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

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Table of Contents

Executive Summary

USDA reported 336 million pounds of U.S. honeydew production in 1993, 23 percent less than in 1992 and marginally lower than the output realized in 1981. California, Texas, and Arizona, respectively, are the leading honeydew-producing states and the only states for which USDA reports honeydew acreage and production. California is by far the leading state in honeydew production.

As with cantaloupe, U.S. honeydew production is highly seasonal, with peak output occurring from May through September. The first domestic shipments originate from south Texas during May, followed by supplies from Arizona (mostly during June and July), and California (from June through October). The domestic season ends during November, with the harvesting of a fall crop in California, Arizona, and Texas.

Virtually all honeydew are used fresh. U.S. honeydew consumption doubled from about 1.0 pound per person during the early 1970's to about 1.8 pounds during the early 1990's. This increase in consumption is due partly to the increased availability of imported honeydew during the winter and spring months, which are considered to be the U.S. off-season.

Grower prices for honeydew are highly variable due to seasonal changes in the volume of production. F.o.b. shipping point prices usually average between $5.00 and $10.00 per 30-pound carton during May, when the domestic season begins and south Texas is the principal source of supplies. Prices typically reach their lowest levels during the July through September period, when California's San Joaquin Valley reaches peak production, and usually rise during the fall and winter.

The Census of Agriculture reported 383 farms with 35,005 harvested acres of honeydews in 1992, up from 374 farms and 25,699 harvested acres in 1987. California reported the largest number of farms with honeydews and about three-quarters of U.S. honeydew acreage. In combination, California, Arizona, and Texas accounted for 98 percent of the 1992 Census honeydew acreage. Virtually all--99 percent--of the U.S. honeydew acreage was irrigated.

The ideal climate for honeydew production consists of a long, frost-free season with plenty of sunshine, warm temperatures, and relatively low humidity. Although closely related, honeydews are more susceptible to fungal diseases than are cantaloupes. This situation may explain why commercial honeydew production is limited almost exclusively to arid climates in Arizona, California, and Texas.

Honeydews 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. Both open-pollinated and hybrid honeydew varieties are grown commercially. Open-pollinated seed is less expensive than hybrid seed, but more hybrid varieties are being planted. Hybrids tend to be sweeter, produce higher yields, and have greater disease resistance than open-pollinated varieties.

Both direct-seeding and transplant-planting are used in establishing honeydew, although increasingly, growers are planting with transplants. Transplanting

is generally more expensive than direct seeding, but growers can harvest transplanted honeydews a few days earlier than direct-seeded honeydews. Early-maturing honeydews often are the most profitable because market prices are highest early in the season.

Unlike cantaloupes, honeydews do not form an abscission layer between the melon and the stem that permits easy separation from the vine at maturity. Consequently, honeydews are harvested by cutting the stem rather than by pulling the melon from the stem. Pickers select melons for harvest on the basis of background color, which changes from predominately greenish to predominately white when the melons mature.

Among production perils, excessive rain is generally the most serious hazard in honeydew production. Excessive heat, excessive cold, excessive cloudiness, hail, drought, and high winds may also cause yield losses. Whiteflies are the most frequently-mentioned insect pest, while vine decline is the most serious disease. Among the major-producing states, weather-related perils appear to be much more serious in Texas than in Arizona and California.

In California, weather-related crop losses are relatively uncommon. However, the sweetpotato whitefly caused severe losses to fall cantaloupe and honeydew crops in the southern desert valleys in 1991 and 1992. The impact on overall state production was less severe for honeydew than for cantaloupe, however, because honeydew production was less heavily concentrated in the infested region. Whiteflies have also been a problem in Arizona, although the insecticide "Admire" has been an effective control in that state.

Our assessment is that honeydew is a good candidate for multiple-peril crop insurance in Texas, but that there would not be very much interest in insurance among Arizona and California growers. Growers in Texas face a wide array of yield-reducing production risks, especially perils linked with excessive moisture. Disaster assistance payments provide evidence. While Texas accounted for 15 percent of the U.S. honeydew acreage during 1988-1993, Texas growers received 87 percent of the U.S. disaster assistance payments for honeydews over that period. These payments were close to 5 percent of the state's crop value.

It is our judgment that interest in honeydew insurance would be relatively minimal among growers in Arizona and California. The basis for this judgment is the small amount of disaster assistance paid for honeydews in these states. California growers harvested about 76 percent of the reported U.S. honeydew acreage between 1988 and 1993, but received only 7 percent of the disaster assistance payments made for that crop. In Arizona, harvested acreage accounted for 9 percent of the U.S. total, but honeydew growers received negligible disaster assistance for that crop between 1988 and 1993. However, there may be some interest among growers in Arizona and the desert valleys of California in buying insurance if the policy covered losses due to whiteflies.

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Introduction

Honeydew is an annual vine crop, grown for its sweet fruit, that is closely related to cantaloupe. Unlike cantaloupe, however, the honeydew fruit does not emit a musky odor and its flesh is green, rather than gold. It belongs to the botanical family Cucurbitaceae (gourd family), which includes cucumbers, watermelon, cantaloupe, squash, and pumpkins.

Honeydew is a warm-season crop with a somewhat longer growing period than cantaloupe. Honeydews, because they are highly susceptible to fungal diseases promoted by humidity, grow best in arid climates. Because of the high temperature and low relative humidity requirements, virtually the entire U.S. honeydew crop is grown in Arizona, California, and Texas. The U.S honeydew crop had a farm value of $58 million in 1993 (USDA, NASS).

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

Because they are closely related plants, honeydew, cantaloupe, and watermelon confront several common insect pests and plant diseases. Also, production practices are quite similar among the three crops, and the same farms frequently produce both cantaloupe and honeydew, or all three crops. Because of these common characteristics, the reports for the three crops may in some places be duplicative. We have, however, tried to assess the feasibility of offering insurance based on each crop's own subtle characteristics.

The Honeydew Market

Supply

USDA reported 3,360 thousand cwt. (336 million pounds) of U.S. honeydew production in 1993, 23 percent less than in 1992 and marginally lower than the output realized in 1981 (Table 1).[1] California, Texas, and Arizona, respectively, are the leading honeydew-producing states and the only states for which USDA reports honeydew acreage and production (Table 2). California is by far the leading state in honeydew production.

As with cantaloupe, U.S. honeydew production is highly seasonal, with peak output occurring from May through September. The first domestic shipments

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[1] NASS statistics do not account for all U.S. honeydew output because production is reported for only three states. The bulk of U.S. output is accounted for, however, as Census data indicate that 97 percent of U.S. harvested honeydew acreage was located in the three NASS honeydew states in 1987.

table 1

Table 1--U.S. honeydews: Supply, utilization, and price, farm weight, 1970-94

Year	Supply			Utilization			Season average price 3/	
	Production 1/	Imports 2/	Total	Exports 2/	Total	Per capita use	Current dollars 1/	Constant 1987 dollars
	Million pounds					Pounds	$/cwt	
1970	193.1	18.9	212.0	26.2	185.8	0.9	5.66	16.13
1971	203.9	14.9	218.8	26.3	192.5	0.9	6.23	16.84
1972	230.7	13.0	243.7	25.5	218.2	1.0	6.24	16.04
1973	245.3	17.6	262.9	27.9	235.0	1.1	7.47	18.09
1974	218.5	24.1	242.6	27.4	215.2	1.0	8.23	18.33
1975	239.5	12.0	251.5	22.3	229.1	1.1	9.31	18.92
1976	234.6	15.0	249.6	27.2	222.3	1.0	10.60	20.27
1977	259.1	18.1	277.2	28.8	248.3	1.1	9.87	17.66
1978	341.3	24.4	365.7	19.6	346.0	1.6	9.62	15.95
1979	347.7	28.7	376.4	19.3	357.1	1.6	10.90	16.62
1980	318.0	26.5	344.5	22.1	322.4	1.4	13.50	18.83
1981	341.9	29.0	370.9	17.2	353.7	1.5	15.40	19.52
1982	378.0	78.6	456.6	31.7	424.9	1.8	14.10	16.83
1983	391.8	39.9	431.7	17.8	413.9	1.8	13.20	15.14
1984	403.1	41.3	444.4	15.2	429.3	1.8	13.80	15.16
1985	475.8	42.7	518.5	20.0	498.5	2.1	12.20	12.92
1986	543.8	62.7	606.5	20.6	585.9	2.4	12.70	13.11
1987	481.1	77.8	558.9	27.6	531.3	2.2	14.40	14.40
1988	524.1	83.8	607.9	32.0	576.0	2.4	14.40	13.86
1989	513.1	134.3	647.4	30.6	616.8	2.5	12.10	11.15
1990	450.3	115.0	565.3	49.6	515.8	2.1	18.00	15.89
1991	373.7	160.2	533.9	53.3	480.5	1.9	18.40	15.63
1992	434.0	125.5	559.5	51.4	508.1	2.0	13.40	11.07
1993	336.0	141.6	477.6	55.0	422.6	1.6	17.20	13.85
1994f	390.0	143.0	533.1	57.0	476.1	1.8	--	--

-- = Not available. f = ERS forecast.

1/ Source: USDA, National Agricultural Statistics Service. 2/ Source: U.S. Dept. of Commerce, Bureau of the Census. Honeydews do not have a separate code. From 1970-79, trade was estimated as 50 percent of the category called "other melons." From 1980-92, shipment data was used to estimate the distribution of the "other melon" category; the ranges used were from 42 to 59 percent. Exports not adjusted using Canadian imports due to data limitations.

Table 2--U.S. honeydew harvested acreage, yield per acre, production, and value of production, by state, 1998-93

State and item	1988	1989	1990	1991	1992	1993
Arizona:						
Harvested acres	2,400	2,100	2,400	3,000	2,500	1,600
Yield (cwt/acre)	175	160	170	130	140	190
Production (1000 cwt)	420	336	425	390	350	304
Value ($1,000)	7,266	4,032	10,037	8,931	6,566	
California:						
Harvested acres	21,300	21,300	19,000	18,200	17,500	16,500
Yield (cwt/acre)	170	190	180	140	180	160
Production (1000 cwt)	3,621	4,047	3,420	2,548	3,150	2,640
Value ($1,000)	47,435	47,755	54,036	39,749	40,950	42,240
Texas:						
Harvested acres	7,500	6,500	5,000	4,700	4,200	2,600
Yield (cwt/acre)	160	115	135	170	200	160
Production (1000 cwt)	1,200	748	675	799	840	416
Value ($1,000)	20,640	10,547	17,145	20,215	12,096	8,944
United States:						
Harvested acres	31,200	29,900	26,400	25,900	24,200	20,700
Yield (cwt/acre)	168	172	171	144	179	162
Production (1000 cwt)	5,241	5,131	4,520	3,737	4,340	3,360

Value ($1,000)	75,341	62,334	81,218	68,895	58,051	57,750

Source: USDA, NASS. *Vegetables*.

originate from south Texas during May, followed by supplies from Arizona (mostly during June and July), and California (from June through October). The domestic season ends during November, with the harvesting of a fall crop in California, Arizona, and Texas.

Imports, primarily from Mexico and central American countries, account for most U.S. honeydew supplies from December through May. Nearly 30 percent of the total U.S. supply was imported in 1993.

Demand

As with cantaloupe, virtually all honeydew are used fresh. Although peak consumption occurs between June and September, honeydews are available year round as imports fill the gap in domestic supplies during the winter and spring.

U.S. honeydew consumption doubled from about 1.0 pound per person during the early 1970's to about 1.8 pounds during the early 1990's (Table 1). This increase in consumption is due partly to the increased availability of imported honeydew during the winter and spring months, which are considered to be the U.S. off-season.

The United States exported about 16 percent of its honeydew output in 1993. Canada is the major foreign market.

Prices

Grower prices for honeydew are highly variable due to seasonal changes in the volume of production (Table 3). F.o.b. shipping point prices usually average between $5.00 and $10.00 per 30-pound carton during May, when the domestic season begins and south Texas is the principal source of supplies. Prices typically reach their lowest levels during the July through September period, when California's San Joaquin Valley reaches peak production. Prices usually rise during October and November when the San Joaquin Valley season ends and the Arizona and California desert areas harvest a fall crop.

Industry Characteristics

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

- Nearly all of the U.S. honeydew acreage is irrigated, which virtually eliminates drought as a cause of yield losses.

- The high proportion of operators on larger farms (those with $50,000 or more of sales) identifying farming as their main occupation may contribute to substantial interest in insurance among these farms. Growers for whom farming is 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.

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

Month	1989	1990	1991	1992	1993
	----------2/3 cartons of 5-6's----------				
January	NR	NR	NR	NR	NR
February	NR	NR	NR	NR	NR
March	NR	NR	NR	NR	NR
April	NR	NR	NR	NR	NR
May	9.93	10.19	7.46	5.07	7.29
June	2.68	7.68	NR	4.80	5.94
July	3.23	4.86	8.38	NR	6.40
August	3.03	3.42	3.07	NR	NR
September	3.75	3.37	3.34	NR	NR
October	NR	8.64	5.19	NR	NR
November	NR	8.23	NR	NR	NR
December	NR	NR	NR	NR	NR

NR = Not reported.

Source: Computed from USDA, AMS.

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

Farms with Honeydew

The Census of Agriculture reported 383 farms with 35,005 harvested acres of honeydews in 1992, up from 374 farms and 25,699 harvested acres in 1987 (Appendix table 1). California reported the largest number of farms with honeydews and about three-quarters of U.S. honeydew acreage. In combination, California, Arizona, and Texas accounted for 98 percent of the 1992 Census honeydew acreage. Virtually all--99 percent--of the U.S. honeydew acreage was irrigated.

The majority of farms with honeydews are relatively large, having sales of $100,000 or more in 1987 (Appendix table 2).[3] Of the three major producing states, Arizona reported the largest proportion of farms with honeydew having sales of $100,000 or more, while Texas reported the fewest. The largest number of small farms with honeydew (those with less than $25,000 in sales) are concentrated in states other than Arizona, California, and Texas.

Sixty-three percent of farms with honeydew in 1987 were individually- or family-owned operations (Appendix table 3). Partnerships accounted for 19 percent of the operations and corporate farming accounted for 14 percent.

Seventy-five percent of the operators identified farming as their main occupation in 1987 (Appendix table 4). Nearly one-half of all farms and nearly 60 percent of small- and medium-size farms (those with less than $100,000 in sales), however, supplemented their income with off-farm employment.

Income Diversification on Farms with Honeydew

Despite considering farming their main occupation, off-farm employment is an important source of income for honeydew growers, particularly on farms with less than $100,000 in crop sales. Operators on 46 percent of all farms with honeydews indicated that they worked off the farm at least one day during the year, and 32 percent worked off the farm for 100 days or more. Among farms with less than $25,000 in sales, 65 percent worked off the farm at least one day and 45 percent worked off the farm 100 days or more. For a number of

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

Crop sales exceeding $100,000 do not necessarily translate into a large honeydew enterprise because honeydews may account for only a portion of total crop sales.

smaller producers, growing honeydews may be a part-time or sideline enterprise that supplements their off-farm income.

Other enterprises, especially vegetables and melons, also provide income diversification for honeydew growers. Of the $324 million in farm receipts reported by the 1987 Census for farms growing honeydews in Arizona, California, and Texas, only 21 percent of the total was from honeydew sales (Table 4). Honeydews accounted for about one-quarter of all sales in California and Texas, but only 7 percent in Arizona.

A 1992 USDA survey of vegetable farms indicates that a number of farms producing honeydew also produce other vegetables (Table 5). In California, for instance, 28 percent of the survey farms reported that they produced both honeydew and other vegetables, and honeydew accounted for 37 percent of vegetable acreage on those farms.

Cultivation and Management Practices

Cultural practices for honeydew are similar to those for cantaloupe because both are closely-related members of the muskmelon family. Generally, they have a similar growing season, although honeydew usually requires a longer period before reaching maturity. The production perils affecting honeydew are also very similar to those affecting cantaloupe.

Climate

The ideal climate for honeydew production consists of a long, frost-free season with plenty of sunshine, warm temperatures, and relatively low humidity. Honeydews, however, are more susceptible to fungal diseases than are cantaloupes. This situation may explain why commercial honeydew production is limited almost exclusively to arid climates in Arizona, California, and Texas.

Soil Requirements

Honeydews 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.

Varieties

Both open-pollinated and hybrid honeydew varieties are grown commercially. Open-pollinated seed is less expensive than hybrid seed, but more hybrid varieties are being planted. Hybrids tend to be sweeter, produce higher yields, and have greater disease resistance than open-pollinated varieties.

Planting

Both direct-seeding and transplant-planting are used in establishing honeydews. Honeydews must be planted after the danger of late spring freezes. Freezing temperatures will kill honeydew plants, and extended periods below

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

State	All products	All crops	Vegetables & melons	Honeydew	Honeydew, % of all products
	----------1,000 dollars----------				Percent
Arizona	74,294	70,550	49,627	5,462	7
California	175,005	172,879	118,081	44,125	25
Texas	74,648	74,552	72,522	19,706	26
Three states	323,947	317,981	240,230	69,293	21

Sources: All data are from the 1987 Census of Agriculture, except for honeydew sales, which are from USDA, NASS.

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

State	Farms sampled	Farms growing both honeydews and other vegetables	Honeydews, percent of total vegetable acreage
	Number	Percent	Percent
Arizona	20	27	9
California	31	28	37
Texas	19	21	15

Source: USDA, *Vegetable Chemical Use Survey*.

55° F retard plant growth and reduce melon yields. Usual planting and harvesting dates for the three honeydew-producing states are shown in Tables 6 and 9.

Honeydews are planted 1 to 3 feet apart in rows that are spaced 4 to 6 feet apart. When using the direct seeding method, growers usually over-plant (plant more seeds than the desired number of plants) to ensure a full stand. The excess seedlings are thinned to one plant per hill after they become established. An alternative to over-planting is to use pelleted seeds and precision planting equipment, which 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 honeydews a few days earlier than direct-seeded honeydews. Early-maturing honeydews often are the most profitable because market prices are highest early in the season.

Fertilization

Honeydews 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

Ample soil moisture is required during the growing period to ensure high yields and good-quality melons. Excessive moisture when the melons are ripening, however, may lower sugar content or cause the melons to crack or split.

Irrigation is used universally in the major honeydew-producing areas (Appendix table 1). Increasingly, growers are using drip irrigation, in which water is applied slowly to the root zone. Drip irrigation requires less water than sprinkler systems or furrow irrigation. In addition, drip irrigation lends itself well to use with plastic mulch because water and fertilizers 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 the melons to moisture.

Pollination

Honeydew yields depend on the number of female flowers that are pollinated. Honeybees are the most effective pollinating agents. The placement of one healthy colony of honeybees per acre in honeydew fields during the flowering stage produces generally large melons and high yields. With intensive plantings, more than one hive may be needed to ensure uniform pollination. Inadequate pollination causes flowers to abort and increases the incidence of misshapen melons.

Table 6--Usual planting and harvesting dates for honeydew melons

State	Planting date	Usual harvest date		
		Begin	Most active	End
Arizona	Mar. 1-Sep. 1	Jun. 15	Jul. 1-Nov. 30	Dec. 15
California	See California state analysis section.			
Texas	Jan. 1-Feb. 28	May 15	May 15-Jun. 15	Jul. 15

Source: USDA, Statistical Reporting Service.

Note: Dates reported in this table may differ 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 or reflect recent changes in planting practices. The data for Texas, for example, reflect data only for the spring crop. Since 1990, Texas has been producing a fall crop, for which the planting and harvesting dates are not reported in this table. (See the state analyses sections for more information.)

Harvesting

Honeydew matures in 100 to 130 days after direct seeding. Sugar content is the principal measure of maturity and an important aspect of quality. The sugar content of mature honeydew, generally higher than for cantaloupe, ranges from 10 to 14 percent (Yamaguchi). Honeydews 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. While honeydews soften after harvest, they do not increase in sugar content once the melon has been removed from the vine.

Unlike cantaloupes, honeydews do not form an abscission layer between the melon and the stem that permits easy separation from the vine at maturity. Consequently, honeydews are harvested by cutting the stem rather than by pulling the melon from the stem. Pickers select melons for harvest on the basis of background color, which changes from predominately greenish to predominately white when the melons mature.

Both honeydews and cantaloupes intended for long-distance shipment are harvested before they are ripe enough for eating. While cantaloupes ripen naturally following harvest, honeydews generally require ethylene treatment to promote ripening (Yamaguchi).

Harvested melons may be field-packed or hauled to a packingshed for washing, grading, and packing. After packing, melons are cooled to remove field heat. The number of times a field is harvested depends on market prices, weather, distance to the market, anticipated yields, and the sugar content of the fruit.

After picking, workers may place the vines to assure that a leaf canopy covers the remaining fruit, to avoid sunburn damage (see later discussion). Sunburn damage can also occur to harvested melons if they are permitted to sit in the hot sun for extended periods.

Packing and Shipping Fresh Honeydew

Honeydews are packed in a single layer in 30-pound fiberboard cartons or wooden crates for handling and shipping. The honeydews are packed using a divider which serves as a barrier or cushion between melons to prevent bruising and scuffing.

Honeydews may be stored for two to three weeks at 45^{o} F to 65^{o} F and 90 percent relative humidity. Chilling injuries such as surface decay, abnormal softening, and off-flavors occur when the melons are stored at temperatures below 41^{o} F.

Marketing

The marketing of honeydews grown in south Texas is regulated by the South Texas Melon Marketing Order. The order, administered by the South Texas Melon

Committee, sets minimum size and grade standards. In Arizona, the Arizona Citrus, Fruit, and Vegetable Standardization Agency, an office within the Arizona State Department of Agriculture, inspects and provides enforcement of minimum quality standards for all fruits and vegetables, including honeydew. In California, honeydew are subject to the minimum quality standards specified in the California State Agriculture Code, and inspection is conducted on a spot-check basis by the County Agricultural Commissioners' offices and state inspectors at border inspection stations.

Costs of Production

Variable harvesting and marketing expenses generally account for 60 percent or more of total honeydew production costs (Table 7). Because variable harvesting and marketing expenses account for such a large share of total costs, low prices at harvest-time may make abandoning part of the crop less unprofitable than harvesting and selling at a loss. Such a situation could create an economic incentive for moral hazard in offering insurance.

Production Perils

Excessive rain is generally the most serious hazard in honeydew production. Excessive heat, excessive cold, excessive cloudiness, hail, drought, and high winds may also cause yield losses. Whiteflies are the most frequently-mentioned insect pest, while vine decline is the most serious disease.

Excessive Rain

If honeydews 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 absorb moisture. When the 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 yield losses.

In addition, excessive rain during ripening hampers development of the honeydew fruit'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. Further, excessive heat can raise soil temperatures to the point of damaging the honeydew plant. In general, when temperatures exceed 105° F, seeds will not germinate, and seedlings may die when they emerge (Splittstoesser).

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

State	Yield	Variable harvest cost	Total cost	Variable harvest percent of total
	30-lb. cartons	---------$/acre---------		Percent
Arizona	415	952	1,727	55
California[2]				
Imperial County (Fall Crop)	800	2,120	3,264	65
San Joaquin Valley	450	1,958	2,398	82
South Texas	600	2,040	2,713	75

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

[2] The San Joaquin Valley figures are for mixed melons, which may include honeydew, crenshaw, casaba, santa claus, juan canary, and persian melons.

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

Excessive Cold

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

Excessive Wind

Strong winds, especially during the spring, can twist and 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 disease pathogens. Some growers plant windbreaks to help reduce wind damage and moderate the environment at ground level, promoting faster plant growth in early-planted melons. Although more costly, row covers, hot caps, and tents are effective means of protecting young plants.

Long Periods of Cloudy Weather

Extended periods of cloudy weather slow development of the honeydew plant and delay maturity of the fruit. Delays can put the melons in a later market window, when prices are usually lower. Long periods of cloudy weather can also reduce the sugar development needed for a sweet honeydew.

Drought

Extended drought may delay maturity, reduce yields, and lower fruit quality. During severe drought, the plants may wilt and die. Drought can also contribute to sunburn damage. The plant's leaf canopy normally protects the melons from excessively hot sunlight. During periods of drought, however, the leaf canopy wilts, exposing the melons to direct sunlight and increasing the incidence of sunburn.

Hail

Hail damages young honeydews by scarring the fruit. Scars limit the fruit's marketability, especially if "cleaner" melons are available.

Insects

The most common insect pests of honeydews are cucumber beetles, pickleworms, aphids, thrips, and whiteflies. Cultural practices can reduce the potential for economic injury. Planting when conditions are optimal for fast germination and seedling growth, for example, 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 honeydew plants, the greatest damage occurs from bacterial wilt disease, which the beetles transmit while 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 cucumber beetles, especially the adults, before they feed widely on the young plants.

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; 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 the 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 attack the young fruit, causing deformed melons. Thrips mechanically damage honeydew plants by rasping the leaf surface during the feeding process. Severe damage usually occurs only during periods of slow growth. Damage is 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 become a serious production problem for melon crops when they are present in large numbers. Whiteflies reduce the plant's vigor by feeding on the plant and releasing toxins into the plant itself. With severe infestations, the leaves turn yellow and wilt, and the plant may die. They remove a large quantity of plant sap during feeding and as they do, they secrete a "honeydew" that provides a hospitable environment for sooty mold (Gruenhagen et. al.). Whiteflies also serve as carriers for plant viruses.

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.

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 melon is usually confined to superficial scarring, but it diminishes the visual appeal of the melon.

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° F or above. As a result, they can become very numerous in a short period of time. Mites feed by sucking sap from the plants and, if present in large numbers, they can reduce plant vigor and cause 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 plants. They produce galls on the roots, which impair the ability of the plants to take up water and nutrients. Serious infestations stunt plant growth and reduce yields. In addition, nematodes promote infection by fusarium wilt and other diseases.

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

Diseases

As with other melons, disease infestations may cause serious honeydew yield losses. Disease controls consist primarily of using resistant varieties, rotating honeydew with non-cucurbit crops, and following a recommended spray program.

Downy Mildew

Downy mildew, a fungal disease, attacks the leaves of the honeydew plant, causing lesions, wilting, and death of leaf tissues. Infected areas on the leaves resembles frost injury. Temperatures between 61° F and 72° F, along with fog, high humidity, and frequent rains, are very conducive to the infection and spread of this disease. Control consists of monitoring the planting frequently for signs of the disease and following a recommended fungicidal 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 honeydews 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, it 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 honeydew plant at any stage of growth. The first symptoms appear as reddish-brown spots on the oldest leaves. Eventually, round, black, sunken spots appear on the melons. Infected plants may die, especially following several rainy days with temperatures of 70° F to 80° F. The threat of anthracnose infection can be lessened if resistant varieties are planted, non-cucurbit crops are grown in rotation with honeydews, and a recommended fungicidal spray program is followed.

Gummy Stem Blight

Gummy stem blight, a fungal disease, attacks the leaves and stems of honeydew plants, and may be associated with other diseases, such as damping-off and alternaria leaf spot. Gummy stem blight produces elongated, water-soaked areas on the stems. The stems crack and usually produce a gummy ooze, while brownish spots appear on the older leaves.

Bacterial Wilt

Bacterial wilt causes wilting and death of individual runners. The pathogen enters the plant through deep wounds caused by the feeding of cucumber beetles on the young honeydew plants. Infection can be prevented only by controlling cucumber beetles.

Fusarium Wilt

Fusarium wilt is a soil-borne, fungal disease which causing honeydew vines to wilt and eventually die. The disease can spread quickly among damaged plants at temperatures ranging from 75° F to 80° F.

The only practical control measures include crop rotation with non-cucurbit crops and the use of resistant varieties. 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, which enlarge and 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 promote young plant growth are essential in preventing damping-off.

Vine Decline

Vine decline 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 honeydew-growing area.

Although not thoroughly understood, vine decline appears to infect the root system early in the plant's life, and makes itself evident only after the plant begins to carry a heavy fruit load. The disease 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 for the disease.

Sunburn

Sunburn becomes a problem when the honeydew 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 plants are healthy and that a good protective leaf canopy is maintained. Typically, sunburn damage is limited to a percentage of the crop, usually not more than 20 or 30 percent.

Salinity

Salinity occurs in soil and water when there is a high concentration of soluble salts, usually chlorides and sulfates of calcium, magnesium, and sodium. Salinity tends to be a problem only in arid or semi-arid regions. In more humid regions, natural rainfall leaches soluble salts from the soil. Excess salinity results in stunted growth and may kill the honeydew plant. Improving soil drainage and leaching with fresh water is an effective means of reducing the detrimental effects of saline soils on crop growth.

Weeds

Weeds compete with the honeydew plant for sunlight and moisture, and create conditions favorable for disease and insect culture. Common weeds that can be expected to germinate in honeydew fields include sicklepods, yellow and purple nutsedge, Florida beggarweed, jimsonweed, cockleburs, and morning glories. If not controlled, weeds can reduce plant yields and fruit quality.

Common options for weed control include hand weeding, mechanical cultivation, herbicides and plastic mulch, 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 control weeds that emerge between the rows. Crop rotation also helps keep land free from troublesome weeds.

State Analyses

Arizona

The Census of Agriculture reported 27 farms in Arizona with honeydews in 1992, harvesting 2,258 acres. All of the acreage was irrigated. The USDA reported 1,600 acres planted and harvested in 1993, with a total farm value of $6.6 million (Table 8).

Honeydew production is concentrated mainly in La Paz and Maricopa counties. La Paz County accounted for about 52 percent of Arizona's honeydew acreage in 1992, and Maricopa County represented about 42 percent.

Arizona farms harvesting honeydews tend to be large, with a few farms growing most of the state's melons. The Census of Agriculture reported that 80 percent of Arizona's farms with honeydews in 1987 had $50,000 or more in sales, and about half had $500,000 or more in sales.

Cultural Practices

The cultural practices used for honeydew and cantaloupe production in Arizona are similar, and a number of producers grow both crops. Most honeydews are direct-seeded (Oebker). Planting begins as early as January, and harvesting begins in May. Producers space plantings throughout the spring to extend harvesting. The vast majority of Arizona's honeydews are harvested from May through July, but some harvesting continues through the summer and fall.

Table 8--Honeydew: Planted and harvested area, by state, 1989-93 average, 1989-93

Year and Item	Arizona	California	Texas	United States
1989:				
Planted acres	2,100	21,300	6,700	30,100
Harvested acres	2,100	21,300	6,500	29,900
Harvested, % of planted	100	100	97	99
1990:				
Planted acres	2,600	19,000	5,400	27,000
Harvested acres	2,400	19,000	5,000	26,400
Harvested, % of planted	92	100	92	98
1991:				
Planted acres	3,200	19,000	5,200	27,400
Harvested acres	3,000	18,200	4,700	25,900
Harvested, % of planted	94	96	90	94
1992:				
Planted acres	2,800	18,000	4,800	25,600
Harvested acres	2,500	17,500	4,200	24,200
Harvested, % of planted	89	97	88	94
1993:				
Planted acres	1,600	16,500	2,800	20,900
Harvested acres	1,600	16,500	2,600	20,700
Harvested, % of planted	100	100	93	99
1989-93 average:				
Harvested, % of planted	95	99	92	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*.

There is widespread use of plastic mulch to promote early maturity, and both drip and furrow irrigation methods are common. Drip and furrow irrigation are preferred to sprinkler systems because they lessen the chance of fungal diseases by keeping the plant's leaves dry. Drip irrigation systems allow for more precise moisture control, especially when used with plastic mulch.

Arizona farms growing honeydews also typically grow other vegetables and other field crops, such as cotton. Growers usually rotate their melon acres with field crops.

Honeydews are selectively hand-picked and field-packed in single-layer cartons. They are marketed nationwide to wholesalers and chain stores.

Production Perils

Arizona honeydew growers face relatively few weather-related perils. Although occasional heavy rains and hail may damage the crop, the climate is generally arid. Vine decline and powdery mildew are the major disease perils in Arizona. Losses to vine decline, however, are not as severe for honeydews as for cantaloupes. Growers also must monitor fields to avoid problems associated with soil and water salinity.

Whiteflies and aphids are reportedly the most serious insect pests. However, whiteflies have become a lesser problem since growers began using the insecticide "Admire." Admire is a systemic insecticide that is introduced into the soil and is absorbed by the plant's roots.

Industry Organizations

Arizona honeydew producers are represented by the Arizona Vegetable Growers Association. The Vegetable Growers Association would be a good vehicle for contacting a broad cross-section of honeydew producers.

Sources of Yield Data

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

Demand for Crop Insurance

There probably would be little interest among Arizona growers in a honeydew crop insurance policy which covered only weather-related perils. Drought is not a serious peril because Arizona's entire honeydew acreage is irrigated, and there have been minimal yield losses due to other weather perils. The small amount of disaster assistance for honeydews indicates that losses due to weather-related perils are minor. Between 1988 and 1993, disaster assistance

payments amounted to less than 0.05 percent of the value of honeydew production, much lower than, for example, the 4.7 percent estimated for Texas. There may be greater interest in insurance if a honeydew policy covered losses due to whiteflies. Depending on the year, six to eleven percent of the 1990-1992 planted acreage was not harvested, largely because of whitefly damage (Table 8). All of the losses occurred to the fall crop, when whiteflies are most serious (Arizona Agricultural Statistics Service). Even if crop insurance were to cover whitefly losses, the demand for insurance may be rather limited because current management practices appear to be controlling this pest. Crop statistics indicate that all of Arizona's planted honeydew acreage was harvested in 1993.

California

The Census of Agriculture reported 147 farms with honeydews in California in 1992, harvesting 26,225 acres. Yolo, Stanislaus, and Fresno counties each reported harvesting over 3,000 acres, and four other counties individually reported more than 500 acres of honeydew harvested in that year. Yolo County accounted for close to one-fourth of the state's honeydew acreage. All of California's acreage is irrigated.

California ranks first in U.S. honeydew production, accounting for 79 percent of total output in 1993. USDA reported 16,500 harvested acres in California in that year, with a total farm value of $42.2 million (USDA, NASS). There is no apparent explanation for the difference between USDA's 1993 harvested acreage estimate and the 1992 Census estimate. Following release of Census data, USDA revises its estimates for the past five years, and may revise its California honeydew numbers if changes appear warranted.

Cultural Practices

Honeydews are almost exclusively propagated by direct seeding in California. Planting begins in the Imperial Valley in January for the production of melons that are to be harvested from May to July (Table 9). In the Sacramento and San Joaquin Valleys, honeydews are planted during February and March for harvest from June through October. Traditionally, growers in the Imperial Valley planted a fall crop during July and August for harvest from mid-October to December. However, in 1991, whiteflies ravaged honeydews in the Imperial Valley. Since then, fall production has declined in Imperial County and increased in the San Joaquin Valley.

The primary honeydew varieties planted in California are Green Flesh Honeydew, Orange Flesh Honeydew, and Hybrid Honeydew. Furrow irrigation is the principal irrigation method.

Most growers rotate honeydew with other crops within the crop year, but rarely follow the recommended 3-4 year rotation between honeydew crops. One horticulturist speculated that growers were using the shorter rotation because of the limited amount of area ideally suited for honeydew production (Hartz).

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

Region	Season	Planting	Harvest	Peak
Imperial Valley:				
	Spring	Early Jan.-mid March	May-early July	June
	Fall	Mid July-mid August	Mid Oct.-Dec.	
Sacramento Valley:				
	Summer	February-March	July-October	July
San Joaquin Valley:				
	Summer	February-March	June-October	July-Sept.

Source: *Marketing California and Arizona Melons*.

Individual fields may yield as high as 1,200-1,300 cartons per acre, but 500-600 cartons is a more typical average. The state average yield was 533 cartons in 1993.

Harvesting and Packing

Honeydews are hand-picked and placed on conveyors attached to a mechanical harvester. They may be field-packed in a mobile packingshed attached to the harvester or hauled to a permanent packingshed. All melons are cooled before shipping to remove field heat.

Production Perils

The major peril confronting California honeydew production is excessive heat, which increases the chances of sunburn damage. Excessively cool temperatures are also a peril, and result in poor stand establishment due to seed rot and damping-off losses among early-planted melons.

The principal disease problems faced by California melon growers include fusarium wilt, mosaic virus, and powdery mildew. Fusarium wilt severely damaged the honeydew crop in Fresno county in 1976, and has since caused losses in Merced, Stanislaus, Kings, and Kern counties.

Whiteflies have been the most serious insect problem, primarily among fall-planted melons in Imperial County. Other insect pests include cutworms, aphids, mites, loopers, leafhoppers, leafminers, ground beetles, crickets, and whiteflies. Cucumber beetles were a major problem in Yolo county in 1992 (Miylo).

The Recent Whitefly Infestation

The sweetpotato whitefly caused severe losses to fall cantaloupe and honeydew crops in the southern desert valleys in 1991 and 1992. The impact on overall state production was less severe for honeydew than for cantaloupe, however, because honeydew production was less heavily concentrated in the infested region. The combined honeydew production of Imperial and Riverside counties prior to the infestation was, at its peak, 15 percent of the state's total honeydew output. In contrast, cantaloupe production in this region accounted for over 30 percent of California's total cantaloupe output. Since 1991, a number of growers have switched out of melon production and into other vegetables, such as broccoli (Mayberry).

Grower Organizations

The Melon Research Board funds production research on cantaloupe, honeydew, and other melons (except watermelons). The Board is financed with assessments from handlers.

Sources of Yield Data

No sources of historical yield data for individual growers appear to be available in California. However, the County Agricultural Commissioners in California maintain a complete list of current growers in each county. The California Department of Food and Agriculture requires that growers obtain permits through the Agricultural Commissioners' offices to apply agricultural chemicals. The Commissioners maintain records on the acreage for which permits were obtained.

Demand for Crop Insurance

Very little interest would likely exist among California growers in a honeydew crop insurance policy which covered only weather-related perils. Drought is not a serious peril because California's entire honeydew acreage is irrigated, and there have been minimal yield losses due to other weather-related perils. Data on disaster assistance payments for honeydew indicate that losses due to weather-related perils are minor. Between 1988 and 1993, disaster assistance payments amounted to only 0.1 percent of the value of honeydew production, much lower than the 4.7 percent estimated for Texas and the three-state (California, Arizona, and Texas) average of 1.2 percent.

Interest in honeydew insurance would likely be greater if the policy covered losses due to whiteflies. Three to four percent of California's 1991 and 1992 planted acreage was not harvested, largely because of whitefly damage (Table 8). Even if crop insurance were to cover whitefly losses, the demand for insurance may be rather limited. Crop statistics indicate that all of the planted acreage was harvested in 1993, as well as in 1989 and 1990.

Texas

The Census of Agriculture reported 52 farms in Texas with honeydew in 1992, harvesting 5,923 acres. Virtually all of the acreage was irrigated. USDA reported only 2,600 harvested acres in 1993, with production having a farm value of $8.9 million (USDA, NASS). USDA reviews its estimates following release of Census data and may revise its numbers.

The majority of honeydews are grown in Hidalgo, Starr, and Willacy counties in the lower Rio Grande Valley. Small amounts are grown in other southern and southwestern counties.

Growers frequently produce both honeydew and cantaloupe. They generally rotate their melons with other vegetables, such as onions, cabbage, carrots, and peppers, and field crops, such as grain sorghum and cotton.

Cultural Practices

Honeydews are mostly direct-seeded in Texas. The spring crop is planted from late February through the middle of March, while the fall crop is planted during late July and early August (Bearden). Production of a fall honeydew crop in Texas is relatively recent, occurring since about 1990. All of the

commercial honeydew acreage is irrigated, using either drip or furrow irrigation.

Increasingly, honeydews are grown with the aid of plastic mulch. Currently, 30 to 40 percent of south Texas growers use black plastic mulch together with drip irrigation (Brandenberger). Drip irrigation is used almost exclusively when honeydews are grown with plastic mulch. Honeydews mature 7 to 10 days earlier when grown with plastic mulch instead of on bare ground. In addition, the mulch reduces the incidence of fruit rots by preventing the melons from contacting the soil.

On farms where honeydews are produced commercially, the size of honeydew acreage ranges from 100 acres to over 1,000 acres (Brandenberger). Growers plant both open-pollinated and hybrid varieties. The most commonly-grown honeydew varieties include Morning Eyes, Moonshine, and Sweet Delight (Brandenberger).

The peak harvest months for Texas honeydews are May and June. In the past five years, growers have increased their plantings for harvest during the October through November period. The spring crop, however, is usually larger than the fall crop.

Workers select mature melons and remove them from the vine by cutting the stem with a sharp knife. After picking, honeydews are taken to a packingshed where they are washed with a chlorine dip, sized, and packed into 30-pound cartons and cooled to remove field heat. Very few honeydews are field-packed in Texas.

Texas honeydews are harvested 3 to 5 times during the season. The frequency of picking depends largely on weather conditions and market prices. Honeydews need to be picked more frequently when temperatures are high because the melons mature faster and can more easily become over-ripe during such periods. In addition, sunburn is likely to occur if mature melons remain in the field during hot weather.

Although growers usually harvest at least one or two times, they may abandon later pickings if current market prices are too low to cover harvesting and marketing expenses. It is unusual for growers to not harvest at least one time, however, despite low prices. By harvesting, they keep the plants producing and may, therefore, benefit if prices rise enough to make subsequent pickings profitable. Usually, the first harvest provides larger yields and higher-quality melons than later harvests, and also is associated with the lowest harvesting costs.

Marketing

Commercial growers may grow melons under contract with packingsheds, they may own a packingshed and pack their own melons, or they may deliver their melons to a handler who packs and sells on a commission basis. Eight to ten packingsheds reportedly handle virtually all honeydew production from the lower Rio Grande Valley (Brandenberger). Smaller farms, especially those

located outside the lower Rio Grande Valley area, tend to market their melons at roadside stands or farmers' markets, or sell directly to a local grocery chain.

Production Perils

Honeydews face essentially the same production perils as cantaloupes in Texas. The weather-related perils include excessive rain, excessive heat, late spring frosts, strong winds, hail, and long periods of cloudy weather.

Excessive rain can drown plants if flooding submerges the plant's roots for more than one day. At harvest, excessive rain may delay harvesting. Melon rots and sunburn may occur if the rain is followed by a period of extreme heat. Excessive rain at harvest was a cause of yield losses for which disaster assistance payments were made in 1992 (Schwertner). Spring frost is a production threat primarily for growers who plant early in the spring.

Downy mildew and vine decline are the major disease problems affecting honeydews in Texas. Rain, accompanied by warm temperatures, exacerbates mildew problems. Whiteflies were identified as the most difficult insect pest to control.

The relatively large amount of disaster payments made to Texas farmers--at 87 percent of the U.S. total for honeydew between 1988 and 1993--attests to the relatively large risks associated with growing honeydew in the state. Payments totaled $1.2 million in 1993 alone. Heavy rains at harvest-time were cited as the major reason for losses in 1992. Abnormally high temperatures in May and June, which increased the incidence of sunburn, were a major cause of losses in 1993 (Schwertner).

Grower Organizations

The South Texas Melon Marketing Order, administered by the South Texas Melon Committee, regulates the marketing of both cantaloupes and honeydews. The Committee regulates the grade and size of honeydews shipped from the area and collects assessments from handlers to support melon promotion and 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 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

Texas growers are more likely to be interested in purchasing crop insurance for honeydew than growers in Arizona and California. Eight percent of Texas' planted acres remained unharvested between 1989 and 1993, indicating that crop losses were relatively common (Table 8). The relatively large amount of disaster assistance paid for honeydew losses provides further evidence that growers experience relatively large crop losses in Texas. Honeydew disaster payments were an estimated 4.7 percent of the value of the Texas honeydew crop between 1988 and 1993, substantially higher than the 1.2-percent average estimated for the United States and the 0.1 percent or less estimated for Arizona and California.

Ad Hoc Disaster Assistance for Honeydew

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 honeydew policy. These data may also suggest the areas where the demand for a honeydew 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 honeydew--were eligible for payments on 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 honeydew were based on 65 percent of a 5-year average price, dropping the high and low years.

Disaster assistance payments for honeydew losses totalled nearly $5.0 million over the 1988-93 period (Table 10). Payments for honeydew losses peaked at over $1.3 million in 1993, and were in the $800,000 to $900,000 range in 1988, 1989, and 1991. Payments in 1990 and 1992 were between $500,000 and $600,000.

Ad hoc disaster payments for honeydew losses were scattered over 123 counties in the 1988-93 period. Twenty-nine states received payments in at least one of the six years, with three states--California, Michigan, and Texas--collecting payments in all years.

In an ordering of counties, Hidalgo County, Texas ranked first in payments for honeydew losses, receiving more than $1.1 million over the 6-year period. The next three counties in the series include: Duval County, Texas ($800,000); Brooks County, Texas ($600,000); and Jim Wells County, Texas ($296,000). Nine of the top-10 counties were located in Texas. The other county in the top-10 is Kern County, California.

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

State	Average honeydew harvested acreage, 1988-93	Share of U.S. acreage	Total honeydew disaster payments, 1988-93	Share of U.S. honeydew disaster payments
	Acres	Percent	Thousand Dollars	Percent
Arizona	2,050	9.1	1.9	0.0
California	17,000	75.7	355.9	7.2
Oklahoma	NR	NR	87.6	1.8
South Carolina	NR	NR	62.3	1.3
Texas	3,400	15.1	4,332.6	87.2
U.S.	22,450	100.0	4,971.3	100.0

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

By state, the largest payments by far were made to Texas growers, at $4.3 million over the six-year period. California growers received $356,000. The third-ranked state in the series--Oklahoma--received a far-distant $88,000.

Ad hoc disaster data can be used to indicate which honeydew-producing areas received large payments relative to their acreage (Table 10). For example, the National Agricultural Statistics Service (NASS) reported an average 3,400 acres produced in Texas in recent years, about 15 percent of the U.S. total. At the same time, ASCS disaster assistance data indicate that Texas accounted for an average of more than 87 percent of U.S. ad hoc disaster payments made for honeydew between 1988 and 1993.

In contrast, Arizona and California collected a small share of ad hoc payments relative to their acreage. California accounted for nearly 76 percent of U.S. honeydew acreage over the 1988-93 period and collected about 7 percent of U.S. ad hoc payments. Arizona accounted for about 9 percent of U.S. honeydew acreage, and only 0.04 percent of ad hoc payments.

Disaster payments for the three NASS honeydew states averaged 1.2 percent of the honeydew crop value over the 1988-93 period (Table 11). Disaster payments as a percent of crop value were highest in Texas and lowest in Arizona and California. The low payments in Arizona and California likely reflect the relatively limited severity of production perils in these states.

Honeydew Insurance Implementation Issues

Adverse Selection

As with cantaloupe, the cropping history of the field is probably more important for honeydews than for most crops, and is a key adverse selection concern. Honeydew are susceptible to infestation by a number of soil-borne diseases, and are more likely to succumb to one of these pests 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, honeydews 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 a price guarantee as the basis for valuing indemnity payments.

A reference price for honeydews should represent the in-field value of the crop, because growers would not incur the expenses of harvesting and marketing on any portion of the production that is lost. Variable harvesting and marketing expenses account for 55 percent to 82 percent of total production costs. Because they would not incur harvesting and marketing expenses on unharvested production, growers could face situations where indemnity payments

Table 11--Honeydew: Crop value and disaster assistance, selected states, 1988-93

State	Total crop value	Total disaster payments	Disaster payments, percent of crop value
	-------1,000 dollars------		Percent
Arizona	37,010	2	*
California	262,254	356	0.1
Texas	92,148	4,333	4.7
Three states	391,412	4,690	1.2

* Less than 0.05 percent.

Source: Disaster payments are from ASCS data files, compiled by the General Accounting Office. Crop values are from USDA, NASS.

based on a market-value price exceeded grower 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 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

Honeydew 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. In Arizona, California, and Texas, growers hope to pick a field of melons several times before abandoning the planting. During periods of low honeydew prices, however, growers may pick a field only one or two times, and if prices are extremely low, they may even abandon a field completely, prior to any harvesting. Consequently, for a given field of melons, the reported yield is higher if market prices are relatively high when the honeydews 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 honeydews (harvestable, but unharvested yield) is to count and weigh marketable melons 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. Honeydew plants in fields with higher plant populations tend to produce smaller melons than plants in fields with lower plant populations.

Market Prices and Moral Hazard

Moral hazard is a potential problem in insuring honeydews 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 situation concerns the timeliness of planting. Profitability sometimes depends on having honeydews for sale early in the season before prices decline. Planting dates largely determine when honeydews 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, growers may be less careful about planting only after the danger of late spring frost.

Availability of Individual Yield Data

The Arizona Citrus, Fruit, and Vegetable Standardization Agency, an arm of the Arizona State Department of Agriculture, is funded by grower assessments based on the quantity of shipments. The agency also assembles a record of acreage. Although no longer published, both acreage and volume data reportedly would be available for estimating individual yield histories (Foster).

The County Agricultural Commissioners in California maintain lists of current honeydew growers in each county. They also maintain acreage records on growers who obtained permits to spray agricultural chemicals. They do not, however, have production data with which to estimate individual yield histories.

Demand for Insurance

Our assessment is that honeydew is a good candidate for multiple-peril crop insurance in Texas, but that there would not be very much interest in insurance among Arizona and California growers. Growers in Texas face a wide array of yield-reducing production risks, especially perils linked with excessive moisture. Disaster assistance payments and planted and harvested acreage statistics suggest relatively large crop losses in Texas compared with those in Arizona and California. While Texas accounted for 15 percent of the U.S. honeydew acreage during 1988-1993, Texas growers received 87 percent of the U.S. disaster assistance payments for honeydews over that period (Table 10). These payments were close to 5 percent of the state's crop value (Table 11).

It is our judgment that participation in honeydew insurance would be relatively minimal among growers in Arizona and California. The basis for this judgment is the small amount of disaster assistance paid for honeydews in these states. California growers harvested about 76 percent of the reported U.S. honeydew acreage between 1988 and 1993, but received only 7 percent of the disaster assistance payments made for that crop (Table 10). These payments amounted to only 0.1 percent of California's honeydew crop value (Table 11). In Arizona, harvested acreage accounted for 9 percent of the U.S. total, but honeydew growers received negligible disaster assistance for that crop between 1988 and 1993.

There may be some interest among growers in Arizona and the desert valleys of California in buying insurance if the policy covered losses due to whiteflies. Whiteflies have been a serious production problem in Arizona and the far southern areas in California since 1991. Losses to whiteflies occurred during 1991 and 1992, and whiteflies continue to be the prime insect pest in these areas.

USDA reports honeydew statistics for only Arizona, California, and Texas, although small acreages are grown in several other states. Honeydew growers may be interested in crop insurance in some of these minor states because they likely deal with more production perils than growers in Arizona and California. The acreage planted with honeydew in the minor states is so small, however, that offering a separate honeydew policy seems unrealistic. The 1992 Census reported 66 acres or less for all but one of these minor states. The one exception was New Mexico, for which the Census reported 350 acres.

Other Implementation Issues

There do not appear to be any intractable implementation obstacles in developing a honeydew insurance policy. The problems encountered in offering honeydew 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. Honeydews, 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 honeydews, 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.

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 honeydews--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 prove equitable in deciding whether growers qualify for disaster payments. Most of the major disasters, including excessive rain, extreme drought, and extreme cold, would often affect all growers more or less the same within a county boundary. In the minor honeydew 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 acreage, that one 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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Appendix table 1--States reporting honeydew melon production: 1992 and 1987

State and major counties	1992				1987			
	Number of Farms	Harvested Acres	Irrigated Farms	Irrigated Acres	Number of Farms	Harvested Acres	Irrigated Farms	Irrigated Acres
Arizona	27	2,258	27	2,258	25	2,708	25	2,708
La Paz	6	1,165	6	1,165	3	(N)	3	(N)
Maricopa	12	939	12	939	8	1,078	8	1,078
Other	9	154	9	154	14	1,630	14	1,630
California	147	26,225	147	26,225	117	18,023	117	18,023
Yolo	8	6,267	8	6,267	8	(N)	8	(N)
Stanislaus	10	4,568	10	4,568	4	(N)	4	(N)
Fresno	28	3,980	28	3,980	15	1,203	15	1,203
Sutter	7	2,868	7	2,868	(N)	(N)	(N)	(N)
Kern	12	1,271	12	1,271	10	1,195	10	1,195
Merced	10	1,126	10	1,126	6	(N)	6	(N)
Imperial	9	547	9	547	30	1,616	30	1,616
Riverside	6	(N)	6	(N)	10	544	10	544
Other	57	5,598	57	5,598	34	13,465	34	13,465
Colorado	20	29	20	29	13	70	13	70

Michigan	23	66	4	28	26	61	9	23
New Mexico	28	315	28	315	13	56	13	51
Texas	52	5,923	29	5,843	45	4,238	35	4,152
Dimmit					3	90	3	90
Hidalgo					16	3,730	15	3,655
Other					26	418	17	407
Utah	17	23	17	23	12	55	12	55
Washington	11	21	8	10	15	236	15	126
These States	245	28,622	223	28,573	266	25,447	239	25,208
United States	383	35,005	300	34,807	374	25,699	288	25,450

(N): Indicates "not available" or "not published" to avoid disclosure of individual operations.
Note: Counties are sorted by 1992 harvested acreage.

Sources: 1992 and 1987 U.S. Census of Agriculture.

Appendix table 2--Size distribution of farms producing honeydew melon, 1987

State	All farms	Total value of crop sales: $500,000 or more	$100,000 to $499,999	$50,000 to $99,999	$25,000 to $49,999	Less than $25,000
	Number	Percent of farms				
Arizona	25	52	20	8	4	16
California	117	42	26	5	7	20
Texas	45	31	18	13	4	33
Other	187	3	16	19	18	45
U.S.	374	22	20	13	12	34

Source: 1987 U.S. Census of Agriculture.

Appendix table 3--Organizational type of farms growing honeydew melons, by sales, class, 1987

Organizational type and state	All farms	Total value of crop sales: $500,000 or more	$100,000 to $499,999	$50,000 to $99,999	$25,000 to $49,999	Less than $25,000
		Number of farms				
Individual or family						
Arizona	6	0	2	1	1	2
California	59	8	17	5	7	22
Texas	32	5	5	6	1	15
Other	139	1	16	21	30	71
U.S.	236	14	40	33	39	110
Partnership						
Arizona	8	6	2	0	0	0
California	29	20	8	0	0	1
Texas	4	2	2	0	0	0
Other	30	1	5	13	2	9
U.S.	71	29	17	13	2	10
Corporation						
Family held						
Arizona	7	5	1	1	0	0
California	22	17	4	1	0	0
Texas	6	6	0	0	0	0
Other	11	2	5	1	0	3
U.S.	46	30	10	3	0	3
Other than family held						
Arizona	1	1	0	0	0	0
California	5	3	1	0	1	0
Texas	2	1	1	0	0	0
Other	0	0	0	0	0	0
U.S.	8	5	2	0	1	0
Other						
Arizona	3	1	0	0	0	2
California	2	1	1	0	0	0
Texas	1	0	0	0	1	0
Other	7	1	3	0	1	2
U.S.	13	3	4	0	2	4

Source: 1987 U.S. Census of Agriculture.

Appendix table 4--Principal occupation and number of days worked off the farm by operators of farms growing honeydew melons, by sales class, 1987

Item	All farms	$500,000 or more	$100,000 to $499,999	$50,000 to $99,999	$25,000 to $49,999	Less than $25,000
			Total value of crop sales			
			Number of farms			
Farming is main occupation						
Arizona	19	12	4	1	0	2
California	96	46	29	6	5	10
Texas	34	13	6	4	1	10
Other	130	4	27	30	27	42
U.S.	279	75	66	41	33	64
			Percent of all farms			
Arizona	76.0	48.0	16.0	4.0	0.0	8.0
California	82.0	39.3	24.8	5.1	4.3	8.5
Texas	75.6	28.9	13.3	8.9	2.2	22.3
Other	69.5	2.1	14.4	16.0	14.4	22.5
U.S.	74.6	20.1	17.6	11.0	8.8	17.1
			Number of farms			
Operator days off-farm						
None						
Arizona	10	7	3	0	0	0
California	67	40	17	4	1	5
Texas	26	8	6	4	0	8
Other	77	3	20	14	16	24
U.S.	180	58	46	22	17	37
Any						
Arizona	11	3	2	2	1	3
California	45	7	11	2	7	18
Texas	17	4	2	2	2	7
Other	99	2	8	21	14	54
U.S.	172	16	23	27	24	82
1 to 99 days						
Arizona	3	1	1	0	0	1
California	17	2	6	1	1	7
Texas	7	1	0	0	1	5
Other	27	0	5	4	6	12
U.S.	54	4	12	5	8	25

Continued

Appendix table 4--Principal occupation and number of days worked off the farm by operators of farms growing honeydew melons, by sales class, 1987, continued

Item	All farms	$500,000 or more	$100,000 to $499,999	$50,000 to $99,999	$25,000 to $49,999	Less than $25,000
	Total value of crop sales					
	Number of farms					
Operator days off-farm, continued						
100 to 199 days						
Arizona	2	1	0	0	1	0
California	13	3	2	1	4	3
Texas	1	0	1	0	0	0
Other	25	1	0	8	2	14
U.S.	41	5	3	9	7	17
200 days or more						
Arizona	6	1	1	2	0	2
California	15	2	3	0	2	8
Texas	9	3	1	2	1	2
Other	47	1	3	9	6	28
U.S.	77	7	8	13	9	40
Not reported						
Arizona	4	3	0	0	0	1
California	5	2	3	0	0	0
Texas	2	2	0	0	0	0
Other	11	0	1	0	3	7
U.S.	22	7	4	0	3	8

Source: 1987 U.S. Census of Agriculture.

Appendix table 5--Honeydew acreage, yield, and production in California, selected counties, 1980-92

County	Year	Harvested Area	Yield	Production
		Acres	Ton/acre	Tons
Fresno	1980	378	9.80	3,704
	1981	770	10.80	8,320
	1982	1,150	7.80	8,970
	1983	1,660	10.90	18,100
	1984	1,450	7.52	10,900
	1985	1,180	13.00	15,300
	1986	2,000	9.30	18,600
	1987	2,200	8.50	18,700
	1988	2,500	9.00	22,500
	1989	2,600	11.90	30,900
	1990	2,920	11.70	34,200
	1991	3,400	14.70	50,100
	1992	3,000	12.00	36,000
Imperial	1980	--	--	--
	1981	--	--	--
	1982	--	--	--
	1983	--	--	--
	1984	2,625	6.37	16,721
	1985	2,939	5.91	17,384
	1986	3,567	4.38	15,633
	1987	3,624	7.15	25,894
	1988	2,423	9.07	21,984
	1989	2,723	11.20	30,427
	1990	2,985	4.38	13,063
	1991	2,204	1.45	3,202
	1992	297	6.99	2,076
Riverside	1980	340	18.00	6,120
	1981	297	20.00	5,934
	1982	783	9.04	7,081
	1983	1,254	5.89	7,386
	1984	1,331	6.28	8,356
	1985	1,498	6.75	10,112
	1986	1,472	6.42	9,455
	1987	1,533	11.30	17,338
	1988	866	11.50	9,963
	1989	1,433	9.38	13,441
	1990	957	8.38	8,024
	1991	504	6.38	3,216
	1992	935	5.00	4,677

Continued

Appendix table 5--Honeydew acreage, yield, and production in California, selected counties, 1980-92, continued

County	Year	Harvested Area	Yield	Production
		Acres	Ton/acre	Tons
Stanislaus	1980	2,450	6.57	16,100
	1981	2,800	7.50	21,000
	1982	2,700	7.48	20,200
	1983	2,545	6.99	17,800
	1984	3,000	6.97	20,900
	1985	3,020	8.18	24,700
	1986	3,010	8.11	24,400
	1987	3,185	7.10	22,600
	1988	2,460	7.00	17,220
	1989	3,650	10.90	39,800
	1990	4,020	7.71	31,000
	1991	2,950	8.00	23,600
	1992	3,120	8.81	27,500
Sutter	1980	1,897	9.23	17,514
	1981	1,930	11.10	21,350
	1982	1,919	8.65	16,600
	1983	2,378	9.96	23,685
	1984	2,242	8.82	19,765
	1985	2,654	8.40	22,300
	1986	2,370	11.10	26,212
	1987	2,162	9.19	19,874
	1988	3,396	7.57	25,708
	1989	2,739	12.20	33,471
	1990	3,142	9.50	29,849
	1991	3,565	8.77	31,265
	1992	5,171	9.67	50,004
Yolo	1980	2,625	9.50	24,930
	1981	3,780	9.50	35,900
	1982	3,715	8.40	31,221
	1983	3,495	8.70	30,407
	1984	3,600	9.42	33,910
	1985	3,380	8.90	30,080
	1986	4,400	10.60	46,464
	1987	3,012	13.20	39,800
	1988	3,038	10.50	32,020
	1989	3,189	8.59	27,379
	1990	5,300	8.80	46,640
	1991	--	--	--
	1992	2,683	11.90	31,928

1/ There is a significant drop in acreage in Fresno, Imperial, and Yolo counties in 1992. Low yields during 1990 and 1991 were due to the whitefly infestation. As a result, most fall crop producers left production in 1992 and acreage in 1992 includes only spring crop acreage (Mayberry).

Source: County Agricultural Commissioners' Reports.