# Fresh-Market Snap Beans: An Economic Assessment of the Feasibility of Providing Multiple-Peril Crop Insurance

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## Executive Summary

Snap bean (*Phaseolus vulgaris* of the legume family, Leguminosae) is an annual, warm-season crop grown primarily for its young, edible, fleshy pods. Snap beans are often referred to as green beans and wax beans (beans with edible yellow pods), or sometimes called “string” beans. There are three general types of snap beans grown in the United States--bush beans, pole beans, and half-runner varieties. All three types are annuals and grown from seed. Commercial snap bean production consists mainly of bush beans and pole beans.

Snap beans are grown widely across the United States, and are marketed either fresh or processed (canned and frozen). Fresh-market snap bean production is dominated by the southern states, especially by Florida and Georgia. California and New York are also leading states in fresh-market snap bean production. Wisconsin, Oregon, and Michigan, on the other hand, lead the country in snap bean production for processing.

Fresh-market snap bean production is estimated to reach 409 million pounds in 1995, about unchanged from 1994. Production has increased annually from 1990 through 1993, due partly to increased acreage. In 1994, production declined fractionally from a year ago, due partly to reduced acreage. Fresh-market snap bean output in 1994 was valued at $150.7 million.

A majority of the snap beans produced in the United States is for processing. According to USDA's National Agricultural Statistics Service (NASS), 80 percent of total snap bean production in 1994 was grown for processing and 20 percent was grown for the fresh market. In terms of harvested acreage, only 27 percent was for the fresh market while the remaining share was for processing.

As a warm-season crop, snap beans thrive in a frost-free climate, with warm days and bright sunshine. However, it is difficult to grow snap beans in areas with hot, humid climates because of problems with diseases. The optimum mean temperature for good growth is 60EF to 70EF. Average temperatures above 80EF or below 50EF may result in slow growth.

Snap beans require a constant supply of moisture, particularly during the blossom and pod-set period. About an inch of water per week is required for successful production. Moisture stress during the blossom or pod-set period may cause blossom and pod drop, which results in reduced yields. Thirty-six percent of all farms with snap bean production in 1992 used irrigation, down 1 percent from 1987. Fifty-seven percent of the harvested acreage in 1992 was irrigated, up from 52 percent in 1987.

Snap beans can be hand harvested or machine harvested. Those harvested for the fresh market are usually hand-picked to minimize the risk of injuries to the bean pods. However, more and more hybrid varieties well-suited for mechanical handling are becoming available to growers. Snap beans grown for processing are generally harvested mechanically.

Frost and drought are major perils affecting snap beans. Snap bean plants are very sensitive to cold temperatures and will freeze from a slight frost. Snap beans are also sensitive to moisture stress, particularly during flowering and pod development. Moisture stress during flowering will most likely cause blossoms to fall off the plant and consequently result in a substantial decline in yields. Moisture deprivation during pod development can also lengthen the maturity period and result in small, shrivelled pods. Excess moisture can also result in low yields.

Beans, along with many vegetable crops, may be subject to many diseases during the growing cycle. Root rot, damping-off, and seed rots are major diseases of snap beans.

Proper crop rotations, field selection, sanitation, plant spacings, fertilization, irrigation, and the use of resistant varieties can reduce the risk of many diseases.

Disaster assistance payments for fresh-market snap bean losses totaled $20.6 million over the 1988-93 period. This total accounted for 61 percent of the total disaster payments made to snap bean growers, including payments made to growers of snap beans for processing. The largest payments were made in 1988, at $5.4 million, due mainly to a serious drought.

In terms of state ranking, eighty-one percent of total disaster payments for fresh-market snap bean losses during 1988 to 1993 were made to Tennessee (17 percent of the U.S. total), Georgia (16 percent of the U.S. total), Michigan, North Carolina, Florida, Alabama, Virginia, Texas, New Jersey, and South Carolina growers. Lack of moisture, very wet conditions, hail, and freeze were the widely-cited production perils during this period.

The demand for crop insurance for fresh-market snap beans appears to be strong in the southern states of Georgia, Tennessee, and North Carolina and in the North Central region, specifically in Michigan. These areas have collected large shares of U.S. disaster assistance payments for fresh-market snap bean losses between 1988 and 1993. In addition, unharvested fresh-market snap bean acreage during 1992 to 1994 averaged 20, 11, 3, and 9 percent of total planted acreage in Georgia, Tennessee, North Carolina, and Michigan, respectively. Unharvested acreage may indicate that crop losses have been significant.

Drought is a major production peril to snap bean production. Hence, based on areas with irrigation, New York and Tennessee growers will likely be interested in crop insurance because the majority of their production area has no access to irrigation. Based on disaster payments collected, the demand for crop insurance in New York, however, may not be as strong as in Tennessee.

Fresh-market snap bean producers from the western United States, particularly in California, will probably have less of an interest in crop insurance. There were no disaster payments for fresh-market snap bean losses in California between 1988 to 1993, even though the state represented an average of 8 percent of the nation’s harvested acreage. During 1992 to 1994, all of the planted acreage was harvested. Other western states such as Idaho, Utah, and Washington, each received only less than one percent of total disaster payments between 1988 and 1993.

# Fresh-Market Snap Beans: An Economic Assessment of the Feasibility of Providing Multiple-Peril Crop Insurance

## Introduction

Snap bean (*Phaseolus vulgaris* of the legume family, Leguminosae) is an annual, warm-season crop grown primarily for its young, edible, fleshy pods. Snap beans are often referred to as green beans and wax beans (beans with edible yellow pods), or sometimes called “string” beans. The stringiness of the beans, however, has largely been bred out (Seelig and Lockshin). Snap bean pods are generally 1/4 to 3/4 inch wide and 3 to 8 inches or more long, varying in cross-sectional shape from flat to oval, or nearly cylindrical (Seelig and Lockshin). The seeds are elongate or globose, about ½ inch long, and with varying shades from red, brown, black, white, to mottled.

There are three general types of snap beans grown in the United States--bush beans, pole beans, and half-runner varieties. All three types are annuals and grown from seed. Commercial snap bean production consists mainly of bush beans and pole beans.

Snap beans are grown widely across the United States, and are marketed either fresh or processed (canned and frozen). Fresh-market snap bean production is dominated by the southern states, especially by Florida and Georgia. California and New York are also leading states in fresh-market snap bean production. Wisconsin, Oregon, and Michigan, on the other hand, lead the country in snap bean production for processing.

This report examines those aspects of the U.S. snap bean industry that relate to the demand for crop insurance and the feasibility of developing a crop insurance policy for fresh-market snap beans.

## The Snap Bean Industry

### Farms Growing Snap Beans

According to the Census of Agriculture, 10,819 farms harvested snap beans (for fresh market and processing) from a total of 272,698 acres in 1992 (Table 1). The number of farms increased 12 percent from the 1987 census year but harvested acreage decreased about 6 percent. Wisconsin, New York,
Florida, Oregon, Michigan, Tennessee, Illinois, California, Georgia, and New Jersey accounted for 78 percent of the total area harvested.

Thirty-six percent of all farms with snap bean production in 1992 used irrigation, down 1 percent from 1987. Fifty-seven percent of the harvested acreage in 1992 was irrigated, up from 52 percent in 1987. The ten leading snap bean-producing states accounted for 84 percent of the irrigated acreage.

### Snap Bean Production: Fresh Market Versus Processed

A majority of the snap beans produced in the United States is for processing. According to USDA's National Agricultural Statistics Service (NASS), 80 percent of total snap bean production in 1994 was grown for processing and 20 percent was grown for the fresh-market (Table 2 and Table 3). In terms of harvested acreage, only 27 percent was for the fresh market while the remaining share was for processing. Output for the fresh

market accounted for 53 percent of the total value of U.S. snap bean production that year.

Table 1--Snap bean production, 1992 and 1987

| Geographic area | 1992 | | | | 1987 | | | |
|---|---|---|---|---|---|---|---|---|
| | Harvested | | Irrigated | | Harvested | | Irrigated | |
| | Farms | Acres | Farms | Acres | Farms | Acres | Farms | Acres |
| Alabama | 221 | 689 | 30 | 74 | 190 | 1,318 | 31 | 441 |
| Alaska | 10 | (D) | 8 | 1 | 3 | 1 | 2 | (D) |
| Arizona | 14 | 586 | 14 | 586 | 11 | 504 | 11 | 504 |
| Arkansas | 131 | 2,391 | 40 | 556 | 122 | 3,231 | 39 | 689 |
| California | 368 | 9,767 | 368 | 9,767 | 341 | 9,409 | 341 | 9,409 |
| Colorado | 76 | 363 | 76 | 363 | 62 | 434 | 62 | 434 |
| Connecticut | 141 | 709 | 21 | 26 | 105 | 1,263 | 23 | 50 |
| Delaware | 41 | 4,104 | 24 | 1,476 | 44 | 3,170 | 26 | 2,586 |
| Florida | 293 | 23,899 | 205 | 22,736 | 283 | 26,948 | 183 | 25,133 |
| Georgia | 370 | 8,680 | 149 | 7,088 | 266 | 4,434 | 107 | 3,840 |
| Hawaii | 136 | 180 | 88 | 149 | 152 | 330 | 112 | 288 |
| Idaho | 71 | 2,296 | 71 | 2,296 | 95 | 3,742 | 95 | 3,742 |
| Illinois | 230 | 10,305 | 115 | 9,207 | 187 | 8,010 | 75 | 4,281 |
| Indiana | 212 | 2,252 | 66 | 1,368 | 205 | 2,490 | 41 | 936 |
| Iowa | 158 | 620 | 37 | 506 | 80 | 104 | 13 | 10 |
| Kansas | 64 | 115 | 22 | 54 | 44 | 84 | 18 | 34 |
| Kentucky | 295 | 289 | 36 | 51 | 216 | 294 | 25 | 58 |
| Louisiana | 147 | 214 | 43 | 32 | 127 | 161 | 39 | 73 |
| Maine | 171 | 148 | 35 | 42 | 132 | 127 | 22 | 23 |
| Maryland | 283 | 4,892 | 71 | 1,390 | 271 | 5,682 | 71 | 1,173 |
| Massachusetts | 220 | 357 | 77 | 80 | 202 | 394 | 78 | 124 |
| Michigan | 549 | 19,515 | 215 | 10,871 | 510 | 21,198 | 154 | 8,557 |
| Minnesota | 167 | 6,240 | 24 | 413 | 182 | 5,398 | 82 | 2,764 |
| Mississippi | 220 | 1,071 | 37 | 744 | 104 | 931 | 18 | 468 |
| Missouri | 218 | 1,141 | 76 | 88 | 125 | 1,141 | 40 | 192 |
| Montana | 18 | 6 | 18 | 6 | 11 | 6 | 11 | 6 |
| Nebraska | 28 | 48 | 17 | 42 | 21 | 20 | 7 | 4 |
| Nevada | 3 | (D) | 3 | (D) | (NA) | (NA) | (NA) | (NA) |
| New Hampshire | 104 | 86 | 28 | 31 | 70 | 82 | 23 | 33 |
| New Jersey | 341 | 7,014 | 126 | 5,062 | 358 | 10,400 | 150 | 7,292 |
| New Mexico | 74 | 1,434 | 74 | 1,434 | 32 | 511 | 32 | 511 |
| New York | 572 | 23,933 | 119 | 399 | 529 | 31,963 | 136 | 973 |
| North Carolina | 479 | 3,411 | 105 | 1,214 | 473 | 2,185 | 131 | 578 |
| North Dakota | 20 | 5 | 11 | (D) | 6 | 1 | 2 | (D) |
| Ohio | 399 | 1,702 | 54 | 724 | 344 | 1,621 | 59 | 408 |
| Oklahoma | 102 | 3,173 | 34 | 1,261 | 79 | 2,643 | 25 | 694 |
| Oregon | 420 | 23,304 | 420 | 23,304 | 401 | 23,197 | 401 | 23,197 |
| Pennsylvania | 596 | 5,739 | 95 | 410 | 605 | 6,516 | 79 | 166 |
| Rhode Island | 34 | 93 | 9 | 2 | 21 | 57 | 6 | (D) |
| South Carolina | 226 | 2,561 | 41 | 974 | 168 | 2,069 | 45 | 745 |
| South Dakota | 8 | 7 | 3 | (D) | 12 | 7 | 11 | 4 |
| Tennessee | 355 | 11,512 | 25 | 342 | 284 | 8,565 | 32 | 276 |
| Texas | 479 | 5,229 | 191 | 3,908 | 462 | 3,580 | 195 | 1,872 |
| Utah | 68 | 2,198 | 68 | 2,198 | 82 | 2,012 | 82 | 2,012 |
| Vermont | 72 | 72 | 13 | 4 | 48 | 33 | 12 | 8 |
| Virginia | 340 | 4,743 | 87 | 1,492 | 301 | 5,136 | 100 | 2,620 |
| Washington | 143 | 1,773 | 117 | 1,270 | 123 | 1,482 | 92 | 1,080 |
| West Virginia | 152 | 165 | 19 | 14 | 131 | 185 | 7 | 5 |
| Wisconsin | 977 | 73,666 | 258 | 40,182 | 1,016 | 86,144 | 252 | 43,036 |
| Wyoming | 3 | (D) | 3 | (D) | 3 | (D) | 3 | (D) |
| United States | 10,819 | 272,698 | 3,886 | 154,241 | 9,640 | 289,213 | 3,602 | 151,367 |

(NA)= Not Available
(D) = Data are not published to avoid disclosure, but are included in U.S. totals.
Source: 1992 Census of Agriculture.

Table 2--Snap beans for fresh market: Area planted and harvested, yield per acre, production, and value of production, by State and United States, 1993-94

| State | 1994 Area planted | 1994 Area harvested | 1994 Yield per acre | 1994 Production | 1994 Value |
|---|---|---|---|---|---|
| | Acres | | Cwt | 1,000 Cwt | 1,000 Dollars |
| California | 7,500 | 7,500 | 70 | 525 | 30,030 |
| Florida | 26,900 | 23,100 | 51 | 1,178 | 52,185 |
| Georgia | 18,000 | 14,000 | 41 | 574 | 16,072 |
| Hawaii | 80 | 80 | 40 | 3 | 300 |
| Maryland | 2,500 | 2,400 | 28 | 67 | 2,144 |
| Michigan | 2,200 | 2,000 | 50 | 100 | 2,380 |
| New Jersey | 4,200 | 4,100 | 30 | 123 | 4,182 |
| New York | 5,200 | 4,600 | 105 | 483 | 13,572 |
| North Carolina | 7,300 | 7,100 | 35 | 249 | 7,221 |
| Ohio | 2,000 | 1,800 | 58 | 104 | 2,839 |
| South Carolina | 2,700 | 2,300 | 26 | 60 | 2,310 |
| Tennessee | 9,900 | 8,800 | 46 | 405 | 11,583 |
| Virginia | 5,200 | 5,100 | 44 | 224 | 5,869 |
| United States | 93,680 | 82,880 | 49 | 4,095 | 150,687 |

| State | 1993 Area planted | 1993 Area harvested | 1993 Yield per acre | 1993 Production | 1993 Value |
|---|---|---|---|---|---|
| | Acres | | Cwt | 1,000 Cwt | 1,000 Dollars |
| California | 7,300 | 7,300 | 80 | 584 | 29,142 |
| Florida | 31,500 | 29,600 | 51 | 1,510 | 70,517 |
| Georgia | 18,000 | 13,000 | 40 | 520 | 13,000 |
| Hawaii | 80 | 80 | 50 | 4 | 362 |
| Maryland | 2,600 | 2,400 | 22 | 53 | 1,749 |
| Michigan | 2,200 | 2,100 | 40 | 84 | 2,436 |
| New Jersey | 5,400 | 4,700 | 52 | 244 | 6,759 |
| New York | 4,200 | 4,100 | 75 | 308 | 8,840 |
| North Carolina | 7,300 | 7,000 | 32 | 224 | 5,824 |
| Ohio | 1,600 | 1,400 | 44 | 62 | 2,164 |
| South Carolina | 1,600 | 1,300 | 23 | 30 | 1,140 |
| Tennessee | 9,900 | 9,300 | 37 | 344 | 8,359 |
| Virginia | 5,400 | 5,000 | 27 | 135 | 3,213 |
| United States | 97,080 | 87,280 | 47 | 4,102 | 153,505 |

Source: USDA, National Agricultural Statistics Service.

Table 3--Snap bean for processing: Area planted and harvested, yield per acre, production, and value of production, by State and United States, 1993-94

| State | 1994 Area planted | Area harvested | Yield per acre | Production | Value |
|---|---|---|---|---|---|
| | Acres | | Tons | | 1,000 Dollars |
| Florida | 3,100 | 2,900 | 2.20 | 6,380 | 1,569 |
| Illinois | 15,800 | 14,000 | 3.40 | 47,600 | 10,472 |
| Indiana | 3,600 | 3,600 | 2.98 | 10,730 | 2,007 |
| Michigan | 23,000 | 22,000 | 3.50 | 77,000 | 11,319 |
| New York | 18,000 | 17,300 | 3.52 | 60,900 | 10,414 |
| Oregon | 23,200 | 23,000 | 6.40 | 147,200 | 24,877 |
| Pennsylvania | 7,000 | 6,900 | 2.96 | 20,420 | 4,125 |
| Wisconsin | 84,800 | 79,500 | 3.60 | 286,200 | 40,068 |
| Other States 1/ | 52,100 | 49,700 | 3.01 | 149,360 | 29,006 |
| United States | 230,600 | 218,900 | 3.68 | 805,790 | 133,857 |
| Canning | 156,550 | 147,250 | 3.58 | 527,010 | 86,765 |
| Freezing | 74,050 | 71,650 | 3.89 | 278,780 | 47,092 |

| State | 1993 Area planted | Area harvested | Yield per acre | Production | Value |
|---|---|---|---|---|---|
| | Acres | | Tons | | 1,000 Dollars |
| Florida | | | | | |
| Illinois | 12,700 | 12,500 | 3.28 | 41,000 | 8,815 |
| Indiana | 2,400 | 2,400 | 3.95 | 9,480 | 1,678 |
| Michigan | 23,000 | 22,000 | 3.20 | 70,400 | 12,672 |
| New York | 18,300 | 16,900 | 3.22 | 54,080 | 10,762 |
| Oregon | 22,100 | 22,100 | 5.53 | 122,210 | 22,975 |
| Pennsylvania | 6,600 | 6,500 | 2.21 | 14,370 | 3,377 |
| Tennessee | 4,500 | 3,900 | 1.70 | 6,630 | 1,545 |
| Wisconsin | 75,200 | 73,900 | 3.19 | 235,740 | 34,182 |
| Other States 1/ | 35,980 | 33,330 | 2.94 | 98,120 | 20,296 |
| United States | 200,780 | 193,530 | 3.37 | 652,030 | 116,302 |
| Canning | 139,700 | 134,070 | 3.20 | 429,190 | 75,211 |
| Freezing | 61,080 | 59,460 | 3.75 | 222,840 | 41,091 |

1/ In 1993, includes Arizona, Arkansas, California, Delaware, Florida, Georgia, Idaho, Iowa, Maryland, Minnesota, Missouri, New Jersey, North Carolina, Ohio, Oklahoma, South Carolina, Texas, Utah, Virginia, and Washington. In 1994, includes Arizona, Arkansas, California, Delaware, Georgia, Idaho, Maryland, Minnesota, Missouri, New Jersey, North Carolina, Ohio, Oklahoma, South Carolina, Tennessee, Texas, Utah, Virginia, and Washington.

Source: USDA, National Agricultural Statistics Service.

Contract production is a major portion of the total U.S. snap bean output for processing. In 1994, ninety-five percent of the snap bean output for processing was grown under contract with processors, up from 88 percent in 1993 (NASS). Snap beans produced under contract totaled 766,730 tons in 1994, up 34 percent from 1993 while snap bean output sold in the open market totaled 3,260 tons, down 51 percent. The increase in contract production partly reflects an increase in harvested acreage. In 1994, the area harvested to processing snap beans under contract totaled 207,500 acres, up 24 percent from a year ago. For snap beans sold in the open market, harvested area totaled 11,400 acres, down 57 percent from the prior year.

**Income Diversification**

Most farms growing fresh-market snap beans in the United States also produce other crops. Industry sources indicate that crop rotation is a common practice among growers, with other vegetable crops, small grain crops, and cotton as examples of rotation crops. Additional income can be derived from these crops, and therefore, the price and yield risks associated with specializing in a single crop are reduced.

## The Fresh Snap Bean Market

**Supply**

Fresh-market snap bean production is estimated to reach 409 million pounds in 1995, about unchanged from 1994 (Table 4). Production has increased annually from 1990 through 1993, due partly to increased acreage. In 1994, production declined fractionally from a year ago, due partly to reduced acreage. Fresh-market snap bean output in 1994 was valued at $150.7 million.

Based on USDA’s National Agricultural Statistics Service (NASS) data, the southern states produced 71 percent of the average fresh snap bean output during 1992-94, with Florida and Georgia accounting for more than half of the region’s average output. California is the major producer of fresh-market snap beans in the western United States, accounting for 14 percent of the U.S. average during 1992 through 1994. In the northeast, New Jersey and New York (in combination) accounted for 12 percent of the average total, while in the north central region, Michigan and Ohio (in combination) accounted for 3 percent.

Snap beans are available all year, with heavy shipments from January through June and from October through December (Table 5). Florida is the largest shipper of snap beans for the fresh market. Florida’s growers usually ship during the winter and fall season. Their harvest dates usually begin around April 15, are most active from November 1 through May 1, and end around June 15 (Florida Agricultural Statistics Service). Summer shipments (July-September) typically originate from Georgia, Maryland, Michigan, New York, and Virginia (Table 6). Fall production in the northern states is also an important source of fresh-market snap beans (Ware and McCollum).

U.S. imports of fresh snap beans have averaged nearly 6 percent of total domestic fresh supplies from 1992 through 1994 (Table 4). In 1995, imports are expected to reach 24 million pounds, 5.5 percent of total supplies. U.S. imports of fresh and frozen beans during 1994 came mainly from Mexico (55 percent) and Canada (30 percent).

**Demand**

Per capita use of fresh snap beans has remained steady at 1.5 pounds during 1992 to 1994, about the same as the levels consumed in the early 1970's. In general, consumption has declined between 1972 and 1992, reaching a low of 1.1 pounds per

Table 4--U.S. fresh snap beans: Supply, utilization, and price, 1970-95

| Year | Supply | | | Utilization | | | Season-average price | |
|---|---|---|---|---|---|---|---|---|
| | Production 1/ | Import 2/ | Total | Export 2/ | Total | Per capita use | Current dollars | Constant 1987 dollars |
| | Million pounds | | | | | Pounds | $/cwt | |
| 1970 | 312.0 | 12.5 | 324.5 | 7.0 | 317.5 | 1.5 | 13.10 | 37.32 |
| 1971 | 309.6 | 12.3 | 321.9 | 7.8 | 314.1 | 1.5 | 14.40 | 38.92 |
| 1972 | 313.7 | 18.0 | 331.7 | 11.1 | 320.5 | 1.5 | 14.80 | 38.05 |
| 1973 | 303.3 | 14.9 | 318.2 | 15.6 | 302.6 | 1.4 | 17.90 | 43.34 |
| 1974 | 292.0 | 15.7 | 307.7 | 16.6 | 291.1 | 1.4 | 18.60 | 41.43 |
| 1975 | 317.9 | 10.5 | 328.4 | 16.0 | 312.4 | 1.4 | 19.60 | 39.84 |
| 1976 | 318.3 | 12.4 | 330.7 | 15.0 | 315.7 | 1.4 | 19.90 | 38.05 |
| 1977 | 296.3 | 17.5 | 313.8 | 17.6 | 296.2 | 1.3 | 21.10 | 37.75 |
| 1978 | 292.1 | 26.1 | 318.2 | 31.2 | 287.0 | 1.3 | 26.00 | 43.12 |
| 1979 | 292.8 | 24.4 | 317.2 | 23.1 | 294.1 | 1.3 | 27.10 | 41.31 |
| 1980 | 304.4 | 25.4 | 329.8 | 30.4 | 299.4 | 1.3 | 27.30 | 38.08 |
| 1981 | 292.6 | 19.9 | 312.5 | 23.4 | 289.0 | 1.3 | 29.70 | 37.64 |
| 1982 | 297.3 | 16.2 | 313.5 | 21.2 | 292.4 | 1.3 | -- | -- |
| 1983 | 288.2 | 23.6 | 311.8 | 21.6 | 290.2 | 1.2 | -- | -- |
| 1984 | 310.7 | 25.7 | 336.4 | 19.3 | 317.1 | 1.3 | -- | -- |
| 1985 | 298.1 | 25.4 | 323.5 | 23.2 | 300.3 | 1.3 | -- | -- |
| 1986 | 299.1 | 32.8 | 331.9 | 30.1 | 301.7 | 1.3 | -- | -- |
| 1987 | 295.7 | 27.0 | 322.7 | 27.7 | 295.0 | 1.2 | -- | -- |
| 1988 | 296.2 | 30.6 | 326.8 | 35.6 | 291.2 | 1.2 | -- | -- |
| 1989 | 293.8 | 30.8 | 324.6 | 29.3 | 295.3 | 1.2 | -- | -- |
| 1990 | 273.8 | 30.0 | 303.8 | 36.5 | 267.3 | 1.1 | -- | -- |
| 1991 | 300.0 | 30.2 | 330.2 | 40.1 | 290.1 | 1.1 | -- | -- |
| 1992 | 393.2 | 23.4 | 416.6 | 44.8 | 371.8 | 1.5 | 35.20 | 29.11 |
| 1993 | 410.2 | 25.3 | 435.5 | 41.2 | 394.4 | 1.5 | 37.40 | 30.28 |
| 1994 | 409.5 | 23.3 | 432.8 | 35.7 | 397.2 | 1.5 | 36.80 | 29.14 |
| 1995 f | 409.0 | 24.0 | 433.0 | 40.0 | 393.0 | 1.5 | -- | -- |

-- = Not available. f = ERS forecast.
1/ Source: National Agricultural Statistics Services, USDA. After 1981, production data was estimated by ERS based on available State reports.
2/ Source: Bureau of the Census, U.S. Dept. of Commerce. From 1978-89, U.S. exports were adjusted using Canadian import data.

Source: USDA, Economic Research Service.

Table 5--U.S. monthly bean shipments, by origin, 1994

| Origin | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1,000 cwt | | | | | | | | | | | | |
| By available truck: | | | | | | | | | | | | | |
| Arizona | -- | -- | 1 | -- | -- | -- | -- | -- | -- | -- | -- | -- | 1 |
| California, South | -- | -- | -- | 6 | 1 | -- | -- | -- | -- | -- | -- | -- | 7 |
| Florida | 104 | 114 | 142 | 130 | 95 | 1 | -- | -- | -- | 10 | 89 | 90 | 775 |
| Georgia | -- | -- | -- | 3 | 146 | 73 | -- | -- | 20 | 77 | 25 | -- | 344 |
| North Carolina | -- | -- | -- | -- | -- | 17 | 10 | 15 | 10 | -- | -- | -- | 52 |
| U.S. Total | 104 | 114 | 143 | 139 | 242 | 91 | 10 | 15 | 30 | 87 | 114 | 90 | 1179 |

Source: USDA, Agricultural Marketing Service.

Table 6--Area harvested to fresh-market snap beans, by season, selected States

| Year and State | Winter (January-March) | Spring (April-June) | Summer (July-September) | Fall (October-December) |
|---|---|---|---|---|
| | Acres | | | |
| 1994: | | | | |
| Florida | 10,200 | 8,000 | | 4,900 |
| Georgia | | 5,100 | 2,400 | 6,500 |
| Maryland 1/ | | | 2,000 | 400 |
| Michigan 2/ | | | 2,000 | |
| New Jersey 3/ | | 1,000 | | 3,100 |
| New York 4/ | | | 4,600 | |
| South Carolina 5/ | | 1,600 | | 700 |
| Virginia 6/ | | | 2,200 | 2,900 |
| Total | 10,200 | 15,700 | 13,200 | 15,600 |
| 1993: | | | | |
| Florida | 10,700 | 11,600 | | 7,300 |
| Georgia | | 6,000 | 2,000 | 5,000 |
| Maryland 1/ | | | 2,000 | 400 |
| Michigan 2/ | | | 2,100 | |
| New Jersey 3/ | | 1,200 | | 3,500 |
| New York 4/ | | | 4,100 | |
| South Carolina 5/ | | 700 | | 600 |
| Virginia 6/ | | | 2,100 | 2,900 |
| Total | 10,700 | 19,500 | 12,300 | 19,700 |
| 1992: | | | | |
| Florida | 8,500 | 14,700 | | 4,900 |
| Georgia | | 6,000 | 2,500 | 6,000 |
| Maryland 1/ | | | 2,000 | 400 |
| Michigan 2/ | | | 1,900 | |
| New Jersey 3/ | | 1,000 | | 3,500 |
| New York 4/ | | | 3,700 | |
| South Carolina 5/ | | 1,400 | | 1,100 |
| Virginia 6/ | | | 2,200 | 2,500 |
| Total | 8,500 | 23,100 | 12,300 | 18,400 |

1/ Usual harvest period for the fall season is October to November.
2/ Usual harvest period for the summer season is July to August.
3/ Usual harvest period for the spring season is June to July; for the fall season is August to October.
4/ Usual harvest period for the summer season is July to October.
5/ Usual harvest period for the spring season is May to August.
6/ Usual harvest period for the fall season is September to October.

Source: USDA, National Agricultural Statistics Service.

person in 1990 and 1991. Consumption is expected to remain at 1.5 pounds per person in 1995, unchanged from the year before.

Per capita fresh snap bean consumption accounted for an averaged of 20 percent of all snap beans consumed (including canned and frozen) during 1992 through 1994. This share has gone up from an average of 18 percent during 1980 to 1991.

U.S. fresh snap bean exports have averaged 11 percent of domestic production during 1990 through 1995, up from an average of 9 percent during the 1980's and 5 percent during the 1970's. The United States exported 35.7 million pounds of fresh snap beans in 1994, and is expected to export 40 million pounds in 1995 (Table 4). In value terms, 95 percent of the U.S. fresh snap bean exports were shipped to Canada in 1994. Mexico, Japan, the Netherlands, and Hong Kong were other markets.

**Prices**

USDA's National Agricultural Statistics Service (NASS) began publishing monthly estimates of prices received by U.S. farmers for fresh snap beans in January 1995. In addition, NASS has been reporting a season-average price (annual value per unit of production) for fresh-market snap beans. However, season average prices were not reported during 1982 to 1990. A season-average price is also available on an annual basis for the following states: California, Florida, Georgia, Maryland, Michigan, New Jersey, New York, North Carolina, Ohio, South Carolina, Tennessee, and Virginia.

Some State Department of Agriculture annual statistical reports provide a marketing year average price for fresh snap beans in their respective states, particularly in Florida, New York, and Tennessee. USDA's Agricultural Marketing Service (Fruit and Vegetable Division) collects representative weekly F.O.B. prices for round green type beans (in bushels, hampers, and crates) in Florida.

## Cultivation and Management Practices

**Land Preparation**

For successful germination, seedbeds should be well-prepared and free of any clods and debris. Previous crop residue should be shredded and turned under before seeding. If the beans are to be machine harvested, the soil should be of uniform type and prepared as smoothly as possible for a more efficient use of the bean harvester (Cook, et al.).

**Climate**

As a warm-season crop, snap beans thrive in a frost-free climate, with warm days and bright sunshine. However, it is difficult to grow snap beans in areas with hot, humid climates because of problems with diseases. The optimum mean temperature for good growth is 60EF to 70EF (Seelig and Lockshin). Average temperatures above 80EF or below 50EF may result in slow growth. Seedlings can also be injured when the air temperature drops to 50EF (Yamaguchi). Temperatures above 85EF may result in uneven pod maturity, and at temperatures above 90EF, pods may fail to set (Mullins). Air temperatures above 90EF during the pollination period may also cause reduced pollen production and slow growth (McLaurin, et al.).

**Soil Requirements**

Uniform maturity is a key factor to success in commercial snap bean production. To ensure uniform development, snap beans should be grown on soils that are uniform in fertility and soil type (Curwen, et al.).

Snap beans can be grown on a wide range of soils if properly managed. However, beans thrive best on well drained, fairly fertile, silt loam soils, containing considerable amounts of organic matter. Beans also produce best on slightly acidic (pH 5.5 to 6.5) soils.

Beans mature in a shorter time on relatively light soils than on heavy soils. Sandy loams are satisfactory but require more frequent irrigation than heavier soils. Good yields are seldom produced on very heavy soils (Ware and McCollum). In addition, soils with very high moisture and nitrogen content could delay maturity.

The optimum soil temperature for good seed germination is 60EF to 85EF. Lower soil temperatures could slow germination and increase chances of seed rot. Poor germination may also arise at temperatures below 50EF and above 95EF (Seelig and Lockshin).

**Varieties**

Snap bean plants are grouped into three general categories, namely, bush-type beans, pole beans, and half runners. Each category consists of several different varieties with varying sizes and shapes of pods (round or flat) and sometimes color (green or yellow). For example, bush-type beans could be further grouped into bush green pods and bush wax pods. Wax beans produce yellow pods.

Bush beans are non-climbing, short, erect plants, that are 1 or 2 feet tall. They are used for quick production (Splittstoesser). Successive plantings of bush beans every two weeks are needed to assure a continuous supply. The flowers of bush-types appear almost simultaneously and the pods mature uniformly.

Pole beans develop twinning vines, generally 5 to 8 feet tall, that should be supported by stakes or trellises. They grow slower than bush beans but produce more pods per plant, and only one planting is needed (Splittstoesser). The half-runner types are bushy plants that develop runners and take somewhat longer to mature than the bush-type snap bean plants (Shuler). There are only a few commercial plantings of half-runner types.

Sprite, Strike, Gator Green, Provider, Bush Blue Lake 47, Tendercrop, and Resistant Cherokee Wax are some examples of bush-type varieties. Dade, Stringless Blue Lake, and White Seeded Kentucky Wonder are examples of pole-type varieties. Sprite and Strike are both grown widely for the fresh market and produce generally rounded pods. Sprite is well-suited for mechanical harvesting. Strike produces high yields. Gator Green and Provider are also suited for commercial fresh-market production. Bush Blue Lake 47 and Tendercrop are well suited for processing, but are generally used for home gardens. Resistant Cherokee Wax is an example of a wax variety, while Mountaineer and State are half-runner varieties (Cook, et al.). Appendix A provides a more detailed description of several snap bean varieties.

**Planting**

All snap beans are grown from seeds. During planting, seeds should be handled carefully by selecting the right planter plates to fit the seed and by adjusting planter speeds to

minimize or avoid cracking of the seed coat. Seed cracks reduce seed germination and seedling vigor (Yamaguchi). Seeds obtained from a reputable source are usually guaranteed to be free of any seed-borne diseases, an important key in obtaining good stands and yields (McLaurin, et al.).

The seeds are drilled in rows spaced 14-20 inches apart. The number of seeds planted per foot of row may vary from three to nine seeds. Depending on soil conditions, seeds are planted from ½ to 2 inches below the soil surface. Shallow planting is recommended for cool and moist soils, while deeper planting is advised on dry and warm sandy soils (Curwen, et al.).

For pole beans, staking or trellising helps prevent pods from touching the ground surface and consequently from becoming injured. Trellising may be done by either tying the bean plants to overhead wires or by using poles. Trellises should be ready before the bean plants begin to run. The climbing tip of the vine may rot if it touches the soil, preventing it from climbing the trellis (McLaurin, et al.).

If overhead wires are used, seeds should be planted in the row at the rate of 3 to 5 seeds per foot of row. If poles are used, seeds should be planted in hills at the rate of two to four seeds per hill and at a depth of ½ to 3/4 inch in heavier soils and 1½ to two inches in lighter soils (McLaurin, et al.).

For overhead trellises, end posts should be spaced 20 feet apart in the row and extend 5½ to 6 feet above the ground (McLaurin, et al.). Each plant will climb a supporting string, tied around the base of the plant and up the overhead wire.

Since snap beans are a shallow-rooted crop (the majority of the plant’s roots are in the upper six inches of the soil), cultivating equipment should be set shallow enough to avoid any damage to the roots. The last cultivation should be done before the bloom stage to avoid injuries to the blossoms. The rows should be left as flat and level as possible, especially if the beans are to be mechanically harvested (McLaurin, et al.).

**Fertilization**

A crops’ response to fertilizers generally varies with soil type, climatic conditions, and cultural practices. Plant nutrient requirements and rates of application will be best determined by a combination of soil test results, field experience, and knowledge of specific crop requirements.

Snap beans generally require adequate levels of all nutrients, particularly if grown on very light soils (Cook, et al.). However, excessive amounts of fertilizers can be detrimental to the crop. For example, excessive nitrogen at planting time increases the concentration of salt in the soil, which may cause seedling injury (Oregon State University Extension Service). For pole-type varieties, excessive nitrogen may also increase vine growth at the expense of pod production (Ware and McCollum). Excessive vine growth may also interfere with mechanical harvesting. Too much nitrogen may also result in more succulent beans that will not ship well (McLaurin, et al.).

**Irrigation**

Snap beans require a constant supply of moisture, particularly during the blossom and pod-set period. About an inch of water per week is required for successful production (Mullins). Moisture stress during the blossom or pod- set period may cause blossom and pod drop, which results in reduced yields.

Adequate moisture is also important at planting time to ensure good, uniform seed emergence. Excessive moisture, however, at any stage of growth, increases the plant's susceptibility to root rot infection, causes nutrients to leach out of the root zone, and results in excessive vine growth at the expense of pod development in pole beans. An effective irrigation program is recommended to ensure high yields, uniform maturity, and good-quality pods.

**Crop Rotation**

The grower should plan a three- to four-year rotation with other vegetable crops or small grain crops, excluding other legume crops. Pole beans should not follow related crops, such as peas and bush beans. Deep-rooted crops can be grown in rotation with beans. Alfalfa and rye are good companion crops. (McLaurin, et al.).

## Harvesting Practices

Snap beans can be hand harvested or machine harvested. Those harvested for the fresh market are usually hand-picked to minimize the risk of injuries to the bean pods. However, more and more hybrid varieties well-suited for mechanical handling are becoming available to growers. Snap beans grown for processing are generally harvested mechanically. The efficiency of harvesting machines varies with weather conditions, plant height and lodging, the incidence of weeds, proper harvester adjustment, and the skill of the harvester operator (Mullins).

Fresh-market snap bean quality and market value depend heavily on the time of picking and pod development. Fresh-market snap beans should be picked before the pods reach maturity--when the pods are nearly full size and the beans small (Ware and McCollum). Beans harvested beyond this stage will be tough, unattractive, and fibrous, and will not bring top price (McLaurin, et al.). Immature pods, on the other hand, wilt quickly after harvesting, especially in hot weather.

Harvesting wet beans is discouraged because it promotes the spread of certain diseases. Beans should be removed from the field as soon as they are harvested to prevent wilting. To maintain high quality, the beans should be carefully picked, avoiding any physical injuries to the pods and contact with the soil surface.

The number of days from planting to maturity varies with the bean variety and with weather conditions. In general, however, bush beans mature over a relatively shorter period than pole beans. Under optimum growing conditions, bush beans may be harvested in 55-60 days (McLaurin, et al.). Pole beans are harvested in 60 to 70 days from planting.

Frequent harvesting induces the plant to continue to produce new pods. Bush varieties usually produce three or four harvests (Splittstoesser). Pole types typically produce about five harvests, ranging from as few as three to as many as ten. About 3 to 5 days occur between harvests (Sanders and Davis).

Since a majority of processing snap beans are grown under contract with processors, the harvest schedules are usually designated by the processors. Harvest dates are usually timed when 60 to 80 percent of the beans reach sieve size No. 4 and under (sieve size No. 4 is over 21/64 to 24/64 inch, inclusive). The actual sieve size percentage, however, may vary depending on processor needs and the bean variety. Since prices paid for processing snap beans are based on sieve size, harvesting should be done when the

highest yield of the proper grade can be obtained, rather than the highest total yield (McLaurin, et al.).

## Grading, Packing, Storing, and Shipping Practices

Higher prices are usually paid for beans that have been sorted and graded. Hence, bean pickers are trained to discard beans that are discolored, broken, over-mature, or wilted. For machine harvested beans, the culling process begins as the beans are dumped onto conveyor belts. Some pickers, however, dump the beans on a table top to remove discards (McLaurin, et al.). This activity can be performed in the field or in the packing house.

Most fresh markets require that beans be packed in tall bushel hampers with lids, each containing about 30 pounds of beans, unless otherwise specified by the buyer. Other packaging means are 26-31 pound bushel wirebound crates or 20-30 pound cartons. Appendix B provides quality and packaging preferences in Georgia.

Beans are cooled immediately after packing to preserve quality and shelf-life, usually using the hydrocooling method. This method is preferred because the free moisture not only cools the beans rapidly, but also helps prevent wilting and shriveling.

Snap beans are transported in refrigerated trucks to retail markets to reduce the amount of soft rot (Ware and McCollum). Containers should be stacked to allow for adequate air circulation. Containers that are arranged close together will receive more heat that stimulates rotting. Growers using new hampers when transporting their produce usually can command a higher price for their product because of better appearance and minimal transport injuries to the product. Used hampers break down easily in transit, and result in an economic loss to the buyer (McLaurin, et al.).

Snap beans should be stored at 40EF to 45$^{o}$F with a relative humidity of 90 to 95 percent. Storage life is about seven days. Storing under high humidity is critical for moisture reduction, which imparts a plump appearance to the beans. Storing at temperatures above 45EF decreases storage life and promotes yellowing of the pod and the development of fiber. When storage temperatures reach 77EF, the beans remain at fair condition for only 4 to 5 days.

Chilling injury becomes a problem when beans are kept at temperatures below 41EF (32$^{o}$-37$^{o}$F) after 10-12 days (Yamaguchi). Chilled beans develop surface pitting and russeting a day or two after they are removed to warm temperatures for marketing (Oregon State University Extension Service). Sensitivity to chilling varies significantly among cultivars. Appendix B provides the storage requirements followed in Georgia.

U.S. standards for grades of snap beans consists of U.S. Fancy, U.S. #1, U.S. Combination, and U.S. #2. The U.S. Fancy grade pertains to beans of similar varietal characteristics, with reasonable and fairly uniform size, and that are well formed, bright, clean, fresh, young, tender, and firm. They also must be free from damage caused by leaves, leaf stems, other foreign matter, hail, disease, insects or mechanical or other damage. The U.S. #1 grade is similar to the standards set for U.S. Fancy, except it calls for beans with reasonable size, that are fairly well formed, fairly bright, fairly young and tender, and free from soft rot.

## Marketing Practices for Fresh-Market Snap Beans

Many large-volume growers of fresh-market snap beans sell directly to brokers who distribute to wholesale markets and large retail outlets. Some growers also sell directly to wholesalers and retailers, including supermarkets and chain restaurants. Some production, particularly from small-volume growers, is marketed locally through

farmers' markets, roadside stands, and pick-your-own operations, along with other fresh produce. Small growers may also sell directly to local retailers.

A large proportion of fresh-market snap beans grown in the southern states, especially in Florida and Georgia, are shipped to the Northeast and Midwest markets and to Canada. Refrigerated trucks are predominantly used in the distribution of fresh snap beans to the various markets.

Fresh-market snap beans are generally shipped by type of bean rather than by variety. Therefore, shipments will consists of round green beans (the most common), flat green beans, round or flat wax (yellow) beans, or round or flat green pole beans (Seelig and Lockshin).

## Costs of Production

Based on the sample costs presented in Table 7, the harvesting costs for fresh-market snap beans generally range from 40 percent to 80 percent of a grower's total production costs. Custom harvesting, as in the Tennessee example, appears to be relatively less expensive, accounting for 21 percent of total production costs. Detailed production budgets for each of the states shown are presented in Appendix C.

Harvesting costs are usually higher when the beans are hand-picked than when mechanically harvested. The significance of harvesting expenses can encourage moral hazard when insuring fresh-market snap beans. According to industry sources, some growers may abandon their crop during periods of very low fresh-market prices. Snap bean processors usually dictate the bean variety to grow, how they should be grown, and have specific requirements for bean maturity (affecting harvest dates) and sieve size. Hence, it is not very easy for fresh-market snap bean growers to divert their produce to the processing market.

## Production Perils

Similar to growers of other agricultural crops, snap bean producers confront poor weather, diseases, insects, and other pests. While crop losses due to unfavorable weather are often beyond the grower's control, problems associated with pests and diseases can often be controlled with prudent management practices.

### Excessive Moisture

Heavy rains can cause flooding. Flood damage to snap beans may range from stunting to plant death. Excessive rains during flowering and pod development may cause blossoms and pods to drop off (Seelig and Lockshin). Heavy rains may also delay seedbed preparation and planting, as well as leach fertilizers from the soil, affecting vine growth in low-lying areas. In addition, bean pods touching the wet soil surface when the humidity is high may be subject to tip rot (Mullins).

### Excessive Heat

Air temperatures above 90EF during the pollination period may cause reduced pollen production and slow growth (McLaurin, et al.). Poor pollination may cause unpollinated blooms to drop off and result in deformed pods. If a substantial number of blossoms drop, yields will be severely reduced due to a decline in the number of developing pods and an increase in grade outs. Harvest dates are also likely to be delayed due to slow

growth.  To increase blossom retention, growers should maintain adequate soil moisture and good leaf growth (McLaurin, et al.).

Table 7--Snap beans: Variable harvesting costs, selected states [1]

| State | Yield[2] | Variable harvest cost | Total cost | Variable harvest percent of total |
|---|---|---|---|---|
| | Bushels per acre | --------$/acre-------- | | Percent |
| California: | | | | |
| Hand-picked (Fresno County) | 650 | 1,784 | 3,527 | 51 |
| Florida: | | | | |
| Bush beans, Machine harvested (Dade County) | 200 | 1,324 | 2,817 | 47 |
| Georgia: | | | | |
| Hand-picked | 140 | 627 | 1,090 | 58 |
| Kentucky | | | | |
| Green beans, Machine harvested (Non-irrigated) | 200 | 425 | 863 | 49 |
| Hand-picked (Overhead irrigated) | 300 | 1,978 | 2,472 | 80 |
| Tennessee | | | | |
| (Custom harvesting) | 150 | 75 | 351 | 21 |

[1] Costs may not be comparable among states because budgets may be for different seasons and may not include the same cost items.

[2] Yields in California are in terms of boxes per acre where each box weighs 30 pounds. In Florida, yields are in terms of 30-pound bushels per acre. The other States only indicated the number of bushels per acre.

Sources: Agricultural Extension Service, University of Tennessee; Ilic; Isaacs, et al.; Smith and Taylor; Snyder; Westberry and Mizelle.

Sunscald may be a problem when bean plants are exposed to intense sunlight or high temperatures, especially following periods of high humidity and overcast skies (Davis, et al.). Symptoms appear as water-soaked spots on the upper surfaces of the leaves, stems, and pods that are exposed to the sun. No form of control is available.

**Excessive Cold, Frosts, and Freezes**

Snap bean plants are very sensitive to cold temperatures and will freeze from a slight frost (Seelig and Lockshin). Cool weather may also delay pod development. Appendix D provides a sample safe fall planting schedule based on an average frost date of November 23.

**Drought**

Snap beans are very sensitive to soil moisture stress, particularly during flowering and pod development (Yamaguchi). Moisture stress during flowering will most likely cause blossoms to fall off the plant and consequently result in a substantial decline in yields. Moisture deprivation during pod development can also lengthen the maturity period and result in small, shrivelled pods.

**Wind**

Sand that is blown by winds may scar young bean pods and consequently reduce yields due to grade outs. Strong winds can also cause rubbing injury to the leaves and pods as a result of swaying. To protect against such problems, growers plant rows in the direction of the prevailing winds to minimize swaying (Davis, et al.). Cold winds may cause yellowing of the vines, particularly in fields that are located in unprotected areas. Hot, dry winds may be very destructive to the delicate flowers of snap beans (Yamaguchi).

**Hail**

Hail storms may tear plant leaves as well as scar the bean pods. Scarring will not only affect the physical appearance of the pods, but will also serve as entry points (both on the scarred pods and the leaves) for disease pathogens. During the flowering stage, hail can also injure the blossoms and cause them to drop off, consequently leading to substantial yield reductions.

**Diseases**

Beans, along with many vegetable crops, may be subject to many diseases during the growing cycle. Root rot, damping-off, and seed rots are major diseases of snap beans. Proper crop rotations, field selection, sanitation, plant spacings, fertilization, irrigation, and the use of resistant varieties can reduce the risk of many diseases. In addition, the use of disease-free seeds can prevent many seed-borne diseases. Spraying of preventive fungicides from bloom to harvest, regardless of whether a disease has been found, will help ensure high-quality beans (McLaurin, et al.).

Anthracnose

Anthracnose is a seed-borne fungal disease that may infect all above-ground parts of the snap bean plant. It is attracted to moist areas, especially with temperatures between 70EF to 80EF. Initial symptoms appear as reddish-brown spots on the oldest leaves, followed by round, black, sunken spots on the bean pods. The quality of the bean pods

is affected, and infected plants may die.  Using resistant varieties and disease-free seeds, crop rotation, and spraying of fungicides help prevent anthracnose development.

Halo Blight

This disease is caused by a bacterium, *Pseudomonas syringae pv. Phaseolicola*, which favors wet weather and is spread by rain, irrigation water, humans, and farm equipment. Water-soaked spots followed by brown spots appear on the undersides of the leaves of infected plants. The spots (surrounded by a yellow halo) later spread to the upper surface of the leaves. In addition, infection may cause stunting, yellowing, or the malformation of leaves, and in severe cases, defoliation.

Infection can also damage pods, stems, and seeds. The water-soaked spots can appear on the surface of the pods, usually with a bacterial ooze. Later, the pods dry and turn brown (Oregon State University Extension Service). Reddish, waxy cankers that form on the plant stems usually girdle and kill the plants, while brown spots on the seeds can lead to shrivelling.

Control measures for halo blight include rotating crops every two to three years, planting disease-free seeds, and spraying insecticides.

Bacterial Blight

Bacterial blight is easily spread by water. Symptoms of infection include lesions of dead, sunken red spots on stems and pods. These symptoms can downgrade bean quality severely, particularly for fresh-market snap beans. Severely infected plants can be completely defoliated (Yamaguchi).

Bacterial Soft Rot

Bacterial soft rot is a seed-borne disease caused by a bacterium known as *Erwinia carotovora*. This disease often results in losses during the marketing phase. Infected plants that survive often produce pods and seeds that are diseased. Seriously affected pods become dry and shrivelled. Harvested pods should be cooled promptly and stored at temperatures between 45EF and 50EF during marketing to prevent the spread of soft rot (Seelig and Lockshin).

Root Rot

Root rot is a disease caused by several soil-borne pathogens, including *Fusarium solani f. Sp. Phaseoli, Rhizoctonia solani, and Pythium sp*. Symptoms of root rot infection include lesions appearing on the stems at or below the soil line and on the roots. Root rot damage is most prevalent during hot, wet weather, particularly after planting. Plant stands may be reduced severely as the pathogens attack germinating seeds and lateral roots. This activity often kills young seedlings and causes severe stunting in older plants. Early and proper land preparation, crop rotation with grains or pasture grasses, good drainage maintenance, and fungicide application at planting time are control measures (McLaurin, et al.).

Fusarium root rot tends to be evenly distributed over a field and thrives during hot weather, in acidic or poorly fertilized soils (North Carolina Cooperative Extension Service). Crop losses caused by this disease are usually more severe than the other root rots. There are no resistant varieties, although some varieties are more tolerant than others.

Rhizoctonia root rot attacks the stems (below and above the soil surface) of young plants and causes damping off, which quickly kills the plant. This root rot thrives in warm weather, and can result in significant yield reduction. Infection may be the most obvious on older, woodier plants. Crop rotation may not be an effective control

practice because this disease is parasitic on a large number of plants (North Carolina Cooperative Extension Service).

Pythium root rot may develop during either hot or cold weather as long as wet conditions prevail. This disease causes wet rot on very young plants, often resulting in quick death (North Carolina Cooperative Extension Service). Older plants may also wilt or die.

Rust

This disease produces small white spots on the leaves. Each spot contains thousands of spores that are easily spread to other leaves and to the pods. The white spots change to a rust color in a few days. Infected leaves and pods turn brown and drop from the plant. Spraying or dusting is an effective preventive measure for rust (McLaurin, et al.).

Downy Mildew

Downy mildew is a fungal disease that attacks the leaves of many plants. Damage can be severe, particularly when the weather is relatively cool and moist. The spores can be carried in the air to other plants, and spores found in the soil may infect the roots of young plants. Infected leaves become girdled, often resulting in dead leaf tips. Sometimes, infected leaves completely wilt. Damage to the leaves may reduce pod development. Fungicide application and field sanitation provide protection.

Powdery Mildew

Powdery mildew may be a serious problem during cool, damp weather. Infected plants appear as though powder has been dusted on the leaves and stems (McLaurin, et al.). Blotches may also appear on the bean pods, affecting the quality of fresh-market snap beans. Other symptoms of the disease are an upward curling of the leaves. Powdery mildew can be managed through the application of appropriate fungicides in the early stages of the disease.

Common Bean Mosaic

This is a viral disease transmitted to the seeds by aphids. Symptoms of infection are characterized by the appearance of green to bluish-green mosaic patterns on the leaves, as well as downward curling and deformity of the leaves. Young plants that grow from infected seeds are usually dwarfed and spindly and yield very poorly. Planting resistant varieties is the only satisfactory control for this disease (Oregon State University Extension Service).

Brown Spot

This seed-transmitted disease is caused by the bacterium *Pseudomonas syringae*. Small, round to oval, brownish-red spots appear on the leaves and on the pods. The lesions on the pods are preceded by small, water-soaked spots. Sometimes, infected pods have a zig-zag appearance (Oregon State University Extension Service). This deformed appearance downgrades the quality of fresh-market snap beans.

Gray Mold

This disease is caused by the fungus *Botrytis cinerea*, which lives in organic matter and favors cool, moist conditions. It attacks all above-ground plant parts, including blossom parts, creating water-soaked lesions with masses of gray spores (Oregon State

University Extension Service). The spores are present in the air during the entire growing season. Gray mold can be particularly destructive because it spreads easily to healthy plants and may lead to significant yield reductions. Damage appears to be most severe when fields are consecutively planted with bean crops. Decay in infected pods after harvest can cause buyers to reject an entire shipment.

Rotation with non-leguminous crops, the avoidance of overcrowding, and good sanitation practices help prevent gray mold.

White Mold

This disease is caused by the fungus *Sclerotinia scerotiorum,* which often attacks blossoms, particularly during cool, moist weather, causing them to drop. On young plants, the symptoms appear as water-soaked spots on the leaves, petioles, and stems. On older plants, the water-soaked spots also appear on the pods and can sometimes be accompanied by white, creamy fungal growth (Oregon State University Extension Service). White mold may also cause leaves to turn yellow and wilt. Control measures include spraying fungicides, increasing planting distances to ensure adequate aeration, practicing crop rotation, and avoiding irrigation practices that keep the plants and soil moist for extended periods.

Necrosis Disease (Sudden Death)

This is a viral disease transmitted by many species of aphids. Initially, the terminal leaf rolls downward and turns brown. From the terminal leaf downward, stem and leaf tissues also become infected and the entire plant may turn dark brown and die within four to seven days (Oregon State University Extension Service). Proper management practices and the control of aphids help prevent necrosis disease.

Damping-off

Damping-off is a seedling disease wherein the stems of young plants rot at the ground level and die. Cool, wet weather is conducive for its development. Sometimes, the disease can sharply reduce plant stands. Seed treatment and cultural practices that promote young plant growth are essential in preventing damping-off.

**Insects and Other Pests**

The various insects that attack bean plants can be grouped into soil insects, foliage and stem feeders, plant sap feeders, and insects that feed on seeds and pods (or the fruit of the plant).

In general, successful pest control in snap bean fields relies on field sanitation, seed treatment, crop rotation, careful field selection, mechanical cultivation, and the use of resistant varieties (Pennsylvania State Cooperative Extension). Many insecticides are also used to effectively control insect damage on snap beans. Sprays are generally more effective than dusts (Cook, et al.).

**A. Soil Insects**

Soil insects generally feed on seeds as well as the roots and lower part of the stems of young developing plants, resulting in reduced plant vigor or plant death. The damage is detrimental when the stems break, the plant lodges, or when the plants' vascular system is severely affected, preventing the upper plant parts from receiving water and

nutrients from the soil. Plants that recover from the attack of soil insects usually remain stunted and yield poorly (Johnson).

Cutworms

Cutworms are stout, dark-colored caterpillars that often feed on the stems of young seedlings and the leaves of older plants at night. Eggs are frequently deposited on weeds (Godfrey). Cutworms are most active during the spring and early summer. Their feeding can result in wilting or death of the severed plant, especially when young seedlings are cut from the base or near the ground level. Cutworms are often controlled by baits (Johnson). Pesticides can also be used for control, with treatments most effective when applied during the seedling stage.

Lesser Cornstalk Borer

The young cornstalk borer caterpillars feed on the foliage and tunnel through the plant stem, causing the plant to wilt and die. The caterpillars attach silken-like tubes on the stem at, or just below, the soil surface while feeding. Infestation can cause severe plant stand reductions during some seasons, especially in south Georgia (McLaurin, et al.). For control, soil insecticides should be applied at, or just after, planting.

**B. Foliage and Stem Feeders**

With their chewing-type mouthparts, these insects generally feed on above-ground plant tissue, except the seeds, seed pods, and fruit. Beetles and caterpillars primarily comprise this group.

Mexican Bean Beetle

The Mexican bean beetle is a common pest of snap beans, often occurring early in the growing season (Mullins). The adult beetle is bronze-colored, about 1/4 to 1/3 inch long, with 16 black spots on its back. The larvae are yellow, about 1/3 inch long when full grown, with rows of long-branched spines with black tips growing from its back (Johnson). Both the beetles and larvae feed on the undersides of the leaves, leaving a “lace-like” appearance. Heavy infestations can cause severe defoliation and damage to the stems and pods unless controlled.

Leaf Miner

The adult leafminer, a small fly, punctures the leaves and lays eggs inside the leaf tissues. Yellow maggots are hatched and feed on the chlorophyll tissues. When the maggots mature, they cut their way out of the leaf, drop to the soil, and pupate (Johnson). Leafminers are controlled with systemic insecticides.

Looper

Loopers are caterpillars that generally feed on the underside of the leaves, producing large holes which consequently affects the ability of the snap bean plant to produce pods. Among most species of caterpiller, loopers are the most difficult to control. This is because they move quickly to protected plant parts upon spraying of insecticides.

Bean Leaf Roller

The young leaf roller larvae roll back a portion of the leaf around its edges, creating a “flap-like” appearance (Johnson). The folds along the leaf edges becomes larger as the larvae mature. The full-grown caterpillar is 1-½ inches long, and is predominantly green with several yellow stripes. Insecticidal sprays are used for control.

**C. Sap Feeders**

With their piercing-sucking mouthparts, this group of pests damages the above-ground parts of snap bean plants by sucking plant sap and injecting toxins into the plants. The toxins can result in wilting, defoliation, off-flavored plant products, irregular/abnormal growth of leaves, stems, and pods, or the death of plants. Some of these pests also transmit plant viruses.

Aphids

Aphids, also known as plant lice, damage leaves and pods by sucking the sap of the plants with their sharp mouthparts and injecting toxic saliva. They multiply rapidly and also serve as primary vectors of plant viruses. The undersurfaces of the leaves and the young developing buds are the preferred feeding sites. Heavy aphid infestations, which often occur late in the summer, may cause plants to wilt, turn yellow or brown, and die. Aphids also secrete a sticky, sugary fluid which gums up the plant and serves as a medium for sooty mold, a fungus which reduces the grade of many fresh-market vegetables (Johnson). Insecticides are applied for control.

Thrips

Thrips feed on many vegetable plants by puncturing the individual leaf cells and sucking the plant sap. They also transmit the tomato spotted wilt virus.
They favor hot and dry weather. Heavy infestations cause reduced yields, increased incidence of bacterial rot, and/or death of seedlings. Some species can cause blemishes on the beans. Systemic insecticide use at planting time will help control thrips on early snap beans (McLaurin, et al.).

Whitefly

The adult whitefly, a moth-like insect, lives, feeds, and lays eggs on the undersurfaces of leaves. The nymphs also suck the juices of the plant. Feeding is often more active during sunny days. Feeding damage results in the accumulation of honeydew on the leaves, with subsequent growth of molds, and the occurrence of vine, leaf, and plant breakdown, chlorotic spots, and abnormalities of the fruiting structure (Johnson). Whiteflies also transmit viral diseases.

Spider Mite

Spider mites are tiny, spider-like pests that usually appear on the undersides of leaves. They feed by sucking plant juices, and move from field to field in the wind. The first outbreak of mites in the field generally occurs around barns, fences, trees, or obstacles in the field (Johnson). Miticide sprays are used for control.

Leafhoppers

Leafhoppers feed in both the adult and nymph stages, resulting in reduced plant vigor, retarded growth, and wilting of leaves, especially when present in large numbers. The feeding of certain species of leafhoppers produces a burning effect on the plants, and causes the tips to wither and die (Johnson). Both the adults and nymphs feed mainly on the undersides of leaves, with the adults laying eggs on the plant stem, buds, and

leaves. Several species of leafhoppers are also carriers of plant viruses. Insecticidal sprays are used for control.

**D. Insects feeding on seeds and pods**

Insects that attack the snap bean's seeds, pods, and fruit generate not only a loss of the fruits attacked, but time, money, and labor spent on the crop.

Corn Earworm

The corn earworm often feeds on the leaves of snap beans. However, it becomes most destructive in snap bean plants when the larvae bore into the pods and feed on the seeds. Early detection of infestation and timely spraying of insecticides can be effective in controlling corn earworms. Insecticides become useless once the pods have been attacked.

Stink Bug

Stink bugs attack the blossoms and developing bean pods, causing pod drop and significant yield reductions (Johnson). Their feeding also results in blemishes on developed bean seeds inside the pods, a concern for fresh-market beans (Oregon State University Extension Service).

Plant Bugs (Lygus)

Lygus bugs feed on the bean pods. Their damage to the plant is similar to that caused by stink bugs.

**Nematodes**

Root knot nematodes are small, eel-like worms that live in the soil and feed on the roots of plants. Their feeding activities produce galls on the roots, which impairs the plant's ability to absorb water and nutrients from the soil. Root knot nematodes are the most damaging of all nematodes. Their populations can reach destructive levels quickly given favorable growing conditions. They can cause stunting, yellowing, reduced yields, and death of plants. Their presence may also promote the development of diseases. They prefer well-drained areas, and are seldom evenly distributed over a large area.

Effective control measures include crop rotation with sod grasses and small grains and nematicide treatments (McLaurin, et al.).

**Weeds**

Several herbicides provide adequate control of many weeds and grasses in snap bean fields. When used properly, they are especially valuable for beans that are to be mechanically harvested. The effectiveness of herbicides varies with soil type and climatic conditions. As a result, they should be used only according to recommended procedures (McLaurin, et al.).

Proper cultivation and crop rotation can reduce or eliminate the need for chemical weed control. Crop rotations, close row spacings, early-season weed control, and cultivation are combined with herbicides to minimize weed competition and contamination of the product. Hard-seeded weeds are often difficult to control with herbicides (Cook, et al.).

**Physiological Disorders**

Excessive Nitrogen

Excessive nitrogen at planting time may result in seedling injury, especially on soils that are acidic (those that have a pH below 5.5). Immediate irrigation at the first sign of burn should reduce further injury. Excessive nitrogen may also increase vine growth at the expense of pod production, and may interfere with mechanical harvesting (Ware and McCollum). Beans become more succulent in the presence of excessive nitrogen and will not ship well (McLaurin, et al.).

Excessive Use of Herbicides

The excessive application of herbicides often results in delayed seed germination and reduced stands (Cook, et al.).

## Florida

According to the Census of Agriculture, there were 293 Florida farms growing snap beans (both for fresh and processed use) in 1992, up 4 percent from 1987. These farms harvested a total of 23,899 acres of snap beans, down 11 percent from 1987. Seventy-two percent of the state's snap bean harvested area was in Dade County, followed by Palm Beach County with 8 percent.

In 1994, 89 percent of Florida's total snap bean harvested area was for fresh-market use (National Agricultural Statistics Service). In terms of quantity, fresh-market output accounted for 90 percent of total output in 1994, with an average yield of 51 cwt per acre. The total value of Florida's fresh-market snap beans was $52.2 million in that year.

In south Florida, all production is for the fresh market (Shuler). Bush beans are grown in most areas of the state. The southeastern area, mainly Dade and Palm Beach counties, is the major production area. Pole beans are grown primarily in Dade County, with a small amount grown in some northern counties (Florida Agricultural Statistics Service).

Cultural Practices

Florida’s snap bean production is continuous throughout most of the year. Fresh-market output is usually large in the fall and winter, particularly from November through January, and then peaks in the spring (Shuler). Production is minimal in the summer months. Dade County growers usually plant from August until March (Lamberts).

Planting is mostly done mechanically. Depending on the labor situation, bush beans are harvested by hand or mechnically. Pole beans are usually hand picked.

Most of Florida's farms growing snap beans have irrigation. According to the Census of Agriculture, about 70 percent of all the Florida farms growing snap beans had irrigation in 1992. These irrigated farms covered 95 percent of the snap bean harvested acreage. The use of sub-surface irrigation is popular among growers, and functions through manipulation of the water table (Shuler). In Dade County, a primary bean-production area, the use of overhead irrigation is also common.

Growers usually practice crop rotation. Growers in Palm Beach County usually plant beans for no more than three years consecutively (Schuler).

Most of the harvested beans are run through a conveyor line where they are graded and washed. As they arrive in the packing house, the beans are packed in bushels or bushel hampers and then hydrocooled.

Beans are transported via refrigerated trucks to various markets. Large volume growers sell mostly through brokers for distribution to local and out-of-state markets. Some growers (both large and small) sell directly to local retailers, such as supermarkets. A small proportion of production is sold through pick-your-own operations and roadside markets. Out-of-state shipments are destined for other states, particularly in the Midwest and the East, and to Canada.

In the past, some cases occured where growers opted to abandon their crop during periods of low fresh-market prices. In the absence of a major processor, it is more costly for

growers to transport their produce to out-of-state processors who may be willing to buy. Most processing snap beans are grown under contract with processors.

Production Perils

Florida's snap bean growers have encountered significant crop losses in the past due to weather-related perils, as well as insect and disease problems. Some of the major calamities that have affected production include frosts and freezes, hail storms, excessive rains (flooding), excessive heat (drought), and strong winds, such as those that occur during hurricanes and tropical storms (Shuler and Lamberts). Hail can cause leaf and pod damage, which may serve as entry points for many disease pathogens. The bean mosaic virus, transmitted by the white fly, is a major problem (Shuler).

Growers received the largest ad hoc disaster assistance payments for fresh-market losses in 1990, stemming from the effects of the 1989 freeze (FSA, Dade County). During more recent years, plenty of rain throughout most of October 1993 leached fertilizer in Dade County, affecting vine growth in some low- lying fields, according to the Florida Agricultural Statistics Service. In some areas, the heavy rains also caused plant stress, delayed bed preparation, slowed planting, and caused blooms to drop off. Wind-blown sand injured some young beans and cold winds yellowed some vines in Dade County in late December 1993 through early January 1994. These events increased grade outs of wind-scarred beans. Frost in late December 1993 led to crop losses in Florida's west central area.

Demand for Crop Insurance

Despite the many weather-related perils that have caused crop losses in the past, Florida growers will likely indicate only some interest in crop insurance for fresh-market snap beans. Some growers appear to believe that crop insurance provisions for currently insurable crops could be written to be more compatible with vegetable farming and the production perils confronted in Florida (Lamberts). For example, tropical storm Gordon in November 1994 resulted in severe losses, but many growers with crop insurance did not receive indemnity payments. Hence, crop insurance for fresh-market snap bean losses may not be well accepted by growers.

The demand for crop insurance will also be based on the amount of premium that growers will have to pay (Shuler). Snap beans are considered to be a relatively less expensive crop to produce compared to tomatoes and sweet corn, and growers do not typically specialize entirely in snap beans. Hence, they may be more likely to insure their higher-valued crops.

Lastly, growers collected about $1.5 million in ad hoc disaster assistance for fresh-market snap bean losses during 1988 to 1993, 7 percent of the U.S. total. This share is relatively smaller than Florida's 35 percent share of total harvested acreage.

**Georgia**

According to the Census of Agriculture, the 370 farms growing snap beans (both for fresh and processed use) in Georgia in 1992 harvested a total of 8,680 acres, up 96 percent from 1987. The increase in harvested acres partly reflects the addition of 104 more farms that grew snap beans in 1992. About 40 percent of all the farms growing snap beans used irrigation in 1992, with these farms covering 82 percent of the harvested acreage. Sumter and Tift counties each harvested more than 1,000 acres of snap beans in 1992, accounting for 35 percent of the state's total snap bean output.

Production for fresh-market sales dominates Georgia's snap bean output. In 1994, 117.8 million pounds of snap beans were harvested from 14,000 acres (National Agricultural Statistics Service). Yields averaged 41 cwt per acre. The 1994 fresh-market crop was valued at $16.1 million, 24 percent above the year before. Of the total area planted to snap beans in 1994, 22 percent was not harvested. Unharvested area averaged 20 percent of total planted acreage during 1992-94.

Cultural Practices

Georgia produces a spring, summer, and fall crop for the fresh market. Fresh- market beans and those grown for processing are produced primarily in the southern part of the state (McLaurin, et al.). Sumter and Colquitt counties are major production areas for fresh-market snap beans in Georgia (Kelly).

Spring plantings begin in early to mid-March and extend through April in south Georgia, while fall plantings may begin around mid-July and extend through August in the Coastal Plain area (McLaurin, et al.). Plantings in central and north Georgia are usually started by mid-April, when the danger of frost has passed.

Most planting is performed mechanically. In Sumter County, planting and harvesting dates vary within a farm because growers plant in blocks (Lawson). The majority of the beans grown in this county are mechnically harvested. On a statewide basis, however, most snap beans are still hand-harvested (Kelly).
Open-pollinated varieties of bush-type green beans are widely planted in Georgia. The state also produces a fair amount of pole beans. Half-runner types are mostly grown in home gardens (Kelly).

Some of the more popular bush-type varieties grown for the fresh market in Georgia are Pod Squad, Provider, Sprite, and Strike (McLaurin, et al.). Processors usually dictate the variety to be grown for processing. Many of these processing varieties are different from the fresh-market varieties. Examples of processing varieties grown in Georgia are Eagle, Early Gallatin, Provider, and Blue Lake 47 (McLaurin, et al.).

Commercial pole bean production is concentrated in the lower coastal plains of southwest Georgia and in the mountain area of northeast Georgia. The climate in the lower coastal plains permit both spring and fall crops, whereas the climate in the mountain area only permits one crop a year, but allows a long harvest period (McLaurin, et al.).

Crop rotation is a common practice among growers. Rotation crops include other vegetable crops, small grains, and cotton.

Snap beans are usually field-packed, then moved to the packing house, where they undergo forced-air cooling (Kelly). In the case of Sumter County, all of the beans are packed in boxes in the packing shed. There are three to four packing sheds in the county. These packing sheds are owned by three corporations who contract with growers for the production of both fresh-market and processing snap beans (Lawson). The majority of fresh-market snap beans in Sumter County is grown under contract. The corporations determine the varieties to be grown. Long shelf-life is an important characteristic for fresh-market varieties.

Growers usually sell to brokers, wholesalers, or directly to retailers. Some growers sell a small proportion of their produce in roadside stands together with other fresh produce (Kelly). In Sumter County, the corporations usually have their own brokers who sell directly to large grocery chains. Most of Georgia's out-of-state shipments of

fresh snap beans go to the Northeast and Midwest markets and to Canada via refrigerated trucks (Kelly).

According to Dr. Kelly, crop abandonment is possible during a market glut, especially if fresh-market prices fall below the cost of harvesting the beans. It is often very difficult to find a processor who will be willing to buy the excess fresh-market supply, especially since most of the processing snap beans are grown under contract and there are only a few snap bean processors in Georgia.

Production Perils

Extreme heat with high humidity, freezes, hail, and excessive rain are the major production perils for snap beans in Georgia (Kelly). Growers also encounter problems with pests and diseases. However, growers usually are able to minimize the risks of loss due to insect and disease damage with the implementation of a good pest control program. Some of the common disease problems growers face are rusts, powdery mildew, and root rots.

Demand for Crop Insurance

Growers in Georgia are likely to have an interest in a crop insurance policy for fresh-market snap beans. Between 1988 and 1993, they collected $3.3 million in ad hoc disaster assistance for fresh-market snap bean losses, the second-largest amount in the country and 16 percent of the total payments made over the six-year period. Georgia's share of harvested acreage is estimated to be 15 percent (Table 8).

Dr. Kelly of the University of Georgia indicated that growers will likely have a strong interest in crop insurance, especially with the dissipation of ad hoc disaster payments and with growers' knowledge of the risks associated with unfavorable weather. In addition, the Valdosta Regional Service Office of the Farm Services Agency have talked with growers in Sumter County and many of these growers have expressed an interest in crop insurance (FSA, Valdosta Regional Service Office).

**California**

In 1992, 368 California farms harvested a total of 9,767 acres of snap beans (Census of Agriculture). The number of farms and the area harvested increased by 8 percent and 4 percent, respectively, from 1987. All of the farms were irrigated. Orange, Stanislaus, San Joaquin, Monterey, Riverside, San Luis Obispo, Tulare, and Santa Cruz counties accounted for 54 percent of California snap bean production.

Fresh-market snap bean production is approximately two-thirds of the state’s snap bean output (Hartz). Fresh-market snap bean production in California totaled 52.5 million pounds in 1994, down 10 percent from the prior year, reflecting reduced yields. Yields averaged 70 cwt per acre in 1994, down from 80 cwt in 1993. The 1994 fresh-market snap bean crop was valued at $30.0 million, up 3 percent from the previous year. Orange and Ventura counties on the coast of Southern California dominate the state’s fresh-market snap bean output, while production for processing is a major activity in Stanislaus County in the Central Valley (Hartz).

Cultural Practices

The coastal counties plant as early as February, with planting extending until March for harvest in the spring (April through June). All of the fresh-market growers plant by mechanical means, although they hand harvest the beans to minimize injuries to the pods

(Hartz). Bush-type green beans are popular among fresh-market growers. Both open-pollinated and hybrid varieties are planted.

Table 8--Disaster assistance payments for fresh-market snap beans, 1988-93

| Region/State | Estimated average fresh-market snap bean harvested acreage, 1988-93 | Share of U.S. acreage | Total fresh-market snap bean disaster payments, 1988-93 | Share of U.S. fresh-market snap bean disaster payments |
|---|---|---|---|---|
| | ---Acres--- | ---Percent--- | ---Dollars--- | ---Percent--- |
| Northeast | 8,709 | 10.12 | 1,770,620 | 8.61 |
| Maine | -- | -- | 714 | 0.00 |
| Massachusetts | -- | -- | 7,210 | 0.04 |
| New Jersey | 4,579 | 5.32 | 930,602 | 4.53 |
| New York | 4,130 | 4.80 | 472,392 | 2.30 |
| Pennsylvania | -- | -- | 359,702 | 1.75 |
| North Central | 3,280 | 3.81 | 3,004,048 | 14.61 |
| Illinois | -- | -- | 238,671 | 1.16 |
| Indiana | -- | -- | 262,545 | 1.28 |
| Iowa | -- | -- | 69,289 | 0.34 |
| Kansas | -- | -- | 6,277 | 0.03 |
| Michigan | 2,039 | 2.37 | 1,732,083 | 8.42 |
| Missouri | -- | -- | 291,174 | 1.42 |
| Nebraska | -- | -- | 7,430 | 0.04 |
| Ohio | 1,241 | 1.44 | 253,662 | 1.23 |
| Wisconsin | -- | -- | 142,917 | 0.69 |
| South | 66,729 | 77.57 | 15,771,987 | 76.69 |
| Alabama | -- | -- | 1,202,853 | 5.85 |
| Arkansas | -- | -- | 678,811 | 3.30 |
| Delaware | -- | -- | 5,520 | 0.03 |
| Florida | 30,198 | 35.10 | 1,495,573 | 7.27 |
| Georgia | 13,114 | 15.24 | 3,316,141 | 16.13 |
| Kentucky | -- | -- | 1,032 | 0.01 |
| Louisiana | -- | -- | 452,290 | 2.20 |
| Maryland | 2,294 | 2.67 | 126,711 | 0.62 |
| Mississippi | -- | -- | 454,222 | 2.21 |
| North Carolina | 7,030 | 8.17 | 1,605,424 | 7.81 |
| Oklahoma | -- | -- | 13,935 | 0.07 |
| South Carolina | 2,512 | 2.92 | 867,600 | 4.22 |
| Tennessee | 7,073 | 8.22 | 3,582,625 | 17.42 |
| Texas | -- | -- | 945,581 | 4.60 |
| Virginia | 4,508 | 5.42 | 1,023,669 | 4.98 |
| West | 6,677 | 7.76 | 17,926 | 0.09 |
| California | 6,542 | 7.60 | 0 | 0.00 |
| Hawaii | 135 | 0.16 | 0 | 0.00 |
| Idaho | -- | -- | 9,982 | 0.05 |
| Utah | -- | -- | 2,635 | 0.01 |
| Washington | -- | -- | 5,309 | 0.03 |
| United States | 86,025 | 99.27 | 20,564,581 | 100.00 |

--= Not reported.

Note: A linear trend was used to estimate fresh-market snap bean acreage for the years 1988 to 1991 with 1981 and 1992 data reported by the USDA's National Agricultural Statistics Service. Disaster assistance data are averaged over the 1988-93 period.

Sources: 1981 and 1994 Vegetable Annual Summaries and ASCS data files.

Crop rotation is a common practice among growers of snap beans. They usually rotate snap beans with other vegetable crops, rather than with field crops (Hartz). Since the weather is predominantly dry, most of the harvested beans are field packed. They are then transported to the packing shed to be hydrocooled.

The majority of California's fresh-market snap beans are sold within the state to local chains and to terminal or wholesale markets. A small portion, however, is shipped to other western states and sold in roadside stands. Refrigerated trucks are predominantly used in transporting fresh produce.

Crop abandonment may occur when fresh-market prices fall sharply, especially since snap beans are considered a minor crop and are relatively less costly to produce than the other major vegetable crops grown in California (Hartz). In addition, growers have minimal ability to shift snap beans to the processing sector. Only a few snap bean processors are present in the state, and these processors have pre-arranged contracts with growers producing for the processing sector. The cost to transport produce to out-of-state processors may not be economically feasible for many growers.

Production Perils

Snap bean growers have faced occasional flooding due to excessive rains, but these situations have not led to serious crop losses. Insect and disease problems are usually controlled through proper management practices. The fungal diseases that could sharply reduce snap bean yields are not as common an occurrence in California as in other states because of California's generally dry climate (Hartz).

Demand for Crop Insurance

California growers may indicate little interest in a crop insurance policy for fresh-market snap beans. This is largely because weather-related perils do not pose a significant threat in most years. Excessive rains, flooding, and hail damage occur occasionally, but these perils have not seriously affected snap bean yields.

Several pieces of evidence indicate that growers did not face any serious crop losses in the recent past. California growers received no ad hoc disaster payments for fresh-market snap beans during 1988 to 1993. In addition, all of the acres planted to snap beans during 1992 through 1994 were harvested (NASS), and all farms growing snap beans have irrigation.

In addition, snap beans are generally considered a minor crop. Consequently, growers may not find it economically feasible to insure their snap beans, and will likely have a greater interest in insuring their major vegetable crops (Hartz).

**New York**

According to the Census of Agriculture, 572 farms grew snap beans (both for fresh and processed use) in New York in 1992, and harvested a total of 23,933 acres, down 25 percent from 1987. Of these farms, only 21 percent had irrigation, covering only 2 percent of the total harvested area. Orleans, Genesee, Erie, Cayuga, Oneida, and Ontario counties each harvested more than 1,000 acres, and accounted for 70 percent of New York’s snap bean harvested area in 1992.

Fresh-market production represents a relatively small share of New York’s snap bean output. In 1994, fresh-market output totaled 483,000 cwt, 28 percent of the state’s total snap bean output. Harvested acreage for fresh-market sales accounted for 21

percent of the total snap bean area harvested in 1994 and 88 percent of the planted acres for fresh-market production.

Cultural Practices

Growers of fresh-market snap beans in New York mainly produce a summer crop. They usually begin planting from May until around mid-July and harvest from July through October (Price). The planting and harvesting operations are mostly done by mechanical means. A few growers practice hand picking, with most of these growers producing for the fresh market.

Hand-picked snap beans are usually field packed, while those that are machine harvested are moved to a packing shed. The bean harvester is run through the field and the harvested beans are dumped onto conveyor belts, moving the produce directly to tractors that provide transport to the packing shed.

Most of the growers use true varieties or open-pollinated varieties of snap beans. They refrain from using hybrid varieties because hybrids tend to be more difficult to produce (Price). Bush-type green beans are the most commonly grown. Most of the growers practice crop rotation. Because of white mold problems in the past, growers usually select rotation crops that are not a host for this disease.

Only a few farms have irrigation systems. This is because most of New York's production areas have heavy soils, which have the ability to hold moisture (Price). However, in the event of a long period of very hot, dry weather, growers face crop losses.

New York is not a major shipper of fresh-market snap beans. Growers usually sell directly to retailers. A few also sell to wholesalers and through roadside stands.

Growers of fresh-market snap beans generally do not abandon their crops during periods of low market prices because they want to maintain credibility with their markets or customers (Price). They cannot easily divert their produce to the processing sector because most of the processing output is prearranged with processors. Contracts are usually based on tonnage, sieve size, and color. Processors have a large influence on planting and harvesting schedules. Flexibility in switching to the processing sector as a produce outlet may only occur if processing supplies are limited.

Production Perils

Lack of moisture and very hot weather appear to be the main obstacles to snap bean production in New York, particularly because growers produce a summer crop and a majority of the farms have no irrigation (Price). While heavier soils generally dominate New York's production areas, extended dry periods can pose a threat. Growers have had problems with insects and diseases, but most such problems have been managed through prudent cultural practices.

Demand for Crop Insurance

New York growers will likely indicate some interest in a crop insurance policy for fresh-market snap beans. During the period from 1988 to 1993, New York's growers collected $472,400 in disaster assistance for fresh-market snap bean losses, 2.3 percent of the U.S. total. These payments account for only a small share of the U.S. total, and are smaller than New York's share of total harvested acreage (5 percent).

With the reduced likelihood of future ad hoc disaster payments, growers will likely seek alternative means of minimizing their production risks. Most of New York's farms have no irrigation, with growers facing a high risk of loss when a prolonged drought occurs. The state is a major production area for fresh-market snap beans, ranking fourth in quantity and value in 1994. During the period from 1992-94, unharvested area averaged about 9 percent of the total area planted for fresh-market sales.

**Tennessee**

According to the Census of Agriculture, 355 farms grew snap beans (both for fresh and processed use) in 1992, and harvested 11,512 acres, up 34 percent from 1987. The number of farms growing snap beans also increased by 71 farms over that period. Fifty-eight percent of the state's output was produced in Cumberland (40 percent) and Fentress (18 percent) counties.

About 75 percent of the snap bean acreage is for the fresh market. Major production areas in Tennessee are Cumberland, Overton, Putnam, Dekalb, and Fentress counties (Rutledge).

Cultural Practices

With the development of mechanical harvesters, bush-type green beans are more widely grown in Tennessee than are pole beans, which were formerly the most popular type. There are a few wax or yellow bush beans grown in the state (Dalton). Bush beans are preferred by growers over pole beans because they are cheaper to produce. Pole bean production is now limited to home and local production (Mullins).

Growers generally begin planting around April 25, followed by multiple plantings up through about mid-July (Rutledge). About 20 to 25 percent of the farms growing snap beans have access to irrigation (Rutledge).

Beans are ready for harvest around mid-June through mid-September. The planting and harvesting operations are mostly handled mechanically. Hybrid varieties have been developed to produce pods that can withstand mechanical harvesting. Still, both open-polinated and hybrid varieties are grown. Most of the harvested beans are packed in the packing house.

Crop rotation is a common practice among snap bean growers. They rotate snap beans with other vegetable crops, corn, forage crops, or even use the land for livestock production (Rutledge).

Growers mostly sell directly to brokers and wholesalers who distribute the produce to other retail outlets. Growers also sell directly to local large retail outlets, such as local supermarkets (Dalton). A small proportion of production is directly retailed through roadside markets, along with other fresh produce (Rutledge).

Tennessee also ships snap bean output out-of-state, with markets from Miami to Boston, Texas, and in some parts of the Midwest (Rutledge).

Crop abandonment is sometimes observed among snap bean farmers, not only in cases of low fresh-market prices, but also in the case of crop damage due to weather, where harvesting may not be economically feasible (Rutledge). Large- volume growers sometimes allot a portion of their output for processing, which is produced under contract with processors.

Production Perils

Dry weather, frequent rains, floods, and hail are the major production perils affecting snap beans in Tennessee. Frequent rains in 1989, for example, caused several problems for growers, such as delayed harvesting (some acreage was never harvested because the beans were overripe), as well as mildew and rot problems (Tennessee Department of Agriculture).

Ad hoc disaster payments made for fresh-market snap bean losses in 1989 totaled $950,300, the highest for the state during the period from 1988 to 1993. Hail damage in 1990 resulted in $539,500 in ad hoc disaster payments for fresh-market snap bean losses (FSA, Cumberland County). Heat and lack of moisture plagued the 1993 crop, with disaster payments totaling $542,400. Excessive rainfall throughout the 1994 growing season in middle and east Tennessee caused flooding and abandonment of some planted acreage, particularly those fields with poorly drained soils (Tennessee Department of Agriculture). Unharvested area for fresh-market snap beans that year accounted for 11 percent of total planted area (Table 2).

Growers also face many problems with insects and diseases. Major disease problems are Rhizoctonia root rot and rust for later-planted beans. Growers, however, are able to reduce losses due to insects and diseases by following prudent management practices.

Demand for Crop Insurance

Tennesse growers will likely have an interest in a crop insurance policy for fresh-market snap beans. In the past, they have experienced crop losses due mostly to unfavorable weather. During the period 1988 to 1993, ad hoc disaster payments for fresh-market snap bean losses totaled $3.6 million, the largest in the United States and 17 percent of the U.S. total. Their share of total harvested acreage was estimated to be 8 percent. The demand for crop insurance will, however, also be influenced by the premium that the growers would have to pay. If growers are diversified, they may have less interest in crop insurance (Dalton and Rutledge).

An annual snap bean meeting, coordinated by the University of Tennessee Cooperative Extension Service, is held every February. A majority of the snap bean growers participate annually. In the past, some private insurance companies also participated in the meetings, and some growers have expressed an interest in crop insurance (Rutledge).

## Ad Hoc Disaster Assistance for Fresh-Market Snap Beans

Ad hoc disaster payments were made available to fresh-market snap bean growers for losses due to natural causes in each of the years 1988 to 1993. In the absence of a crop insurance policy for fresh-market snap beans, producers of fresh-market snap beans who faced a yield loss of at least 40 percent of expected production were eligible for ad hoc disaster payments in those years.
Data on ad hoc payments provide an indication of potential high-loss areas. The states and counties with large ad hoc payments from 1988 to 1993 are most likely to face a relatively high risk of loss under a potential FCIC policy for fresh-market snap beans, and would likely have a relatively high demand for crop insurance.

Disaster assistance payments for fresh-market snap bean losses totaled $20.6 million over the 1988-93 period. This total accounted for 61 percent of the total disaster payments made to snap bean growers, including payments made to growers of snap beans for processing. The largest payments were made in 1988, at $5.4 million, due mainly to a serious drought (Table 9). Payments peaked again in 1993 at $4.1 million, 91 percent

higher than in 1992, but 24 percent below the peak in 1988. Lack of moisture was the major cause of losses during 1993 (FSA, various counties, various states).

Total disaster payments during the six-year period were scattered across the United States, with 32 states receiving payments in at least one of the six years. Eighteen of these states (11 from the South region, 4 from the North Central, and 3 from the Northeast) received payments in all of the six years (Table 9).

Table 9--Ad hoc disaster assistance payments for fresh-market snap beans, individual years

| State | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1988-93 |
|---|---|---|---|---|---|---|---|
| | ----------Dollars---------- | | | | | | |
| Alabama | 475,391 | 91,174 | 93,988 | 100,243 | 119,386 | 322,671 | 1,202,853 |
| Arkansas | 288,255 | 3,086 | 185,976 | 81,867 | 4,831 | 116,796 | 678,811 |
| Delaware | 0 | 0 | 0 | 0 | 5,520 | 0 | 5,520 |
| Florida | 16,459 | 141,304 | 894,343 | 255,211 | 109,085 | 79,171 | 1,495,573 |
| Georgia | 780,001 | 416,265 | 486,104 | 538,771 | 279,470 | 815,530 | 3,316,141 |
| Idaho | 4,651 | 4,812 | 0 | 519 | 0 | 0 | 9,982 |
| Illinois | 77,897 | 20,682 | 24,293 | 18,305 | 12,176 | 85,318 | 238,671 |
| Indiana | 0 | 4,733 | 70,890 | 91,888 | 23,181 | 71,853 | 262,545 |
| Iowa | 5,801 | 897 | 9,016 | 3,493 | 0 | 50,082 | 69,289 |
| Kansas | 2,389 | 105 | 0 | 3,476 | 307 | 0 | 6,277 |
| Kentucky | 1,032 | 0 | 0 | 0 | 0 | 0 | 1,032 |
| Louisiana | 99,298 | 233,083 | 19,017 | 73,412 | 13,867 | 13,613 | 452,290 |
| Maine | 0 | 0 | 0 | 250 | 464 | 0 | 714 |
| Maryland | 469 | 63,048 | 3,419 | 22,785 | 7,862 | 29,128 | 126,711 |
| Massachusetts | 0 | 1,436 | 0 | 1,859 | 1,571 | 2,344 | 7,210 |
| Michigan | 794,351 | 132,832 | 68,639 | 128,292 | 169,928 | 438,041 | 1,732,083 |
| Mississippi | 282,601 | 28,034 | 55,395 | 49,737 | 34,722 | 3,733 | 454,222 |
| Missouri | 226,443 | 22 | 10,631 | 244 | 123 | 53,711 | 291,174 |
| Nebraska | 1,190 | 148 | 0 | 0 | 2,720 | 3,372 | 7,430 |
| New Jersey | 468,891 | 152,028 | 6,011 | 145,805 | 13,265 | 144,602 | 930,602 |
| New York | 132,688 | 133,546 | 372 | 31,708 | 152,246 | 21,832 | 472,392 |
| North Carolina | 413,287 | 307,458 | 134,903 | 94,043 | 218,362 | 437,371 | 1,605,424 |
| Ohio | 33,480 | 32,629 | 8,576 | 28,135 | 30,153 | 120,689 | 253,662 |
| Oklahoma | 0 | 0 | 10,716 | 0 | 2,838 | 381 | 13,935 |
| Pennsylvania | 119,377 | 12,652 | 1,329 | 85,635 | 32,279 | 108,430 | 359,702 |
| South Carolina | 150,733 | 309,327 | 157,085 | 89,710 | 43,523 | 117,222 | 867,600 |
| Tennessee | 581,536 | 950,257 | 539,542 | 371,530 | 597,331 | 542,429 | 3,582,625 |
| Texas | 331,415 | 438,022 | 13,827 | 31,990 | 25,348 | 104,979 | 945,581 |
| Utah | 0 | 0 | 2,635 | 0 | 0 | 0 | 2,635 |
| Virginia | 76,564 | 31,895 | 52,366 | 257,344 | 222,403 | 383,097 | 1,023,669 |
| Washington | 0 | 0 | 2,602 | 0 | 1,554 | 1,153 | 5,309 |
| Wisconsin | 30 | 131,980 | 0 | 3,076 | 6,425 | 1,406 | 142,917 |
| Total | 5,362,229 | 3,641,455 | 2,851,675 | 2,509,328 | 2,130,940 | 4,068,954 | 20,564,581 |

Source: Consolidated Farm Service Agency Disaster Assistance Data Files compiled by the General Accounting Office.

These three regions accounted for nearly all of the disaster payments for fresh-market snap bean losses during the six-year period, with southern state growers receiving over three-quarters of the total. The western region accounted for only 0.09 percent of the total payments, with payments received by growers in Idaho, Utah, and Washington.

In terms of state ranking, eighty-one percent of total disaster payments for fresh snap bean losses during 1988 to 1993 were made to Tennessee, Georgia, Michigan, North Carolina, Florida, Alabama, Virginia, Texas, New Jersey, and South Carolina growers. Lack of moisture, very wet conditions, hail, and freeze were the widely-cited production perils during this period (FSA, various counties, various states).

Tennessee received $3.6 million in disaster assistance during the six-year period, 17 percent of the U.S. total, and the largest of all the states that received payments. Georgia received $3.3 million, the second largest payment volume, accounting for 16 percent of the total. Florida received $1.5 million, 7 percent of the total. California, the second largest producer of fresh snap beans in terms of crop value, received no disaster assistance payments during the six-year period.

A total of 744 counties across the United States received ad hoc disaster payments for fresh snap bean losses in at least one of the six years from 1988 through 1993. Sixty-eight counties in Georgia received payments, 51 counties in Tennessee, 45 counties in Michigan, 20 counties in Florida, and 13 counties in New Jersey. Cumberland County in Tennessee received the largest ad hoc disaster payments for fresh snap bean losses during the six-year period, collecting a total of $1.3 million, six percent of the U.S. total. The next counties in the series are Dade County in Florida, with $765,113, Northampton County in Virginia, with $754,013, Benton County in Arkansas, with $628,085, and Putnam County in Tennessee, with $594,659. These top five counties represented only 20 percent of total disaster payments for fresh snap beans.

Ad hoc disaster data can be used to indicate which production areas received large payments relative to their harvested acreage (Table 8). Georgia, Tennessee, Michigan, and South Carolina’s shares of total disaster payments were larger than their estimated shares of U.S. harvested acreage for fresh snap beans during 1988 through 1993. Florida, the largest producer of fresh-market snap beans in the United States, accounted for a small share of disaster payments relative to its share of average harvested acreage. New Jersey, Ohio, North Carolina, and Virginia’s shares of total disaster payments were relatively close to their shares of estimated average acreage during the same period.

## Fresh-Market Snap Bean Insurance Implementation Issues

### Adverse Selection

Flooding caused by excessive rains is a key adverse selection concern when insuring fresh-market snap beans, especially since it has been cited as a major production peril among the states studied. Damage caused by floods tend to be field-specific, affecting low-lying areas of the fields, flood plains, or fields with poor drainage. Growers are usually better informed about the likelihood of crop losses due to floods than the insurer, and may use this to their advantage. With crop insurance, for example, a grower may increase his or her risk-taking by planting snap beans in very heavy soils that usually tend to have poor drainage.

The cost of producing snap beans may also be a factor in adverse selection. All snap beans are grown from seeds and are, therefore, relatively less costly to produce than

other vegetable crops that require propagating and transplanting seedlings. In addition, most snap bean plantings are performed mechanically, avoiding higher costs associated with manual labor. Based on the cost of production, a grower may not be discouraged from planting snap beans in an area not suitable for the crop when indemnity payments from crop insurance can be collected.

**Setting Reference Prices**

The reference price for estimating the value of pre-harvest losses for fresh-market snap beans is best represented by an in-field value rather than an average market value price. The use of an in-field value will ensure that indemnity payments to producers will not include non-incurred harvesting and marketing expenses on that portion of production that was lost. Harvesting and marketing expenses account for a large proportion of total production costs, especially for those snap beans that are hand-harvested. Harvesting and marketing expenses for hand-picked beans account for about one-half of total production costs. Many fresh-market growers still hand-harvest their beans. Hence, the use of an average market value price for a reference price could result in indemnity payments to producers that are larger than their net returns had they harvested and marketed the crop. This situation may encourage moral hazard to fresh-market growers during periods of low fresh-market prices.

A close approximation to the in-field value of fresh-market snap beans is to use an estimated cost of production, excluding harvesting and marketing expenses. Another method would be to use an average grower price, and subtract the estimated harvesting expenses. When fresh-market production is grown under contract, such as the case in Georgia’s Sumter County, an average of the contract prices could be used to represent an in-field value, but it should be adjusted also for non-incurred harvesting and marketing costs.

**Estimating "Appraised Production"**

The number of bean pods produced by one snap bean plant varies from one plant to another. Snap bean production, therefore, is determined by the number of bushels, bushel hampers, or boxes filled at harvest time, typically with 30 pounds as the standard weight per unit-filled container. Appraised production could be estimated by multiplying the average number of containers filled from an acre of land and then multiplying the average per acre yields (in terms of 30-pound bushels) by the total planted area. Another approach, particularly in the case of immature bean pods, would be to take an average weight of harvested beans per plant from a sample plot, multiplied by the total number of plants in the production area, and then divided by 30 pounds (per container).

**Market Prices and APH Distortions**

Snap bean yields are measured in terms of the quantity (typically in terms of 30-pound bushels) harvested and marketed instead of quantity produced and potentially available for harvest. The frequency of harvesting per crop depends on the type of snap bean plant grown. Growers of bush-type beans harvest three to four times before they replace their crop while growers of pole beans could harvest three to ten times per crop. In Florida and Tennessee, industry sources have indicated that, in the past, some growers have opted to abandon their crop during periods of low fresh-market prices to avoid large expenses associated with harvesting and marketing their crop. This is especially true if market prices fall below market returns. In California and Georgia, industry sources have indicated that economic abandonment is also very feasible. Growers in New York, however, continue to harvest their crop in the hope of maintaining the trust of

their markets or customers. Because crop abandonment due to low market prices appears to exist to some extent, a grower's actual production history may not necessarily indicate farming ability.

**Market Prices and Moral Hazard**

Moral hazard poses a potential problem under a crop insurance policy for fresh-market snap beans, particularly since alternative markets are limited during glut periods. Fresh-market growers cannot easily divert their output to the processing sector. Snap beans for processing are usually grown under contract and the processors generally have a large influence on planting and harvesting schedules as well as the type and variety that is planted. Since most of the processing volume is pre-arranged, fresh-market growers can only sell to processors when the pre-set volume is not met and there is a shortage. In addition, not all processing plants are accessible to fresh-market growers. Some growers may have to ship to out-of-state processors and pay the transportation cost. With these market limitations, adopting a practice that increases a growers' chances of receiving an indemnity may be very appealing to fresh-market snap bean producers, particularly when the insurance indemnity is expected to be higher than the grower's market returns.

Growers who neglect to follow a good pest and disease control program and those who intentionally fail to provide adequate moisture during the flower and pod development period, despite the presence of irrigation systems, are likely to face large crop losses and are examples of moral hazard situations.

**Availability of Individual Yield Data**

Individual grower yield data for fresh-market snap beans appear to be available only from the growers themselves. County yield data in California are available from the County Agricultural Commissioners annual reports, which are compiled by the California Agricultural Statistics Service (Appendix E). However, these data are not broken down into fresh-market and processing snap bean categories.

**Demand for Crop Insurance**

According to industry sources, growers in the southern, north central, and northeast United States may indicate an interest in a crop insurance policy for fresh-market snap beans to reduce their production risks, especially with the reduced likelihood of individually-based ad hoc disaster assistance. Since most of the growers, in general, do not specialize in fresh-market snap bean production, their decision to apply for insurance will also depend on the amount of premium they have to pay. Growers who produce snap beans as a minor crop may decide to grow their snap bean crop without any insurance coverage and instead insure their major crops.

The demand for crop insurance for fresh-market snap beans appears to be strong in the southern states of Georgia, Tennessee, and North Carolina and in the North Central region, specifically in Michigan. These areas have collected large shares of U.S. disaster assistance payments for fresh-market snap bean losses between 1988 and 1993. Their shares of disaster payments were, if not close to, relatively larger than their estimated shares of harvested acreage. In addition, unharvested fresh-market snap bean acreage during 1992 to 1994 averaged 20, 11, 3, and 9 percent of total planted acreage in Georgia, Tennessee, North Carolina, and Michigan, respectively. Unharvested acreage may indicate that crop losses have been significant.

Drought is a major production peril to snap bean production. Hence, based on areas with irrigation, New York and Tennessee growers will likely be interested in crop insurance

because the majority of their production area has no access to irrigation. Based on disaster payments collected, the demand for crop insurance in New York, however, may not be as strong as in Tennessee.

Fresh-market snap bean producers from the western United States, particularly in California, will probably have less of an interest in crop insurance. There were no disaster payments for fresh-market snap bean losses in California between 1988 to 1993, even though the state represented an average of 8 percent of the nation's harvested acreage. During 1992 to 1994, all of the planted acreage was harvested. Other western states such as Idaho, Utah, and Washington, each received only less than one percent of total disaster payments between 1988 and 1993.

**Other Implementation Issues**

There appears to be no major obstacles in developing a crop insurance policy for fresh-market snap beans. In the case of the Florida analysis, the policy should provide adequate flexibility for the growers in terms of eligibility for payments when crop losses do occur.

FCIC may also investigate mandating prerequisites for snap bean producers who apply for fresh-market snap bean insurance coverage. These mandatory requirements could include soil tests for nematodes and other soil-borne pathogens, soil fumigation, the use of resistant varieties, as well as disease-free seeds. FCIC could also possibly enforce a requirement for mandatory access to irrigation. These prerequisites would help reduce the likelihood of adverse selection.

Note: See appendix F for major fresh-market snap bean production areas in Florida, Georgia, and California.

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County Agricultural Commissioner data for snap beans in California, 1990-93

| Year and county | Harvested acreage | Yield per acre | Production 1/ | Unit price 2/ | Value of production |
|---|---|---|---|---|---|
| | Acres | ----------Tons---------- | | $/ton | Thousand dollars |
| 1993: | | | | | |
| Contra Costa | 114 | 5.94 | 677 | 456 | 309 |
| Orange | 1,346 | 4.92 | 6,622 | 748 | 4,955 |
| Riverside | 876 | 4.21 | 3,688 | 1,349 | 4,975 |
| San Diego | 449 | 5.01 | 2,250 | 1,467 | 3,300 |
| Stanislaus | 3,100 | 1.50 | 4,650 | 210 | 977 |
| Other counties | 3,753 | NA | NA | -- | 6,382 |
| Total | 9,637 | 3.04 | 29,297 | 713 | 20,899 |
| 1992: | | | | | |
| Contra Costa | 132 | 3.66 | 483 | 878 | 424 |
| Orange | 1,658 | 6.67 | 11,059 | 669 | 7,399 |
| Riverside | 546 | 5.18 | 2,828 | 642 | 1,816 |
| San Diego | 521 | 4.87 | 2,537 | 1,470 | 3,730 |
| Stanislaus | 2,950 | 2.65 | 7,818 | 214 | 1,673 |
| Other counties | 4,117 | NA | NA | -- | 5,017 |
| Total | 9,924 | 4.26 | 42,276 | 475 | 20,059 |
| 1991: | | | | | |
| Contra Costa | 117 | 3.47 | 406 | 840 | 341 |
| Orange | 1,860 | 5.14 | 9,560 | 751 | 7,178 |
| Riverside | 375 | 2.33 | 874 | 1,211 | 1,058 |
| San Diego | 360 | 6.68 | 2,405 | 1,020 | 2,453 |
| Stanislaus | 2,000 | 3.50 | 7,000 | 230 | 1,610 |
| San Luis Obispo | 771 | 4.32 | 3,331 | 459 | 1,530 |
| San Bernardino | 64 | 5.25 | 336 | 563 | 189 |
| Other counties | 1,671 | NA | NA | -- | 1,407 |
| Total | 7,218 | 4.31 | 31,110 | 507 | 15,767 |
| 1990: | | | | | |
| Contra Costa | 245 | 2.04 | 500 | 702 | 351 |
| Orange | 1,829 | 5.00 | 9,145 | 702 | 6,423 |
| Riverside | 508 | 3.04 | 1,544 | 1,002 | 1,547 |
| San Diego | 490 | 7.96 | 1,200 | 2,113 | 2,536 |
| Stanislaus | 2,280 | 3.30 | 3,900 | 453 | 1,767 |
| San Luis Obispo | 789 | 5.16 | 4,071 | 615 | 2,505 |
| Santa Clara | 700 | 5.10 | 3,570 | 340 | 1,214 |
| Other counties | 2,813 | NA | NA | -- | 7,913 |
| Total | 9,654 | 4.42 | 42,671 | 568 | 24,256 |

1/ Estimated based on harvested acreage and yield per acre.
2/ Estimated based on total value of production and calculated production.

Source: California Agricultural Statistics Service.