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

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Executive Summary

USDA reported 1.855 billion pounds of U.S. cantaloupe production in 1993, up 6 percent from the prior year and about 39 percent above output reported for 1981. California, Arizona, and Texas were the leading cantaloupe-producing states, accounting for 91 percent of 1993 output. California alone accounted for two-thirds of U.S. production in that year.

U.S. cantaloupe production is highly seasonal, with peak output occurring from May to September. During May, the first domestic shipments of the season originate from south Texas, California (the Imperial Valley), and Arizona. By the first week of June, Georgia and other southern, central, and eastern states begin to ship cantaloupes. The central and eastern states ship mostly during July and August.

Cantaloupe is consumed almost exclusively fresh. U.S. cantaloupe consumption has increased modestly in recent years, rising from about 6-7 pounds per person during the early 1970's to about 8-9 pounds during the early 1990's. This rise is due partly to the increased availability of imported cantaloupes during the winter and spring months, which are considered to be the "U.S. off-season."

Domestic grower prices for cantaloupe are highly variable due to seasonal changes in the volume of production. F.o.b. shipping point prices usually average between $5.50 and $11.00 per 40-pound carton during May, when the domestic season begins. Prices typically drop to their lowest levels by July, when California's San Joaquin Valley reaches peak production, and remain relatively flat during July, August, and September. Prices usually then rise during October and November when the San Joaquin Valley season ends.

The Census of Agriculture reported 7,501 farms with 106,938 harvested acres of cantaloupes in 1992. Pennsylvania and Texas have the largest number of farms with cantaloupes, while California reported the largest acreage. Eighty-five percent of the total U.S. cantaloupe acreage was irrigated in 1992. All of the acreage in California, Arizona, and Colorado was irrigated, and 79 percent of that in Texas. On the other hand, only about a quarter of the acreage in Pennsylvania and about half of that in Michigan was irrigated.

The ideal climate for growing cantaloupe consists of a long, frost-free season with plenty of sunshine and heat, and relatively low humidity. Cantaloupe may be grown in nearly all areas of the United States, but the largest share of commercial production is located in somewhat arid regions--particularly in Arizona and California. Production is relatively more concentrated in arid areas than for certain other melons, such as watermelons, because cantaloupes are more susceptible to fungal diseases.

Numerous cantaloupe varieties are grown commercially, varying in their fruit characteristics (size, shape, flavor, sugar content, rind color, amount of netting, shipping quality), and in their level of disease resistance. Both open-pollinated and hybrid varieties are planted across the United States. Open-pollinated seed is less expensive than hybrid seed, but more hybrid

varieties are being planted because they tend to be sweeter and firmer, and to show increased plant vigor and higher yields.

Cantaloupes mature in 80 to 110 days after direct seeding. Sugar content is the principal measure of maturity and an important aspect of quality. Cantaloupes should have at least 10 percent soluble solids (sugar) for good dessert quality. High quality, crown-set fruit (the first melons on the vine to mature) may have a soluble solid content of 14 percent or higher. Sugar content does not increase once the melon has been removed from the vine.

Cantaloupes are usually harvested at what is known as "three-quarters-" to "full slip." Full slip is the condition in which an abscission layer has formed between the stem and the melon that allows the whole stem to separate cleanly from the melon with a slight tug. At three-quarters slip, one-fourth of the stem usually adheres and breaks rather than slipping free. In addition to sugar content, growers may consider market prices, weather conditions, anticipated yields, and distance to the market in deciding when to harvest.

Among production perils, excessive rain is identified as the most serious peril in south Texas and in the eastern and midwestern cantaloupe-producing areas. Excessive heat, excessive cold, excessive cloudiness, hail, drought, and high winds may also cause yield losses. Whiteflies, pickleworms, and cucumber beetles are identified as the most widespread insect problems, while mildews, blight, and vine decline are the chief disease problems.

In California, weather-related crop losses are relatively uncommon. However, the sweetpotato whitefly strain B (silverleaf whitefly) has caused extensive crop damage in the southern desert valleys since 1991, with the Imperial Valley sustaining the greatest losses. Whiteflies reduce the plant's vigor and serve as carriers for plant viruses. Because damage occurs only after whitefly populations build up, losses have been limited to fall cantaloupes. Extended periods of heat are needed for rapid growth of whitefly populations, and the spring crop, consequently, has been largely unaffected.

Our assessment is that cantaloupe is a good candidate for multiple-peril crop insurance in Texas and in the central and eastern United States. Growers in these areas face a wide array of yield-reducing production perils, especially perils linked to excessive rain and moisture. Disaster assistance payment and crop production statistics suggest relatively large crop losses among growers in the central, southern, and eastern U.S., when compared with those in Arizona and California.

It is our judgement that participation in cantaloupe insurance would be low among growers in Arizona and California. The basis for this judgment is the small amount of disaster assistance paid to Arizona and California growers in recent years (0.1 percent of the value of crop sales for each state), and the high percentage of planted acreage that is harvested (100 percent for the 7 reported years between 1977-81, 1992, and 1993). However, in California's Imperial Valley, growers may have an interest if whiteflies were covered by the policy.

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Introduction

Cantaloupe is an annual vine crop grown for its sweet fruit. It belongs to the botanical family Cucurbitaceae (gourd family), which includes cucumbers, watermelon, squash, and pumpkins. Cantaloupe, along with casaba and honeydew, are commonly called muskmelons. Cantaloupe, however, is distinguished from other muskmelons by its netted rind, orange flesh, and musky aroma.

A warm-season crop, cantaloupe is grown widely across the western and southern United States. The largest production states are Arizona, California, and Texas. Cantaloupe grows best in arid conditions; in humid environments, it is susceptible to fungal diseases. The U.S cantaloupe crop had a farm value of $283 million in 1993 (USDA, NASS).

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

Cantaloupe, honeydew, and watermelon confront many common insect pests and diseases because they are closely related. Also, production practices are quite similar for the three crops, and the same farms frequently produce both cantaloupe and honeydew, or all three crops. Because of these common bonds, our reports for the three crops may in places be duplicative. We have, however, tried to account for subtle differences among the crops in assessing the feasibility of offering insurance.

The Cantaloupe Market

Supply

USDA reported 18,551 thousand cwt. (1.855 billion pounds) of U.S. cantaloupe production in 1993, up 6 percent from the prior year and about 39 percent above output reported for 1981 (Tables 1 and 2).[1] California, Arizona, and Texas, respectively, were the leading cantaloupe-producing states, accounting for 91 percent of 1993 output. California alone accounted for two-thirds of U.S. production in that year.

[1] USDA-NASS discontinued collecting cantaloupe data during the 1982-91 period, creating a gap in U.S. cantaloupe production statistics. In addition, NASS statistics do not account for all U.S. cantaloupe output because production is reported for only 10 states. The bulk of U.S. output is likely accounted for, however, as Census data indicate that 90 percent of U.S. harvested cantaloupe acreage was located in the 10 NASS cantaloupe states in 1987.

Table 1--U.S. cantaloupe harvested acreage, yield per acre, and production, by state, 1992-93

State	1992			1993	
	Harvested acreage	Yield per acre	Production	Harvested Acreage	Yield per acre	Production
	Acres	Cwt.	1,000 cwt.	Acres	Cwt.	1,000 cwt.
Arizona	13,200	180	2,376	13,600	195	2,652
California	64,000	180	11,520	65,000	190	12,350
Colorado	1,200	90	108	1,600	150	240
Georgia	9,000	92	828	7,000	80	560
Indiana	3,000	120	360	3,200	150	480
Maryland	1,500	88	132	1,600	92	147
Michigan	800	80	64	1,100	90	99
Ohio	400	120	48	450	180	81
Pennsylvania	1,300	96	125	1,300	91	118
Texas	11,000	170	1,870	11,400	160	1,824
United States	105,400	165	17,431	106,250	175	18,551

Source: USDA, NASS. *Vegetables*.

Table 2--U.S. cantaloupes: Supply, utilization, and price, 1970-94 1/

	Supply			Utilization			Season ave. price 1/	
Year	Production 2/	Imports 3/	Total	Exports 3/	Total	Per capita use	Current dollars	Constant 1987 $
	Million pounds					Pounds	$/cwt	
1970	1,328.2	148.8	1,477.0	--	1,477.0	7.2	6.16	17.55
1971	1,238.2	180.8	1,419.0	--	1,419.0	6.8	6.56	17.73
1972	1,304.5	155.2	1,459.7	--	1,459.7	7.0	7.28	18.71
1973	1,130.2	157.5	1,287.7	--	1,287.7	6.1	8.08	19.56
1974	972.0	168.2	1,140.2	--	1,140.2	5.3	9.99	22.25
1975	985.8	138.9	1,124.7	--	1,124.7	5.2	10.40	21.14
1976	1,014.0	141.0	1,155.0	--	1,155.0	5.3	11.00	21.03
1977	1,089.9	182.8	1,272.7	--	1,272.7	5.8	10.60	18.96
1978	1,331.8	195.5	1,527.3	62.0	1,465.3	6.6	9.64	15.99
1979	1,242.1	194.6	1,436.7	59.6	1,377.1	6.1	11.30	17.23
1980	1,224.2	169.9	1,394.1	62.7	1,331.4	5.8	13.60	18.97
1981	1,334.6	138.0	1,472.6	65.5	1,407.2	6.1	14.10	17.87
1982	1,682.4	182.5	1,864.9	83.7	1,781.2	7.7	--	--
1983	1,453.7	166.1	1,619.8	87.8	1,532.0	6.5	--	--
1984	1,651.6	246.7	1,898.3	86.5	1,811.8	7.7	--	--
1985	1,874.3	246.0	2,120.3	100.4	2,020.0	8.5	--	--
1986	2,056.2	319.9	2,376.1	105.8	2,270.3	9.4	--	--
1987	2,027.3	300.8	2,328.1	107.1	2,221.0	9.1	--	--
1988	1,691.6	327.0	2,018.6	93.2	1,925.4	7.9	--	--
1989	2,171.4	476.2	2,647.6	84.1	2,563.5	10.4	--	--
1990	1,856.7	530.3	2,387.0	78.8	2,308.1	9.2	--	--
1991	1,664.0	602.5	2,266.5	75.7	2,190.8	8.7	--	--
1992	1,743.1	481.9	2,225.0	115.9	2,109.1	8.3	13.90	11.48
1993	1,855.1	458.1	2,313.2	116.2	2,197.1	8.5	15.20	12.24
1994f	1,754.1	514.2	2,268.2	102.6	2,165.6	8.3	--	--

-- = Not available. f = ERS forecast.

1/ Source: USDA, NASS except as noted. 2/ Estimated by ERS from 1982 to 1991 based on data from reporting states adjusted to the national level. 3/ Source: U.S. Dept. of Commerce, Bureau of the Census. From 1978-89, U.S. exports were adjusted using Canadian import data.

U.S. cantaloupe production is highly seasonal, with peak output occurring from May to September. During May, the first domestic shipments of the season originate from south Texas, California (the Imperial Valley), and Arizona. By the first week of June, Georgia and other southern, central, and eastern states begin to ship cantaloupes. The central and eastern states ship mostly during July and August. The domestic season ends during October and November with the harvesting of a fall crop from southern California and Arizona.

Imports, primarily from Mexico and Central American countries, account for most U.S. cantaloupe supplies from December through April. About 20 percent of the total U.S. supply has been imported in recent years.

Demand

With the exception of a very small amount of frozen melon balls, cantaloupes are used almost exclusively fresh. U.S. cantaloupe consumption has increased modestly in recent years, rising from about 6-7 pounds per person during the early 1970's to about 8-9 pounds during the early 1990's (Table 2). The rise in consumption is due partly to the increased availability of imported cantaloupes during the winter and spring months, which are considered to be the "U.S. off-season."

The United States exported about 6 percent of it cantaloupe output in 1993. Canada is the major foreign market.

Prices

Domestic grower prices for cantaloupe are highly variable due to seasonal changes in the volume of production (Table 3 and Figure 1). F.o.b. shipping point prices usually average between $5.50 and $11.00 per 40-pound carton during May, when the domestic season begins. Prices typically drop to their lowest levels by July, when California's San Joaquin Valley reaches peak production, and remain relatively flat during July, August, and September, coinciding with the San Joaquin Valley's season (Figure 2). Prices usually rise during October and November when the San Joaquin Valley season ends and the Arizona and California desert areas become major suppliers.

Industry Characteristics

Some of the more salient aspects of the cantaloupe industry which have significance in assessing the demand for crop insurance include:

- The large amount of non-irrigated cantaloupe acreage in the eastern, southern, and midwestern states makes yield losses due to drought more likely to occur in these areas than in Arizona, Texas, and California, where cantaloupes are universally irrigated.

- The high proportion of cantaloupes produced on farms where farming is identified as the grower's main occupation may be associated with a fair amount of interest in insurance. Growers for whom farming is

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

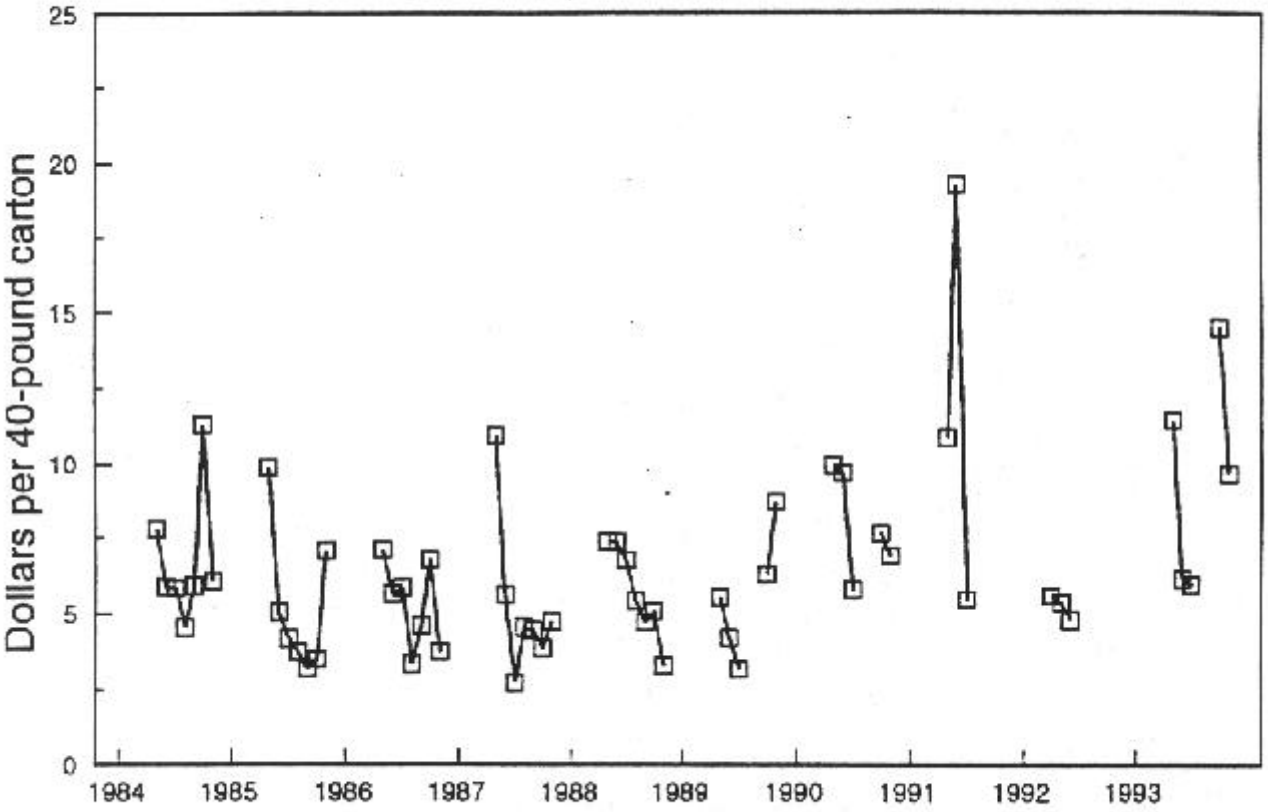
Month	1989	1990	1991	1992	1993
	$/40-lb. carton of 18s				
January	NR	NR	NR	NR	NR
February	NR	NR	NR	NR	NR
March	NR	NR	NR	NR	NR
April	NR	NR	NR	5.58	NR
May	5.53	9.95	10.88	5.37	11.43
June	4.21	9.71	19.27	4.80	6.14
July	3.19	5.78	5.45	NR	5.94
August	NR	NR	NR	NR	NR
September	NR	NR	NR	NR	NR
October	6.29	7.67	NR	NR	14.50
November	8.71	6.91	NR	NR	9.67
December	NR	NR	NR	NR	NR

NR = Not reported.

Source: Computed from USDA, AMS.

Figure 1--Cantaloupes: F.o.b. Prices,

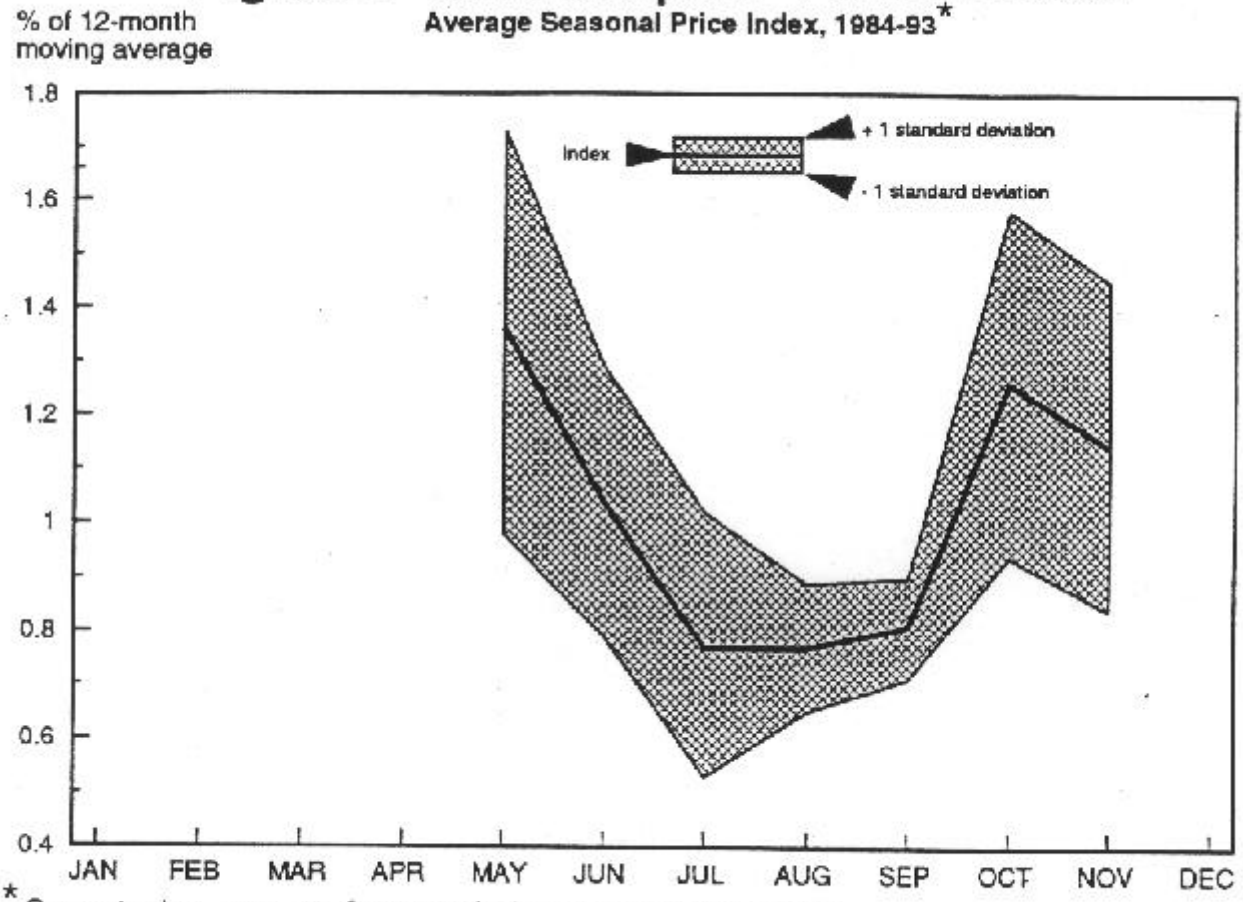
U.S. Monthly Average, 1984-93



Source: Computed from USDA, AMS.

Discontinuities result because of no data.

Figure 2--Cantaloupes: F.O.B. Prices



* Current price, percent of centered 12-month moving average

Insufficient data to estimate index for December-April

- their major occupation may feel a greater need for crop insurance as a risk management tool than those for whom farming is a secondary occupation.

- However, the tendency for operators of small- and medium-size farms to have substantial off-farm employment may lessen income risks and reduce these farmers' demand for crop insurance.

The primary sources of available information on farms producing cantaloupes are the 1987 and 1992 Census of Agriculture and USDA's 1992 Vegetable Chemical Use Survey.[2]

Farms with Cantaloupes

The Census of Agriculture reported 7,501 farms with 106,938 harvested acres of cantaloupes in 1992 (Appendix table 1). Pennsylvania and Texas reported the largest number of farms with cantaloupes, while California reported the largest acreage.

Eighty-five percent of the total U.S. cantaloupe acreage was irrigated in 1992, but this high percentage belies a relatively large amount of cantaloupes grown without irrigation in some states. All of the acreage in California, Arizona, and Colorado was irrigated, and 79 percent of that in Texas. On the other hand, only about a quarter of the acreage in Pennsylvania and about half of that in Michigan was irrigated, increasing the vulnerability of cantaloupes in these states to yield losses during periods of extreme drought.

The majority of farms with cantaloupes are relatively small, but the bulk of cantaloupe production appears to be from medium- and larger-size operations. According to the 1987 Census of Agriculture, 58 percent of the farms producing cantaloupes had total crop sales of less than $25,000 (Appendix table 2). The greatest number of small cantaloupe farms tend to be located in the southern, eastern, and central United States. Pennsylvania, with 711 farms producing cantaloupe in 1987, reported 68 percent with sales of less than $25,000, and Texas, with 579 farms, reported 57 percent with sales of less of $25,000. In contrast, California and Arizona report a substantial number of farms with crop sales of $100,000 or more.[3]

Eighty-three percent of farms with cantaloupes in 1987 were individually- or family-owned operations (Appendix table 3). Partnerships accounted for 11 percent of the operations and corporate farming accounted for 5 percent. The

[2] The statistical description of industry structure is based on a special tabulation of Census farms growing cantaloupes in 1987. No comparable tabulation for farms with cantaloupes in 1992 has been completed at the time this report was prepared.

[3] Crop sales exceeding $100,000 does not necessarily translate into a large cantaloupe enterprise because cantaloupes may account for only part of total crop sales.

individual- or family-owned classification is the most common type of operation among smaller farms. Partnerships and corporate operations are more common among the larger farms.

Seventy-two percent of the operators identified farming as their main occupation in 1987 (Appendix table 4). Even among the small- and medium-size farms (those with less than $100,000 in sales), the majority of operators reported that farming was their main occupation. A large proportion of the small- and medium-size farms, however, supplemented their income with off-farm employment.

Income Diversification on Farms with Cantaloupes

Despite considering farming their main occupation, off-farm employment appears to be an important source of income diversification for cantaloupe growers, particularly on farms with less than $50,000 in crop sales. Operators on 46 percent of all farms with cantaloupes indicated that they worked off the farm at least one day during 1987, and 31 percent worked off the farm for 100 days or more. For a number of such operators, cantaloupe production may be a part-time or sideline enterprise that supplements off-farm income.

Returns from other enterprises also provide income diversification for farms with cantaloupes. Of the $747 million in market sales reported by the 1987 Census for farms growing cantaloupes in California, Georgia, Maryland, and Texas, only 24 percent of the total was from cantaloupe sales (Table 4). Cantaloupe sales accounted for 30 percent of the sales in California, but only 9 percent in Georgia and 11 percent in Texas.

A 1992 USDA survey of vegetable farms indicates that a number of farms producing cantaloupe also grow other vegetables. In California, for instance, 29 percent of the survey farms reported that they produced both cantaloupes and other vegetables, and cantaloupe accounted for 45 percent of the total vegetable acreage on those farms (Table 5).

Cultivation and Management Practices

Climate

The ideal climate for growing cantaloupe consists of a long, frost-free season with plenty of sunshine and heat, and relatively low humidity. Cantaloupe may be grown in nearly all areas of the United States, but the largest share of commercial production is located in somewhat arid regions--particularly in Arizona and California.

Cantaloupes are more susceptible to fungal diseases than are watermelons. In particular, excessive rain and humidity, which are more common occurrences in the southeastern and midwestern states than in the more arid western regions, can amplify cantaloupe disease problems. As a result, cantaloupe production is relatively less concentrated in the southeastern and midwestern states than is the production of watermelon.

Table 4-- Market value of sales on farms producing cantaloupes, selected states, 1987

State	All products	All crops	Vegetables & melons	Canta-loupes	Cantaloupes, % of all products
	1,000 dollars				Percent
California	493,110	478,999	255,456	146,798	30
Georgia	14,338	11,718	4,388	1,225	9
Maryland	23,751	13,845	8,693	5,920	25
Texas	215,470	170,325	144,250	23,205	11
Four states	746,669	674,887	412,787	177,148	24

Sources: All data are from the 1987 Census of Agriculture, except for cantaloupe sales, which are from the respective state agricultural statistics services (California Agricultural Statistics Service, Georgia Crop Reporting Service, Maryland Agricultural Statistics Service, and Texas Agricultural Statistics Service).

Table 5--Enterprise diversification on farms growing cantaloupes, 1992

State	Farms sampled	Farms growing both cantaloupes and other vegetables	Cantaloupes, percent of total vegetable acreage
	Number	Percent	Percent
Arizona	23	30	19
California	86	29	45
Georgia	79	43	26
Michigan	101	23	13
Texas	108	32	39

Source: USDA, *1992 Vegetable Chemical Use Survey*.

Soil Requirements

Cantaloupes can be grown on a wide range of soil types, but produce the highest yields and best-quality melons on fertile, well-drained, slightly acid (pH of 6.0 to 6.5) sandy or silt loam soils. Cantaloupes grown in poorly-drained soils may crack or split if excessive moisture is present at maturity.

Varieties

Numerous cantaloupe varieties are grown commercially, varying in their fruit characteristics (size, shape, flavor, sugar content, rind color, amount of netting, shipping quality), and in their level of disease resistance. Some varieties are used primarily for local sales because they do not hold up well to the rigors of handling and storage that occur during long-distance shipping. Others, because of their resistance to bruising and longer shelf life, are used primarily for shipping.

Both open-pollinated and hybrid varieties are planted across the United States. Open-pollinated seed is less expensive than hybrid seed, but more hybrid varieties are being planted because they tend to be sweeter and firmer, and to show increased plant vigor and higher yields. Recommended varieties for each region are identified in the "State Analyses" section.

Planting

Cantaloupes are planted using both direct-seeding and transplant-planting. Planting must be timed to avoid frost and extended periods of cold weather. Freezing temperatures kill cantaloupe plants, while extended periods with temperatures below 55^0 F retard growth and reduce yields.

The earliest plantings occur in southern California, Arizona, and south Texas, and move northward with the onset of warmer weather. Planting returns to the southern areas during the mid-summer. In California, for example, cantaloupes are planted in the desert valleys during February and early March for harvest during June, in the San Joaquin Valley from March through June for harvest during the summer and early fall, and in the desert valleys again during July and August for harvest during the late fall. Usual planting and harvesting dates for several cantaloupe-producing areas are shown in Tables 6 and 9.

Cantaloupes are planted 1 to 3 feet apart in rows spaced 4 to 6 feet apart. When using the direct-seeding method, growers often over-plant (plant more seeds than the desired number of plants) to ensure a full stand. Excess seedlings are thinned after the planting becomes established. However, the use of pelleted seeds and precision planting equipment usually results in an adequate stand without over-planting. Precision planting reduces labor expenses for thinning and makes more economical use of expensive hybrid seed.

Increasingly, growers are planting with transplants. Transplanting is generally more expensive than direct seeding, but growers can harvest transplanted cantaloupes 7 to 10 days earlier than direct-seeded cantaloupes

Table 6--Usual planting and harvesting dates for cantaloupes

State	Planting date	Usual harvest date		
		Begin	Most active	End
Arizona	Feb. 1-Sep. 10	May 20	Jun. 10-Jul. 10	Nov. 30
California	See "California" state analysis section.			
Colorado	Apr. 15-May 15	Aug. 1	Aug. 10-Aug. 30	Sep. 30
Georgia	Mar. 1-May 1	Jun. 1	Jun. 15-Jul. 31	Aug. 25
Indiana	May 10-Jun. 15	Jul. 10	Jul. 10-Aug. 31	Sep. 20
Michigan	May 15-Jun. 20	Aug. 15	Aug. 20-Sep. 15	Oct. 5
S. Carolina	Mar. 15-May 10	Jun. 20	Jul. 1-Jul. 31	Sep. 5
Texas	Jan. 15-May 15	May 1	May 15-Jul. 31	Sep. 1

Source: USDA, Statistical Reporting Service.

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

(Granberry). Growers prefer having some cantaloupes that mature early because they generally command higher prices than those that are harvested later.

Fertilization

Cantaloupes require moderate amounts of nitrogen (N), phosphorus (P_2O_5), and potassium (K_20). Fertilizers should be applied according to nutrient needs, as indicated by soil testing. Excessive levels of nutrients, especially nitrogen, may delay maturity and reduce fruit quality.

Irrigation

Cantaloupes need a constant supply of soil moisture during crop establishment, vine growth, and fruit development to ensure high yields and good-quality melons. Insufficient moisture, especially during fruit development, slows fruit growth and results in small melons. However, fields should not be irrigated when the melons are ripening, as this may result in reduced sugar content and cause some melons to split or crack.

The western cantaloupe-growing areas use irrigation universally to ensure that moisture needs are met. While less universally utilized, much of the acreage in the eastern and midwestern areas also is irrigated (Appendix table 1).

Increasingly, growers are using drip irrigation, a system where small amounts of water are slowly applied to the root zone. This system requires less water than sprinkler systems or furrow irrigation. In addition, drip irrigation lends itself well to use with plastic mulch because water and fertilizer can be delivered to the root zone beneath the plastic. Drip irrigation also reduces foliar and fruit disease problems by minimizing the exposure of the leaves and melons to moisture.

Pollination

Cantaloupe yields depend on the number of female flowers that are pollinated. Honeybees are the most effective agents for pollination. The placement of one healthy colony of honeybees per acre in cantaloupe fields during flowering results in generally larger melons and higher yields. With intensive plantings, more than one hive may be needed to ensure uniform coverage. Inadequate pollination results in the increased incidence of low yields and misshapen fruit.

Harvesting

Cantaloupes mature in 80 to 110 days after direct seeding. Sugar content is the principal measure of maturity and an important aspect of quality. Cantaloupes should have at least 10 percent soluble solids (sugar) for good dessert quality. High quality, crown-set fruit (the first melons on the vine to mature) may have a soluble solid content of 14 percent or higher. Sugar content does not increase once the melon has been removed from the vine.

Cantaloupes are usually harvested at what is known as "three-quarters-" to "full slip." Full slip is the condition in which an abscission layer has formed between the stem and the melon that allows the whole stem to separate cleanly from the melon with a slight tug. At three-quarters slip, one-fourth of the stem usually adheres and breaks rather than slipping free. Some of the newer hybrid varieties are harvested at half slip. In addition to sugar content, growers may consider market prices, weather conditions, anticipated yields, and distance to the market in deciding when to harvest.

Cantaloupes are selectively hand picked based on the background color of the rind and ease with which the melon separates from the vine. They may be field packed or hauled to a packingshed and packed.

Sunburn damage can occur to harvested melons if they are permitted to sit in the hot sun for extended periods. As a result, harvested melons must be protected from direct sunlight.

Packing and Shipping Fresh Cantaloupes

Cantaloupes destined for the national market are packed in 40-pound cartons for handling and shipping. Field-packed melons are cooled using a forced air cooler to remove field heat. Shed-packed melons are usually hydro-cooled.

Cantaloupes may be stored for roughly two weeks at 36^0 F to 41^0 F and 95 percent relative humidity. Chilling injury may occur if melons are held at lower temperatures.

Hot water dips of 135^0 F to 140^0 F for three minutes are used to reduce the number of surface decay organisms. When treated with hot water dips, cantaloupes can be stored for up to 30 days (Mayberry).

Marketing

Most cantaloupes grown in the eastern states are marketed locally, either through farmers' markets, road-side stands, or grocery stores. In Georgia, for example, the largest share of sales is to buyers at the state farmers' market in Cordele, Georgia (Mizelle). The remainder of the crop is generally sold to buyers in larger regional cities. Since sales are primarily to local and regional markets, Georgia's cantaloupes generally are not graded or packed. Because the costs of grading and packing are not incurred, prices for Georgia melons average less than those for western-produced melons.

Most cantaloupes produced in California, Arizona, and Texas are grown and packed for sales in national markets. Because they are shipped long distances and held for a week or more before reaching consumers, varieties grown in these areas are firmer, and sometimes smaller, than those produced for local markets.

Since high quality is essential for cantaloupes to withstand the stress of long-distance hauling, the industries in these three states require that melons shipped from their areas meet minimum grade standards. Grade standards

in south Texas are specified by the South Texas Melon Marketing Order. In Arizona, standards are specified by the Arizona Citrus, Fruit, and Vegetable Standardization Agency. In California, a state marketing order, the Cantaloupe Advisory Board, sets minimum standards. Currently, the Advisory Board has defaulted to a state Department of Agriculture minimum.

Costs of Production

Variable harvesting and marketing expenses generally account for about 50 percent or more of total costs (Table 7). Because harvesting and marketing expenses account for such a large share of total costs, low prices at harvest-time may cause producers to abandon part of their melon crop, rather than harvest the entire crop and sell a portion at a loss. Although most growers pick their fields at least one time during the season, harvesting expenses rise with each picking as the quantity and quality of melons decline. Low prices could create a potential for moral hazard when abandonment of the field becomes more profitable than selling at less than the variable costs of harvesting.

Production Perils

Among production perils, excessive rain is identified as the most serious peril in south Texas and in the eastern and midwestern cantaloupe-producing areas. Excessive heat, excessive cold, excessive cloudiness, hail, drought, and high winds may also cause yield losses. Whiteflies, pickleworms, and cucumber beetles are identified as the most widespread insect problems, while mildews, blight, and vine decline are the chief disease problems.

Excessive Rain

If cantaloupes are located in areas where prolonged flooding submerges the plant's roots for one or more days, growth may be retarded or the plant may die. Roots require free oxygen in order to take up moisture. When roots are submerged, their oxygen supply is depleted and they no longer absorb the moisture needed by the plant.

Excessive moisture also is conducive to the development of foliar diseases and fruit rots. Diseases such as powdery mildew, downy mildew, damping-off, and anthracnose may range out of control during extended periods of warm, wet weather and cause plant losses.

In addition, excessive rain during fruit ripening hampers development of the melon's characteristic sweetness. It may also lead to reduced yields due to cracking and splitting of the fruit. Excessive rain and wet fields can also prevent timely harvesting, resulting in yield losses.

Excessive Heat

Excessive heat, especially if accompanied by conditions that reduce the plant's normal protective leaf canopy, can cause yield losses due to sunburn (see later discussion). Further, excessive heat can raise soil temperatures

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

State	Yield	Variable harvest cost	Total cost	Variable harvest percent of total
	40-lb. cartons	$/acre		Percent
Arizona:				
Spring crop	320	749	1,419	53
Fall crop	480	1,091	1,612	68
California:				
Fall crop (Imperial County)	400	1,200	2,061	58
San Joaquin Valley	450	1,800	2,264	80
Mid-bed trench and slant bed systems	350	1,050	2,159	49
Georgia	437	379	802	47
South Texas	395	1,600	2,342	68

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

Note: Yields and costs for the mid-bed trench and slant bed practices are an average of the two planting systems.

Sources: Wade, et. al.; University of California; Westberry and Mizelle; Texas Agricultural Extension Service.

to the point of damaging the cantaloupe plant. In general, when temperatures exceed 105^0 F, seeds will not germinate, and seedlings may die soon after emergence (Splittstoesser).

Excessive Cold

A late spring frost can kill early-planted cantaloupes, requiring replanting and delaying harvesting. Extended cool weather can also reduce seed germination. In particular, cantaloupe seeds may fail to germinate when soil temperatures fall below 65^0 F (Splittstoesser). Low soil and air temperatures during the growing period can stunt the plant's development and reduce fruit set.

Excessive Cloudiness

Long periods of cloudy weather slow development of the cantaloupe plant, delaying maturity of the melons. In several areas, delays in harvesting put growers in direct competition with California's crop, resulting in the receipt of lower prices than if the melons were marketed earlier. Cloudiness can also affect melon quality. During cloudy weather, the plant may not photosynthesize properly, and the melons may not develop the desired sugar content.

Drought

Extended drought may delay maturity of cantaloupe melons, reduce yields, and lower fruit quality. During severe drought, plants may wilt and die.

Drought can also contribute to sunburn damage. The plant's leaf canopy normally protects cantaloupes from excessively hot sun. During periods of drought, however, the leaf canopy wilts, exposing the melons to the direct sun and increasing the incidence of sunburn.

Hail

Hail can damage young cantaloupes by scarring the skin. Scars limit the marketability of the cantaloupes, especially if "cleaner" melons are available.

Winds

Strong winds, especially during the spring, can twist or tear young plants from the ground, reducing plant stands. In addition, wind-blown sand hampers the growth of young melon seedlings and opens wounds for the entry of diseases. Some growers plant windbreaks to reduce wind damage and promote faster plant growth in early-planted melons. Although more costly, row covers, hot caps, and tents are also effective means of protecting young plants.

Insects

The most common insect pests of cantaloupes are cucumber beetles, pickle worms, aphids, thrips, and whiteflies. Cultural practices can reduce the potential for economic injury. For example, planting cantaloupes when conditions are optimal for fast germination and seedling growth minimizes the period when the plants are vulnerable to injury from seedling insect pests. Proper timing and application of pesticides or insecticides also help control insect populations.

Cucumber Beetles

Although cucumber beetles feed on the stems and leaves of young cantaloupe plants, their greatest damage occurs from the transmission of bacterial wilt disease, which occurs during feeding. Most muskmelons are highly susceptible to bacterial wilt, and even a limited amount of feeding by cucumber beetles can result in plant losses. Foliar insecticides can be used to control beetles, especially the adults, before they feed widely on the cotyledons and the first true leaves of the crop.

Pickleworms and Melonworms

Pickleworms and melonworms are migratory insects that over-winter in areas from southern Florida to South America. The larva of these worms bore holes in the melon and feed on the inside. Damage usually occurs late in the season. Late plantings should be monitored closely for signs of pickleworms and melonworms, and if present, they should be controlled with insecticides.

Aphids

Aphids are green, soft-bodied (usually wingless) insects that obtain food by sucking plant juices. Heavy infestations cause the leaves to curl downward, turn yellow, and eventually die. Aphids secrete a substance which provides sustenance for the development of sooty mold, a fungus that blackens the surface of the leaves and melons. With severe infestations, sooty mold can make the melons unmarketable (Whittaker). Aphids can also transmit viral diseases that reduce fruit quality and yields. Foliar insecticides are effective in aphid control.

Thrips

Thrips are very small, spindle-shaped insects, 1/10-inch or less in length. Certain species cause early foliage damage, while others may attack the young melons, resulting in misshapen fruit. Thrips mechanically damage plants by rasping the leaf surface during the feeding process. Severe damage usually occurs only during periods of slow growth. Damage can be quickly outgrown during periods of favorable conditions, and usually no treatment is required. If treatment is necessary, thrips can be controlled with foliar insecticides.

Whiteflies

Whiteflies can become a serious production problem for cantaloupe when they are present in large numbers. Since whitefly populations build up during warm weather and are suppressed by cold weather, they tend to be more of a problem for fall melons than for spring melons.

When present in large numbers, whiteflies reduce the plant's vigor by feeding and releasing toxins into the plant itself. Whiteflies also serve as carriers of plant viruses, and can provide a hospitable environment for sooty mold fungus (Gruenhagen, et. al.). Sooty mold fungus causes the fruit to appear undesirable, and field packing becomes nearly impossible as the fruit must be washed to remove the discoloration (University of California, 1994).

Cutworms

Cutworms feed on all plant parts, but the most severe damage occurs when they chew on the stems of newly emerged seedlings, severing the young plant from its roots. Damage from chewing on the fruit is usually confined to superficial scarring, but it diminishes the visual appeal of the melon and reduces marketability.

Mites

Mite infestations generally enter the planting from the margins of the field and surrounding grassy areas. Mites reproduce very rapidly during hot, dry weather, and can complete a life cycle in five days when the temperature is 75^0 F or above. As a result, they can become very numerous in a short period of time. Mites feed by sucking sap from the plant, and if present in large numbers, they can reduce plant vigor and cause eventual yield losses. Mites can be controlled with miticide sprays.

Nematodes

Root knot nematodes are small, eel-like worms which live in the soil and feed on the roots of cantaloupe plants. Nematode feeding produces galls on the roots, impairing the plant's ability to absorb water and nutrients. Consequently, nematode attacks result in stunted plant growth, improper fruit maturity, and reduced yields. In addition, nematodes also allow diseases such as fusarium wilt to enter the plant.

The most practical control measures include the use of nematode-resistant cantaloupe varieties and the rotation of cantaloupes with crops that are poor nematode hosts. Cultivated grasses and cereals such as corn, oats, wheat, rye, barley, and sorghum are poor hosts and, therefore, are good crops for rotation with cantaloupes. Although more costly, soil fumigants may be incorporated in the soil before planting. However, a disadvantage of this practice is that the required waiting period after soil fumigation can delay planting beyond the desired date.

Diseases

As with other melons, disease infestations may cause serious cantaloupe losses. The use of resistant varieties, along with a spray program, can be used to control such diseases as powdery mildew, downy mildew, and gummy stem blight.

Downy Mildew

Downy mildew, a fungal disease, attacks the leaves of the cantaloupe plant, causing lesions, wilting, and death of leaf tissues. Infected areas on the leaves resemble frost injury. Temperatures between 61^0 F and 72^0 F, along with fog, high humidity, and frequent rains, are very conducive to the spread of this disease. Control consists of monitoring the planting frequently for signs of the disease and following a recommended spray program.

Powdery Mildew

Powdery mildew, a fungal disease, causes white, talcum-like mold growth on the leaf surfaces, which may spread to the petioles and young stems. This disease does not usually defoliate cantaloupes as rapidly as does downy mildew, but if not properly controlled, it may cause serious crop losses. It results in stunted, wilted growth and in serious cases, may kill the plant. Powdery mildew can be controlled with fungicidal sprays.

Anthracnose

Anthracnose, a fungal disease, can infect all above-ground parts of the cantaloupe plant. The first symptoms are reddish-brown spots that appear on the oldest leaves. Eventually, round, black, sunken spots appear on the fruit. Infected plants may die, especially following several rainy days with temperatures of 70^0 F to 80^0 F. Anthracnose damage can be minimized by the use of resistant varieties, the production of non-cucurbit crops in rotation with cantaloupes, and the use of fungicides at the first sign of infection.

Gummy Stem Blight

Gummy stem blight, a fungal disease, attacks the leaves and stems of cantaloupe plants. It may be associated with other diseases, such as damping-off and alternaria leaf spot. Gummy stem blight produces elongated, water-soaked areas on the stem. It causes the stems to crack open and brownish spots to appear on the older leaves. Light brown cracks on the vines usually produce a gummy ooze.

Bacterial Wilt

Bacterial wilt causes the cantaloupe plant to wilt quickly after the onset of infection, and results in the death of individual runners. It reaches plant tissues through deep wounds caused by the feeding of cucumber beetles on young cantaloupe plants. Infection can be prevented only by controlling cucumber beetles.

Fusarium Wilt

Fusarium wilt is a soil-borne, fungal disease that causes the cantaloupe vine to wilt and eventually kills the plant. Crop rotation with non-cucurbit crops and the use of resistant varieties are the only practical control measures. Wilt-resistant varieties, however, are not completely immune to the fusarium fungus, so it is desirable to use land on which fusarium-susceptible crops have not been grown for a minimum of 8-10 years.

Alternaria Leaf Spot

Alternaria leaf spot, a bacterial disease, produces small, circular tan spots on the oldest leaf surfaces. As these spots enlarge, they form concentric rings. Crop rotation and fungicidal sprays can help control this disease.

Damping-Off

Damping-off, a seedling disease, causes the stems of young plants to rot at the ground level and die. The ideal condition for the serious spread of damping-off is cool, wet weather, which retards rapid emergence and early plant growth. In some years, the disease can reduce stands by up to 50 percent, while in other years, losses are rare. Seed treatment and the use of cultural practices that encourage young plant growth are essential in preventing damping-off.

Vine Decline

Vine decline disease is thought to be caused by a complex of soil-borne pathogens, including *monosporascus cannonballus*. Vine decline causes infected vines to wilt just before the melons are ready to harvest, and appears to be a problem primarily in the lower Rio Grande Valley and in the Arizona cantaloupe-growing areas.

Although vine decline is not thoroughly understood, the fungi appear to infect the root system early in the plant's life and become evident only after the plant begins to carry a heavy fruit load. Vine decline may be native to the soils in a number of melon-growing areas, but becomes a problem only after repeated melon production. Reportedly, experienced growers in the lower Rio Grande Valley know in which fields vine decline is most likely to be a problem and avoid those fields when renting land for melon production (Brandenberger).

Mosaic Virus

Mosaic is caused by several different viruses, and can reduce fruit size and quality. The disease is usually spread by aphids and other sucking insects. The only control is to contain the insects that serve as carriers.

Sunburn

Sunburn occurs when the cantaloupe plant does not provide an adequate leaf canopy to protect the melon from direct sunlight. Diminished leaf canopy can

be associated with diseases, such as downy mildew, or with plant damage during harvesting. Sunburn may also be associated with periods of excessive rain, particularly when followed by extreme heat, during which the plant's roots cannot provide the plant with adequate moisture to maintain a vigorous leaf canopy. Sunburn damage can be minimized by ensuring that the plants are healthy and that a good protective canopy is maintained. Typically, sunburn damage is limited to a percentage of the crop, usually not more than 20 or 30 percent.

Weeds

Weeds compete for sunlight and moisture and create conditions favorable for disease and insect culture. Common weeds that can be expected to germinate in the mid- to late-growing season in cantaloupe fields include sicklepods, yellow and purple nutsedge, Florida beggarweed, jimsonweed, cockleburs, and morning glories. If not controlled properly, weeds can reduce both cantaloupe yields and fruit quality.

Common options for weed control include hand weeding, mechanical cultivation, herbicides, or a combination of these methods. Black plastic mulch in combination with herbicides is a particularly effective weed control method. Plastic mulch is used to control weeds within the rows, while herbicides are used for control between the rows. Crop rotation also helps keep land free from troublesome weeds.

State Analyses

Arizona

The Census of Agriculture reported 63 farms in Arizona with cantaloupes in 1992, harvesting 10,536 acres. All of those farms were irrigated. The USDA reported 13,600 acres in 1993, having a farm value of $45 million (USDA, NASS).

Maricopa County is the primary cantaloupe-producing county in Arizona, accounting for 73 percent of the state's 1992 Census acreage. Other important cantaloupe-producing counties include Yuma and La Paz.

Arizona's cantaloupe operations tend to be relatively large. The smaller operations generally range from 50 to 100 acres, while the state's two largest growers, Del Monte and Martorri Brothers, have several thousand acres (Umeda).

Cultural Practices

Arizona cantaloupe producers harvest a spring crop and a fall crop. Planting for the spring crop begins in February, and continues through March. The spring harvest begins in late May and continues through July. Planting for the fall crop runs from July through mid-September, with the melons harvested during October and November. A few cantaloupes are harvested during August and September.

Direct seeding is the principal method for planting cantaloupe. A number of growers use plastic mulch and drip irrigation, although furrow irrigation is also common (Umeda).

The most common cantaloupe varieties produced in Arizona include Caravelle, Top Mark (an older variety), Prismo, Laredo, Durango, Mission, Gold Mark, Desert Mark, and Laguna.

Arizona farms that produce cantaloupes often grow other vegetables and field crops, such as cotton. Melon land is typically planted with grains and other vegetables during the off-season for cantaloupes. Although the Extension Service recommends that cantaloupes not be planted in consecutive years, some growers follow this practice. Those growers who rotate out of cantaloupes rarely skip more than one year without planting cantaloupes (Umeda).

Production Perils

Arizona growers face few weather-related perils. Occasionally, excessive rain or a hail storm may cause cantaloupe losses. The major disease peril to cantaloupe production in Arizona at present is the vine decline pathogen called *monosporascus cannonballus*. Although Arizona's climate is generally arid, and most foliar diseases are not considered a serious problem, growers occasionally encounter powdery mildew.

The principal insect pests affecting cantaloupes include aphids, leaf miners, and whiteflies. Whiteflies are less of a problem since producers began using the insecticide "Admire" (Oebker).

Grower Organizations

Many Arizona cantaloupe producers are members of the Arizona Vegetable Growers' Association, which provides promotional programs for Arizona vegetables and melons.

Sources of Yield Data

The Arizona Citrus, Fruit, and Vegetable Standardization Agency, an arm of the Arizona Department of Agriculture, inspects all fruits and vegetables shipped by Arizona handlers. The agency is funded by grower assessments based on the quantity of shipments. Although the agency no longer plans to publish acreage and volume data for each shipper, it collects these data and indicated that they could be released with the shipper's permission for actuarial purposes (Foster).

Demand for Insurance

There is not likely to be very much interest among Arizona growers in purchasing crop insurance for cantaloupes because they confront relatively few production perils. Drought is not viewed as a production peril since all of Arizona's cantaloupes are irrigated, and other weather-related perils are minimal.

Disaster assistance and crop statistics data both suggest that yield losses in Arizona due to natural causes are generally minor. Disaster assistance payments to Arizona cantaloupe producers only amounted to 0.1 percent of the value of the crop during 1988-93. And, crop statistics indicate that usually all of the planted acreage is harvested (Table 8).

California

California ranks first in U.S. cantaloupe production, accounting for two-thirds of U.S. output in 1993. USDA's crop statistics indicate that California harvested 65,000 acres in that year, with a farm value of $184 million (USDA, NASS).

The Census of Agriculture reported 426 farms in California with cantaloupes in 1992, harvesting 51,531 acres. Fresno, Imperial, Merced, and Riverside counties all reported over 5,000 acres, and six other counties reported 500 acres or more. All of California's cantaloupes are irrigated.

Cultural Practices

Direct seeding is the most widely used planting method, especially for cantaloupes intended for the summer and fall harvests. For the spring crop, harvested mainly from the Imperial Valley, growers form trenches, plant the seed on the southern-facing shoulder, and cover the trench with plastic to create a heat tunnel. This method promotes faster seed germination during cool weather and provides the plant with an early start (Dickey).

Both open-pollinated and hybrid varieties are grown in California. Top Mark is a popular open-pollinated variety. Primo, Topscore, Easyrider, Mission, Highline, and Laredo are the main hybrid varieties.

California growers rotate cantaloupes with other crops, such as alfalfa and vegetables. Although a 3- or 4-year rotation is recommended, some growers plant cantaloupes more frequently. One horticulturist speculated that growers were using the shorter rotation because of the limited amount of area ideally suited for cantaloupe production (Hartz).

Planting Dates

California produces cantaloupes for three seasonal markets: spring, summer, and fall. Spring production is located in the Imperial and Palo Verde valleys in Imperial and Riverside counties, and is marketed from late May to July (Table 9). Almost all of the summer production is located in the San Joaquin Valley in Kern, Fresno, Kings, and Merced counties, and is harvested from late June through October. A small amount of summer production is grown in the Sacramento Valley, in Colusa, Sutter, and Yolo counties.

Traditionally, California's fall cantaloupe crop was produced in the Imperial and Palo Verde valleys, and marketed in October and November. In 1991, however, whitefly infestations ravaged cantaloupes in Imperial and Riverside counties. Since then, fall production has shifted to the southern San Joaquin

Table 8--Cantaloupes: Planted and harvested area, by state, 1977-81 average, 1992, and 1993

State	1977-81	1992			1993	
	Harvested, % of planted	Planted Acres	Harvested Acres	Harvested, % of planted	Planted Acres	Harvested Acres	Harvested, % of planted
	Percent	-----Acres-----		Percent	----Acres-----		Percent
Arizona	100	14,000	13,200	94	13,600	13,600	100
California	100	64,000	64,000	100	65,000	65,000	100
Colorado	71	1,300	1,200	92	1,700	1,600	94
Georgia	82	11,000	9,000	82	9,000	7,000	78
Indiana	95	3,200	3,000	94	3,300	3,200	97
Maryland	NR	1,700	1,500	88	1,700	1,600	94
Michigan	92	1,200	800	67	1,200	1,100	92
Ohio	NR	500	400	80	480	450	94
Pennsylvania	NR	1,300	1,300	100	1,300	1,300	100
Texas	94	13,000	11,000	85	12,400	11,400	92
United States	97	111,200	105,400	95	109,680	106,250	97

Note: Abandonment may be caused by not only low yields, but also low prices. However, to be reported as planted, but not harvested, the acreage would not have been picked even once during the season. With economic abandonment, one harvest pass-through would likely occur during the season; later pickings would not be made.

Source: USDA, NASS. *Vegetables*.

Table 9--Usual planting and harvesting dates for cantaloupes in California

Region	Season	Planting	Harvest	Peak harvest
Imperial Valley	Spring Fall	Jan.- mid-March mid-July - mid-Aug.	May-early July mid-Oct. - Dec.	June
Palo Verde	Spring	Jan. - March	May- July	July
San Joaquin Valley	Summer Fall	Feb.- March July	Jun.- Oct. Oct. - mid-Nov.	July-Sep.

San Joaquin Valley data include production from San Joaquin County in the north to Kern County in the South.

Source: *Marketing California and Arizona Melons*.

Valley. The fall crop from the San Joaquin Valley is small, however, relative to its summer production. The fall harvest lasts until the first frost, which usually occurs in mid-November.

Harvesting

California cantaloupes are picked by crews with the aid of mechanical harvesters. Pickers select melons to be harvested and place them on conveyors attached to the harvester. The melons may be packed on the harvester or placed in bulk bins and hauled to a central packingshed for packing. After packing, melons are cooled to remove field heat.

The basic harvest crew uses 14-17 people, including a field supervisor, and usually harvests 12 beds with each pass through the field. A crew can harvest 50-60 cartons per hour.

Although cantaloupes are generally not harvested until they reach at least 10 percent sugar content, the minimum sugar content required by the state's quality standards is 8 percent.

Marketing

Growers and handlers use a variety of different marketing arrangements. Some of the larger growers have integrated growing, packing, and selling operations and may, in addition to handling their own melons, pack melons for other growers. Smaller growers at times contract with larger handlers for packing and selling services. California's cantaloupes are sold to grocery chains and other wholesale markets throughout the United States.

The minimum grade requirement for California's cantaloupes was altered at the end of the 1994 season. Prior to the change, the state marketing order for cantaloupes required that melons at least meet the U.S. # 1 grade standard. Following the change, cantaloupes must only satisfy the California state minimum, which is less stringent than the U.S. # 1 grade. Inspections will be conducted by the County Agricultural Commissioners on a "spot-check" basis.

Production Perils

The principal weather-related production peril in California is excessive heat, which increases the likelihood of sunburn damage to unharvested melons. Excessively cool temperatures can also be a peril. Cool weather results in poor stand establishment among early-planted melons, and can necessitate re-planting due to seed rot and damping-off losses.

The principal disease problems affecting California cantaloupes include fusarium wilt, mosaic virus, powdery mildew, and vine decline. Fusarium wilt severely damaged the cantaloupe crop in Fresno County in 1976, and has caused losses in Merced, Stanislaus, Kings, and Kern counties since that time. Mosaic virus has been a particular problem for spring melons.

Severe whitefly infestations in southern California have been the most intractable insect problem. A number of growers have stopped growing fall melons in the Imperial and Palo Verde valleys since 1990 because of problems caused by the sweetpotato whitefly (see below). The sweetpotato whitefly reportedly caused a 96-percent loss of the 1991 fall cantaloupe crop in Imperial Valley (Mayberry).

The Recent Whitefly Infestation in California

The sweetpotato whitefly strain B (silverleaf whitefly) has caused extensive crop damage in the southern desert valleys since 1991, with the Imperial Valley sustaining the greatest losses. Whiteflies reduce the plant's vigor and serve as carriers for plant viruses. Because damage occurs only after whitefly populations build up, losses have been limited to fall cantaloupes. Extended periods of hot weather are needed for rapid growth of whitefly populations, and the spring crop, consequently, has been largely unaffected.

Because sweetpotato whiteflies have been extremely resistant to pesticides, current research in California is centered on biological control (Parella, et. al.). The pesticide "Admire" has shown promise in controlling whiteflies in Arizona, but is not registered for use on cantaloupe in California. Predatory beetles have shown promise in reducing whitefly infestations in Florida and raise the prospect for control in California (Heinz, et. al.).

Cantaloupe Organizations

The California Cantaloupe Advisory Board is a state marketing order which collects assessments from handlers (exclusive of those in the Imperial Valley) for the promotion of California cantaloupes. Although the Board also sets minimum quality standards for California cantaloupes, it recently reduced its minimum from U.S. # 1 to the less stringent California State Agriculture Code requirement.

The Melon Research Board, also a state program, funds production research on cantaloupe, honeydew, and other melons (not including watermelons). The Melon Research Board is financed with assessments from handlers throughout the state, including those in the Imperial Valley.

Sources of Yield Data

The California Department of Food and Agriculture requires that growers obtain permits through the County Agricultural Commissioners' offices to apply agricultural chemicals to crops. The Commissioners maintain lists of current cantaloupe growers in each county and acreage records on all those growers who have obtained a permit. No sources of historical yield data were identified, however, for individual growers.

Demand for Insurance

There is not likely to be very much interest among California growers in purchasing crop insurance for cantaloupe because they confront relatively few

unmanageable production perils. Drought is not considered a serious risk because all of the state's cantaloupes are irrigated. In most cases, insect and disease problems can be contained through management practices. The exception may be problems with the whitefly in Imperial County, where infestations in recent years have caused growers to reduce plantings for the fall harvest. There may be interest among these growers in insurance if it were to cover losses due to whiteflies.

Disaster assistance data and crop statistics, however, both suggest there are not very many yield losses due to natural causes. Disaster assistance payments to California cantaloupe producers only amounted to 0.1 percent of the value of the crop during 1988-93. And, crop statistics indicate that 100 percent of the planted acreage is usually harvested (Table 8).

Georgia

The Census of Agriculture reports 303 farms in Georgia harvesting 3,865 acres of cantaloupes in 1992, up from 178 farms and 1,876 acres in 1987. Fifty-four percent of Georgia's cantaloupe acreage was irrigated in 1992.

USDA reported that Georgia harvested 9,000 acres of cantaloupes in 1992, substantially more than indicated by the Census. For 1993, USDA reported Georgia's acreage down slightly from the 1992 estimate, at 7,000 acres, with a farm value of $4.6 million (USDA, NASS). The divergence between Census and USDA numbers may narrow when USDA revises its estimates, as is typically done following the release of Census data.

Cantaloupes are grown throughout Georgia, but the heaviest concentration of acreage is in the southwestern part of the state. Major production counties in 1987 include Dooley, Turner, Crisp, and Mitchell. Cantaloupe producers in Georgia generally also produce other vegetables, peanuts, or tobacco.

Cultural Practices

Georgia cantaloupes are planted from the last week of March through the first week of April. Direct seeding is the primary planting method, although some producers are planting transplants and using plastic mulch in order to have cantaloupes mature for an earlier market. The major varieties include Cordele, Saticoy, and Magnum 45 (Guy).

Cantaloupes in Georgia are harvested two or three times during the season, which runs from June through August. If prices fall below harvesting and marketing costs, the third harvest may be omitted. The third harvest produces the fewest, and usually, the lowest-quality, melons.

Georgia's cantaloupes tend to be larger and have a softer flesh than those grown in Texas, Arizona, and California. Although these larger melons may be as sweet or sweeter than western-grown melons, they do not have the long shelf-life needed for long-distance shipment. Consequently, a large share of Georgia's cantaloupes are sold in local and regional markets.

The largest share of Georgia's cantaloupes are sold to buyers at the state farmers' market in Cordele, Georgia (Mizelle). Melons also are sold to buyers in some of the larger regional cities, such as Atlanta, Columbia, and Birmingham. A few growers pack and ship melons throughout the eastern U.S, but account for only a small share of Georgia's output.

Since they are sold primarily in local and regional markets, Georgia's cantaloupes generally are shipped in bulk, without being graded and packed. Prices for Georgia cantaloupes average less than those for western melons.

Production Perils

The major weather-related perils affecting Georgia cantaloupes are drought, late-spring frosts, excessive rains, and hail. Georgia growers experienced severe crop losses due to flooding in 1994. Disaster assistance payments for cantaloupes in Georgia were highest in 1992, the result of very dry weather. Disaster payments for cantaloupes in 1993 also were quite large, because of too much rain at harvest (Watson).

The primary disease problem affecting Georgia cantaloupes is gummy stem blight. Producers also experience problems with downy mildew, powdery mildew, and anthracnose.

Insect pests include pickleworms and cucumber beetles, which serve as carriers for bacterial wilt. Nematodes are also a production peril.

Demand for Insurance

Georgia growers are likely to show substantial interest in cantaloupe crop insurance because of the relatively high probability of losses. Sizeable disaster payments to Georgia growers for cantaloupes--4 percent of the value of their cantaloupe production during 1988-1993--indicate that they experience substantial yield losses. In addition, differences between planted and harvested acreage suggest that crop losses are relatively high in Georgia. Approximately 20 percent of Georgia's planted cantaloupe acreage was not harvested in 1992 and 1993, similar to the average for the 1977-81 period (Table 8).

Grower Associations

There are no grower associations for cantaloupes in Georgia. However, the Georgia Watermelon Association would likely be a good avenue for contacting a broad spectrum of cantaloupe growers, since many of Georgia's watermelon producers also grow cantaloupe.

Data Sources

No sources of individual yield data for Georgia cantaloupes were identified. Georgia does not have a commodity promotion program for cantaloupes, which might maintain such data.

Indiana

The Census of Agriculture reported 302 farms in Indiana, harvesting 3,023 acres of cantaloupes in 1992. About one-third of the farms, and more than half of the acreage, was irrigated. Indiana's cantaloupes had a farm value of $6.5 million dollars in 1993.

The bulk of Indiana's cantaloupes are grown in Knox, Gibson, Jackson, and Sullivan counties in southwestern Indiana. Knox County alone accounted for about half of the state's acreage in 1992.

Most Indiana cantaloupe operations have fewer than 50 acres. The average size operation in 1992 was about 10 acres. There are a few farms, however, with up to 300 acres (Foster, Latin, and Weller).

Production Practices

Cantaloupes in Indiana are typically started in greenhouses and transplanted to the field. Planting occurs in early May in southern Indiana and during mid-May in the rest of the state. Growers plant on both raised beds and on flat rows. Most of the crop is grown with the aid of black plastic. Growers use both overhead and drip irrigation (Maynard).

Cantaloupe producers also typically grow other vegetables and field crops, such as soybeans, corn, and wheat. While field rotation is recommended, growers do not always rotate their cantaloupe fields with other crops. Most cantaloupe growers also grow watermelons, and usually have more watermelon acreage than cantaloupe acreage.

Harvesting begins in southern Indiana in late July and extends through August. In the northern areas, harvesting begins a week or two later. A field is generally harvested several times over a three to four week period.

Typically, growers haul their cantaloupes to a centralized location for packing and cooling. Packing, cooling, and selling is handled by growers' cooperatives. A few growers have their own packing and cooling facilities and handle melons for other growers.

Cantaloupes are sold through both wholesale and retail outlets. Wholesale sales are to dealers, who buy at packingsheds and distribute nationally, or to local grocery chains. The direct marketing outlets include roadside stands and farmers' markets.

Production Perils

The most common weather-related problems include hail, which damages the melons and makes them unmarketable, and excessively heavy rains. Although the largest disaster assistance payments in recent years were made for drought losses in 1988, many southern producers now irrigate and drought is less of a problem (Brust).

The most common diseases include powdery mildew, bacterial wilt, alternaria leaf spot, gummy stem blight, and anthracnose. Mites and aphids are the most serious insect problems.

Yield Data

No data sources were identified that could be used to generate yield histories for individual growers.

Producer Organizations

The Southwest Indiana Melon and Vegetable Growers Association includes Indiana cantaloupe producers. The Association is funded by growers' dues. It provides promotional and educational programs and funding for research on melons and vegetables. It could serve as an avenue for identifying cantaloupe producers.

The Watermelon Growers Association also could serve as a vehicle for identifying cantaloupe growers, since a number of cantaloupe producers also grow watermelons. The Illiana (Illinois and Indiana) Watermelon Association represents Indiana's growers.

Demand for Insurance

Indiana cantaloupe growers likely would be interested in crop insurance. They face a number of serious production perils including crop loss due to hail, excessive rain, and drought. Although more producers use irrigation now than they did during the drought of 1988, only about 54 percent of the cantaloupe acreage was irrigated in 1992.

Disaster assistance payments to Indiana cantaloupe growers averaged 4.8 percent of the state's cantaloupe crop value between 1988 and 1993. While not the highest percentage among all states, it was well above the ten-state average of 1.6 percent.

Texas

The Census of Agriculture reported 693 farms with cantaloupes in Texas in 1992, harvesting 18,703 acres. Seventy-nine percent of the cantaloupe acreage was irrigated in that year.

USDA's crop statistics reported 11,400 harvested acres in 1993, with a farm value of $31.7 million (USDA, NASS). Hidalgo County accounted for nearly a quarter of this acreage, but Pecos, Presidio, Reeves, and Starr counties all reported 750 acres or more (Texas Agricultural Statistics Service).

Cantaloupes are grown throughout Texas, although an estimated 85 percent of the crop originates in the lower Rio Grande Valley and the Trans-Pecos area in the far western part of the state (Dainello). Commercial melon enterprises in south Texas, which usually produce both cantaloupe and honeydew, range in size from 60 to over 2,000 acres (Brandenberger).

Cultural Practices

Most cantaloupes in Texas are planted from seed. In recent years, however, the planting of transplants has increased. The prospects of achieving an earlier harvest, along with savings in the cost of high-priced hybrid seeds, has caused growers to shift toward transplants. The most common cantaloupe varieties include Mission, Explorer, and Caravelle.

Cantaloupes in the lower Rio Grande Valley are produced almost exclusively using plastic mulch. In contrast, growers in far western Texas generally grow cantaloupes without plastic mulch. Both drip and furrow irrigation methods are used. Cantaloupes grown with plastic mulch are irrigated using the drip method.

Cantaloupes are a higher-cost crop than watermelons. Production costs for irrigated cantaloupes in the lower Rio Grande Valley are estimated at $2,334 per acre, compared with about $1,029 for irrigated watermelons. Virtually all of the additional costs for cantaloupe production are added expenses for harvesting and packing.

Cantaloupe producers often grow other melons, onions, and field crops, such as grain sorghum, corn, peanuts, wheat, and cotton. Fields are rotated out of melon crops annually to reduce the incidence of soil-borne diseases (Dainello).

Cantaloupes are planted from late February through mid-March for harvest beginning in mid-April. Most Texas cantaloupes are harvested during May and June. Texas cantaloupe producers try to get their crop planted as early as possible after the threat of frost. Their goal is to harvest before the California season reaches peak volume, when prices usually decline. Planting with transplants and using plastic mulch shortens the growing season.

Cantaloupes are harvested by hand. A field may be picked 6 to 12 times during the season, depending on weather and market conditions. Growers pick fewer times if prices are too low to cover harvesting and marketing expenses. Growers do not typically abandon a crop due to low prices before it has been harvested at least once. Even if current prices do not cover harvesting and marketing expenses, growers may pick the cantaloupes in order to keep the field producing with the expectation that prices will rise enough to make future picking profitable.

After picking, cantaloupes are loaded into bulk wagons and transported to cooling sheds. There they are washed, graded, and packed into 40-pound cartons for shipping.

The "window of opportunity" for marketing cantaloupes from Texas is late April through the first week of June. Earlier in the spring, Texas cantaloupes compete with those from Mexico, and after the first week of June, prices usually plummet because of large volumes from California. Since about 1990, some growers have experimented with producing a fall crop of melons. However,

the fall crop accounted for only about 3 percent of Texas' reported shipments in 1993.

The larger producers operate growing, packing, and shipping operations, and market their own melons. Some of these producers grow melons in both Mexico and Texas in order to extend their marketing season. Texas cantaloupes are marketed largely in the Midwest and Northeast. Smaller enterprises, which are located primarily around San Antonio and in the northern part of the state, market locally.

Production Perils

The most serious perils associated with cantaloupe production in Texas are excessive rain, excessive heat, high winds, hail, long periods of cloudiness, and late spring frosts. Excessive rain can cause plants to drown if the roots are submerged in water for more than a day; it is also conducive to the development of fruit rots.

Excessive heat may cause yield losses due to sunburn. Sunburn occurs most frequently when high temperatures follow a period of excessive rain. Excessive rain diminishes the leaf canopy, making the melons more vulnerable to sun damage. Sunburn is manifested by dark spots on the fruit's skin, which weaken it and allow pathogens to infect the fruit.

Wind damage occurs when young plants are broken or torn from their roots. Wind-driven sand also may scar the young plant, creating an entry for disease organisms. Hail also can cause yield losses by damaging young plants, and by scarring the melons of more mature plants.

Long periods of cloudy weather slow development of the cantaloupe plant, placing it in a later market window when it is more likely to face lower prices. Clouds also reduce photosynthetic activity, limiting the amount of sugar build-up in the melon.

Late spring frosts can be a problem in the lower Rio Grand Valley, where growers often plant cantaloupes as early as possible in the spring. The cantaloupe plant is very cold-sensitive, and frost will kill unprotected young plants.

The sweetpotato whitefly is frequently mentioned as a serious insect pest in the Rio Grande Valley. Because its population builds up during hot weather and declines during cold weather, whiteflies are more serious pests for the fall crop, which is planted in August, than for the spring crop.

Heavy rains and abnormally high temperatures are mentioned as the major causes of yield losses for which disaster payments for cantaloupes were made in 1992 and 1993 (Garcia, Schwertner). Untimely rains during September, 1994, killed some cantaloupe plants and diminished sugar development in the melons (Garcia).

Grower Organizations

Cantaloupe and honeydew marketed from south Texas are regulated by the South Texas Melon Marketing Order. The order regulates the grades and sizes of cantaloupe and honeydew shipped from south Texas, and requires that handlers pay assessments to support melon promotion, production, and marketing research.

The Texas Vegetable Growers Association is an organization of growers, horticulturists, and others concerned with research and education related to vegetables and melons. The association does not collect acreage or yield data.

The Texas Citrus and Vegetable Association is an organization composed primarily of shippers, and deals mainly with issues of concern to shippers.

Sources of Yield Data

The major source of individual grower data is the South Texas Melon Committee, which administers the Federal marketing order. The committee collects acreage statistics for individual growers, but its production statistics are collected at the handler level. Because a handler's volume may include production from a number of growers, it cannot be used to estimate yield histories for individual growers (Barter).

Demand for Insurance

Growers in Texas are more likely to be interested in a cantaloupe crop insurance policy than growers in Arizona and California. Usually, 6 to 15 percent of Texas' planted acreage remain unharvested, indicating that growers confront significant crop losses (Table 8). In addition, Texas growers collected relatively more in disaster assistance payments for cantaloupe than did the industry as a whole, suggesting that they face substantial production risks. Disaster payments in Texas are estimated at 7.7 percent of the value of cantaloupe production between 1988 and 1993, substantially higher than the 1.6-percent average estimated for the ten cantaloupe states that report production statistics.

Ad Hoc Disaster Assistance for Cantaloupe

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

Under the 1988-93 legislation, payments were made under the categories of participating program crops, nonparticipating program crops, sugar, tobacco, peanuts, soybeans, sunflowers, nonprogram crops, ornamentals, and at times, aquaculture. Producers without crop insurance--the case for cantaloupe--were

eligible for payments for losses greater than 40 percent of expected production. If a producer had no individual yield data to use in calculating "expected production," county-level or other data were used as a proxy. Payment rates for cantaloupe were based on 65 percent of a 5-year average price, dropping the high and low years.

Disaster assistance payments for cantaloupe losses totalled nearly $39.0 million over the 1988-93 period (Table 10). Payments for cantaloupe losses peaked at nearly $11.0 million in 1993, and were in the $7.0 to $7.5 million range in 1988, 1989, and 1992. Payments in 1990 and 1991 were between $2.5 and $3.5 million.

Ad hoc disaster payments for cantaloupe losses were scattered over a geographically broad area. Forty-six states received payments in at least one of the six years, with thirty states, scattered across the Southeast, Midwest, and Plains states, collecting payments in all years.

In an ordering of counties, Hidalgo County, Texas ranked first in payments for cantaloupe losses, receiving about $2.0 million over the 6-year period. The next three counties in the series include: Montague County, Texas ($1.8 million); Wise County, Texas ($1.4 million); and Comanche County, Texas ($1.3 million). Over 1,200 counties received payments in at least one of the 6 years for cantaloupe losses. Eight of the top-10 counties were located in Texas, one each were in Alabama and Mississippi.

By state, the largest payments by far were made to Texas growers, at $19.7 million over the six-year period. Alabama growers received $2.6 million. Other states that received over $1.0 million in payments over the six years include Indiana, Mississippi, Georgia, Tennessee, and Arkansas.

Ad hoc disaster data can be used to indicate which cantaloupe-producing areas received large payments relative to their acreage (Table 10). For example, the National Agricultural Statistics Service (NASS) reported an average 11,200 acres produced in Texas in recent years, about 11 percent of the U.S. total. At the same time, ASCS disaster assistance data indicate that Texas accounted for an average of more than 50 percent of U.S. ad hoc disaster payments made for cantaloupe between 1988 and 1993. Disaster payments made to Alabama and Mississippi were also large relative to those state's share of U.S. acreage.

In contrast, Arizona, California, and Georgia collected a smaller share of ad hoc payments relative to their acreage. California accounted for nearly 61 percent of U.S. cantaloupe acreage in recent years and collected less than 2 percent of U.S. ad hoc payments for that crop over the 1988-93 period. Arizona accounted for nearly 13 percent of U.S. cantaloupe acreage, and only 0.5 percent of ad hoc payments made for cantaloupe.

Disaster payments for the eleven NASS cantaloupe states averaged 1.6 percent of the cantaloupe crop value over the 1988-93 period (Table 11). Disaster payments as a percent of crop value were highest in Ohio, Texas, and Michigan, and lowest in Arizona and California. The low payments in Arizona and

Table 10--Disaster assistance payments for cantaloupe, 1988-93

State	Average cantaloupe harvested acreage, 1992-93	Share of U.S. acreage	Total cantaloupe disaster payments, 1988-93	Share of U.S. cantaloupe disaster payments
	Acres	Percent	Thousand Dollars	Percent
Alabama	NR	NR	2,560.5	6.6
Arizona	13,400	12.7	206.0	0.5
California	64,500	60.9	702.2	1.8
Colorado	1,400	1.3	428.3	1.1
Georgia	8,000	7.6	1,276.1	3.3
Indiana	3,100	2.9	1,497.3	3.8
Maryland	1,550	1.5	177.8	0.5
Michigan	950	0.9	680.5	1.7
Mississippi	NR	NR	1,491.8	3.8
Ohio	425	0.4	557.3	1.4
Pennsylvania	1,300	1.2	197.4	0.5
Tennessee	NR	NR	1,086.5	2.8
Texas	11,200	10.6	19,657.9	50.4
U.S.	105,825	100.0	38,998.9	100.0

NR= Not reported.

Note: Cantaloupe harvested area is averaged for the years 1992 and 1993 only. This is because little data exist for cantaloupe for the 1981-91 period. Disaster assistance data are averaged over the 1988-93 period.

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

Table 11--Cantaloupes: Estimated crop value and disaster assistance, selected states, 1988-93

State	Estimated cumulative crop value	Total disaster payments	Disaster payments, percent of crop value
	---------1,000 dollars--------		Percent
Arizona	181,503	206	0.1
California	1,044,101	702	0.1
Colorado	10,224	428	4.2
Georgia	31,704	1,276	4.0
Indiana	30,924	1,497	4.8
Maryland	18,532	178	1.0
Michigan	9,483	680	7.2
Ohio	5,790	557	9.6
Pennsylvania	12,750	197	1.5
Texas	254,196	19,658	7.7
10 states	1,599,207	25,413	1.6

Source: Disaster payments are from ASCS data files, compiled by the General Accounting Office. Crop values for 1992 and 1993 are from USDA, NASS. Crop values for Arizona, California, Maryland, and Texas for 1988-91 are from the state agricultural statistical services (Arizona Agricultural Statistics Service, California Agricultural Statistics Service, Maryland Agricultural Statistics Service, and Texas Agricultural Statistics Service). Crop values for other states were estimated by assigning the average of reported values for 1992 and 1993 to the unreported years, 1988 through 1991.

California likely reflect the relatively limited severity of production perils in these states.

Cantaloupe Insurance Implementation Issues

Adverse Selection

The cropping history of the field is probably more important for cantaloupe than for most crops, and is a key adverse selection concern. Cantaloupe are susceptible to infestation by a number of soil-borne diseases, and are more likely to succumb to one of these diseases if planted in an infected field than if planted in a field relatively free of diseases. If planted in fields in which fusarium- or anthracnose-susceptible crops have been grown in the recent past, for example, cantaloupes are at greater risk than if planted in fields where susceptible crops had not been grown. With insurance, however, some growers may be less careful about not planting in disease-prone fields, increasing the likelihood of yield losses.

Setting Reference Prices

FCIC provides reference prices (price elections) for insured crops, which become the basis for assigning values to yield losses. Insured growers elect the price guarantee as the basis for valuing indemnity payments.

A reference price for cantaloupes should represent the in-field value of the crop, because growers would not incur the expenses of harvesting and marketing on that portion of the yield that is lost. Variable harvesting and marketing expenses account for 50 percent to 80 percent of total production costs. Because they would not incur harvesting and marketing expenses on unharvested production, growers could face situations where indemnity payments based on a market-value price would exceed net returns had they harvested and marketed the crop. Such situations would provide undue incentive for moral hazard, particularly during periods of low market prices.

There are two approaches for deriving an "in-field" reference price. One is to deduct the estimated harvesting costs from a specified market price. The second is to estimate the cost of production (exclusive of harvesting and marketing expenses) and use it as a proxy for the in-field price. The market price refers to the grower price and not the retail price.

Market Prices and APH Distortions

Cantaloupe yields are measured in terms of the quantity of melons harvested and marketed rather than in terms of the quantity produced and potentially available for harvest. Growers plan to pick a field of melons at least three times (more frequently in some areas) before abandoning the planting. During periods of low cantaloupe prices, however, growers may pick only one or two times. Consequently, for a given field, the reported yield is higher if market prices are relatively high when the cantaloupes mature, than would be the case if market prices were extremely low. Because of this relationship

between market price and yields, a grower's actual production history may not necessarily indicate farming ability.

Estimating "Appraised Production"

One approach to estimating appraised production for cantaloupes (harvestable, but unharvested yield) is to count and weigh the marketable cantaloupes in a sample of plots and expand the plot yields to a per-acre basis. For plantings in which the melons have not yet reached marketable size (immature melons), the yields per plot would be estimated by counting the potentially harvestable fruit in the plots and multiplying by an average or typical weight per melon. Weight per melon would need to account for variety differences and for the number of plants per acre. Cantaloupe plants in fields with higher plant populations tend to produce smaller melons than plants in fields with lower plant populations. Also, melons grown in Georgia tend to be larger (due to variety selection) than those grown in Texas, Arizona, and California.

Market Prices and Moral Hazard

Moral hazard is a potential problem in insuring cantaloupe as the situation sometimes arises where, because of low market prices, an indemnity payment would be larger than the net return from harvesting and marketing the crop. Moral hazard would arise if the grower could contribute to causing a yield loss by neglecting prudent management practices.

One potential moral hazard concerns the timeliness of planting. Profitability sometimes depends on having cantaloupes for sale early in the season before prices decline. Planting dates largely determine when cantaloupe will be ready for harvest. Growers are faced, consequently, with a trade-off between planting earlier and risking losing their young plants to frost, and planting later, and risking losing market value at harvest-time due to low prices. Growers who plant early run a higher risk of losing their plants due to a late spring frost or freeze. Some growers reduce the chances of loss to frost by using row covers. With an insurance policy in place, some growers may rely on a potential crop insurance indemnity, rather than prudently take the necessary precautions for frost protection.

Availability of Individual Yield Data

We did not locate any yield data for individual growers. The Arizona Citrus, Fruit, and Vegetable Standardization Agency, however, assembles a record of acreage and production for melon producers that may serve as a basis for estimating individual yield histories. Although no longer published, both acreage and volume reportedly would be available for estimating individual yield histories (Foster).

The County Agricultural Commissioners in California maintain a complete list of current cantaloupe growers in each county. They also maintain records on the acreage on which permits to spray agricultural chemicals were issued. They do not, however, have production data with which to estimate individual yield histories.

Demand for Insurance

Our assessment is that cantaloupe is a good candidate for multiple-peril crop insurance in Texas and in the central and eastern United States. Growers in these areas face a wide array of yield-reducing production perils, especially perils linked to excessive moisture. Disaster assistance payment and crop production statistics suggest relatively large crop losses among growers in the central, southern, and eastern U.S., when compared with those in Arizona and California.

It is our judgement that participation in cantaloupe insurance would be relatively minimal among growers in Arizona and California. The basis for this judgment is the small amount of disaster assistance paid to Arizona and California growers in recent years (0.1 percent of the value of crop sales for each state), and the high percentage of planted acreage that is harvested (100 percent for the 7 reported years between 1977-81, 1992, and 1993).

FCIC has received several requests for cantaloupe insurance in recent years. Since 1989, requests for insurance have been sent to FCIC from California (5 requests), Nebraska (1 request), New Jersey (3 requests, all originating from the state agriculture commission), Oklahoma (1 request), Tennessee (various requests from grower associations), Virginia (1 request), and Indiana (various requests from grower associations).

Other Implementation Issues

There do not appear to be any intractable implementation obstacles in developing a policy for cantaloupe insurance. The problems encountered in offering cantaloupe insurance would likely be about the same as those confronted with commodities such as green peppers and fresh tomatoes, for which insurance is currently available. Cantaloupe, like peppers and fresh tomatoes, are grown as an annual commodity, have a high proportion of costs made up of harvesting and marketing expenses, and have yields subject to current market prices.

Because of these similarities, implementation problems for cantaloupe, such as market-price distortion of yields and moral hazard problems due to low market prices, are likely to be similar to those encountered with peppers and fresh tomatoes. Also, a policy for cantaloupe likely would be almost identical to one for watermelon and honeydew. In large part, it would be purchased by the same growers, since cantaloupe growers frequently also grow watermelons and/or honeydew, depending on the region.

Defining "Areas" for the Non-Insured Assistance Program

The Non-insured Assistance program (NAP) of 1994 Crop Insurance Reform covers crops that are not currently insured by FCIC--including cantaloupes--until the development of an insurance policy. Under NAP, an "area" must incur at least a 35-percent yield loss in order to trigger assistance payments. The definition of "areas" for purposes of calculating "area average yield" may

determine whether or not growers with a qualifying yield loss (50 percent or greater of the individual average) are eligible for NAP payments.

In general, defining area average yields along county boundaries should not create great inequities in deciding whether growers qualify for disaster payments. Most of the major disasters, including excessive rain, extreme drought, and extreme cold, would usually affect all growers more or less equally within a county boundary. In the minor cantaloupe counties, area yields may need to be defined along state lines, or at least at a greater level of aggregation than the county. The reason is that in some counties, there are so few growers, and most of the growers have such small acreages, that one large grower's yield may effectively determine the county average. Individual growers, if they had a 50 percent yield loss, would essentially trigger their own NAP payments.

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