural Stabilization and Conservation Service. Personal Communication. July 1994.

"Fresh Trends, 1988." *The Packer*. Vance Publishing, 1989. (As quoted in the *Vegetables and Specialties Situation and Outlook Report*. March 1989.)

George, P. S. and G. A. King. *Consumer Demand for Food Commodities in the United States with Projections 1980*. Giannini Foundation Monograph No. 26. March 1976.

Glow, Bonnie. Chief Program Assistant. Georgia Agricultural Stabilization and Conservation Service. Colquitt County, Georgia. Personal Communication. July 1994.

Granberry, Darbie M. and Wayne J. McLaurin. *Sweetpotato Commercial Vegetable Production*. Cooperative Extension Service. University of Georgia College of Agriculture. Athens, Georgia. No date.

Hinson, Roger. Department of Agricultural Economics. Louisiana State University. Baton Rouge. Unpublished crop budget. June 1994.

Kelley, Melba. Alabama Agricultural Stabilization and Conservation Service, Cullman County, Alabama. Personal Communication. July 1994.

Mizelle, William O. Jr. Extension Agricultural Economist. Georgia Cooperative Extension Service. University of Georgia. Athens, Georgia. Personal Communication. May 1994.

Mizelle, William O. Jr. Unpublished crop budget. June 1994.

New Jersey Agricultural Statistics. *New Jersey Agriculture 1992.* issued cooperatively by the New Jersey Department of Agriculture and the U.S. Dept. of Agriculture. No date.

Nonnecke, Ib Libner. *Vegetable Production*. Van Nostrand Reinhold: New York. 1989.

North Carolina Agricultural Statistics Service. *North Carolina Agricultural Statistics 1993.* Issued cooperatively by the North Carolina Department of Agriculture and the U. S. Dept. of Agriculture. 1993.

Post, Diane. Sales manager. California Sweet Potato Growers Association. Livingston, California. Personal Communication. July 1994.

Scheuerman, Bob. *Sweetpotatoes*. Unpublished information. Cooperative Extension Service. Merced County, California. No date.

Schultheis, John. Extension horticulturalist. North Carolina State University. Personal Communication. June 1994.

Riley, Tracy. Program Assistant for Disaster Assistance. Agricultural Stabilization and Conservation Service. Cumberland County, New Jersey. Personal Communication. July 1994.

Tunnell, Ed. Extension Sweetpotato Specialist. Baldwin County, Alabama. Personal Communication. June 1994.

U.S. Department of Agriculture. Agricultural Marketing Service. Unpublished price data.

U.S. Department of Agriculture. Agricultural Research Service. *Sweetpotato Culture and Diseases*. Agriculture Handbook No. 388. 1971.

U.S. Department of Agriculture. Agricultural Stabilization and Conservation Service. Disaster Assistance Data Files, 1988-93. Compiled by the General Accounting Office.

U.S. Department of Agriculture. Economic Research Service. *Vegetables and Specialties Situation and Outlook*. Various issues.

U.S. Department of Agriculture. National Agricultural Statistics Service. *Crop Production*. Annual Summaries.

U.S. Department of Agriculture. *1993 Potato Objective Yield Survey Interviewer's Manual*. May 1993.

U.S. Department of Agriculture. Statistical Reporting Service. *Usual Planting and Harvesting Dates for Fresh Market and Processing Vegetables*. Agricultural Handbook No. 507. February 1977.

U.S. Department of Commerce. Census of Agriculture, 1987. (Including special runs requested by USDA/ERS.)

VanVranken, Rick. Cooperative Extension Agent. Atlantic County, New Jersey. Personal Communication. July 1994.

Walters, Vic. County Executive Director. Tift County ASCS office. Tift County, Georgia. Personal Communication. July 1994.

Williams, Louis and James Dangler. *1992 Budgets for Vegetable Crops in Alabama*. AECBUD 1-4. Department of Agricultural Economics and Rural Sociology. Auburn University. January 1992.

Wilson, L. George. Extension horticulturalist. North Carolina State University. Personal Communication. July 1994.

Wilson, L. George, and Charles W. Averre. *Growing and Marketing Quality Sweet Potatoes*. North Carolina Agricultural Extension Service. North Carolina State University at Raleigh. January 1989.

Yagi, George. Treasurer (and retired grower). Sweetpotato Council of California. Livingston, California. Personal Communication. July 1994.

Yeargin, Billy. Executive Director. North Carolina Sweetpotato Commission. Personal Communication. July 1994.