Crop Profile Watermelons in Delaware

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General Production Information

- Annually, 175,000 acres of watermelon (*Citrullus lanatus*) are planted in the United States with production concentrated in Florida, Texas, Georgia, and California (1).
- National production has increased each year from 1992 (37,783, 000 Cwt) to 1996 (44,128,000 Cwt) (2).
- The value of national production in 1995 and 1996 was $357,062,000 and $275,650,000, respectively (2).
- Approximately 1,800 acres are planted and harvested in Delaware each year (1).
- From 1994 to 1996, Delaware production averaged 313 Cwt./A for a total of 533,000 Cwt.
- The cash farm income to watermelon producers in Delaware for the years 1994 to 1996 was $1,795,000, $4,704,000, and $3,276,000, respectively.
- Watermelons are either sold at auction through the Laurel, DE Auction Market or directly to major shippers. Significant quantities of watermelons are also sold through roadside markets and local produce outlets (1).
- 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 (1).

Production Regions (1)

Production in Delaware is concentrated in western Sussex County.

Cultural Practices

Traditionally, the watermelon industry in Delaware 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. At least 20 varieties are available to Delaware growers.

(1)Seeded Watermelons

The Crop Profile/PMSP database, including this document, is supported by USDA NIFA.

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. The following varieties are known to produce well in Delaware: (a) Standard Types- Open Pollinated: Crimson Sweet, Jubilee, and All Sweet; (b) Standard Types - Hybrids: Royal Jubilee, Sangria, Royal Majesty, Royal Star, Royal Sweet and Fiesta; (c) Ice Box Types - Open Pollinated: Sugar Baby; (d) Ice Box Types - Hybrids: Jade Star, Yellow Doll, Mickeylee.

(b) Seedless Watermelons
Seedless watermelons are hybrids and are the result of a selected tetraploid(4X chromosomes) female plant crossed with a selected diploid(2X chromosomes) male plant. The final product of the tetraploid and diploid cross is a triploid (3X chromosome) plant that is sterile and does not produce viable seed. Seedless watermelons have small, rudimentary seeds that develop and are eaten like cucumber seeds along with the fruit. The following varieties are known to produce well in Delaware: Crimson Trio, Queen of Hearts, Tri-X 313, Laurel, Millionaire, Supersweet 5244, and Supersweet 5032.

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.

Insect Pests

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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

This insect is primarily a problem in early planted melon fields, especially during cool, wet growing seasons. Only a few maggots per seed or plant can significantly reduce stands. Maggots overwinter as puparia in the soil with flies emerging as early as late February. Eggs are laid in freshly plowed fields as well as in greenhouse flats before transplanting into the field. Outbreaks are favored by planting into freshly plowed ground that is high in organic matter; freshly manured fields; and/or heavy crop residues (e.g. small grain covers) where spring tillage is delayed and/or surface residue is visible after spring tillage operations.

Monitoring: Scouting and applying rescue treatments after the damage is observed are ineffective. Management options must be applied to high risk fields prior to planting for direct-seeded fields or prior to laying the plastic strip for transplanting.

Controls:

Biological - None Available

Cultural:.The use of cultural management practices before planting are critical 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 .

Chemical: Currently available seed treatments and soil insecticides provide only fair control, especially under heavy seed corn maggot pressure. Commercial seed treated with lindane/captan will not be protected form maggot infestations. The use of a diazinon seed treatment in direct seeded fields can help to reduce damage; however, a combination of a seed treatment and soil insecticide are needed if population pressure is heavy. The only labeled chemical control options are the use of Furadan 4F (24C label in Delaware) at planting or the use of a broadcast application of diazinon incorporated just prior to planting or transplanting. Control with Diazinon has been fair to good because it must be incorporated 3-4 inches immediately before planting to achieve the best control. In general, Furadan has provided only fair controls during years of high population pressure.

- **Diazinon AG500:** At planting; 2-4 qt/A ; Labeled for crop but not pest. Must be broadcast and shallow incorporated in top 3-4 inches immediately before planting to be effective. One application per season. Used on 30% of the acreage.
- **Furadan 4F:** At planting; 3.8 oz/1000 ft; Labeled for crop not pest. This is Special Local-Needs label 24(c). Control has only been fair under high population pressure. Use at planting has lead to spider mite outbreaks in season. One application per season. Used on 55% of the acreage.

Striped and spotted cucumber beetles

Both species of cucumber beetles are known to infest watermelon fields. The striped cucumber beetle has a black head, yellow thorax and three black stripes along the length of its body. The spotted cucumber beetle is similar in size but has a yellowish-green body and 12 black spots on its back. Beetles overwinter in nearby hedgerows and woodlands feeding on alternate weed hosts in the early spring. 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 damage mature fruit.

Monitoring: Sampling should begin as soon as transplants are set in the field or at plant emergence. Sample fields twice a week, especially along field margins next to overwintering areas. During hot, windy days, look for beetles hiding in cracks in the soil surface and under the plastic mulch. Examine 5 plants in 5-10 locations throughout a field and count the number of beetles per plant. Foliar treatment will be needed if you find 2 beetles per plant and beetles are affecting stand establishment during the cotyledon stage.

Controls:

Biological - None Available

Cultural - None Available

Chemical -The use of at-planting insecticides or one-two properly timed foliar insecticides will provide effective control.

- **Permethrin 3.2EC** - 0 day PHI; 4- 8 oz/A; Applied 1-2 times on seedling plants, to 5 % of the acreage.
- **Asana XL** - 3 day PHI; 5.8-9.6 oz/A; Applied 1-2 times on seedling plants, to 5 % of the acreage.
- **Furadan 4F** - At planting; 3.8 oz/1000 ft ; This is a Special Local-Needs label 24(C). Used at planting on 55% of the acreage. Use at planting has lead to spider mite outbreaks in season.
- **Lannate LV** - 3 day PHI; 1.5 pt/A; Applied 1-2 times on seedling plants, to less than 5 % of the acreage.
- **Sevin 80S** - 0 days PHI; 1.25 lb/A; Applied 1-2 times on seedling plants, to 10% of the acreage. Reduced levels of efficacy observed in recent years.

Melon aphid

Melon aphid is the predominant aphid species attacking watermelons grown in the Mid-Atlantic region. They vary in size and color from light yellow, green to black. Infestations begin when winged forms fly to the fields in late May. In-season,

only colonies of wingless forms are generally found on plants. They can be identified from other aphids by the black cornicles or "tailpipes" found on the abdomen. The cornicles are entirely black from the tip to where they attach to the abdomen. 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. Infestations are usually higher in hot, dry summers following cool springs which reduced the efficiency of natural enemies. In addition, over fertilization with nitrogen results in lush growth which can be very attractive to aphids.

Monitoring: Scouting should begin as soon as plants form runners. Look for wilting and curled leaves that will be found in small scattered spots throughout the field. Examine 5 runners in 5-10 locations throughout a field and record the percentage of runners with 5 or more aphids per leaf. A foliar treatment should be applied if beneficial insect populations are low and you find 20% or more of the runners infested with 5 or more aphids per leaf.

Controls:

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.

Cultural - None available

Chemical -

- **Lannate LV -** 3 day PHI; 1.5 pt /A; Applied 2-4 times per year on 60 - 70% of the acreage during an outbreak year. Although it is one of the two available materials labeled on watermelons, efficacy was reduced in 1998.
- **Thiodan 3 EC-** 2 day PHI; 1.33 - 2.67 pt/A; Applied 2-4 times per year on 20% of the acreage during an outbreak year. Fair to good control but must be applied before populations have exploded.

Spider mites

Spider mites are a serious pest of watermelons, especially during hot, dry weather. Infested plants appear yellow and become visible from a distance. They are primarily found on the undersides of leaves making the leaves appear tan or yellow and have a "crusty appearance". 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.

Monitoring: Since mite infestations generally begin along field margins next to grassy areas, near rye windbreaks, and in the sandiest areas of fields, be sure to carefully sample these areas early in the season. Since we are limited in our insecticide control options, early detection is critical. Once populations explode in hot, dry weather, control is extremely difficult. Look for the early signs of white stippling on the crown leaves. Mites can be identified by shaking leaves onto a sheet of white paper and watching for moving specks or by using a hand lens to count the number of mites per leaf. Examine 5 crown leaves in 5-10 locations throughout a field for the presence of mites and feeding damage. A treatment should be applied when 10-15% of the crown leaves are infested with mites.

Controls:

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

Cultural - None available

Chemical -

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

- **Agri-Mek 0.15EC** - 7 days PHI; 8-16 oz/A ; Applied 1 -2 times per season, to 20% of the acreage.
- **dimethoate 4EC** - 3 day PHI; 1 pt/A; Labeled for crop not the pest. Applied 2- 4 times per season, to 50 % of the acreage (80% of the acreage in outbreak years). In recent years, control has been extremely poor. This may be a result of poor coverage, resistance, storage conditions of the chemical, and/or high pH/iron content of the spray water.
- **Kelthane 50WP** - 2 day PHI; 1.25 lb/A; Applied 2- 4 times per season, to 50 % of the acreage (80% of the acreage in outbreak years). Mite resistance has been observed.

Diseases

Identification of diseases, knowledge of factors that influence disease development and application of timely control measures are critical to production of watermelons. Diseases can reduce yield by reducing photosynthesis, nutrient uptake or translocation, and result in smaller or fewer fruit. Pathogens may also directly invade fruit or reduce foliage to the extent that fruit become sunburned and therefore unmarketable. Disease management includes site selection, transplant production, protecting seedlings and growing plants once they are in the field, and sanitation after harvest.

Site selection begins with a good rotation plan. Pathogens overwinter in different ways, therefore each disease requires a different crop free (rotation) period for reduction of inoculum (Table 1). Transplants should be grown from disease free seed, under conditions that prohibit disease development or make disease development very unlikely. Cultural controls are extremely important in the greenhouse because chemical control options are limited.

After the transplants go to the field, fungicides become the major disease control option. Several fungicides are available for controlling various diseases but must be applied at the proper time and managed to remain effective (Table 1). There is mounting evidence that spraying according to a weather based fungicide application model using appropriate threshold values will minimize fungicide costs while controlling disease and maintaining yield.

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 these pathogens cannot survive.

Watermelon diseases are (3, 4, 5):

Damping-off refers to a number of fungal disease organisms that cause seeds to rot before they germinate, shoots to decay before they emerge, or seedlings to collapse. Severity is strictly dependent upon the weather.

Bacterial Fruit Blotch is an occasional disease problem on Delmarva.

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

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

Fusarium wilt is a vascular disease caused by soil born fungus. Leaves on one branch or stem wilt and turn color.

Anthracnose is probably the most destructive disease 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.

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.

Alternaria leaf blight causes plants to loose leaves. This fungus also overwinters in infected plant debris in the soil and seed.

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.

Phytophthora Blight is not a critical disease on Delmarva.

Table 1. Watermelon Diseases and Their Control (1)

Disease	Reduce Initial Inoculum	Reduce Disease Spread
Damping-off		**Chemical Control**: Ridomil, Gold EC-1-2 pts/ treated acre. Apply in 7-inch band after seeding
Bacterial Fruit Blotch	**Cultural Control:** 2 years between watermelon crops. Buy seed that has been tested. Sanitation during transplant production.	
Viruses (CMV, WMV, PSRV, and ZYMV)		**Chemical Control:** Practice strict aphid control. **Cultural Control:** Plant fields as far away from existing cucurbit plantings as possible.
Air pollution		**Cultural Control:** Plant varieties which are less sensitive to ozone injury.
Fusarium wilt	**Cultural Control:** 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.	**Cultural Control:** Use resistant varieties.
Anthracnose	**Cultural Control:** Plant in fields which have not been planted with any cucurbits for 2 years.	**Cultural Control:** Use resistant varieties when possible. **Chemical Control:** Apply chlorothalonil product (such as Bravo WeatherStik 2-3 pt 6 F/A or Terranil 2-3 pt 6L/A) on a 7-day schedule or timed according to a weather based fungicide application model.

Downy Mildew		**Chemical Control:** Scout fields for presence of downy mildew and apply Aliette 3 lb 80WDG/A or Ridomil Gold/ Bravo 2 lb 76.5 WP/A plus Bravo WeatherStik 1 pt 6 F/A or Terranil 1 pt 6L/A. Alternately, Ridomil Gold/Copper 2 lb 65 WP/A
Alternaria leaf blight		**Chemical Control:** Bravo WeatherStik 2-3 pt 6 F/A or Terranil 2-3 pt 6L/A
Gummy Stem Blight	**Cultural Control:** Plant in fields which have not had cucurbits for 2 years	**Chemical Control:** Apply Bravo WeatherStik 2-3 pt 6F/A or Terranil 2-3 pt 6L/A. When disease presence is severe, add Topsin M 0.5 lb 70 WP/A
Phytophthora Blight	**Cultural Control:** Plant to field which has not had a crop of cucurbits, eggplant, pepper or tomato for 3 years	**Cultural Control:** 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. **Chemical Control:** Apply Ridomil Gold/Bravo 2 lb 76.5 WP/A or Ridomil Gold/Copper 2 lb 65 WP/A every 14 days and alternate with Copper, fixed--2 lb 77WP/A or OLF plus chlorothalonil.

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.

Weed escapes can produce seed that will be in the soil and increase weed populations for the next several years. Theoretically all weeds can be eliminated simply be preventing seed formation. Therefore, any weeds present may not only be a problem this year but also for many future years. Fields should not be allowed to remain idle after harvest because weeds will produce seeds until frost. Always cultivate fields after crop harvest to prevent late summer and fall weed seed production.

Cultivations are an essential component of watermelon production, because herbicides alone seldom control all the weed seeds or all weed species. However, studies have shown that without herbicides or hoeing, four weekly cultivations still allowed weeds to reduce watermelon yields 82%. The best herbicide treatments (mostly combinations of herbicides) provided 90 to 100% weed control with four cultivations and the yields were equal to or greater than the hand weeded control. When weed escapes occur, cultivation is preferable to hoeing or applying post-emergence herbicides. In one study when herbicides were omitted at the time of watermelon seeding and the watermelons were cultivated three

times, over 20 hours/A of hand weeding were required to prevent yield loss. This demonstrates the great economic benefit of herbicides for watermelon production. Since herbicides alone seldom control all weed species, they must be used in conjunction with cultivation to ensure high yields in watermelon crops.

Herbicides are an aid to cultivation because they delay weed growth until the watermelon plants become large enough for cultivation. Herbicides continue to aid cultivation by delaying weed growth and this increases the length of time that cultivation will effectively control weeds.

Cultural Control - 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. Cyanazine (Bladex) and metribuzin (Sencor or Lexone), which are both triazines, do 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 (Treflin, Trilan) and pendimethalin (Prowl) do not have a residual effect on watermelons. 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:

Herbicide choices on watermelons have increased in the past two years with new registration. Herbicides are usually less effective under dry soil conditions, especially soil surface applied herbicides. Irrigation or rainfall activates herbicides by providing soil moisture that will deliver the dissolved or suspended herbicide into contact with the germinating weed seeds or sprouts.

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

- bensulide (Prefar) - 4 to 6 quarts/A of the 4 lb ai/gal formulation. Prefar may be applied preplant incorporated or preemergence. If applied preemergence, rainfall or irrigation must occur prior to weed emergence to activate the herbicide. Depending on the time of year, this period may be 2 to 6 days after crop planting. The irrigation amount should be less than 0.4 inches or excessive dilution of the herbicide may occur. If incorporated, the depth should be about 2 inches. 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) - 4 to 6 fl oz/A of the 4 lb ai/gal formulation. Command has been registered as a Section 18 Emergency Registration for watermelon by individual states on an annual basis. Command may be applied preplant incorporated or preemergence, and herbicide effectiveness is the same for both methods of application. Command incorporation depth should not be below the depth of the seed placement. Incorporation will reduce volatility of the 4E formulation. Command will cause severe damage to off-target crops or vegetation from drift during application. Application should be made when wind is calm or less than 5 mph and blowing away from critically sensitive areas such as businesses, homes, vegetables and ornamental plant nurseries. Surface applied (preemergence) Command is acceptable for transplanted watermelon if the transplanting is delayed for 3 to 5 days after the Command application. Otherwise, expect the transplants to develop temporary chlorosis from Command volatilization. Preplant incorporated applications must be 1000 ft from sensitive crops and preemergence (soil surface applied) applications must be 1500 ft from sensitive crops. 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) - 2 lb ai/gal as a 2S formulation. 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.

II. Preemergence Herbicides

- terbacil (Sinbar 80 W) - use at rates of 1.5 to 3 ounces/A of the 80% wettable powder formulation. Preemergence application to the soil surface only, after seeding or before transplanting. Sinbar was registered annually in 1996 and 1997 for preemergence application on watermelons in Delmarva as a Section 18 Emergency Registration . The IR-4 Project has a program to obtain a national registration for Sinbar on watermelon. Seeded watermelon are tolerant to low rates of Sinbar. Transplanted watermelons have shown moderate tolerance to Sinbar in a few studies, and growers should evaluate this use with their own plants and soil type. Sinbar should be applied to the soil surface before transplanting.
- Sinbar will provide excellent control of morningglory species. Most morningglories will emerge but the leaves will become brown (necrotic) and die. Other weeds controlled are ragweed, carpetweed lambsquarters, jimsonweed and cocklebur. Pigweed may be suppressed but only fair control is obtained for pigweed and combinations with Curbit or Prefar are necessary for control. The low rates of Sinbar do not affect crops after watermelons.
- ethalfluralin (Curbit 3EC) - applied preemergence only for seeded watermelon. Do not use on transplants. Apply 1.5 to 2 pints per acre Curbit 3E preemergence 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): Apply 1 to 1.5 pint/A Poast 1.5 EC (1.5 lb ai/gal formulation) with oil concentrate added to be 1 percent of the spray solution (1 gallon per 100 gallons of spray solution) 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 at 4 to 8 quarts/A plus non-ionic surfactant. Generally 1 gallon/A plus surfactant will provide adequate weed suppression and 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.

IV. Post-Directed Herbicides

- paraquat (Gramoxone 2.5S) - 1.5 pints/A. 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 - 0.25 lb/A. Apply 1.6 pints per acre of Gramoxone Extra 2.5SC in 30 gallons of water 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) 4 lb ai/gal. Apply 1 to 3 pints/A 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 - 0.5 to 0.6 lb/A. A Special Local-Needs 24(c) label has been approved for the use of Gramoxone Extra 2.5SC as a broadcast spray after the last harvest. Apply 1.6 to 1.9 pints/A of Gramoxone. 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.

Table 2. Watermelon herbicides for grasses and sedges.

	GRASSES AND SEDGES						
Herbicide	Barnyard grass	Crabgrass, Large	Fall Panicum	Foxtail sp.	Goose grass	Johnson grass (Seedling)	Yellow Nutsedge
Preemergence or Preplant Incorporated:							
Command	G	G	G	G	G	G	N
Prefar	G	G	G	G	F/G	G	N
Alanap	P	P/F	P	F	P/F	----	N
Preemergence Only:							
Curbit	F	G	G	----	G	----	N
Sinbar	F	F	----	F	F	----	P
Post:							
Alanap	N	N	N	N	N	N	N
Poast	G	G	G	G	G	G	N

Herbicide performance is affected by weather, soil type, herbicide rate, weed pressure and other factors. These ratings indicate ONLY relative effectiveness in tests conducted by the University of Delaware, University of Maryland System, The Pennsylvania State University, Rutgers , The State University of New Jersey, and Virginia Polytechnic Institute and State University. Actual performance may be better or worse than indicated in this chart.

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

Table 3. Watermelon herbicides for broadleaf weeds.

	BROADLEAF WEEDS

Herbicide	Barnyard grass	Galinsoga, Hairy	Cocklebur Common	Jimson weed	Lambsqtr. Common	Morning glory sp.	Pig weed sp.	Purslane Common	Ragweed Common	Smartweed, Pennsylv.	Nightshade East. Black	Velvet leaf
Preemergence or Preplant Incorporated												
Command	N	N/F	F	G	G	P	N/P	G	F	G	----	G
Prefar	N	N	N	N	F/G	N	F	F	N	----	P	N
Alanap	F/P	P	F	F	P	F/P	F/G	F/P	F	P	P	F
Preemergence Only:												
Curbit	G	N	N	N	P/F	P	F	F/G	N	P	P	P
Sinbar	G	----	G	G	G	G	F	G	G	G	G	G
Post:												
Alanap	N	----	----	----	F	G	G	G	----	----	----	----
Poast	N	N	N	N	N	N	N	N	N	N	N	N

Herbicide performance is affected by weather, soil type, herbicide rate, weed pressure and other factors. These ratings indicate ONLY relative effectiveness in tests conducted by the University of Delaware, University of Maryland System, The Pennsylvania State University, Rutgers, The State University of New Jersey, and Virginia Polytechnic Institute and State University. Actual performance may be better or worse than indicated in this chart.

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

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[1] FOOTNOTES:
Adios is not labeled for use on Watermelon. This insecticide was deleted from this crop profile for use against Striped and Spotted Cucumber Beetles. Dibrom is not labeled for use on Watermelon. This insecticide was deleted from this crop profile for use against Spider Mites. Ambush 2EC and Pounce 3.2 EC have been changed to Permethrin 3.2EC for

use against Striped and Spotted Cucumber Beetles at 4- 8 oz/A. Benlate is not labeled for use on watermelon and has been deleted from this crop profile for use against Gummy Stem Blight.