Crop Profile for Melons in Arizona

Prepared February, 2000

General Production Information

Cantaloupes

- Arizona's 1998 cantaloupe production accounted for 20.4% of U.S. production. Arizona is ranked 2nd behind California.(1)
- Acres planted and harvested between 1995 and 1998 averaged 18,175. Cantaloupe production averaged 4,241,000 hundredweight annually, with an average cash value of 78,768,800 dollars.(1)
- Spring cantaloupes are grown in Maricopa, Yuma, La Paz and Pinal Counties. Yuma County accounted for 37.6% of Arizona's production in 1998.
- Fall cantaloupes are grown in Maricopa, Yuma, La Paz, Pinal and Cochise Counties. Maricopa and La Paz Counties accounted for 79.6% of Arizona's production in 1998. (1)
- Production costs from 1998 crop budgets for spring cantaloupe range from $1291 in Pinal County to $2651 in Yuma County.
- Fall cantaloupe production costs range from $1125 in La Paz County to $1274 in Maricopa. Fall cantaloupe production costs for Yuma were unavailable for 1998.(2)
- Arizona cantaloupes are primarily shipped to domestic markets.

Honeydews

- Arizona's 1998 honeydew melon production accounted for 15.3% of U.S. production. Arizona is ranked 2nd behind California.(1)
- Acres planted and harvested between 1995 and 1998 averaged 3,850. Cantaloupe production averaged 680,000 hundredweight annually, with an average cash value of 12,533,000 dollars.(1)
- Spring cantaloupes are grown in Maricopa, La Paz, Yuma and Pinal Counties with Maricopa and La Paz accounting for 87.5% of Arizona's production in 1997.
- Fall cantaloupes are primarily grown in Maricopa County which accounted for 83.8% of Arizona's production in 1997.(1)
- Production costs from 1998 Arizona crop budgets for spring honeydews range >from $2117 in Yuma County to $2783 in La Paz County, with Maricopa County at $2749.
- Fall honeydew production costs range from $2404 in La Paz County to $3259 in Maricopa County.(2)
- Arizona honeydews are primarily shipped to domestic markets.

Watermelons

- Arizona's 1998 watermelon production accounted for 5.9% of U.S. production. Arizona is ranked 5th in the U.S.(1)
- Acres planted and harvested between 1995 and 1998 averaged 7,250. Cantaloupe production averaged 2,094,000 hundredweight annually, with an average cash value of 17,706,750 dollars.(1)
- Watermelons are grown in Maricopa, Yuma, La Paz, Cochise and Pinal Counties. Maricopa, Yuma and Pinal Counties accounted for 92.5% of Arizona's production in 1998.(1)
- Production costs from 1998 crop budgets for watermelon range from $870 per acre in Cochise County to $2207 in Maricopa County. Pinal County came in at $2089 per acre.(2)
- Arizona watermelons are primarily shipped to domestic markets.

Production Regions

Melons are grown in central and western Arizona. Maricopa County, in central Arizona is the largest producer for all melons and seasons for which separate county data is available. Yuma and La Paz Counties, in western Arizona, have a combined production just greater than Maricopa County.

Cultural Practices

Arizona melons are typically planted on 80 inch beds. Spring melons can be direct seeded or transplanted between January and March depending on the location. The spring crop can be grown with or without plastic mulch and with furrow or drip irrigation. Fall melons are direct seeded into either pre-irrigated mulched beds or sprinkler irrigation is used to germinate the crop.(3)

Cantaloupes are the largest melon crop in Arizona. In recent years approximately 20% more acres have been planted to spring cantaloupe than the fall crop. Yields are lower for the fall crop but prices are better.

A smaller percentage of honeydew acreage is planted in the fall. Fall Honeydew yields are only slightly lower than spring honeydew yields but there is no price premium.

Insect Pests

I. Ground Dwelling Pests

Field crickets, *Gryllus* spp.,
Crickets are annual pests in fall melons, especially where over-head sprinkler irrigation is being used. Eggs are laid in damp soil both within and outside of cultivated fields. Adults and nymphs are usually present throughout the season, but appear to be most harmful during stand establishment of direct seeded melon crops.

Crickets will reduce crop stands by eating the newly emerged seedlings. When they occur in large numbers, they can quickly destroy most of a field. Problems usually occur in fields planted adjacent to cotton or sudangrass in August and September, where large numbers are capable of migrating to seedling cantaloupes and watermelons. Most damage occurs at night and crickets hide during the day in soil cracks, ditches, weeds, and under irrigation pipes. It is difficult to monitor for cricket abundance.

Controls

Cultural
Immediate postharvest discing of previous crops aids in area-wide cultural control of crickets.

Chemical
Direct seeded melons planted in close proximity to cotton or sudangrass should be considered high risk fields and damage should probably be treated as soon as seedlings begin emerging.

Insecticide-treated baits are available that can be placed around field edges to control migrating populations. Additionally, insecticides can be applied through the sprinkler system during plant emergence.

Arizona insecticide use on cantaloupe, honeydew, watermelon and all melons (including unspecified) for the 1997-98 season. Information on Arizona pesticide use reporting is essential to interpreting use statistics.

Cutworms,
Agrotis ipsilon,
Peridroma saucia,
Feltis subterranea
All melons are susceptible to attack by several species of cutworm larvae. Young plants are often damaged or killed by cutworms. Cutworms typically cut off seedlings or young plants at or just below ground level. Losses can be especially serious in fields that have an abundance of organic matter, which attracts moths to deposit eggs. Larvae usually hide in the soil under debris, or under clods during the day and come out at night to feed. Some species can reduce the cosmetic appearance of cantaloupes by scarring the undersides of mature melons. Damage is often more serious on the edges of fields, but stand losses can occur in clumped patterns throughout the field.

Controls

Cultural
Cultural control methods can help minimize cutworm damage. Areas with weeds, or crop residue or areas located near alfalfa fields often have high populations. Pay close attention to fields that follow small grains, corn or alfalfa. Eliminate weeds from field margins and plow fields at least 2 weeks before planting. Destroy plant residue from previous crops and avoid planting fields coming directly out of pasture. Several natural enemies attack cutworms but none are effective enough to provide reliable control.

Arizona insecticide use on cantaloupe, honeydew, watermelon and all melons (including unspecified) for the 1997-98 season. Information on Arizona pesticide use reporting is essential to interpreting use statistics.

Seedcorn maggot, ***Delia platura***
The seedcorn maggot is a white, legless larvae of a small light gray fly that attacks the planted seed of cantaloupes and watermelons during the spring. They can be particularly serious if there is a cold period that prevents quick germination of the seed. Maggots may overwinter as a larvae in the soil or hatch from eggs laid in the spring. There usually have three to four generations per year, but only the first is economically significant.

The maggot attacks germinating seeds or transplants, but may be a severe pest in the early spring when the soil is cool. The maggots bore into seeds or into the developing hypocotyl of developing plants. Seedlings with maggots will wilt and die within a few days . Under favorable growing conditions for melons (80-85&δεγ; F), little damage is likely to occur. The conditions that favor seed maggot infestations include high levels of decaying organic matter and cool wet weather. The flies can also be attracted to the commercially prepared growing medium used to start melon transplants in the greenhouse.

Controls

Cultural
Fields with heavy-textured soil usually experience the worst problems with seedcorn maggots. Incorporation of previous crop residues by discing or plowing well in advance of planting helps to

reduce the attractiveness of the field to ovipositing adults. Avoid direct seeding or transplanting melons after root crops, cole crops or fall tomatoes. Rapid seed germination greatly reduces the risk of infestation. Late season planting may avoid the early season infestation of this pest.

Chemical
A preventative seed treatment or transplant drench is the best method of control when conditions are ideal for maggot infestation.

Arizona insecticide use on cantaloupe, honeydew, watermelon and all melons (including unspecified) for the 1997-98 season. Information on Arizona pesticide use reporting is essential to interpreting use statistics.

Darkling Beetles, *Blapstinus* spp.
Darkling beetle adults chew off seedlings, feed on foliage, and occasionally on fruit that is on the soil. Darkling beetles are generally not a problem unless large populations move into a field when plants are emerging. They usually invade fields from weedy areas or crops such as cotton and alfalfa, so damage is often first observed on field edges. Seedling plants may be girdled or cut off at the soil surface. Once the plants have 5-6 leaves, the beetles are usually not a problem. As the season progresses, feeding can occur on flowers, on the undersides of leaves and on the netting of mature melons. Under moist soil conditions, they can also bore into fruit where it rests on the seed bed.

Controls

Cultural
Several cultural practices can help reduce potential problems associated with darkling beetles. Maintain fields and ditches free of weeds. Water barriers placed around the field can aid in reducing migrating populations. Reducing organic matter in the soil by fallowing or deep-plowing will minimize beetle reproduction.

Chemical
When beetles are observed migrating into melons from surrounding fields, a bait placed around the edges of the field will usually provide adequate control. Treat fields with insecticides whenever beetles are readily observed feeding on plants, flowers or fruit.

Arizona insecticide use on cantaloupe, honeydew, watermelon and all melons (including unspecified) for the 1997-98 season. Information on Arizona pesticide use reporting is essential to interpreting use statistics.

II. Foliar Feeding Pests

Leafminers, *Liriomyza sativae* and *Liriomyza trifolii*
Liriomyza leafminers can readily cause economic damage to melon plants, particularly in fall plantings. Mining of leaves by the larvae is the principal cause of plant injury. Larvae mine between upper and lower leaf surfaces creating winding tunnels that are initially small and narrow, but increase in size as the larvae grow. These mines can cause direct injury to seedling plants by removing chlorophyl and reducing the plants photosynthetic capacity. Mines and feeding punctures also produce an entrance for pathogenic organisms. Excessive leaf mining in older plants can cause leaves to dry, resulting in sunburning of fruit and reduction in yield and quality. In severe infestations, leafmining may cause plant death. Damage to mature plants can occur when attempting to hold the crop longer for a second or third harvest.

Early season leafminer infestations are common, but in most cases are controlled by numerous species of parasitic wasps. The absence of these natural enemies can result in leafminer outbreaks. Leafminers are seldom damaging to spring melons unless temperatures are unusually high. Leafminers in fall melons can be particularly damaging in fields planted near cotton or alfalfa because adults migrate onto emerging melon seedlings in the absence of their natural enemies. Secondary leafminer outbreaks can occur >from the destruction of parasitoids by frequent insecticide applications used to control other pests. Thus, evaluation of leafminer parasitism is an important criterion to determine the need for control. Young seedling plants should be monitored regularly for the presence of adults, larvae and parasitized mines. Mining will initially occur on the cotyledons and first true leaves. Yellow sticky traps can assist in determining when early migrations take place, and also help in determining species composition. It is important to identify the predominant leafminer species because *L. trifolii* is much harder to control with insecticides than *L. sativae*.

Controls

Cultural
Cultural management can help reduce potential problems with leafminers. Avoid planting adjacent to cotton and alfalfa whenever possible. Deep plowing after harvesting crops aids in reducing leafminer populations. Row covers applied at planting and removed at first bloom have been shown to exclude leafminer adults. Melons plants that are not stressed for moisture or by other environmental factors can often better tolerate leafminer injury.

Chemical
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Beet Armyworm, *Spodoptera exigua*
Beet armyworm can cause economic damage to spring and fall watermelons, honeydews and cantaloupes. The beet armyworm is primarily a foliage feeder, but causes cosmetic damage to watermelons by attacking immature fruit. The injury caused by fruit feeding is superficial and little loss would result if not for the cosmetic blemishes left on mature melons and fruit rot that may occur from secondary pathogenic organisms that enter the wounds. The larvae will occasionally develop inside the fruit, causing abnormal development and abortion of the fruit.

Controls

Cultural
Check surrounding vegetation for the presence of beet amyworm larvae. Sanitation along field borders is important as beet armyworms often migrate >from weedy field edges into newly planted fields. Populations of this pest also tend to build up in cotton and alfalfa during the summer.

Biological
There are natural enemies and viral pathogens that will attack populations of armyworm larvae, but may not always provide adequate and reliable control. Monitor fields by checking developing fruit for larvae and feeding damage. To conserve natural enemies important for the natural control of leafminers, consider using *Bacillus thuringiensis* sprays if small larvae (neonate and 1st instar) are present.

Chemical
Treat with insecticides if feeding is observed on the fruit.

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Cabbage Looper, ***Trichoplusia ni***

The cabbage looper can be a destructive pest of all melon crops. Populations can be especially prevalent in the fall, when newly-planted seedlings are emerging. Loopers injure plants by feeding primarily on the underside of leaves, leaving ragged holes. In fall crops, high populations can chew seedlings severely enough to reduce stands or delay crop growth and maturation. In cantaloupes, larvae may move to the mature fruit and feed on the netted surface causing cosmetic blemishes. Watermelons are damaged by larval feeding on small developing fruit and the rind of more mature melons, leaving cosmetic blemishes similar to that caused by beet armyworm.

The cabbage looper has many natural enemies that will keep larval populations below damaging levels unless disrupted by insecticide applications. Several parasitic wasps (both egg and larval parasitoids) are important natural control agents. The tachinid fly, *Voria ruralis*, also attacks developing loopers. Under ideal environmental conditions, a nuclear polyhedrosis virus that occurs naturally in fields may control looper populations.

Controls

Cultural

Cultural control tactics employed for beet armyworm are also recommended for management of cabbage looper.

Chemical

Monitor for larvae and eggs by looking on the underside of leaves. Insecticide treatments are recommended when larvae feeding on the leaves can easily be found. In addition, adult flights monitored with pheromone traps and observations of egg deposition can be used to time treatments. Cabbage loopers are particularly susceptible to *Bacillus thuringiensis*, and should be applied when eggs start to hatch and larvae are small.

III. Sucking Pests

Two-spotted Spider Mite, ***Tetranychus* spp.**

Spider mites are widespread on melon crops throughout the southwestern U.S, but only occasionally cause significant damage. Spider mites injure melons by puncturing the surface cells on the underside of leaves where they feed. This results in the destruction of chlorophyl and reduction in photosynthetic activity. Injured leaves become pale, stippled and can dry up and die under heavy infestations. Injury often is not noticed until reddish brown patches of affected plants appear in the field. Injury is most common in hot, dry weather from late spring to early fall when temperatures are favorable for rapid development. Light infestations can be tolerated, but severe injury can result in lowered yields and reduced fruit quality.

Controls

Biological

Several natural enemies (including predatory mites and thrips, minute pirate bugs and lacewings) play an important role in regulating mite populations below economic injury levels. Predator populations should be encouraged by limiting chemical rates and numbers of applications for other insect pest.

Cultural

Spider mites feed on a large number of crops and weeds, and will overwinter in soil and debris on the ground. Infestations in melons often begin with adults carried into fields by wind from adjacent crops. Because dust favors spider mite populations, minimize dust by watering field roadways.

Good irrigation and fertilization management increases plant tolerance to mites.

Chemical
No economic thresholds have been established for spider mites. However, treatment with an acaricide is recommended when webbing occurs before vines reach 14 inches in length and predatory mites and thrips are absent. Spider mites inhabit the undersurface of leaves and thorough spray coverage is important.

Arizona insecticide use on cantaloupe, honeydew, watermelon and all melons (including unspecified) for the 1997-98 season. Information on Arizona pesticide use reporting is essential to interpreting use statistics.

Silverleaf Whitefly, *Bemisia argentifolii*
In the past few years, the silverleaf has shifted from a position as a secondary pest (virus vector) to being the primary pest in fall vegetables, melons and cotton in the southwest. This shift in pest status is thought to have occurred due to the development of a new strain of the sweetpotato whitefly (B-strain), or as many now believe, the emergence of the species, silverleaf whitefly.

Although the sweetpotato whitefly has a wide host range, one of its most preferred hosts is cantaloupes. It has become a serious pest on melons because of its high reproductive capability, wide host range, high rate of feeding, exudation of sticky honeydew and habit of feeding on the undersides of leaves where they are protected from insecticide sprays. Adults and nymphs feed on melon leaves by inserting their tubular mouthparts into vascular tissue and extracting plant assimilates (carbohydrates and amino acids). They also injure developing plants by destroying chlorophyll and reducing the plants photosynthetic activity. Heavy populations on young plants can cause desiccation of leaves and plant death. Whitefly populations cause serious economic damage to melons crops by reducing fruit quantity and size. Fruit quality is also impacted by the lowering of soluble sugars in the fruit and by the contamination of fruit with honeydew which gives rise to sooty mold fungus.

Controls

Cultural
Whitefly populations will build in cotton and alfalfa, so growers should pay particular attention to melons planted downwind or adjacent to these fields. For spring melons, termination of winter vegetable crops immediately following harvest is important in the area wide management of whiteflies. Whiteflies are best controlled by preventing immature populations from colonizing plants; do not allow adult populations to build up and deposit large numbers of eggs. If available, a systemic insecticide should be used at planting to protect emerging seedlings from colonizing adult populations. Subsequently, melons should be monitored as soon as the plants emerge.

Biological
Although several parasitic wasps (*Encarsia* and *Eretmocerus* spp.) are effective parasitoids of sweetpotato whitefly, populations of these natural enemies are not capable of naturally controlling whitefly populations under desert growing conditions.

Chemical
Melons planted in high risk situations (late spring and fall plantings) should be treated prophylactically with a soil-applied systemic insecticide such as imidacloprid. Melons planted in January and February when temperatures are cool and when there is no significant source of whiteflies in a one mile radius should be treated as needed with foliar adulticides. Good spray coverage is essential for control. If possible use ground application equipment that delivers spray at high pressure and volumes.

Arizona insecticide use on cantaloupe, honeydew, watermelon and all melons (including unspecified) for the 1997-98 season. Information on Arizona pesticide use reporting is essential to interpreting use statistics.

Green Peach Aphid, ***Myzus persicae***

The green peach aphid occurs throughout the Southwest and has a wide host range. The green peach aphid is generally considered to be a pest in spring melons. The major injury from green peach aphid is a result from virus transmission. Watermelon mosaic virus, zucchini yellow mosaic virus, and papaya ringspot virus are transmitted to melons primarily by the green peach aphid. The spread of virus to a melon field is due to the movement of winged forms during the spring. Infected aphids move into spring melons fields in large numbers from surrounding crops and weed hosts. Within field spread occurs as aphids feed and move from one plant to another. The incidence of these viruses causes significant reduction in melon yields and heavy virus infection can result in total yield loss. Incidence of green peach aphid and its associated viruses are rare in fall planted melons. Severe colonization of green peach aphids can reduce plant growth due to removal of plant fluids, but this aphid is rarely numerous enough to cause economic injury.

Controls

Biological

Naturally-occurring populations of predators, parasitoids and fungal pathogens may provide effective control in early spring.

Cultural

Green peach aphids are often most numerous in fields containing weedy mustards and members of the goosefoot family. Control of these weeds may help prevent buildup of green peach aphid. Green peach aphids can be excluded >from plants by placing row covers over the seed bed following planting until first bloom. Reflective mulches have also been shown to be effective in repelling aphids from plants.

Chemical

Because of the short feeding time required for these aphids to transmit viruses, insecticide treatments will not prevent virus introduction, but may reduce the spread of the virus within the field. Monitor for aphid flight activity and species composition using yellow sticky traps. Melons planted in January and February prior to peak aphid flight should be prophylactically treated with a soil-applied systemic insecticide at planting. The decision to treat for aphids should be based on the presence of winged forms in the field.

Arizona insecticide use on cantaloupe, honeydew, watermelon and all melons (including unspecified) for the 1997-98 season. Information on Arizona pesticide use reporting is essential to interpreting use statistics.

Melon Aphid, ***Aphis gossypii***

The melon (or cotton) aphid appears in high numbers in the cooler spring months, but unlike the green peach aphid, melon aphid populations can be found infesting melons when temperatures are warm. They reproduce parthenogenically and develop at a very high rate under ideal growing conditions. They can also be serious problems on fall melons. Melon aphid has an extensive host range including, cotton, citrus, and many summer annual weeds.

Damage is similar to green peach aphids. The melon aphid is a known vector of several viruses. However, they can also cause injury to melons through their feeding. They can be a major problem on young plants where they cluster on the terminal growing points of the developing vines, distorting and curling the leaves, and producing large amounts of honeydew. Feeding damage can lead to loss in plant vigor, reduced growth rate and plant death. Melon aphids will injure all melon types grown in the southwest.

Controls

Biological
Numerous naturally-occurring predators and parasitoids will attack melon aphids and are capable of keeping them under control if not disrupted by insecticide applications.

Cultural
The same cultural control tactics used for green peach aphid should be employed for management of melon aphid populations.

Chemical
Melon aphid is very difficult to control with insecticides. No thresholds have been established for timing treatments, but applications should be made if large numbers of aphids build up early in the season and natural enemies are absent. Early treatment does not prevent virus transmission, but may reduce within-field spread of the virus.

Arizona insecticide use on cantaloupe, honeydew, watermelon and all melons (including unspecified) for the 1997-98 season. Information on Arizona pesticide use reporting is essential to interpreting use statistics.

Insecticide Use in Cantaloupe in Arizona, 1998

Active Ingredient(AI)	Reports	Acres Treated	Mean Rate	% Acres		APH	LC	CB	LM	MTS	THR	WF
Oxamyl	92	5,978	0.65	32.3%					X			
Esfenvalerate	59	3,625	0.04	19.6%			X	X				X
Imidacloprid	56	3,521	0.23	19.0%		X						X
Endosulfan	62	2,869	0.71	15.5%		X		X				X
Permethrin	34	1,793	0.16	9.7%			X	X	X			
Diazinon	21	1,171	1.46	6.3%		X	X		X	X	X	
Methomyl	26	978	0.72	5.3%			X	X				
Buprofezin	16	788	0.37	4.3%								X
Avermectin	15	780	0.01	4.2%					X	X		
Bt (Bacillus thur.)	20	764		4.1%			X					
Azinphos-methyl	14	620	0.34	3.3%				X				
Carbaryl	20	573	0.87	3.1%			X	X				
Cyromazine	11	426	0.12	2.3%					X			
Dimethoate	5	360	0.49	1.9%		X			X	X		
Oxydemeton-methyl	7	309	0.22	1.7%		X				X		

APH - Aphids
LC - Lepidoperous complex -- beet armyworm, yellowstriped armyworm, cabbage looper, corn earworm, tobacco budworm, cutworms and saltmarsh caterpillar
CB - Cucumber Beetles
LM - Leafminers

MTS - Mites
THR - Thrips
WF - Whiteflies

Insecticide Use in Honeydew Melons in Arizona, 1998

Active Ingredient(AI)	Reports	Acres Treated	Mean Rate	% Acres		APH	LC	CB	LM	MTS	THR	WF
Esfenvalerate	17	835.0	0.04	21.4%			X	X				X
Oxamyl	12	707.6	0.29	18.1%					X			
Endosulfan	8	489.6	0.70	12.6%		X		X				X
Buprofezin	4	401.4	0.36	10.3%								X
Dimethoate	3	217.5	0.50	5.6%		X			X	X		
Imidacloprid	5	138.2	0.24	3.5%		X						X
Cyromazine	2	97.5	0.12	2.5%					X			
Avermectin	2	88.2	0.05	2.3%					X	X		
Azinphos-methyl	1	71.4	0.25	1.8%				X				
Carbaryl	3	68.5	0.80	1.8%			X	X				
Diazinon	1	55.0	0.36	1.4%								
Oxydemeton-methyl	1	53.2	0.09	1.4%								
Bt (Bacillus thur.)	2	47.1		1.2%								
Malathion	1	22.2	1.75	0.6%								

APH - Aphids
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CB - Cucumber Beetles
LM - Leafminers
MTS - Mites
THR - Thrips
WF - Whiteflies

Insecticide Use in Watermelons in Arizona, 1998

Active Ingredient(AI)	Reports	Acres Treated	Mean Rate	% Acres		APH	LC	CB	LM	MTS	THR	WF
Bt (Bacillus thur.)	32	1,515.2		20.8%			X					
Dicofol	8	680.0	0.408158	9.3%						X		
Avermectin	16	600.8	0.00997	8.2%					X	X		

Permethrin	11	451.3	0.161293	6.2%			X	X	X			
Neem Oil	7	432.0	0.74872	5.9%						X		
Imidacloprid	10	386.3	0.260705	5.3%		X						X
Esfenvalerate	8	277.1	0.045591	3.8%			X	X				X
Endosulfan	6	217.1	0.721776	3.0%		X		X				X
Buprofezin	4	172.0	0.385123	2.4%								X
Dimethoate	2	42.1	0.473254	0.6%		X			X	X		
Diazinon	1	40.0	0.5	0.5%		X	X		X	X	X	
Oxamyl	2	31.0	0.483871	0.4%					X			

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CB - Cucumber Beetles
LM - Leafminers
MTS - Mites
THR - Thrips
WF - Whiteflies

Insecticide Use in All Melons (including "unspecified") in Arizona, 1998

Active Ingredient(AI)	Reports	Acres Treated	Mean Rate	% Acres		APH	LC	CB	LM	MTS	THR	WF
Endosulfan	162	9,489.9	0.73	32.0%		X		X				X
Imidacloprid	126	7,268.0	0.24	24.5%		X						X
Oxamyl	109	6,872.7	0.60	23.1%					X			
Esfenvalerate	110	6,565.4	0.04	22.1%			X	X				X
Bt (Bacillus thur.)	97	4,563.9		15.4%			X					
Permethrin	90	4,390.2	0.18	14.8%			X	X	X			
Avermectin	46	2,104.6	0.01	7.1%					X	X		
Buprofezin	37	2,013.9	0.36	6.8%								X
Diazinon	30	1,599.3	1.19	5.4%		X	X		X	X	X	
Dimethoate	26	1,441.5	0.39	4.9%		X			X	X		
Carbaryl	34	1,319.2	0.81	4.4%			X	X				
Oxydemeton-methyl	25	1,184.5	0.32	4.0%		X				X		
Methomyl	27	1,037.5	0.72	3.5%			X	X				
Dicofol	12	966.0	0.56	3.3%								
Neem oil	14	874.2	1.27	2.9%						X		

Azinphos-methyl	16	784.3	0.34	2.6%				X				
Cyromazine	17	771.6	0.12	2.6%					X			

APH - Aphids
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Diseases

Alternaria Leaf Spot

Alternaria leaf spot is caused by the fungus *Alternaria*. The fungus produces dark, multicelled spores on host tissue only when there is substantial moisture, usually during summer rains. The spores are easily carried in wind and splashing water and infect only the leaves. Brown necrotic spots appear on the leaves wherever spores germinate and infect leaf tissue. Spots are small at first then may enlarge and coalesce to form circular lesions with visible concentric rings.

Disease severity is dependent on varietal susceptibility and environmental conditions. Extended periods of moisture and warm temperatures favor disease development.

Controls

Chemical
Applications of fungicides chlorothalonil or mancozeb, are preventative only, so fungicides should be applied regularly at the onset of summer rains to fields or plants in areas where disease is known to have occurred previously.

Arizona insecticide use on cantaloupe, honeydew, watermelon and all melons (including unspecified) for the 1997-98 season. Information on Arizona pesticide use reporting is essential to interpreting use statistics.

Downy Mildew

Downy mildew of melons is caused by *Pseudoperonospora cubensis*. *P. cubensis* is a fungal-like organism that causes foliar necrosis and decline, and like the causal agents of other downy mildews, is an obligate parasite infecting only cucurbits. It does not affect the roots. Disease occurs on melons in the late summer and early fall during summer monsoon rains and in the late winter and early spring when there is rain and heavy dew. With sufficient moisture in the foliage, disease progresses rapidly. *P. cubensis* produces spores that are carried by splashing water, wind and rain. Plants of all ages are susceptible.

Early infections cause yellow spots on leaves that coalesce, and the leaf turns brown. When humidity is very high, especially early in the morning, a white to light purple growth is visible on the underside of leaves, which consist of asexual spores. Older leaves are usually infected first.

Controls

Chemical
In areas where disease has been previously confirmed, it is important to watch for the initial symptoms and signs of disease so that fungicides can be applied as soon as possible. Formulations of metalaxyl with chlorothalonil or manganese/zinc, as well as chlorothalonil, mancozeb and maneb alone are effective for control. Repeat applications of fungicides may be necessary if conducive weather conditions persist. Alternating different chemicals is important to avoid development of resistance.

Arizona insecticide use on cantaloupe, honeydew, watermelon and all melons (including unspecified) for the 1997-98 season. Information on Arizona pesticide use reporting is essential to interpreting use statistics.

Monosporascus Vine Decline

Monosporascus Vine Decline is caused by the fungus *Monosporascus cannonballus*. Plants may be infected when they are young, but symptoms often do not appear until vines are mature and fruit are developing. These spores are commonly found in many different soils, and the fungus seems to be indigenous to certain semiarid soils.

There is no resistance in melons, but some varieties are much more susceptible than others. Caravelle and Desert Mark are among the most susceptible. The presence of spores in soils can be determined in laboratory assays, but to date there has been no direct correlation between the numbers of spores in soil samples and the incidence or prevalence of disease. Disease can be reduced in drip irrigated systems by more frequent applications of water when plants have a heavy fruit load.

Controls

Chemical
No fungicides have been shown to be effective, but high rates of soil fumigants such as chloropicrin may be effective.

Arizona insecticide use on cantaloupe, honeydew, watermelon and all melons (including unspecified) for the 1997-98 season. Information on Arizona pesticide use reporting is essential to interpreting use statistics.

Charcoal Rot

Charcoal rot is caused by a soil borne fungus, *Macrophomina phaseolina*. This fungus is common in Arizona soils, and causes disease in a wide variety of plants. The fungus produces microsclerotia, small black structures that develop under the cortical tissue of roots or on the surface of stem lesions, that enable the fungus to survive in the soil for many years in the absence of a host. *M. phaseolina* has been associated with late season vine decline.

Controls

Chemical
There are no control measures currently recommended for Charcoal Rot. Cultural practices such as rotation, deep plowing and maintenance of soil moisture have not been effective. There has been little or no control using solarization or fumigation.

Arizona insecticide use on cantaloupe, honeydew, watermelon and all melons (including unspecified) for the 1997-98 season. Information on Arizona pesticide use reporting is essential to interpreting use statistics.

Powdery Mildew

Powdery mildew of melons is caused by *Sphaerotheca fuliginea*. The disease is found wherever cantaloupe, honeydew and other melons are grown in Arizona. It is favored by moderate to high humidity and low light intensity. A white powdery growth on the leaf surface starts out as small spots, often on the lower leaf surface, and gradually covers the entire leaf . The mycelium of the fungus grows over the leaf surface and produces many asexual spores that are easily carried in the wind. These spores germinate on the leaf surface where new infections develop within a few days. Advanced infections cause necrotic areas in leaves that can become extensive and result in a severe decline in foliage. Photosynthetic area is reduced and fruit exposed to sunburning. Variability in pathogenicity has been demonstrated in the fungus and several races have been described based on host range. *Sphaerotheca fuliginea* has two mating types which is probably why the sexual spores of the fungus are rarely found.

Controls

Chemical
Registered fungicides used for control include sulfur dust, micronized sulfur, thiophanate methyl, chlorothalonil and benomyl. Myclobutanil and azoxystrobin have had special registrations for seasonal applications (Sect 18). Disease incidence may be reduced when foliar feeds of monopotassium phosphate, potassium nitrate or sodium bicarbonate are applied. Early detection and treatments are important since control is very difficult once disease develops. Varieties with tolerance to *Sphaerotheca fuliginea* are available.

Arizona insecticide use on cantaloupe, honeydew, watermelon and all melons (including unspecified) for the 1997-98 season. Information on Arizona pesticide use reporting is essential to interpreting use statistics.

Pythium Root Rot and Seedling Damping-off

Root rot of melons in Arizona is usually caused by *Pythium aphanidermatum*, but other *Pythium* species may also be involved. Species of *Pythium* are soil borne organisms that are common in agricultural soils. *Pythium aphanidermatum* is active when soil temperatures are warm, above about 85 F, and very moist. Motile asexual spores called zoospores are produced in wet soils, and these spores can infect roots within a few hours. A thick-walled sexual spore, produced in infected tissue, can remain inactive in the soil for months or years, germinating only when a susceptible host is present under suitable environmental conditions. Infected roots are brown then become soft and very dark. In seedlings, the roots are rotted quickly and young seedlings fall over or "damp-off" when infected.

Controls

Cultural
Damping-off of seedlings can be reduced by planting into pre-irrigated soils that are still moist since under these circumstances the soil is cooler and the seedling begins to grow faster, both of which reduce chances of infection. Metalaxyl fungicide is effective for controlling *Pythium aphanidermatum* and can be applied as a soil drench or through drip lines. It is important to get a confirmed diagnosis before application of metalaxyl since there have been reports of resistance with repeated applications. There are no tolerant melon varieties.

Viruses

Several viruses have historically been severe problems of melons in Arizona although their incidence and severity fluctuate. These are listed with their host range, symptoms, vector and available control strategies:

Papaya Ringspot Virus (Watermelon Mosaic Virus I) infects cucurbits only. It causes mottled and mosaic leaves, blisters and distortion. It is sap transmissible and is carried non-persistently in aphids. There is tolerance in some varieties.

Watermelon Mosaic Virus (Watermelon Mosaic Virus 2) infects cucurbits, many weed species and especially legumes. It causes variable symptoms including mottled and mosaic leaves and stunting. It is sap transmissible and is carried non-persistently in aphids. There is tolerance in some varieties.

Zucchini Yellows Mosaic Virus infects cucurbits but little is known of other off-season hosts. It causes severe mosaic, shoe-stringing, stunting, and blisters. It is sap transmissible and is carried non-persistently by aphids. There is tolerance in some varieties.

Lettuce Infectious Yellows Virus infects cucurbits and many other hosts. It has been uncommon in Arizona for the past several years. It causes leaf yellowing, usually on older leaves and stunting. It is carried semi-persistently by the sweet potato whitefly, *Bemesia tabaci* biotype 1 only; sanitation and weed control may reduce incidence.

Curly Top Virus infects cucurbits and many other hosts. It causes leaf cupping and rolling, plant dwarfing and chlorosis. It is transmitted by the beet leafhopper, *Circulifer tenellus.* There are no tolerant varieties and no control measures are practiced.

Squash Mosaic Virus infects cucurbits only. It causes a mild mosaic to a severe leaf mottle, yellowing and stunting. The virus is seed borne, sap transmissible and carried persistently by cucumber beetles. The best prevention is the use of clean seed.

Cucumber Mosaic Virus infects cucurbits and many other hosts. It causes mild to severe leaf mosaic, stunting and deformed fruit. It is sap transmissible, is carried non-persistently in many species of aphids and may be seed borne in other hosts; tolerance is available.

Nematodes[5]

Root Knot Nematode

The Root Knot Nematode, *Meloidogyne incognita*, infects all varieties of melons and many other plants. This nematode is widespread in Arizona, but is usually found in sandy or sandy loam soils. It is an obligate parasite that must complete its life cycle in a plant host, but eggs are persistent and can remain inactive in the absence of a host and/or fallow for months or years.

As *M. incognita* larvae enter the plant root, feed and mature, the surrounding cells of the plant root increase in size and divide causing swellings, often referred to as galls, on the roots. The flow of nutrient and water is restricted, and plants wilt quickly when water becomes limiting. If plants are infected when young, they are often severely stunted and chlorotic. Infected vines rarely die, but are generally not productive.

Controls

Cultural
Because of the nematodes wide host range, control is difficult. Cotton, sorghum, corn, and beans, among many other crops, are all hosts and should not be rotated with melons when *M. incognita* is a problem. Rotations to alfalfa and oats, which are not hosts, are effective, especially in multiple year rotations.

Chemical
Preplant soil fumigation with 1,3 Dichloropropene or metam-sodium is also effective in reducing early infections. Soil solarization is an option for small areas that can be effectively tarped for at least 6 weeks in summer.

Arizona insecticide use on cantaloupe, honeydew, watermelon and all melons (including unspecified) for the 1997-98 season. Information on Arizona pesticide use reporting is essential to interpreting use statistics.

Fungicide and Fumigant Use in Cantaloupe in Arizona, 1998

Active Ingredient(AI)	Reports	Acres Treated	Mean Rate	% Acres		ALT	DM	PM	P	NEM
Metam-sodium	60	4,459	29.90	24.1%						X
Dichloropropene	46	2,786	60.58	15.1%						X
Mefenoxam	32	2,427	0.16	13.1%			X		X	
Thiophanate-methyl	22	1,339	0.34	7.2%				X		
Benomyl	30	1,229	0.23	6.6%				X		
Sulfur	23	1,170	14.63	6.3%				X		
Triadimefon	26	1,096	0.12	5.9%				X		
Azoxystrobin	27	1,009	0.22	5.5%				X		
Mancozeb	11	471	1.34	2.5%		X				
Metalaxyl	7	358	0.12	1.9%			X		X	
Chlorothalonil	5	168	1.98	0.9%				X		

ALT - *Alternaria*
DM - Downy mildew
PM - Powdery mildew
P - *Pythium* and Damping off
NEM - Nematodes

Fungicide and Fumigant Use in Honeydew Melons in Arizona, 1998

Active Ingredient(AI)	Reports	Acres Treated	Mean Rate	% Acres		ALT	DM	PM	P	NEM
Azoxystrobin	17	720.6	0.21	18.5%				X		
Thiophanate-methyl	5	388.3	0.33	10.0%				X		
Metam-sodium	7	305.7	30.22	7.8%						X

Mancozeb	3	166.7	0.98	4.3%		X				
Metalaxyl	3	166.7	0.12	4.3%			X		X	
Dichloropropene	3	164.6	63.27	4.2%						X
Benomyl	4	121.4	0.24	3.1%				X		
Sulfur	3	78.9	15.79	2.0%				X		

ALT - *Alternaria*
DM - Downy mildew
PM - Powdery mildew
P - *Pythium* and Damping off
NEM - Nematodes

Fungicide and Fumigant Use in Watermelons in Arizona, 1998

Active Ingredient(AI)	Reports	Acres Treated	Mean Rate	% Acres		ALT	DM	PM	P	NEM
Azoxystrobin	62	2,332.5	0.229055	32.0%				X		
Thiophanate-methyl	27	1,761.3	0.291424	24.1%				X		
Dichloropropene	11	624.0	59.04004	8.5%						X
Sulfur	7	494.2	6.979796	6.8%				X		
Chlorothalonil	11	423.3	1.89916	5.8%		X	X	X		
Benomyl	13	420.8	0.23445	5.8%				X		
Mefenoxam	9	273.5	0.119058	3.7%			X		X	
Triadimefon	6	232.0	0.123431	3.2%				X		
Metam-sodium	3	165.5	26.81	2.3%						X

ALT - *Alternaria*
DM - Downy mildew
PM - Powdery mildew
P - *Pythium* and Damping off
NEM - Nematodes

Fungicide and Fumigant Use in All Melons (including unspecified) in Arizona, 1998

Active Ingredient(AI)	Reports	Acres Treated	Mean Rate	% Acres		ALT	DM	PM	P	NEM
Metam-sodium	91	6,219.0	32.54	20.9%	>					X
Azoxystrobin	132	5,560.9	0.22	18.7%				X		

Benomyl	106	5,185.0	0.23	17.5%				X		
Thiophanate-methyl	82	5,127.4	0.32	17.3%				X		
Triadimefon	83	4,687.0	0.11	15.8%				X		
Dichloropropene	67	4,188.5	73.87	14.1%						X
Mefenoxam	67	3,926.2	0.14	13.2%			X		X	
Sulfur	55	3,283.7	11.72	11.1%				X		
Chlorothalonil	42	2,158.4	1.68	7.3%		X	X	X		
Mancozeb	24	984.7	1.36	3.3%		X				
Metalaxyl	13	785.6	0.13	2.6%			X		X	

ALT - *Alternaria*
DM - Downy mildew
PM - Powdery mildew
P - *Pythium* and Damping off
NEM - Nematodes

Weeds

Weed management in melons grown in the low desert regions of Arizona is challenging. Spring and fall crops face different mixes of weeds. In Arizona, melons are planted from January through March using a variety of systems. In January and February, early spring crops planted or transplanted in the mid-bed trench system grown under plastic face both winter and summer weeds. Another technique is to plant on a slant-bed system to maximize the solar radiation impinging on the south-facing soil surface of the bed to warm the soil and encourage seed germination and seedling establishment and growth. Planting on an 80-inch bed with black plastic mulch offers soil warming to enhance early spring plantings. Conventional planting on beds without plastic is done during March when the danger of frost is past and emerging seedlings have the optimum spring growing conditions. The fall melon crop is generally planted during July and early August on conventional beds. In some situations, the black plastic mulch previously used in the spring is re-used and painted white to reflect solar radiation.

Irrigation methods contribute to the difficulties of managing weeds. Conventional furrow irrigation is used on the mid-bed trench, slant-bed, and conventional plantings and sprinklers can be used to germinate the crops for any of the systems of plantings and subsurface drip irrigation is increasing on much of the acreages. Weeds that occur in drip irrigated fields are prevalent only where soils are wetted compared to furrow and sprinkler irrigation that moistens all of the surface area in the field.

Available preemergence herbicides are limited in their efficacy and safety on the crops. No postemergence herbicides are labeled for broadleaved weeds. Few herbicides are available and effective under all of the conditions that melons are grown and the various weeds infestations that occur. Cultivations take place between the rows before the vines spread and handhoeing is the only way of removing weeds from within the row. (3,6,7)

Controls

Chemical

Bensulide, the most commonly used pre-emergence herbicide is effective against grass weeds(*Echinochloa crus-galli* or E.*colona*), common purslane (*Portulaca oleracea*) and sometimes other small seeded broadleaved weeds like the pigweeds (*Amaranthus* spp.). Ethalfluralin may be used in some growing areas but melon phytotoxicity may occur during extreme cold or hot temperatures during the emergence or seedling stages. Trifluralin's use is also limited due to possible plant injury that may occur. Sethoxydim is a postemergence herbicide that will control grasses. Alternative postemergence products are presently under review but are not yet labeled in melons.

Winter weeds that are difficult to control include London Rocket (*Sisymbrium irio*), nettleleaf goosefoot (*Chenopodium murale*), Cheeseweed (*Malva* spp.) and sow thistle (*Sonchus oleracea*). These weeds occur during the winter months under plastic or in the early spring season on slant-beds or conventional plantings. Summer weeds, like various pigweed species, groundcherry and purslane, will germinate under plastic during the winter as well as during the summer. Groundcherry (*Physalis wrightii*) is a summer weed for which available chemistries provide no control.

Herbicide Use in Cantaloupe in Arizona, 1998

Active Ingredient(AI)	Reports	Acres Treated	Mean Rate	% Acres
Bensulide	75	2,986	1.23	16.1%
Trifluralin	22	1,794	0.61	9.7%

Herbicide Use in All Melons (including unspecified) in Arizona, 1998

Active Ingredient(AI)	Reports	Acres Treated	Mean Rate	% Acres
Bensulide	143	6,376.7	1.83	21.5%
Trifluralin	29	2,348.6	0.60	7.9%
Sethoxydim	11	341.7	0.18	1.2%
Ethalfluralin	6	315.7	0.55	1.1%

Arizona pesticide use reporting

The state of Arizona mandates that records be kept on all pesticide applications. Submission to the Arizona Department of Agriculture (ADA) of these pesticide use reports is mandated for all commercially applied pesticides, pesticides included on the Department of Environmental Quality Groundwater Protection List (GWPL) and section 18 pesticides.

- Commercial applicators licensed through the state must submit Arizona Department of Agriculture Form 1080 Pesticide Use Reports for all applications. The use of commercial applicators varies across crops. Aerial application is all done by commercial applicators.

- The GWPL is a list of active ingredients determined by the Department of Environmental Quality to potentially threaten Arizona groundwater resources. Enforcement of this list is difficult. Strictly speaking, only specific types of soil application of GWPL active ingredients must be reported. Inclusion on the GWPL should indicate a higher level of reporting but without further research no useful distinctions can be drawn.

- Section 18 active ingredients should have 100% reporting. There were no section 18s active in Arizona lettuce in the 1997-98 growing season.

- Voluntary reporting does take place. Anecdotal evidence indicates some producers submit records of all applications

Reported pesticide usage provides a solid lower bound of acres treated and a mean application rate of reported applications. Relative magnitude of reported acres is useful for rough comparison but could reflect a bias among commercial applicators or differing reporting rates as a result of inclusion on the GWPL. Finally, while the quality of data from the ADA 1080 forms has improved dramatically in recent years, there is still the possibility of errors.

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