Pest Management Strategic Plan for Watermelons in Delaware, Maryland, New Jersey, and North Carolina

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EXECUTIVE SUMMARY

Needs for Insect Control in Watermelon

Education
Improved management practices for bees
safe use of pesticides
Improved understanding of migratory/invasive pest species: whiteflies

Research
Seed treatments: seed corn maggot, cucumber beetles
Trickle irrigation for insect control
Honey bees and natives (conserve populations): management of pesticides for efficient pollination
Evaluate reduced risk pesticides, specifically biorationals
Miticides needed- for improved control: different modes of action and resistance management
Look at attractant baits (bait & kill) for cucumber beetle adult
Cooperation with plant pathologists on insects as vectors of plant diseases

IPM approach using improved thresholds
Cultivate soil prior to planting -- is it good or bad? Seed corn maggot
Lannate for aphids - inconsistent -- determine why

Regulatory
Belief (flonicimid) registration for aphids -- currently pipeline
Watermelon returned to actara label: product can be used early season without harm to bees
Miticides: Fujimite (fenpyroximate), Zeal (etoxazole: currently submitted to EPA)
Make sure reduced risk pesticides are registered

Needs for Disease Control in Watermelon

Education
-Cultural controls for Fusarium Wilt
    -cover crop to reduce current populations
-Bacterial Fruit Blotch- clean seed
-Recognition and identification of Powdery Mildew
-Recognition and identification of Downy Mildew
-Control measures for Phytophthora Blight
-Air pollution
-Vine decline (problem in FL, may be emerging problem in NE)

Research
Fusarium Wilt
    -chemical control
    -cultural practices
        -soil solarization
        -grafting - quality and yield
-Fungicide resistance
    -Gummy Stem Blight (regionally)
    -Downy Mildew (regionally)
    -Powdery Mildew
    -Phytophthora
-Phytophthora -chemical control and alternatives
-Disease management and epidemiology of Downy Mildew
-Need more fungicide efficacy data on Powdery Mildew on watermelon
-We need efficacy data on tanos for Bacterial Fruit Blotch
-Topsin M -- more data needed on efficacy for Anthracnose when used by itself

Regulatory
-labels for new products: mandipropamid (REVUS) - *syngenta*
: fluopicolide - *valent* - research number:
: quintec- Dow Agrosciences - requesting economic data (NJ)

Needs for Weed Control in Watermelon

Education
-specifics of herbicide use (dangers to crops)
    -specifics related to transplants and direct seeded
-spray technology
    -minimizing drift
    -hooded sprayers (pressure)
-components of weed control
    -interception of spray
-weed seed production (post season) and resulting impact on subsequent crops

Research Needs

-amaranth and nutsedge control in the row (under plastic)
-Management of ALS resistant biotypes

    -effectiveness of Reflex and other herbicides for ALS-resistant Pigweed
-control of morning glory (regional differences)
-removal of plastic and its result on weed control (as related to black nightshade's seed production)
    -late season weed control
-products for eastern black nightshade control
-control weeds on the shoulders of the plastic
-alternatives to synthetic products for organic growers

Regulatory
-get Dual registered on watermelon

GENERAL PRODUCTION INFORMATION
(http://www.nass.usda.gov/Data_and_Statistics/Quick_Stats/)

National

- In 2005, 136,400 acres of watermelon were harvested in the United States with production concentrated in Florida, Texas, Georgia, and California.
- National 2005 production was 37,896, 000 hundredweights.
- The value of national production in 2005 was $410,281,000

Delaware

- In 2005, 2,800 acres were harvested in Delaware.
- 2005 production was 854,000 hundredweights.
- The value of production in 2005 was $8,113,000.

North Carolina

- In 2005, 6,100 acres were harvested in North Carolina.
- 2005 production was 1,037,000 hundredweights.
- The value of production in 2005 was $7,259,000.

Maryland

- In 2005, 2,400 acres were harvested in Maryland.
- 2005 production was 672,000 hundredweights.
- The value of production in 2005 was $8,736,000.

New Jersey figures are not available.

Production Regions

Production on Delmarva is concentrated in western Sussex County, Delaware, and in the Maryland counties of Dorchester, Wicomico, and Caroline Counties. For North Carolina, most watermelons are grown in the Coastal Plain of eastern North Carolina or in the northeastern region of the state. Production in New Jersey is primarily in the northern and western counties, Hunterdon, Warren, Morris and Sussex.

Cultural Practices

Traditionally, the watermelon industry concentrated on standard, seeded watermelons that are large in size (18 to 30 pounds per melon) and the smaller Ice Box types (8 to 12 pounds per melon). Since 1990, however, significant production (estimated to be as high as thirty percent of the total acreage) of seedless watermelons has occurred.

The plant is a very aggressive vining annual, warm-season crop best adapted to mean temperatures greater than 70F. It has a deep and penetrating root system, reaching six feet or deeper. Flowering in late May, June and July allows good fruit production. Bees are necessary to achieve good pollination and, hence, good yields. Variety selection is perhaps the most important management decision a producer makes. Varieties should have good yield capability, resistance to anthracnose and Fusarium wilt, desired horticultural characteristics and market acceptability.

Seeded Watermelons

Seeded watermelon varieties can be divided into two variety types: open-pollinated and hybrid melons. Within these two categories, there are Standard and Ice Box types. Seed for open-pollinate varieties is produced by self-fertilization of the flowers within one variety. Hybrids are the result of cross-fertilization of a male parent with a female parent. Hybrids have better yield, vigor

and disease resistance compared to open pollinated varieties; however, the seed is more expensive.

Seedless Watermelons

Seedless watermelons are hybrids that have small, rudimentary seeds that develop and are eaten like cucumber seeds along with the fruit.

The basic production system consists of direct-seeding melons into worked ground, applying herbicides for weed control, making several cultivations, irrigating, and then harvesting when the melons are mature. This is the least costly system and lends itself to larger, extensive operations that are planting standard melons for harvest in August. To ensure seedless watermelon production success, current recommendations are to use transplants, plastic mulch, and drip-irrigation production system. Crop rotation may be recommended for disease control. Fusarium wilt is a major soil-borne fungus organism that can severely impact production. The disease organism is long-lived in the soil. If Fusarium is present, a field should not be planted to watermelon for five to eight years, unless the soil is fumigated.

Plastic Mulch and Row Covers

Plastic mulch with drip irrigation results in earlier melons (1 week) and helps increase yields (total yields may reach 80,000 pounds per acre). Other benefits from using black plastic mulch include: higher quality fruit, reduced blossom-end rot, and better placement and use of fertilizer.

TIMELINE

Transplants: Transplant container-grown plants through plastic mulch when daily mean temperatures have reached 60oF (15.6oC). Planting dates vary from May 1 in southern regions to June 20 in northern areas.

Direct-seeded: Seed April 20 to May 15 in warmer areas, and May 15 to June 10 in cooler areas.

Drip/Trickle Fertilization

The first soluble fertilizer application should be applied through the trickle Irrigation system within 1 week after field transplanting the watermelons. The same rate of soluble fertilizer should be applied 2 weeks later. The third application should be made when the first fruit set. A fourth application needs to be applied 2 weeks before the first harvest. The fifth application should be applied right after the first harvest. To maintain good production late into the season, apply another application three weeks after the fifth complete fertilizer application.

Mulching
Plastic and fumigant--Vapam HL (30 to 37 gallons per acre)--should be applied on well-prepared planting beds 30 days before field planting. Fertilizer must be applied during bed preparation.

Harvesting
Harvest is usually late June to August.

WORKER ACTIVITIES

Spring preparations

Watermelon production activities begin in March. Many North Carolina growers produce watermelon transplants in greenhouses. Worker activities include filling the transplant trays with soil-less media and sowing of seed. In many cases, the grower sows the seed, irrigates and fertilizes the transplants. In conjunction with greenhouse transplant activities, land preparation begins in March. Mold board plowing and disking are common tillage practices employed before rows are laid out in the field. Approximately 75% of plantings are made on bare ground, while about 25% utilize plasticulture management techniques. For plasticulture, approximately three to four workers are needed to lay plastic in a grower field when using one-row equipment. With three-row equipment, as many as eight workers may be needed for the application of plastic and fumigant. Telone II is commonly used as the fumigant for nematode control as well as In-line and Vapam, which can be injected directly into the drip irrigation line.

Land preparation for sowing a watermelon crop on bare ground begins in March and April. After land has been plowed and/or disked, some growers may fumigate the soil for nematode control. These tillage and fumigation operations typically only involve a tractor operator.

Planting

Field planting operations begin in mid-April and are mostly complete by late May. In plasticulture, transplant equipment typically is 1 or 3-row, while some transplants are set in the field by hand. In bareground, transplants are set with two-row equipment. Several workers are needed when mechanical equipment is used to set transplants and even a greater number of workers are needed if transplants are set by hand. Workers' exposure occurs to plants that possibly are treated with pesticide. When watermelon fields are established by sowing seed, only one worker is needed to operate the tractor and worker exposure is negligible.

After Planting

After planting, fertilizer is applied two to three times when grown on bare ground, while fertilizer application in the drip tape is typically made weekly in the plasticulture system. Only one worker is needed to drive the tractor and apply fertilizer when applying fertilizer to watermelon grown on bare ground. A trained

worker with technical expertise is needed to “fertigate” when production is by plasticulture.

Irrigation is more labor intensive when watermelon is grown on bare ground. A traveling gun is typically used to irrigate the crop as needed. About three to four workers are needed to move irrigation pipe and equipment in the field. Irrigation for watermelon grown in a plasticulture production system is managed by a worker with technical expertise. A worker or two may help maintain the drip irrigation by scouting and repairing water leaks when located.

Pesticides are applied during the production season beginning May until harvest. Fungicide and insecticide applications are usually applied together. Applications are usually made on a 7 to 14 day interval with an average of four total sprays. Herbicides are typically applied immediately after planting. Workers are potentially exposed to pesticides in a watermelon crop during hand weeding which is usually a one-time event during the season. However, the main worker exposure to pesticides is the tractor driver; the exception is during hand weeding.

Harvest

The last field activity involves harvest, which begins in late June and is completed by August. Worker exposure in a watermelon crop is greatest as fruit are handled and removed from fields. This requires much physical labor, especially in fields in which larger fruit are produced. Typically four workers are needed to cut the fruit and remove them from the vine and 8 to 10 workers to pick the fruit up and place in the truck.

COSTS

The total cost to produce an acre of watermelon varies from $1,418.79 to $2,957.32 depending on the variety and mulching and irrigation practices.

CRITICAL PEST INFORMATION

Diseases

Major diseases of watermelon are: anthracnose, Bacterial Fruit blotch, Cercospora Leaf Spot, Damping Off, Downy Mildew, Fusarium Wilt, Gummy Stem Blight, Nematodes, Phytophthora Blight, and Powdery Mildew.

Weeds

Major weeds in watermelon are: Carpetweed, Cocklebur, Cranesbill, Galinsoga, Jimsonweed, Lambsquarters, Morningglory, Shepherds purse, Palmer Amaranth, Prostate Pigweed, Smooth Pigweed, Common Purslane, Common Ragweed, Smartweed, Eastern Black Nightshade, Velvet Leaf, Barnyard Grass, Crabgrass, Fall Panicum, Foxtail, Goosegrass, and Johnson Grass.

Insects

Common insect pests in watermelon are: Seed Corn Maggot, Cucumber Beetle, Cutworms, Pickleworm, Melonworm, Green Peach Aphid, Melon aphid, Leafminers, Rindworms, Cabbage Looper, Mites, and Thrips.

CRITICAL PESTICIDE INFORMATION

Fungicides

Fungicides used in watermelon are: Apron, azoxystrobin, metamsodium, chloropicrin, chlorothalonil, cyazofamid, cymoxanil, dichloropropene, dimethomorph, famoxadone + cymoxanil, fenamidone, fixed copper, carbofuran, mancozeb, maneb, fludioxinol, mefenoxam, myclobutanil, phosponate, propamocarb, pyraclostrobin, sulfur, thiophanate-methyl, thiram, trifloxystrobin, triflumizole, vydate and zoxamide.

Herbicides

Herbicides used in watermelon are: Alanap, Prefar, Command, Curbit, Dacthal, Treflan, Sandea, Sinbar, Strategy, Poast, Delect and Gramoxone products.

Insecticides

Insecticides used in watermelon are: abamectin, esfenvalerate, diazinon, dimethoate, carbofuran, dicofol, methomyl, permethrin, carbaryl, endosulfan, imidacloprid, bifenthrin, beta-cyfluthrin, thiamethoxam, spiromesifin, fenpropathrin, dinotefuran, spintor, vydate, and fulfill.

DISEASES

Diseases of watermelon may reduce yield by increasing respiration, or reducing photosynthesis, nutrient uptake or translocation, and therefore result in smaller or fewer or no fruit. Reduced photosynthesis also may reduce sugar accumulation in fruit reducing fruit quality. Pathogens also may directly invade fruit or damage foliage to the extent that fruit become sunburned and therefore unmarketable. Disease management includes site selection: selection of disease resistant cultivars, disease free transplant production, protecting seedlings and growing plants once they are in the field, and sanitation after harvest.

Pathogens may survive between crops in host tissue as a special survival structure or on a living cucurbit host. Therefore diseases require different crop free (rotation) periods to minimize initial inoculum and disease development.. Transplants should be grown using seed that has been tested and found to be symptomless (watermelon growers will need to sign a waiver in order to purchase seed)., under conditions that minimize disease development. Cultural controls are extremely important in the greenhouse because chemical control options are limited.

After the transplants go to the field, application of fungicides becomes the major disease control option. There is mounting evidence that spraying according

to a weather based fungicide application model , such as MELCAST, using appropriate threshold values will minimize fungicide costs while controlling disease and maintaining yield. However, disease models should always be tested locally prior to implementation.

Harvest often occurs while fungicides are still being used. After harvest, crop refuse should be plowed into the ground to speed decomposition of the plant material where many pathogens survive. Once the refuse decomposes, some pathogens cannot survive.

DAMPING-OFF

Damping-off refers to a disease caused by a number of fungal disease organisms that cause seeds to rot before they germinate, shoots to decay before they emerge, or seedlings to collapse after emergence. Disease severity depended on presence of pathogen, innoclum levels and the weather. Fungicide seed treatments are often used to manage damping-off.

A. Chemical Control

1. Organo-phosphates - none

2. Carbamates - none

3. B1, B2 potential carcinogens

Captan (North Carolina)
Widely used as a seed treatment for a wide range of fungi
IPM and/or resistance management issues: None
Regional differences: Should not be any

4. Other chemical pesticides

Ridomil, Gold EC (mefenoxam)
Used as application after transplanting for Pythium damping off.

Apron (metalaxyl)
seed treatment for Pythium damping-off

Maxim (fludioxinil)
seed treatment for Fusarium and Rhizoctonia damping-off.

Thiram (North Carolina)
Old standby, used extensively for seedling damping-off
IPM and/or resistance management issues: None
Environmental issues (water & air quality, endangered species, etc.): None

B. Biologicals

Several biologicals are available; **Kodiak, YieldShield, Serenade (Bacillus subtilis), PlantShield (Trichoderma harzianum), SoilGard (*Gliocladium virens*)**.

C. Cultural methods

Choose well drained fields that have been rotated away from cucurbits for at least one year.

D. Non-registered (Pipeline materials) pest management tools - none

BACTERIAL FRUIT BLOTCH

Bacterial Fruit Blotch is an occasional disease problem on Delmarva. Begin treatment at first bloom.

A. Chemical Control

1. Organo-phosphates - none

2. Carbamates - none

3. B2 carcinogens - none

4. Other chemical pesticides

Tanos

Suppression of bacterial fruit blotch

Fixed copper

Needs to be applied early and often if weather is conducive for disease development. Cannot be expected to provide control, maybe suppression.

B. Biologicals - none

C. Cultural methods

2 years between watermelon crops. Buy seed that has been tested to be free of the pathogen. Sanitation during transplant production and possibly fungicide use if the label allows.

D. Non-registered (Pipeline materials) pest management tools: none

VIRUSES

Viruses (CMV, WMV, PSRV, and ZYMV) are transmitted through aphid feeding.

A. Chemical Control

1. Organo-phosphates - none

2. Carbamates - none

3. B1, B2 potential carcinogens - none

4. Other chemical pesticides - none

B. Biologicals - none

C. Cultural methods

Practice strict aphid control. Plant fields as far away from existing cucurbit plantings as possible. Select disease resistant varieties if available.

D. Non-registered (Pipeline materials) pest management tools - none

AIR POLLUTION (OZONE)

Air pollution (ozone) will cause chlorosis and upper surface scorching on older leaves, which leads to defoliation.

A. Chemical Control

1. Organo-phosphates - none

2. Carbamates - none

3. B1, B2 potential carcinogens - none

4. Other chemical pesticides - none

B. Biologicals - none

C. Cultural methods -

Plant varieties which are less sensitive to ozone injury.

D. Non-registered (Pipeline materials) pest management tools - none

FUSARIUM WILT

Fusarium wilt is a vascular disease caused by soilborne fungus. Initial symptoms are that plants appear to wilt in the middle of the day (when transpiration is high) then recover. Leaves on one branch or stem may wilt and turn color. Finally entire plant collapses.

A. Chemical Control

1. Organo-phosphates - none

2. Carbamates - none

3. B1, B2 potential carcinogens - none

4. Other chemical pesticides - none

B. Biologicals

Non-pathogenic Fusaria suppress Fusarium wilt. However, these are not yet commercialized.

C. Cultural methods -

Plant in fields which have not had watermelons for 5-6 years. Adherence to a rotation schedule is important, but is not completely reliable as a control method. Use resistant varieties. Planting into a tilled hairy vetch cover crop has been tested and is effective in the mid-Atlantic. At present, growers are experimenting with adoption of practice.

D. Non-registered (Pipeline materials) pest management tools - none

ANTHRACNOSE (PRIMARY PEST)

Anthracnose is one of the most destructive foliar diseases of watermelon. All above ground parts of the plants are affected. The fruit becomes susceptible to infection at about the time of ripening. The fungus overwinters in infected plant debris in the soil and seed. Begin treatment when vines run or earlier if symptoms begin to develop.

A. Chemical Control

1. Organo-phosphates - none

2. Carbamates - none

3. B1, B2 potential carcinogens –

"chlorothalonil" (Bravo Weather Stick, Echo, Equus)
Mancozeb (North Carolina)

4. Other chemical pesticides

Pristine--18.5 oz 38W/A, or a tank mix of **chlorothalonil** *plus* one of the following:
azoxystrobin (Amistar--3.5-5 oz 80WDG/A or
Quadris (azoxystrobin)--11- 15.4 fl oz 2.08F/A), or

Cabrio--12-16 oz 20EG/A, or
Tanos--8 oz 50 WDG/A (must be tank mixed with either chlorothalonil, mancozeb, or copper)

B. Biologicals - none

C. Cultural methods -

Plant in fields which have not been planted with any cucurbits for 2 years. Use resistant varieties when possible.
Some varieties offer excellent resistance, so use them whenever possible. For disease control in susceptible varieties, it is important to combine protectant fungicide applications with seed treatments and crop rotation with noncucurbits. If infection does occur, know that the disease overwinters in infected seeds, leaf litter, and plant debris and can remain in the soil for several years. After harvest, be sure to remove all plant debris to avoid a possible re-infection.

MELCAST is a weather-based fungicide application program for watermelon anthracnose and gummy stem blight. Use of this program can reduce fungicide application 10 to 40%. This is available through UD IPM program.

D. Non-registered (Pipeline materials) pest management tools - none

DOWNY MILDEW

Downy Mildew generally does not occur until mid-August. This fungal disease is dependent on moisture and can cause heavy losses in a short time if the aggressive strain of the fungus is present and the weather is ideal for infection and spread. Begin sprays when vines run or if disease occurrence is predicted for the region.

A. Chemical Control

1. Organo-phosphates - none

2. Carbamates –

Previcur Flex (propamocarb) (North Carolina)
One of the most effective fungicides on cucumbers.

3. B1, B2 potential carcinogens –

Ridomil Gold/Bravo 76.5 WP plus Bravo WeatherStik 6 F or Terranil 6L. IPM and/or resistance management issues: Bravo needed for resistance management as a tank mix partner as well as a rotation product.

Mancozeb (North Carolina)
Gavel--1.5-2 lb 75 DF/A (Gavel contains mancozeb, which is a protectant, and does not need a tank mix partner.)

IPM and/or resistance management issues: Tank mix partner for resistance management less effective than chlorothalonil

4. Other chemical pesticides –
The following are the most effective materials (tank mix these products with a protectant such as **chlorothalonil**--1.5-2 pt 6F/A, or OLF):
Ranman--2.1-2.75 fl. oz. 400 SC/A, or
Previcur Flex--1.2 pt 6F/A, or
Curzate--3.2 oz 60DF/A, or
Tanos (famoxadone + cymoxanil)--8 oz 50WDG/A

B. Biologicals - none

C. Cultural methods - none

D. Non-registered (Pipeline materials) pest management tools - none

ALTERNARIA LEAF BLIGHT

Alternaria leaf blight causes plants to loose leaves. This fungus also overwinters in infected plant debris in the soil and seed. Begin spraying when vines begin to run.

A. Chemical Control

1. Organo-phosphates - none

2. Carbamates - none

3. B1, B2 potential carcinogens –
Bravo, WeatherStik 6 F or **Terranil 6L (chlorothalonil)**

4. Other chemical pesticides –
Begin sprays when vines begin to run.
Alternate:
chlorothalonil--2-3 pt 6F/A, or OLF (Use low rate early in season)
With:
Pristine--12.5-18.5 oz 38W/A, or a tank mix of **chlorothalonil** *plus* one of the following every 14 days:
azoxystrobin (Quadris--11-15.4 fl oz 2.08F/A or **Amistar**--3.7-5 oz 80WDG/A), or
Cabrio--12-16 oz 20EG/A

B. Biologicals none

C. Cultural methods –

Using resistant varieties whenever possible and following a proper management routine will help reduce the risk of infection. Make sure you rotate cucurbits out with other vegetables for three or four years. After harvest, plow under or burn? any crop debris left in the field.

D. Non-registered (Pipeline materials) pest management tools - none

GUMMY STEM BLIGHT (PRIMARY PEST)

Gummy stem blight usually attacks the leaves and stems of watermelon; however, in favorable weather it can infect any plant part. This fungus also overwinters in infected plant debris in the soil and seed. Begin sprays when vines begin to run.

A. Chemical Control

1. Organo-phosphates - none

2. Carbamates –

Topsin M 70 WP (thiophanate-methyl) Our recs book does not recommend thiophanate-methyl any longer because of widespread resistance.

3. B1, B2 potential carcinogens –

(chlorothalonil) Bravo WeatherStik 6F
Mancozeb (North Carolina)

4. Other chemical pesticides –

Alternate **chlorothalonil--**2-3 pt 6F/A or OLF
*With**:***
a tank mix containing **chlorothalonil** *plus* **Pristine (pyraclostrobin + boscalid**) --12.5-18.5 oz 38W/A, or
azoxystrobin (Quadris) --11-15.4 fl oz 2.08F/A or **Amistar**--3.5-5 oz 80WDG/A), or
Cabrio--12-16 oz 20EG/A

B. Biologicals none

C. Cultural methods –

Plant in fields which have not had cucurbits for 2 years. MELCAST is a weather-based fungicide application program for watermelon anthracnose

and gummy stem blight. Use of this program can reduce fungicide application 10-40%. This program is available through DE IPM program.

D. Non-registered (Pipeline materials) pest management tools - none

POWDERY MILDEW (PRIMARY PEST) Minor pest in DE

This disease was observed for the past few seasons in Delaware and Maryland and could occur in other States. Detection of powdery mildew is more difficult in watermelons than in other cucurbits because sporulation is sparse and masked by leaf color. Look for chlorotic spots on upper leaf surface of young, fully expanded leaves, and then inspect the corresponding lower leaf surface with a hand lens to confirm presence of the fungus. The fungus that causes powdery mildew has developed resistance to several classes of fungicides. Strains of the pathogen that are highly resistant to the strobilurins/FRAC group 11 fungicides (see table) were reported in the Eastern U.S. Powdery mildew generally occurs from mid-July until the end of the season. Observe fields for the presence of powdery mildew. If one lesion is found on the underside of 45 old leaves, begin the following fungicide program:

A. Chemical Control

1. Organo-phosphates - none

2. Carbamates - none

3. B1, B2 potential carcinogens - **chlorothalonil**--2-3 pt 6F/A

4. Other chemical pesticides –

*Alternate**:***
Nova--5 oz 40WP/A, or
Procure--4-8 oz 50WS/A,
Pristine--12.5-18.5 oz 38WG/A

Nova (myclobutanil)

Procure (trifumizole)

B. Biologicals none

C. Cultural methods - none

D. Non-registered (Pipeline materials) pest management tools - none

PHYTOPHTHORA BLIGHT

Phytophthora Blight is an emerging disease of watermelons on Delmarva; however, in other areas this highly destructive disease can cause many different problems for a crop, including: seedling damping-off, leaf spots and fruit rot, and possibly total crop loss. Older plants, with root infections, may suddenly wilt even though they show no signs of stem or vine lesions. In fruit the symptoms begin as small, water-soaked lesions in the rind, which enlarges quickly and becomes a soft, sunken area covered with white fungal growth. This eventually will lead to fruit collapse in the field or storage. During periods of heavy rainfall, this disease can spread rapidly, quickly becoming a very serious problem. Experience in DE and Maryland has been limited to fruit rot infections.

Fields should be adequately drained to ensure that soil water does not accumulate around the base of the plants. In addition, when the vines begin to run, subsoil between rows to allow for faster drainage following rainfall. When conditions favor disease development, apply the following for suppression only: Forum--6.0 oz 4.18SC/A (Must be tank mixed with another fungicide that is effective against Phytophthora blight on watermelon such as fixed copper), or Gavel--1.5-2 lb 75DF/A, or Tanos--8-10 oz 50DF/A+ mancozeb, or Ranman--2.75 fl oz 400 SC/A *plus* an adjuvant (see label for details, do not tank mix with copper)

A. Chemical Control

1. **Organo-phosphates** – none
2. **Carbamates** - none
3. **B1, B2 potential carcinogens** –
   Gavel **Mancozeb**
4. **Other chemical pesticides** – none

B. Biologicals none

C. Cultural methods –

Plant to field which has not had a crop of cucurbits, eggplant, pepper or tomato for 3 years. Select a field with excellent drainage and use cultural practices that insure good drainage from around the base of the plant and out of the field.

D. Non-registered (Pipeline materials) pest management tools - none

CERCOSPORA LEAF SPOT (NORTH CAROLINA)

Cercospora leaf spot is a secondary pest in Delaware and Maryland. It is often present but has not been observed to cause yield loss.

A. Chemical Control

1. Organo-phosphates - none

2. Carbamates - none

3. B1, B2 potential carcinogens –
Bravo (chlorothalonil)

Mancozeb

4. Other chemical pesticides –
Quadris (azoxystrobin)

B. Biologicals none

C. Cultural methods - none

D. Non-registered (Pipeline materials) pest management tools - none

Nematodes

The southern root-knot nematode (*Meloidogyne incognita)* is the most important species of nematode affecting watermelons in Maryland and Delaware.

A. Chemical Control

1. Organo-phosphates –

2. Carbamates –

Vydate L (oxamyl)
Water soluble can be applied through drip irrigation and used post transplanting, effective when used as a spray when nematodes detected early

3. B1, B2 potential carcinogens –
Metam sodium (Busan, Nemasol, Vapam HL)

4. Other chemical pesticides –
Chloropicrin

Terr-O-Gas 67, MC-33 (methyl)

Telone II (dichloropropene)

B. Biologicals - none

C. Cultural methods –

Exclusion and Sanitation are the best preventative measures against nematodes. Examples include obtaining nematode-free transplants and washing soil from machinery and tools before using them at different locations. Crop rotation with non-host crops to lower their population size is highly recommended in the event of nematode activity.
There are no resistant varieties.

D. Non-registered (Pipeline materials) pest management tools - none

Watermelon Disease Control Efficacy – Chemical Control

	Alternaria Leaf Blight	Anthracnose	Bacterial Fruit Blotch	Cercospora Leaf Spot	Damping Off	Downy Mildew	Fusarium Wilt	Gummy Stem Blight	Nematodes	Phytophthora Blight	Powdery Mildew
CHEMICAL CONTROL											
Apron	NA	NA	NA	NA	F	NA	NA	NA	NA	NA	NA
Azoxystrobin (Amistar Quadris)	G	VG	NA	VG	NA	F to NE resistance	NA	VG to NE resistance	NA	NA	G to NE resistance
Busan, Nemasol, Vapam HL Metam sodium	NA	NA	NA	NA	NA	NA	NA	NA	G	NA	NA
Chloropicrin	NA	NA	NA	NA	NA	NA	NA	NA	G	NA	NA
Chlorothalonil (Bravo/Terranil/ Equus)	VG	F to G	NA	VG	NA	G	NA	VG	NA	NA	F-VG
Cyazofamid (Ranman)	NA	NA	NA	NA	NA	VG	NA	NA	NA	F	NA
Cymoxanil (Curzate)	NA	NA	NA	NA	NA	G	NA	NA	NA	NA	NA
Diclhloropropene Terr-O-Gas 67, MC-33 Methyl Telone II	NA	NA	NA	NA	NA	NA	NE	NA	VG	NA	NA
Dimethomorph (Forum)	NA	NA	NA	NA	NA	P	NA	NA	NA	P	NA
Famoxadone + Cymoxanil (Tanos)	?	VG	?	NA	NE	VG	NA	NA	NA	F	NA
Fenamidone (Reason)	F	NA	NA	NA	NA	VG to NE (resistance)	NA	NA	NA	NA	NA
Fixed Copper	P	P	F- G	F	NE	P	NA	P	NA	?	P

Furadan carbofuran	NA	NA	NA	NA	NA	NA	NA	NA	G	NA	NA
Mancozeb (Dithane, Manzate, Penncozeb)	G	G	NA	VG	NA	G	NA	G	NA	P	P
Mancozeb + Fixed Copper (ManKocide)	G	G	F	G	NA	G	NA	F	NA	P	P
Maneb	G	G	NA	VG	NA	G	NA	G	NA	NA	NA
Maxim fludioxinol	NA	NA	NA	NA	G	NA	NA	NA	NA	NA	NA
Mefenoxam (Ridomil Gold EC, Ultra Flourish)	NA	NA	NA	NA	NE	NA	NA	NA	NA	F – NE (resistance)	NA
Mefenoxam + Chlorothalonil (Ridomil Gold/Bravo, Flouronil)	G	G	NA	F	NA	NE (resistance)	NA	G	NA	F	F
Mefenoxam + Copper (Ridomil Gold/ Copper)	P	NA	P	P	NA	NE (resistance)	NA	P	NA	F – NE (resistance)	NA
Mefenoxam + Mancozeb (Ridomil Gold MZ)	F	F	NA	F	NA	resistance issues NE (resistance)	NA	F	NA	F – NE (resistance)	NE
Myclobutanil (Nova)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	VG - E
Phosponate (Aliette, AgriFos, Phostrol, Prophyte)	NA	NA	NA	NA	NA	P	NA	NA	NA	NE	NA
Propamocarb	NA	NA	NA	NA	?	VG	NA	NA	NA	NA	NA

(Previcur Flex)											
Pyraclostrobin (Cabrio)	VG	E	NA	?	NA	VG (resistance)	NA	VG to NE (resistance)	NA	NA Bob will check	G to NE (resistance)
Pyraclostrobin + Boscalid (Pristine)	VG	F-VG	NA	VG	NA	G	NA	G	NA	P	G
Sulfur	NE	NE	NE	NE	NE	NE	NA	NE	NA	NE	VG (may cause phyto)
Thiophanate-methyl (Topsin M) Bob will check	(NA)	F	NA	F (NA)	NA	NA	NA	F	NA	NA	G
Thiram	NA	NA	NA	NA	F	NA	NA	NA	NA	NA	NA
Trifloxystrobin (Flint)	VG (NA)	VG (NA)	NA	NA	NA	P (resistance)	NA	NE (resistance)	NA	NA	VG (resistance)
Triflumizole (Procure) Bob will check	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	VG-E
Vydate L Oxamyl	NA	NA	NA	NA	NA	NA	NA	NA	G	NA	NA
Zoxamide + Mancozeb (Gavel)	G	F (NA)	NA	G	NA	VG	NA	F (NA)	NA	NA	NA

E = excellent
VG = very good
G = good
F = fair
P = poor
? = research needed
NA = not labeled for this disease, not used
NE = although labeled for this disease, product is not effective

Regional differences exist in efficacy of same products.

Watermelon Disease Control Efficacy – Cultural Controls

	Alternaria Leaf Blight	Anthracnose	Bacterial Fruit Blotch	Cercospora Leaf Spot	Damping Off	Downy Mildew	Fusarium Wilt	Gummy Stem Blight	Nematodes	Phytophthora Blight	Powdery Mildew	Viruses
CULTURAL CONTROLS												
Aphid control	-	-	-	-	-	-	-	-	-	-	-	+
Avoid field operations when leaves are wet	+	+	++	-	-	+	-	+	-	-	-	-
Avoid overhead irrigation	+	+	++	+	-	+	-	++	-	+	+	+
Buy tested seed or transplants grown from them	-	++	+++	-	-	-	-	++	-	-	-	-
Change planting date from Spring to Fall	+++ (NC) to -	+++ (NC) to -	-	+++ (NC) to -	-	+++ (NC) to -	-	+++ (NC) to -	-	++ (NC) to -	+ (NC) to -	-
Crop rotation with non-host	++ (2-3 years)	++ (2-3 years)	++ (2 years)	++ (2-3 years)	-	-	+ (5 or more years)	+++ (3 years)	-	+ (3 years)	-	-
Deep plowing	+	+	-	+	-	-	-	+	-	+	-	-
Destroy crop residue immediately	+	+	+	+	-	-	-	+	-	+	-	-
Destroy Volunteer	+	+	++	+	-	+	-	+	-	+	-	-

Plants												
Encourage air movement	+	+	+	+	-	+	-	+	-	-	-	-
Insecticide/ horticultural oils	-	-	-	-	-	-	-	-	-	-	++	-
Less-sensitive varieties Host tolerance or resistance	-	++	-	-	-	-	+++ (D) to + (T)	-	-	-	-	-
Nematode-free roots	-	-	-	-	-	-	-	-	++	-	-	-
Pathogen free planting materials	+	++	+++	-	-	+	+	-	-	-	-	-
Plant in well-drained soil	-	-	-	-	+	-	-	-	-	+	-	-
Plant on raised beds	-	-	-	-	+	-	-	-	-	+	-	-
Plastic mulch bed covers	-	-	-	-	-	-	-	-	-	+	-	-
Postharvest temperature control (fruit)	-	-	+	-	-	-	-	-	-	+	-	-
Cover Crop, Green Manure or Soil organic amendments	-	-	-	?	-	-	++ (with resistance)	+	+	-	-	-
Soil solarization	+	+	-	-	-	-	-	+	-	+	-	-

(reduce soil inoculum)												
Reduce mechanical injury	+	-	+	+	-	-	-	+	-	+	-	-
Remove plant debris after harvest	+	++	-	-	-	-	-	+	-	-	-	-

Provides minimal (+); moderate (++); to excellent (+++) disease suppression or avoidance
NC = North Carolina only
- = not applicable
D= diploid varieties (seeded)
T = triploid (seedless) varieties

WEEDS

Weeds cause economic loss in watermelons in many ways. Some of these are 1) competition for nutrients, water and light will reduce yields 2) weed foliage may intercept the spray of fungicides and insecticides and prevent contact with the watermelon foliage and fruit 3) harvesting crews cannot find the watermelons covered by weeds and this slows or prevents harvest 4) weed leaves or other plant parts that contact watermelon rind usually create an imprint on the rind and make the melon unsaleable due to a visual defect in the rind.

CULTURAL CONTROL

Cultivation

Cultivations are an essential component of watermelon production, because herbicides alone seldom control all the weed seeds or all weed species. When weed escapes occur, cultivation is preferable to hoeing or applying post-emergence herbicides. Cultivation is not commonly an option in plasticulture watermelon, but is used extensively in bareground watermelons.

Crop Rotations

Soil persistence (carryover) from herbicides used on previous crops may cause injury to watermelons. Advance planning in herbicide selections is essential to safely rotate watermelons after most agronomic crops and some vegetable crops. The herbicides Scepter, Pursuit and Classic have a great potential for vine crop injury in the next season. The labels for atrazine and simazine (Princep) prohibit most vegetable crop for over 12 months; however, experience has shown that rates of less than 2.0 lb ai/A total triazines do not cause vine crop injury the next year. Metribuzin (Sencor or Lexone), which is a triazine, does not cause carry-over injury to vine crops.

The only safe preemergence herbicides to use on soybeans prior to watermelons are linuron (Lorox, Linex), alachlor (MicroTech, Partner) or metolachlor (Dual, Magnum). Also the dinitrioaniline herbicides trifluralin (Treflan, Trilan) and pendimethalin (Prowl) might have a residual effect on watermelons, but do not carry over to the next year. The postemergence soybean herbicides acifluorfen (Blazer), bentazon (Basagran), lactofen (Cobra), thifensulfuron (Pinnacle) and Roundup would not affect watermelons in the next year.

CHEMICAL CONTROL – HERBICIDES

Of the pesticides listed in this document, bensulide is an organophosphate. The rest are neither an OP, Carbamate, or B1 B2 potential carcinogen.

I. Preplant incorporated or Preemergence Herbicides - Seeded and Transplanted Watermelon

- **bensulide (Prefar)**

Prefar may be applied preplant incorporated or preemergence. If applied preemergence, rainfall or irrigation must occur prior to weed emergence to activate the herbicide. Prefar may be tank mixed with most other herbicides to control more weed species. Watermelons may be transplanted directly through the Prefar herbicide zone on the soil surface or preplant incorporated. Surface applied or shallowly incorporated combinations of Prefar plus Command are acceptable for transplanted watermelons.

- **clomazone (Command 3ME)** –

Command 3ME now has a Section 3 label. Command 3ME is for preemergence applications, not preplant incorporated. Command 3ME does not have the volatility concerns that Command 4EC had which would cause severe damage to off-target crops or vegetation from drift during application. Command provides good to excellent control of annual grasses, lambsquarters, purslane and ragweed. Jimsonweed is usually suppressed by Command. Pigweed control is not acceptable with Command alone and combinations with Sinbar, Curbit or Prefar greatly improve control. Command does not control morningglories.

- **naptalam (Alanap)** –

Alanap may cause temporary stunting, especially if cool wet weather follows application. Alanap is applied preemergence or preplant incorporated for seeded and transplanted watermelon. Alanap should be combined with other herbicides to improve weed control. Although Alanap does not control grasses it may improve control of cocklebur, jimsonweed and ragweed. Also, Alanap may improve weed control when combined with Prefar, Curbit or Command.

- **Paraquat** (Gramoxone Inteon 2SC)

(North Carolina) Labeled for preplant application to non-selectively kill emerged weeds before watermelon emergence. This herbicide is used on little of the watermelon acreage. This low usage is probably because producers rely on tillage to kill sprouted weed seed and emerged weeds. Killing weeds prior to watermelon planting is critical since weeds that survive the planting operation can drastically reduce watermelon yield. Certain formulations of glyphosate are also registered preplant in watermelon for non-selective kill of emerged weeds. The label lists precautions on when growers can plant after glyphosate application.

II. Preemergence Herbicides

- **ethalfluralin (Curbit 3EC)** –

Applied preemergence only for seeded watermelon. Do not use on transplants. To control annual grasses and certain broadleaf weeds. Curbit can be used at a 3 pint/A on soils with approximately 2% O.M. or more, especially if manures have been applied. Control of many broadleaf weeds, including pigweed sp., common lambsquarter, jimsonweed, morningglory sp., ragweed sp., mustard sp., and others may not be acceptable. Dry weather following application may reduce weed control. Cultivate to control tolerant weeds or if rainfall or irrigation does not occur prior to weed emergence. Curbit should be combined with herbicides such as Command, Prefar, and Sinbar.

To prevent injury: 1) DO NOT preplant incorporate. 2) DO NOT apply under plastic mulch or tunnels. 3) DO NOT use on transplanted watermelon. 4) DO NOT use when soils are cold or wet.

III. Postemergence Herbicides

- **sethoxydim (Poast)**1.5 EC

With oil concentrate postemergence to control annual grasses and certain perennial grasses. The use of oil concentrate may increase the risk of crop injury when hot or humid conditions prevail. To reduce the risk of crop injury, omit additives or switch to nonionic surfactant when grasses are small and soil moisture is adequate. Control may be reduced if grasses are large or if hot, dry weather or drought conditions occur. For best results, treat annual grasses when they are actively growing and before tillers are present. Poast provides excellent control of fall panicum, goosegrass, lovegrass, and foxtails. Crabgrass smooth and large should be sprayed when relatively small for effective control. Generally Poast is most effective if applied 3 to 5 days prior to cultivation because it will weaken grasses and make them more vulnerable to killing by cultivation. A second application may be made for grasses that are difficult to control or for new flushes of germinating grasses. Poast will control johnsongrass and shattercane and it is also effective for control of volunteer rye and wheat. Repeated applications may be needed to control certain perennial grasses. Yellow nutsedge, wild onion, or broadleaf weeds will not be controlled with Poast. Do not tank-mix Poast with pesticides or apply within 2 to 3 days of any other pesticide unless labeled, because the risk of crop injury may be increased or reduced control of grasses may occur. Observe a minimum preharvest interval of 14 days and apply no more than 3 pints per acre in one season. Use 20 gal/A spray volume or less per acre.

Our studies indicate that if grasses are controlled in the first six weeks after planting, watermelon yields will not be reduced by competition from the grasses.

Therefore, Poast applications later than six weeks after seeding would be unnecessary provided grasses had been controlled during the initial six week period. Exceptions would be for crabgrass or johnsongrass that may require two applications.

- **Naptalam (Alanap 2S)** –

Applied broadcast postemergence to watermelons may be applied anytime up through early flowering. Alanap will stop the growth of many weeds for 4 to 5 weeks. Weeds suppressed are ragweed, all morningglory species, purslane, lambsquarters and pigweed. Slight watermelon leaf crinkling may occur, but it is a temporary condition.

- **DCPA (Dacthal)** (North Carolina)

DPCA can be applied 5-6 weeks after planting, and is useful in fields that develop severe common purslane infestations during the summer. DPCA is an option for application when watermelon has at least 4 to 5 true leaves. It is registered in bareground culture and has potential to give late season weed control. It has only had limited used in North Carolina.

- **trifluralin (Treflan and various other trade names**) (North Carolina)

Trifluralin is not recommended in the mid-Atlantic states.

- **Halosulfuron (Sandea)** (North Carolina)

Is registered in watermelon for postemergence control of yellow and purple nutsedge and broadleaf weeds (wild mustard, wild radish, common ragweed, galinsoga, and cocklebur). It is most effective postemergence on yellow and purple nutsedge compared to preemergence application. It can only be used in the middles between rows as it has potential to injure watermelon if applied over the top of watermelon plants.

- **Glyphosate** (North Carolina)

Certain formulations of glyphosate are registered for weed control in row middles of watermelon in North Carolina, but they are not recommended in the mid-Atlantic states. This herbicide controls most plants; thus must not contact the crop. It has had limited used in North Carolina due to the potential for crop injury.

- **clethodim (*Select* 2EC and SelectMax 0.97EC)**

PHI - 14 days. Postemergence. Select 2EC requires oil concentrate to control many annual and certain perennial grasses, including annual bluegrass. However, it will not consistently control goosegrass. The use of oil concentrate

may increase the risk of crop injury when hot or humid conditions prevail. To reduce the risk of crop injury, omit additives or switch to nonionic surfactant -- SelectMax 0.97EC can be applied with nonionic surfactant which reduces the risk of crop injury during “soft” growing conditions -- when grasses are small and soil moisture is adequate. Control may be reduced if grasses are large or if hot, dry weather or drought conditions occur. For best results, treat annual grasses when they are actively growing and before tillers are present. Repeated applications may be needed to control certain perennial grasses.. Yellow nutsedge, wild onion, or broadleaf weeds will not be controlled. Do **NOT** tank-mix with or apply within 2 to 3 days of any other pesticide unless labeled, as the risk of crop injury may be increased, or reduced control of grasses may result. REI - 24 hours.

IV. Post-Directed Herbicides

- **paraquat (Gramoxone Inteon 2SC)** –

Use a directed shielded applicator and spray at very low pressure of approximately 20 psi or less. Apply for the control of existing weeds between rows of watermelons. Gramoxone provides contact kill of most all broadleaf weeds and small grasses. Grasses may recover from Gramoxone contact injury. Gramoxone will kill most grasses under 2 to 4 inches height, but larger grasses may recover and continue to grow. This application may be made to soil between the rows of watermelon on bare ground and on the soil between plastic mulch strips.

V. Contact Herbicides

1. Delayed Preemergence

- **Paraquat** –

Apply Gramoxone Inteon 2SC just before emergence of crop to control early germinating weeds. Use wetting agent as directed on label. Emerged melon seedlings will be killed.

2. Pre Plant Application

- **Glyphosate (Roundup Ultra**)

for control of annual weeds. Apply 3 days before seeding or transplanting. Used for the control of most annual weeds and cereal cover crops.

VI. Postharvest

- **paraquat** –

A Special Local-Needs 24(c) label has been approved for the use of Gramoxone Inteon 2SC as a broadcast spray after the last harvest. Add nonionic surfactant according to the labeled instructions. This application method may be used to prepare plastic mulch for replanting, or to aid in the removal of the mulch.

Watermelon Herbicides for Broadleaf Weeds.

Herbicide	*Under plastic*	*BGa in-row*	*Row middles*	*POST Over Crop*	Carpet-weed	Cockle-bur	Cranes-bill	Galin-soga	Jimson-weed	Lambs-quarters	Morning-glory
Pre-emergence or Preplant Incorporated											
Alanap		*YES*	*YES*		F	P	N	F	F	F	F
Prefar	*YES*	*YES*	*YES*		N	N	N	N	N	F/G	N
Pre-emergence											
Command		*YES*	*YES*		N	N/F	-	F	G	G	P
Curbit		*YES*	*YES*		G	N	-	N	N	P/F	P
Sandea	*YES*	*YES*	*YES*		P	G	-	G	G	F	F
Strategy2		*YES*	*YES*		G	N/F	-	F	G	G	P
Post-emergence											
Alanap				*YES*	N	N	N	P	-	P	P/F
Poast				*YES*	N	N	N	N	N	N	N
Sandea					P	G	-	G	G	N	F
Gramoxone products 3 - hooded sprayers					G	G	F	G	G	F/G	F/G

Watermelon herbicides for Broadleaf Weeds.

Herbicide	Shepherds-purse	Palmer amaranth**	Prostrate pigweed**	Smooth pigweed**	Common purslane	Common ragweed**	Smart-weed	East. Black night-shade	velvet-leaf
Pre-emergence or Preplant Incorporated									
Alanap	N	F/G	F/G	F/G	F/G	F	P	P	F
Prefar	P/F	F	F	F	F	N	N	N	N
Pre-emergence									
Command	F	N/P	N/P	N/P	G	P	G	-	G
Curbit	-	F	F	F	F/G	N	P	P	P
Sandea	-	F	P	G	F	G	F	N	G
Strategy2	F	F	F	F	G	P	G	P	G
Post-emergence									
Alanap	-	F	F	F	F	P	-	P	P
Poast	N	N	N	N	N	N	N	N	N
Sandea	-	F	P	G	P	G	F	N	G

Gramoxone products 3 - hooded sprayers	F/G	G	G	G	F/G	G	P	G	G

a. BG = Bareground
1. Dacthal is an option for bareground watermelons with at least 4 to 5 true leaves. Dacthal will not control emerged weeds, but has potential to give late season weed control
2. Strategy is a pre-packaged mixture of Curbit and Command
3. Gramoxone is one trade-name for paraquat. There are various formulations of Gramozone; as well as generic brands of paraquat.

**ALS-resistant biotypes exist in the region. These biotypes will not be controlled with Sandea regardless of application timing or rate.

Watermelon herbicides for grasses and sedges

Herbicide	Barnyard	Crabgrass	Fall panicum	Foxtail sp.	Goosegrass	Johnson grass	Yellow nutsedge
Pre-emergence or Preplant Incorporated							
Alanap	P	P/F	P	F	P/F	-	N
Prefar	G	G	G	G	F/G	G	N
Pre-emergence							
Command	G	G	G	G	G	G	N
Curbit	F	G	G	-	G	-	N
Sandea	N	N	N	N	N	N	F
Strategy2	G	G	G	G	G	G	N

Watermelon Herbicides

Herbicide	Barnyardgrass	Crabgrass, Large	Fall Panicum	Foxtail sp.	Goosegrass	Johnsongrass (Seedlings)	Yellow Nutsedge	Carpetweed	Cocklebur, Common	Cranesbill	Galinsoga, Hairy	Jimsonweed	Lambsquarters, Common	Morningglory sp.	Shepherdspurse	Pigweed sp.	Purslane, Common	Ragweed, Common	Smartweed, Pennsylvania	Nightshade, Eastern Black	Velvetleaf
Preplant or Preplant Incorporated																					
Prefar	G	G	G	G	F/G	G	N	N	N	N	N	N	F/G	N	P/F	F	F	N	N	N	N
Pre-emergence or Preplant Incorporated																					
Alanap	P	P/F	P	F	P/F	-	N	F	P	N	F	F	F	F	N	F/G	F/G	F	P	P	F
Pre-emergence																					
Command	G	G	G	G	G	G	N	N	N/F	-	F	G	G	P	F	N/P	G	F	G	-	G
Curbit	F	G	G	-	G	-	N	G	N	-	N	N	P/F	P	-	F	F/G	N	P	P	P
Sandea	N	N	N	N	N	N	F	P	G	-	G	G	F	F	-	G	F	G	F	N	G
Strategy2	G	G	G	G	G	G	N	G	N/F	-	F	G	G	P	F	F	G	F	G	P	G

Herbicide	Barnyardgrass	Crabgrass, Large	Fall Panicum	Foxtail sp.	Goosegrass	Johnsongrass (Seedlings)	Yellow Nutsedge	Carpetweed	Cocklebur, Common	Cranesbill	Galinsoga, Hairy	Jimsonweed	Lambsquarters, Common	Morningglory sp.	Shepherdspurse	Pigweed sp.	Purslane, Common	Ragweed, Common	Smartweed, Pennsylvania	Nightshade, Eastern Black	Velvetleaf
Post-emergence																					
Alanap	N	N	N	N	N	N	N	N	N	N	P	-	P	P/F	-	F	F	P	-	P	P
Gramoxone products 1	F/G	F/G	F/G	G	F/G	-	G	G	G	-	G	G	F/G	F/G	-	G	F/G	G	P	-	-
Poast	G	G	G	G	G	G	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
Sandea	N	N	N	N	N	N	G	P	G	-	G	G	N	F	-	G	P	G	F	N	G

G = good
F = fair
P = poor
N = no control
- = insufficient data

INSECT PESTS

Several key insect and mite pests are known to attack watermelons grown in the Mid-Atlantic region. Certain species cause economic losses on an annual basis while others may only be occasional pests. The most important pests of watermelons include seed corn maggot, cucumber beetles, melon aphids and spider mites. Occasional pests include thrips and leafhoppers.

Seed corn maggot (Primary pest)

Seed corn maggot eggs are laid in freshly plowed fields as well as in greenhouse flats before transplanting into the field. Only a few maggots per seed or plant can significantly reduce stands. At the present time, there are no labeled materials for seed corn maggot on melons. However, broadcast applications of diazinon for other soil insect pests as well as at planting treatments of labeled neonicotinoid insecticides (i.e. Admire and Platinum) and Furadan 4F (24 C label) have helped to reduce problems. However, in high risk fields, control levels have been variable.

A. Chemical

Pros and Cons:

Currently, there are no available seed treatments or soil insecticides available for seed corn maggot control in watermelons. As indicated above, the use of diazinon for other soil insecticide as well as the use of at planting applications of the neonicotinoids and Furadan 4F for cucumber beetle control have helped to reduce problems. However, these treatments provide only fair control, especially under heavy seed corn maggot pressure.

1. Organophosphates

Diazinon AG500 – REI = 24 hrs; 3 day PHI;
Currently, a broadcast application of diazinon is only labeled for wireworms and cutworms; however, the use for SCM is allowed under Section 2ee of FIFRA in Delaware. According to the current diazinon IRED, one soil application of diazinon should still be allowed under the new labels. Although the use of a broadcast application of diazinon before planting can reduce maggot populations, it is only effective if applied immediately before planting. Since it must be applied before plastic is layed, it is often applied weeks before planting resulting in reduced levels of control. No Resistance Issues

2. Carbamates

Furadan 4F (carbofuran) (24C label in Delaware, Maryland, VA) – REI – 48 hours; no PHI on 24C label

The only 24C label only states cucumber beetle control; however, the use for SCM control is allowed under Section 2ee of FIFRA in Delaware. Overall, SCM control has been fair, especially under heavy pressure. In addition, a notice was issued in 2006 by EPA regarding the potential cancellation of Furadan on numerous vegetables. In many cases, the use of Furadan has also been shown to flair spider mites. No resistance issues.

3. B2 Carcinogens – none

4. Other chemical pesticides

Admire 2F (imadacloprid, neonicotinoid) (VA , MD, DE) – REI – 12 hours; 21 day PHI
Currently, an at-planting application of Admire is only labeled for aphid and cucumber beetle control; however, the use for SCM is allowed under Section 2ee of FIFRA in Delaware. In general the use of Admire at planting to control aphids and cucumber beetles has helped reduce problems; however, it is not adequate under heavy population pressure. No resistance issues.

Platinum (thiamethoxam, neonicotinoid) (VA,DE, MD) – REI – 12 hours; 30 day PHI
Currently, an at-planting application of Platinum is only labeled for aphid and cucumber beetle control; however, the use for SCM is allowed under Section 2ee of FIFRA in Delaware In general the use of Platinum at planting to control aphids and cucumber beetles has helped reduce problems; however, it is not adequate under heavy population pressure. No resistance issues.

B. Biological – none

C. Cultural
The use of cultural management practices before planting can help to reduce the potential for economic problems. A combination of the following cultural strategies can be used: (1) plow down cover crops at least 3-4 weeks before planting or transplanting, (2) completely bury cover crops or previous crop residue to reduce fly attraction to rotting organic matter on the soil surface, and (3) avoid the use of heavy manure applications close to planting. However, tillage must be done before seed corn maggots lay eggs early in the spring. Unfortunately, weather conditions are often not favorable for early tillage; therefore, this is often not a viable management option. Even if plowed down early SCM can still be pests.
Use clear plastic mulch or Infra red selective mulch to heat soil to 21.7O C which will reduce SCM infestations.
Heavier soils will remain cooler for a longer period than sandy soils and will take more time for plant material plowed down to decay.

D. Non-registered pipeline materials

Seed treatments in IR-4 pipeline include thiamethoxam (Cruiser) and fipronil (Regent)

Striped and spotted cucumber beetles (primary pests)

As soon as melons are planted in May, beetles migrate to the field and begin feeding on young seedlings. Although most watermelon cultivars have good bacterial wilt resistance, heavy beetle populations (greater than 5 per plant) can severely affect stand establishment during the cotyledon stage. Once the first three leaves are established, plants generally compensate for damage and growth delays before harvest. However, beetles can also damage mature fruit (rindworm damage). The use of at-planting insecticides or one-two properly timed foliar insecticides can provide effective control of overwintering beetles. Control of beetles late in the season to prevent rind damage is more difficult and inconsistent.

A. Chemical

1. Organophosphates – none

2. Carbamates

Furadan 4F (carbofuran) – Special Local-Needs label 24(C) in Delaware, MD and VA . REI – 48 hours; no PHI on 24C label.
In recent years, some producers have reported reduced efficacy with Furadan for cucumber beetle control. In addition, the use at planting has lead to spider mite outbreaks in season, but gives 2-3 weeks of protection from beetle feeding. No resistance issues.

Lannate LV (methomyl) – REI – 48 hours; 3 day PHI
Has provided effective control in Delaware and is most often used when both aphids and cucumber beetles are present early in the season; however, Maryland reports moderate to poor control of cucumber beetles. Under certain conditions (i.e. exploded populations; heavy weed pressure; poor coverage), it has not provided effective late season control. No resistance issues.

Sevin 80S (carbaryl) – REI – 12 hours; 0 days PHI
Pros and cons – In recent years, growers have reported reduced efficacy. In addition, repeated use has been shown to flair two-spotted spider mite and aphid populations later in the season. Extremely harmful to bees. No resistance issues.

3. B2 Carcinogens – none

4. Other chemical pesticides

Asana XL (esfenvalerate; pyrethroid) – REI – 12 hours; 3 day PHI
– In general, it has provided good control. Repeated use of pyrethroids has been shown to flair aphids and mites in season. No resistance issues.

Baythroid XL – (new label for 2006; **beta-cyfluthrin; pyrethroid**) – REI – 12 hours; 3 day PHI
Limited experience with product on cucurbits in DE; however, should provide effective control. However, same concern over multiple use and aphid flairs like other pyrethroids. No resistance.

Permethrin 3.2EC (pyrethroid) – REI – 12 hours; 0 day PHI
In recent years, growers have reported poor control with permethrin. In addition, multiple applications have resulted in aphid flairs. No resistance. .

Capture 2EC (bifenthrin; pyrethroid) - REI - 24 hours; 3 day PHI. (DE and MD)
Has provided good cucumber beetle control and help control low-moderate mite populations. Repeated use has been shown to flair aphids in season. No resistance issues.

Admire (imidacloprid; neonicotinoid) (NOTE –Provado does not have a federal label for cucurbits) (North Carolina, DE, MD.VA) - REI – 12 hours; 21 day PHI
The use of Admire at planting or through the drip system has provided good cucumber beetle control for 3-6 weeks depending on beetle population levels. It will not interfere with foliar natural enemy populations. No resistance.

Thionex (endosulfan chlorinated hydrocarbon;) (North Carolina, DE and MD ? VA)- NOTE – Do not think trade names Phaser or Thiodan are available anywhere anymore; REI – 24 hours; 2 day PHI
Has provided good cucumber beetle control in DE; however, MD reports poor control. It has also provided good melon aphid control in DE so is often used when both insects are present. In addition, it is relatively safe when used around bees so can be used after flowering. No resistance

Platinum (thiamethoxam, neonicotinoid) (VA,DE, MD) – REI – 12 hours; 30 day PHI
The use of Platinum at planting or through the drip system has provided good cucumber beetle control. No resistance. .

Venom (dinotefuran, neonicotinoid) (VA, DE, MD) – REI – 12 hours; 21 day PHI (soil); 1 day PHI (foliar)
The use of Venom both as a soil application and foliar application has worked well in VA. Currently a 2ee label in all states for cucumber beetle control.

B. Biological - None Available

C. Cultural

Plant varieties resistant to bacterial wilt (there are a limited number of resistant cultivars that also have the desirable horticultural attributes that growers want). Always cultivate the soil thoroughly before planting. The use of plastic or straw as bedding for the developing watermelons may deter rindworm feeding (NOTE only useful for small plantings JW), but may also increase squash bug populations. Areas of the field near woods will be the first sections attached by overwintering beetle populations. In the fall, eliminating surrounding weeds will reduce the overwintering sites for the beetles (Has this worked ?JW).

D. Non-registered pipeline materials
Assail (acetamiprid; neonicotinoid)

Melon aphid (Primary pest)

Melon aphid is the predominant aphid species attacking watermelons grown in the Mid-Atlantic region. Infestations begin when winged forms fly to the fields in late May. They feed mainly on the undersides of the leaves resulting in cupping of leaves, leaf distortion, plant stunting, and a reduction in the quality and quantity of fruit. In addition to feeding damage, the melon aphid is one of the chief vectors of cucumber mosaic virus. A foliar treatment should be applied if beneficial insect populations are low and 20% or more of the runners are infested with 5 or more aphids per leaf.

A. Chemical

1. Organophosphate-

Diazinon; Spectracide (diazinon) (North Carolina) – not used in DE

Dimethoate (North Carolina) – not effective on melon aphid in DE so is not used for aphid control; however MD reports good control.

2. Carbamates
Lannate LV (methomyl) – REI – 48 hours; 3 day PHI
In Delaware and Maryland, Lannate has provided good early season control of aphids (MD reports moderate to poor control). In recent years, growers have experienced variable levels of control generally due to exploded populations at application and coverage issues. No documented resistance in DE.

3. B2 Carcinogens – none

4. Other chemical pesticides

Thionex 3 EC (endosulfan; chlorinated hydrocarbon; cyclodiene organochlorine)- REI – 24 hours; 2 day PHI
Has provided good – excellent melon aphid control, especially if populations have not exploded at the time of application. In addition, it is relatively safe when used around bees so can be used after flowering. No resistance.

Fullfill (pymetrozine; triazine?; pyridine azomethine) – REI – 12 hours; 0 day PHI
Fulfill has provided good control of aphids, especially before populations explode. The use of penetrating type spray adjuvant is recommended to provide the most effective coverage and control. In general, it should not be applied with a "sticky fungicide" to provide effective control. Low toxicity to honey bees; however, should not be applied directly to bees that are actively foraging in the field. No resistance.

Venom (dinotefuran, neonicotinoid) (VA, DE, MD) – REI – 12 hours; 21 day PHI (soil); 1 day PHI (foliar)
New label in 2006. Provides good control as a soil applied material. Still some questions on efficacy as a foliar product.

Beleaf (flonicomid; pyridine carboxamide) – Might have labels in 2007 – in December still no state label in DE

B. Biological

The level of natural controls (e.g. lady beetles, lacewings, and parasitized aphids) should also be considered when making a treatment decision. In general, chemical controls are not needed if you can find one beneficial insect for every 50 aphids per plant. But if you know that you have a potential for virus problems in your area, only a few aphids can vector enough virus to cause economic losses. In these cases, early detection and control of aphids is critical. Spraying to stop initial virus infection into a field is useless as viruses are transmitted within seconds and pesticide-use cannot stop this initial plant infection. You can slow down secondary spread (aphids
acquiring the virus from initially infected watermelon plants and spreading it to nearby plants) by early detection and control of aphids, but this results in only small reductions in the number of virus infected plants.

C. Cultural –

Many watermelon cultivars are resistant to plant viruses and should be considered in the pest management decision-making process for aphids. Know what viruses are most common for your growing area to be sure you are

purchasing the correct virus resistant cultivars. Plant disease-free certified seed. Avoid planting fields immediately downwind of a barrier such as hedgerows or woodlots, which reduce wind velocity and increase the number of dispersing aphids falling into fields. These barriers can also cause over-fertilization with nitrogen, which results in lush growth attractive to aphids. Use of reflective mulch can give 2-4 weeks more time before initial virus infection takes place and reduces aphid populations in the field.

D. Non-registered pipeline materials

Spider mites (Primary pest)

Spider mites are a serious pest of watermelons, especially during hot, dry weather. Mites feed on the plant sap and can defoliate vines in a few weeks in hot, dry weather. Defoliated plants tend to yield small, poor quality fruit. A treatment should be applied when 10-15% of the crown leaves are infested with mites. Treatments should be applied before populations explode. Two applications spaced 4-5 days apart are needed in most years. The addition of crop oil or an organosilicone to most insecticides has improved control, especially with aerial application.

A. Chemical

1. Organophosphate

Dimethoate 4EC – REI **–** 48 hours; 3 day PHI
Pros and cons – In recent years, dimethoate has not provided effective spider mite control in Delaware.
Highlight general IPM and/or resistance management issues – Although not documented, spider mites may be resistant to dimethoate in our area. In addition, drought stressed plants and pH of the water could results in reduced efficacy.

2. Carbamates – none

3. B2 Carcinogens – none

4. Other chemical pesticides

Kelthane 50WP (dicofol; organocholirine) – REI – 48 hours; 2 day PHI
Pros and cons – MD reports that this product still gives excellent control of mites in most circumstances, but mite resistance has been observed. DE reports fair to poor control in many fields in recent years.
Highlight general IPM and/or resistance management issues – Although not officially document, it appears that mite resistance has been observed
Agri-Mek 0.15EC (abamectin; ? glycoside) – REI – 12 hours; 7 day PHI

Has provided good control when used at higher rates but is an expensive product to use. Reduced control observed when combined with “sticky fungicides”. Should not be applied directly to bees foraging in a field.
Highlight general IPM and/or resistance management issues – Good resistance management tool.

Capture 2EC (**bifenthrin**; **pyrethroid)** – REI – 24 hours; 3 day PHI; (DE and MD)
Pros and cons – Provides effective control when applied before mites explode. In season, have seen reduced control on exploded populations. In addition, have see mite explosions if not timed correctly and over used. MD reports that at times its use can cause dispersion of mites so that it appears there is a reduction in numbers when in fact they have spread to other plants.

Danitol (fenpropathrin; pyrethroid) – REI – 24 hours; 7 day PHI
Pros and cons – Provides effective control when applied before mites explode. In season, have seen reduced control on exploded populations. In addition, have see mite explosions if not timed correctly and over used.

Oberon (spiromesifin;tetronic acid) REI – 12 hours; 7 day PHI
Pros and Cons - Excellent new miticide – providing control of nymphs as well as has ovicidal properties. Excellent resistance management tool. Extremely safe on bees

B. Biological

Although predatory mites can be found in fields, populations rarely reach high enough levels to provide economic control.

C. Cultural

If possible, avoid mowing field margins and grassy areas until after midsummer since this forces mites in the crop.

D. Non-registered pipeline materials

Cabbage Looper (minor pests)

These insects feed on the underside of leaves, producing ragged holes of various sizes. Feeding begins in late July or early August and usually continues through harvest. Healthy plants can usually sustain feeding injury unless populations become exceedingly large. Loopers are not usually serious pests of watermelon.

A. Chemical

1. Organophosphates -none

2. Carbamates
Lannate (methomyl)--1.5-3 pt LV/A or OLF – REI – 48 hours; 3 day PHI- Provides effective control of cabbage loopers.

3. B2 Carcinogens - none

4. Other chemical pesticides

Asana XL (esfenvalerate; pyrethroid) – REI – 12 hours; 3 day PHI
Starting to see reduced levels of control of cabbage looper in some fields treated with pyrethroids.

Bacillus thuringiensis – REI – 4 hours ; 0 day PHI
Only effective in small caterpillars

Baythroid XL(beta-cyfluthrin; pyrethroid) – REI – 12 hours; 0 day PHI
Starting to see reduced levels of control of cabbage looper in some fields treated with pyrethroids.

Capture (bifenthrin; pyrethroid)- REI 12 hours; 3 day PHI
Starting to see reduced levels of control of cabbage looper in some fields treated with pyrethroids

Entrust –(spinosad; naturalyte)– REI – 4 hours; 3 day PHI
Provide good cabbage looper control but need higher rates

Intrepid (methoxyfenozide; diacylhydrazine)–- REI – 4 hours; 3 day PHI
Provides good cabbage looper control

permethrin—(pyrethroid)– REI – 12 hours; 0 day PHI
Starting to see reduced levels of control of cabbage looper in some fields treated with pyrethroids

SpinTor—(spinosad;naturalyte) - REI – 4 hours; 3 day PHI; Provides good cabbage looper control but need higher labeled rates

Highlight general IPM and/or resistance management issues: Although not documented have see reduced control of cabbage loopers with pyrethroids.

B. Biological Control

There are several parasitic wasps and predators that attack the cabbage looper. Also, a nuclear polyhedrosis virus (NPV) can substantially reduce population levels of larvae, especially after a period of precipitation.

C. Cultural Control - No current recommendations for commercial production.

D. Non-registered pipeline materials - none

Cutworms, minor pest
Black cutworm, *Agrotis ipsilon*
Variegated cutworm, *Peridroma saucia*
Granulate cutworm, *Feltia subterranea*

Cutworms are sporadic pests of numerous crops. Several species of cutworm may be found in the mid-Atlantic. Newly hatched cutworm larvae feed on young plants at the soil line, often severing the stems. Later generations of cutworms feed on developing melons and in severe cases may tunnel completely through the fruit, greatly diminishing marketability. If cutworms are actively cutting plants, a postplanting contact treatment may be used. In Delaware, watermelon fields are rarely sprayed for cutworm.

A. Chemical

1. Organophosphates -none

2. Carbamates

Lannate (methomyl) (North Carolina) – – REI - 48 hours; 3 day PHI; not used in Delaware

Sevin (carbaryl) (North Carolina)- – REI – 12 hours; 0 days PHI not used in DE

3. B2 Carcinogens -none

4. Other chemical pesticides
Asana XL- (esfenvalerate; pyrethroid)- REI – 12 hours; 3 day PHI

Baythroid XL (beta-cyfluthrin; pyrethroid) -– REI – 12 hours; 0 day PHI

Capture 2EC (bifenthrin; pyrethroid) - PHI - 3 days; REI - 24 hours. (DE)

Ambush (**permethrin**) (North Carolina) – not available in DE as Ambush
Just as generic **permethrin—(pyrethroid)**)– REI – 12 hours; 0 day PHI

Pros and cons - In general – pyrethroids have provided very effective cutworm control. Reduced control is seen during drought conditions when cutworms feed below the soil surface.

B. Biological control

Cutworms are attacked by numerous ground-dwelling insect predators, especially carabid beetles. Also, pathogens such as *Beauveria bassiana* and entomopathogenic nematodes often will infect larvae.

C. Cultural Control

Proper tillage will help eliminate some species of cutworms that may move off of cover crops.

D. Non-registered pipeline materials -none

Leafminers
Serpentine Leafminer, *Liriomyza brassicae*

Leafminers cause injury to leaves primarily as a result of their mining of leaves, which results in the destruction of leaf mesophyll tissue. Leaf mining depresses the level of photosynthesis and may result in leaf droppage. Fewer leaves in the canopy can result in sun scalding of fruit. Many generations occur annually, but the first is usually the most damaging. In Delaware , we have seen some damage but generally do not treat. Level of control has been questionable with available products – may be an issue of timing.

A. Chemical

1. Organophosphates

Dimethoate 4EC - PHI - 3 days. REI - 48 hours.
Pros and cons – This product has been used in DE and MD with limited success.

Diazinon (North Carolina) REI – 24 hours; 3 day PHI; not used in DE; poor control in MD

2. Carbamates

Vydate L-(oxamyl) REI – 48 hours; 1 day PHI- not used in DE for this pest

3. B2 Carcinogens -none

4. Other chemical pesticides

Agri-Mek 0.15EC (abamectin ? glycoside;) -; REI 12 Hrs.; 7 day PHI
Pros and cons – Has been used in DE with some success; however, very expensive and control can be variable. MD reports excellent control of leafminers and is considered a reduced risk pesticide.
Thiodnex (endosulfan; – chlorinated hydrocarbon cyclodiene organochlorine)- REI – 24 hours; 2 day PHI (North Carolina) not used in DE
The following are listed in the Mid-Atlantic Guide – no knowledge of efficacy since we rarely spray for this pest

Entrust – –(spinosad; naturalyte)– REI – 4 hours; 3 day PHI

SpinTor—(spinosad;naturalyte) - REI – 4 hours; 3 day PHI

Venom –(dinotefuran, neonicotinoid) – REI – 12 hours; 21 day PHI (soil); 1 day PHI (foliar)

B. Biological Control

Parasitoids often provide excellent suppression of leafminers if broad-spectrum insecticides are not applied to the crop. The level of control will often preclude the need for an insecticide in most cases.

C. Cultural Control: No current recommendations.

D. Non-registered pipeline materials -none

Pickleworm, *Diaphania nitidalis*
Melonworm, *Diaphania hyalinata*

The melonworm is generally a foliage feeder (unlike the pickleworm, which attacks the developing leaf and flower buds) but also causes damage to the vines and fruit. Although several generations can occur during a year, pickleworm and melonworm are rarely serious pests of watermelon in the mid-Atlantic. As soon as pickleworms or their damage appears, begin insecticide treatments.
Not aware of any melon fields sprayed in Delaware for these 2 insect pests.

A. Chemical

The following are all listed in mid-Atlantic Veg Reccs under these 2 insect pests: See above sections for REIs and PHIs
Asana XL—(esfenvalerate; pyrethroid) – (pickleworm only),
Baythroid XL – (beta-cyfluthrin) –

Capture(bifenthrin; pyrethroid)
Entrust (spinosad; naturalyte
Capture(bifenthrin; pyrethroid)
Intrepid –(methoxyfenozide; diacylhydrazine) -
Lannate-(methomyl; carbamate) -
permethrin—(pyrethroid)
Sevin-(carbaryl; carbamate)
SpinTor(spinosad; naturalyte)
Thionex-(endosulfan; chlorinated hydrocarbon)

1. Organophosphates

2. Carbamates

See above for Lannate

Sevin 80S (carbaryl) - PHI - 3 days; REI - 12 hours. Carbaryl is not used as extensively anymore because of its high toxicity to bees.

3. B2 Carcinogens -none

4. Other chemical pesticides -none

B. Biological Control - No current recommendations

C. Cultural Control

After harvest, remove all debris from the field, destroy vines and unused fruit, and control adjoining weeds. Also, plowing early in the fall will bury the pupae. In the spring, planting early will help the crop establish itself, thus preventing major damage. Resistant varieties are also available.

D. Non-registered pipeline materials -none

Rindworm (North Carolina)-DE and MD as well – Includes cucumber beetle larvae; beet armyworm

Damage to the rinds may result from a complex of insects including cucumber beetle, wireworms, and a number of “worm species, including but not limited to beet armyworm. Larvae of several insects attack the bottom of the fruit that contacts the soil. Management of adult cucumber beetles early in the season may help reduce damage. See cucumber beetle for labeled products.
The following are the labeled beet armyworm products:

1. Organophosphates -none

2. Carbamates- none

3. B2 Carcinogens -none

4. Other chemical pesticides

Entrust – (spinosad; naturalyte)– REI – 4 hours; 3 day PHI

Intrepid –(methoxyfenozide; diacylhydrazine)–- REI – 4 hours; 3 day PHI

SpinTor– (spinosad; naturalyte)– REI – 4 hours; 3 day PHI

All three provide good BAW control. High rates needed. To be effective, spray applications must reach the underside of the fruit, which necessitates adequate volumes (> or equal to 100 gals/a) of water be used.

Flower Thrips (North Carolina)

There are several species that can appear in watermelon flowers. Unless there are many individuals, they should pose no economic problem.

A. Chemical

1. Organophosphates

2. Carbamates

Vydate L-(oxamyl) REI – 48 hours; 1 day PHI- not used in DE for this pest

3. B2 Carcinogens -none

4. Other chemical pesticides

Entrust – (spinosad; naturalyte)– REI – 4 hours; 3 day PHI

SpinTor— (spinosad; naturalyte)– REI – 4 hours; 3 day PHI

Entrust and Spintor have provided effective thrips control

Venom– (dinotefuran, neonicotinoid) – REI – 12 hours; 21 day PHI (soil); 1 day PHI (foliar) – New material in 2006

B. Biological Control - none

C. Cultural Control - none

D. Non-registered pipeline materials -none

Efficacy of Insect Control Measures on Watermelon

	Seed Corn Maggot	Cucumber Beetle	Cutworms	Pickleworm Melonworm	Green Peach Aphid	Melon Aphid	Leafminers	Rindworms	Cabbage Looper	Mites	Thrips
CHEMICAL CONTROLS											
abamectin Agri-Mek 0.15EC	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**F-G**	**NA**	**NA**	**G-VG**	**NA**
esfenvalerate Asana XL	**NA**	**G - E**	**G - VG**	**G**	**NA**	**NA**	**NA**	**G**	**F-VG**	**NA**	**NA**
diazinon Diazinon AG500	**NL-E**	**NA**	**G**	**F**	**P**	**P**	**F**	**NA**	**NA**	**P**	**F**
dimethoate Dimethoate 4EC	**NA**	**NL-E**	**NA**	**NA**	**P**	**P**	**VG**	**NA**	**NA**	**P-F**	**G**
carbofuran Furadan 4F	**NL-E**	**F-G**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**
dicofol Kelthane 50WP	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**F-G**	**NA**
methomyl Lannate LV	**NA**	**F-G**	**G-VG**	**G**	**F- G**	**F-G**	**NA**	**NA**	**G-E**	**NA**	**NA**
permethrin Permethrin 3.2EC	**NA**	**G**	**G-VG**	**G**	**P**	**P**	**NA**	**G**	**F**	**NA**	**NA**
carbaryl Sevin 80S	**NA**	**G**	**NA**	**F**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**

endosulfan Thiodan 3EC Thionex Phaser	**NA**	**G-VG**	**NA**	**G**	**G-VG**	**G-VG**	**NA**	**G**	**G**	**NA**	**NA**
imidacloprid Admire	**NL-E**	**VG-E**	**NA**	**NA**	**VG**	**VG**	**NA**	**NA**	**NA**	**NA**	**G**
Bt	**NA**	**NA**	**G**	**G**	**NA**	**NA**	**NA**	**NA**	**VG**	**NA**	**NA**
bifenthrin Capture 2EC	**NA**	**G-E**	**G-VG**	**G**	**P-F**	**P-F**	**NA**	**G**	**G**	**G**	**NA**
Beta-cyfluthrin Baythroid	**NA**	**G**	**G**	**G**	**NA**	**NA**	**NA**	**G**	**G**	**NA**	**NA**
thiamethoxam Platinum	**NL-E**	**VG-E**	**NA**	**NA**	**VG**	**VG**	**NA**	**NA**	**NA**	**NA**	**NA**
spiromesifin Oberon	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**VG**	**NA**
Fenpropathrin Danitol	**NA**	**G**	**NA**	**NA**	**P**	**P**	**NA**	**NA**	**G-VG**	**G**	**P**
dinotefuran Venom	**NA**	**VG**	**NA**	**NA**	**G**	**G**	**?**	**NA**	**NA**	**NA**	**NA**
spinosad Entrust, Spintor	**NA**	**NA**	**NA**	**G**	**NA**	**NA**	**VG**	**G**	**G**	**NA**	**VG**
oxamyl Vydate (drip)	**NA**	**NL-E**	**NA**	**NA**	**NL-E**	**NL-E**	**VG**	**NA**	**NA**	**NA**	**NA**
pymetrozine Fullfill	**NA**	**NA**	**NA**	**NA**	**G**	**G**	**NA**	**NA**	**NA**	**NA**	**NA**
methoxyfenozide Intrepid	**NA**	**NA**	**NA**	**G**	**NA**	**NA**	**NA**	**G**	**G**	**NA**	**NA**
flonicimid Belief					**G**	**G**					

BIOLOGICAL CONTROLS											
Beneficial insects	**NE**	**NE**	**NE**	**NE**	**G**	**F**	**NE**	**NE**	**NE**	**P**	**NE**
CULTURAL CONTROLS											
Plow down cover crops	**F**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**
Bury cover crops	**F**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**
Avoid heavy manure	**F**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**
Resistant varieties	**?**	**?**	**?**	**?**	**?**	**?**	**?**	**?**	**?**	**?**	**?**
Disease-free seed	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**
Plant placement	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**
Cultivate soil prior to planting	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**
Use of plastic or straw as bedding	**NE**	**NE**	**NE**	**NE**	**F**	**F**	**NE**	**NE**	**NE**	**NE**	**F**
Eliminate overwintering sites	**NE**	**F**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**
Remove debris after harvest	**NE**	**F**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**
Avoid mowing field margins until after mid-summer	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**	**F**	**NE**

Crop rotation	NE	G	NE	NE	NE	NE	NE	NE	NE	NE	NE
Weed-free fields	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	F-G

E = excellent
VG = very good
G = good
F = fair
P = poor
? = research needed
NA = not labeled for pest, not used
NE = not effective
NL-E = not labeled for that pest, but effective

CONTACTS

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