

# Crop Profile for Tomatoes (Fresh Market & Processing) in Ohio

Prepared: August, 1999

## General Production Information

(Solanaceae: *Lycopersicon esculentum*)



- Acres in Ohio: 3000 (F) and 6300 (P) (8)
- Percent of US Acreage/Rank: 2.6%/3<sup>rd</sup> (1)
- Number of Growers: 921(1)
- Per Acre Value: \$9500 (F) and \$2185 (P) (8)
- Value of Production in Ohio: \$28,445,000 (F) and \$13,764,000 (P) (8)

## Location Of Production

Fresh market tomatoes are produced by growers all over the state of Ohio but concentrated pockets of production exist in the southeast (Washington and Meigs Counties) and northwest regions of the state. Processing tomatoes are primarily grown in the counties of northwestern (Putnam, Wood, Fulton and Sandusky) and western (Darke) Ohio.

## Production Methods

Tomatoes are a tender warm season perennial cultivated as an annual crop and one of the most economically important vegetables grown in Ohio.

### Fresh Market Tomatoes

Most of Ohio's fresh market tomatoes are produced from transplants raised either in Ohio (in SE Ohio) or in the southern U.S. Transplants are not planted in the field until the soil temperature consistently reaches 60°F and are usually hardened by exposure to slightly decreased temperatures and water. The

soil is prepared by adjusting the pH between a range of 6.0 to 6.8. A nitrogen fertilizer, 60 –80 lb./A, is applied prior to planting, while phosphorus and potassium are added according to the spring soil test. When transplants are planted, a starter solution is applied to each plant. The common rate used is 3 lb. of fertilizer mixed in 50 gallons of water and then ½ pint is applied to each plant.

Transplants are placed in the soil no more than 1 inch deeper than the flats. If tomatoes are not to be staked or trellised, they are usually planted on black plastic. However, it has become more popular for growers to employ the staked method on black plastic to produce their crop. Tickle irrigation is also commonly used under the plastic. The large vined indeterminate varieties of tomatoes are transplanted in rows 5-8 feet apart with plants 15-30 inches apart in the row. The small vined determinate or semi-determinate varieties are planted in rows 3-8 feet apart with 15-24 inches between plants.

Tomatoes grown for the supermarket or wholesale market are picked when they reach the mature green stage. The fruit is washed and packed in 20-25 lb. boxes. Tomatoes grown for the roadside retail market are harvested at a more mature stage, usually showing at least 30-60% red color. These tomatoes are cleaned and packed in the appropriate market container.

### **Processing Tomatoes**

Nearly all of the processing tomatoes in Ohio are produced from transplants. They are usually planted in the field between late April and June 15<sup>th</sup>. Sites selected for processing tomato production are well drained and are part of a 3 year rotation with a crop other than corn in the previous season. Soil pH is adjusted to be between 6.5 and 6.8. Nitrogen is added depending upon the harvest method used. Half of the nitrogen is added before planting while the rest is sidedressed after the plants are established. Phosphorus and potassium are added per pre-season soil test. Usually between 100 –175 lbs. of P<sub>2</sub>O<sub>5</sub> and 200 – 350 lbs. of K<sub>2</sub>O are applied.

Processing tomatoes transplants are planted in beds placed 60-66 inches apart and whose shape is determined by the type of harvester used. A starter fertilizer is applied at the time of planting. Twin row plantings have become popular with many growers. The transplants are placed in two rows separated by 16-18 inches and with 12-18 inches between each plant. In single row plantings the transplants are placed in rows that are usually 5 feet apart with 9-16 inches between each plant.

To provide for a more uniform time of harvest, the plant growth regulator, Ethephon (Ethrel) is applied to mature green fruit. Approximately 80% of the processing tomato acres are treated each year with Ethephon. The best time for applying the chemical is when 5-15% of the fruit on any given plant are pink to red. The tomatoes are usually harvested 14-18 days after the treatment.

# Insect Pests

All insect pests listed below occur occasionally in Ohio tomato fields. Often when they do appear, they cause serious damage to the crop. There are no significant differences in the pest complexes affecting fresh market and processing tomatoes. However, different amounts of damage are tolerated depending upon the end use for the fruit. So the importance of a pest may vary between the two production systems. Additionally, different pests are more common depending upon the area of the state. For instance, because the tomatoes are planted earlier in southeastern Ohio, aphids, Colorado potato beetle and flea beetles are more of a significant problem than the hornworms and fruitworms.

## 1. **Hornworm (Tobacco and Tomato)**

Hornworms overwinter in the soil as pupae. They become most active in early summer in the south and mid-Summer in northern Ohio. The adult is a large, quick flying hawk-moth. They deposit green, spherical eggs on the underside of leaves. The larvae emerge and grow quickly, reaching lengths of 3 to 4 inches. A characteristic horn is located on the rear of the larvae (the horn is red on the tobacco hornworm and is black on the tomato hornworm) and its body is usually blue-green with 7-8 white stripes on the sides. Larvae can defoliate a plant and chew large holes in to the green tomato fruit. If more than 2 infested plants per 40 plants sampled at any stage of growth show hornworm damage, treatment is recommended.

## 2. **Tomato Fruitworm (Corn Earworm)**

The tomato fruitworm does not overwinter well north of I70, but it migrates from the south each year. Peak activity for the adult moth is from mid-July in southern areas to late August in northern areas. Corn is the primary host for the worm, so when corn is no longer an attractive egg laying site, the adult moths will move to tomato fields usually in the flower and fruiting stage. The moths are active at night and lay their tiny, yellowish eggs near the fruit, usually on the outer section of the plant. The only two reliable characteristics of larvae are a light brown head and dense microspines on the skin. Older larvae can range in color from yellow and pink to light green to brownish-black to reddish brown. The young larvae quickly bore deeply into the green tomato fruit, from the stem end down, rendering it unmarketable. When the larvae reach 1 ¾ inch long they drop to the soil where they pupate. Adults emerge in 1-2 weeks and can begin to lay eggs within 48 hours of emergence.

## 3. **Potato Aphid**

Damage is caused by both nymphs and adult aphids sucking plant sap from the young foliage causing it to curl and turn brown in severe infestations. The excrete honeydew can drip on fruit and act as a substrate for black sooty mold. Usually aphids are not a problem except for growers in southern Ohio because they are controlled by numerous natural enemies.

## 4. **Colorado Potato Beetle**

The Colorado potato beetle overwinters in the soil as an adult. Adults emerge in April in southeastern Ohio and in May and June in the north and begin to search for food but do not migrate far. The females lay orange-yellow, cylindrical eggs in masses of 12 or more on the undersides of tomato leaves. The eggs hatch usually in 3-7 days depending on the air temperature. The young larvae are dark red with black heads, but later become orange with two rows of black dots on both sides of their bodies. In 2-3 weeks the larvae drop from the plant and burrow into the soil to pupate. New adults, yellow-cream to orange insects with 10 black stripes on each wing cover, will emerge in another 2-3 weeks. Both the larvae and the adults feed on tomato leaves and sometimes the small green fruit. Whereas their preferred host is potato, the Colorado potato beetle larvae can defoliate a tomato plant in 3-4 days.

## 5. **Stink Bugs**

Both the adult and nymphs feed on the fruit of the tomato by inserting their mouthparts into the tomato to extract juices. The adult stink bug is usually brown and shield shaped, with a large triangle on its back. The nymphs are green and more rounded in shape. The site of feeding on green fruit appears as a dark pin prick which can be surrounded by a white or yellow area. When the tomato skin is peeled back, white spongy cells are found. This damage is caused by the removal of fluid from the fruit and the injection of enzymes by the stink bug. Stink bug damaged fruit is unmarketable in fresh markets but tolerated by processors.

## 6. **Potato Flea Beetles**

The potato flea beetle is one of the earliest insect pests to attack young tomato plants in the spring, but it is not commonly a serious pest. Damage is caused by the feeding of adult beetles on both leaf surfaces, but it usually starts on the underside where they chew small circular holes through the tissue to the upper cuticle. The round holes give the plant a shotgun blast appearance.

## 7. **Variegated Cutworms**

The adult moth becomes active in southern parts of the state in early to mid-May and in early to mid-June in the north. The females lay eggs on the lower leaves and stems of tomato plants in patches. The larvae grow to 1-1 ½ inches long and are brown to black in color with 5 or 6 orange spots on their back. The larvae are most active at night and return to hiding places in the soil or under plant debris during the day. Damage occurs when the cutworms climb mature plants and feed on green fruit. The variegated cutworms can cause 5-10% damage to tomato fruit, but their occurrence is sporadic.

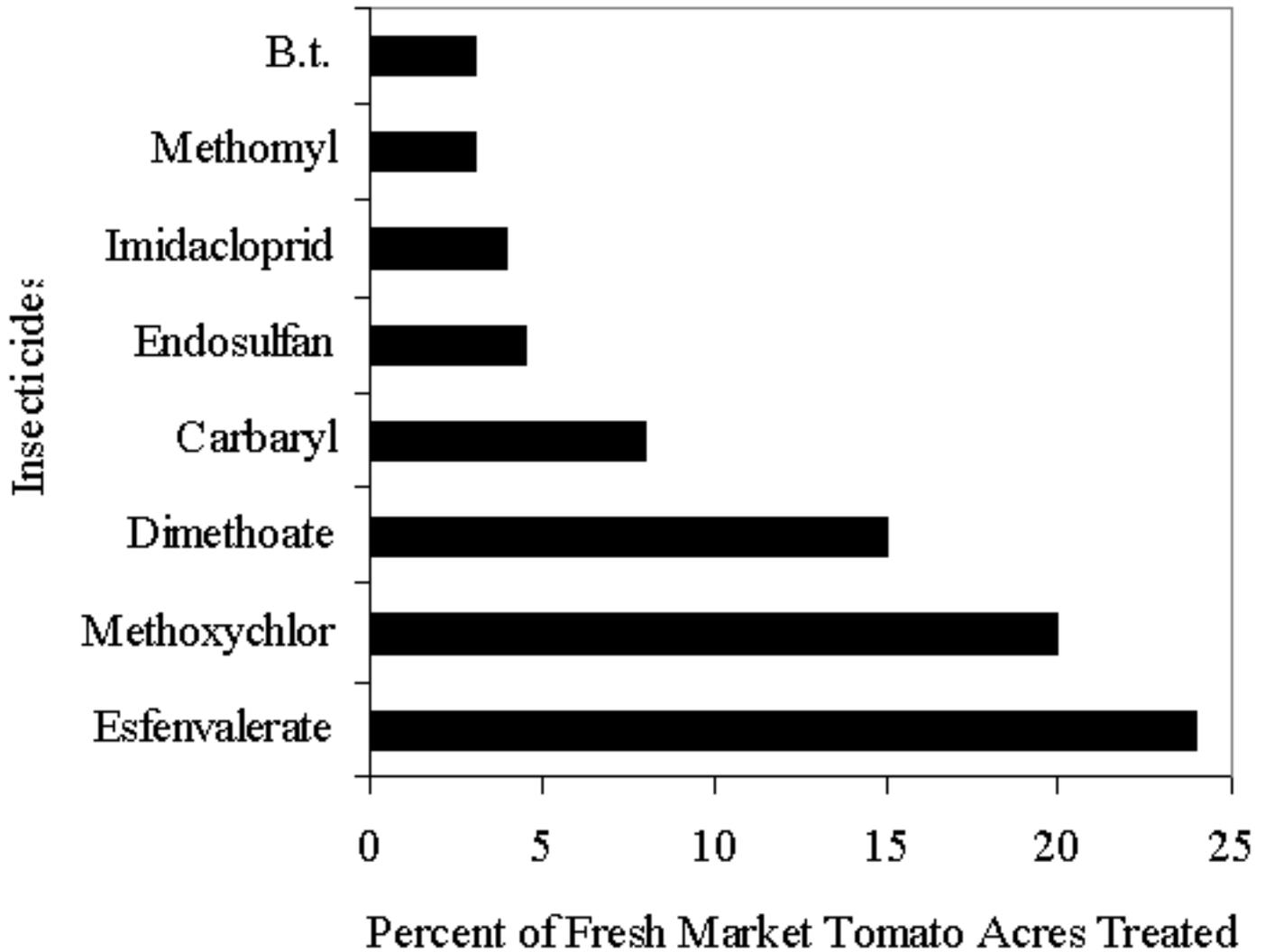
## 8. **European Corn Borer**

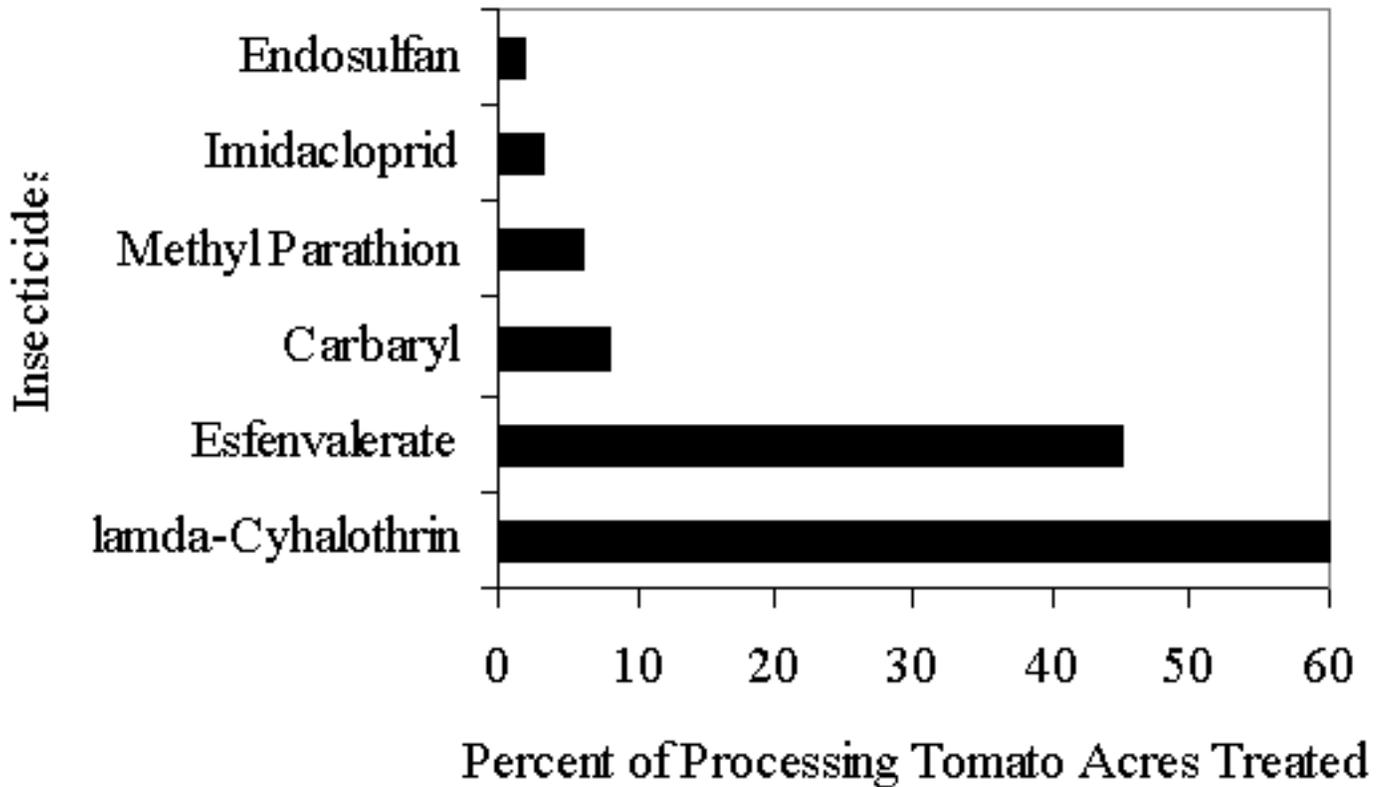
The European corn borer occasionally infests stems of tomato plants in June especially if early corn is planted nearby or if corn is planted too late to be available when the borer emerges. The adult moths will migrate from the dying corn to find a new source of food upon which to lay their eggs.

## 9. **Grasshoppers**

Occasionally, grasshopper feeding has caused significant damage in fresh market tomatoes in Ohio. In large numbers, grasshoppers can defoliate a tomato plant. Damage usually occurs in late summer.

**Chemical Insect Controls:**





#### Lambda-Cyhalothrin (Warrior)

- Target pests: cutworms, hornworms, other caterpillars, stink bugs and Colorado potato beetle (7)
- Percent acres treated: 60% (P) (6)
- Average rate and frequency of application:  
Warrior – 3 oz/A, twice (P) (6)
- PHI: 5 days (7)
- Efficacy rating: Good to Very Good

#### Esfenvalerate (Asana)

- Target pests: Cutworms, hornworms, Colorado potato beetles, fruitworms (3)
- Percent of acres treated: 24% (F) , 45% (P) (6)
- Average rate and frequency of application: (6)  
Asana XL – 7 oz/A, 3 times (F) and 6.5 oz/A, twice (P)
- PHI: 1 days (7)
- Efficacy rating: Very Good (6)

#### Methoxychlor (Marlate)

- Target pests: Flea beetles, Colorado potato beetle (3)
- Percent of acres treated: 20% (F) (6)
- Average rate and frequency of application: (6)
  - Methoxychlor 2EC – 4 qt./A, twice (F)
  - Marlate 50WP – 4 lb/A, twice (F)
- PHI: 7 days (3)
- Efficacy rating: Good (6)

### Dimethoate

- Target Pests: Aphids, flea beetles, Colorado potato beetle (3)
- Percent of acres treated: 15% (F) (6)
- Average rate and frequency of application: (6)
  - Dimethoate 267EC – 1 pt/A, once (often alternated with methoxychlor) (F)
  - Dimethoate 400 – 0.75 pt/A, once (F)
- PHI: 7 days (3)
- Efficacy rating: Good (6)

### Carbaryl (Sevin, Adios)

- Target pests: Colorado potato beetles, fruitworms, flea beetles and hornworms (3)
- Percent of acres treated: 8% (F), 8 % (P) (6)
- Average rate and frequency of application: (6)
  - Sevin 80S - 1.5lbs/A, 4 times (F)
  - Sevin XLR - 1 qt/A, 3 times (F) and 1.75pt/A, twice (P)
  - Sevin 50WP - 2lbs/A, 2-3 times (F)
- PHI: 3 days (3)
- Efficacy rating: Good to Very Good (6)

### Methyl Parathion, encapsulated (PennCap-M)

- Target pests: Stink bugs, flea beetles, European corn borer, Colorado potato beetle, cutworms, hornworms, tomato fruitworm (3)
- Percent of acres treated: 6% (P) (6)
- Average rate and frequency of application: (6)
  - PennCap-M – 3 pt/A, once
- PHI: 15 days (3)
- Efficacy rating:

### Endosulfan (Thiodan)

- Target pests: Stink bugs, aphids, Colorado potato beetle, flea beetles, European corn borer

and stink bug (3)

- Percent of acres treated: 4.5% (F), 2% (P) (6)
- Average rate and frequency of application: (6)
  - Thiodan 50WP – 1.67lbs/A, 3 times (F)
  - Thiodan 3EC – 2.5 pt/A, twice (P)
- PHI: 2 days (3)
- Efficacy rating: Good (6)

### Imidacloprid (Provado)

- Target Pests: Aphids, Colorado potato beetle (3)
- Percent of acres treated: 4% (F), 3% (P) (6)
- Average rate and frequency of application: (6)
  - Provado 1.6F – 3.75oz/A, once (F) and 4 oz/A, once (P)
- PHI: 0 days (3)
- Efficacy rating: Good to Very Good (6)

### Methomyl (Lannate)

- Target Pests: Variegated cutworms, fruitworms, and hornworms (3)
- Percent of acres treated: 3% (F) (6)
- Average rate and frequency of application:
  - Lannate LV – 1.5pts/A, once (F)
- PHI: 1 day (3)
- Efficacy rating: Good (6)

### Bacillus thuringiensis (B.t., Dipel)

- Target pests: hornworms (6)
- Percent acres treated: 3% (F) (6)
- Average rate and frequency of application (6)
  - Dipel – 1 lb/A, 3 times (F)
- PHI: 0 days (3)
- Efficacy rating: Very good (6)

### **Cultural Controls:(3,4)**

Rotate crops and monitor/scout fields for insect populations because none consistently occur each year at levels to provide significant injury to crop. Blacklight traps and pheromone traps are used to monitor adult moth populations. Clearing fields of winter annual weeds at least 10-14 days before planting helps to limit cutworm damage. For Colorado potato beetle control, potatoes can be planted at a trap crop.

### **Biological Controls:(4)**

The tachnid fly *Lydella stabulans grisescens* parasitizes fruitworm larvae. A braconid wasp parasitizes adult hornworms while the trichogramma wasp will parasitize hornworm eggs. Because of their size, many vertebrate predators such as birds feed on hornworms.

## Diseases

Diseases are a much more significant problem for tomato producers in Ohio than insects. The following diseases are listed in order of importance as identified by the growers.

### 1. **Early Blight**

Early Blight, caused by the fungus *Alternaria solani*, is the most common tomato disease for which treatment is applied in Ohio. The disease produced a wide range of symptoms at all stages of plant growth. On established plants the most common symptoms include the development of dark brown spots with dark concentric rings on the older leaves first. These spots soon enlarge to  $\frac{1}{4}$  to  $\frac{1}{2}$  inch in diameter, run together, and cause the leaf to turn brown and drop off the plant. The disease can cause substantial defoliation, fruit sunscald and poor fruit color. The fungus overwinters on diseased plant residues (where it can last up to a year) and on seeds. So Early Blight can be introduced on seed or transplants. The disease is promoted under wet, warm conditions but it occurs under a wide range of weather conditions.

### 2. **Anthracnose**

Anthracnose is a common rot of mature tomato fruits caused by the fungus, *Colletotrichum coccodes*. Symptoms first appear as a small slightly sunken circular spot. The spot becomes larger and a dark spot appear in the center of the circle. Eventually the spots merge and cover a large area of the fruit or the entire fruit rots. This fungus overwinters in the soil, in residues from diseased plants and in and on seeds. The disease often develops after the fungus is splashed on the fruit from the soil or other plant parts. Green fruit can be infected but it will not show symptoms until the fruit ripens. Wet weather conditions promote disease development. The disease is also common on fruit that comes in contact with the soil.

### 3. **Septoria Leaf Blight**

The disease is caused by the fungus, *Septoria lycopersici*, which overwinters on residues from diseased plants and on or in diseased plants. The first symptoms of the disease appear later in the season (early to mid-July) on the older leaves near the ground where small, water-soaked spots can be seen. The spots soon become nearly circular and have gray centers surrounded by darker margins. Later the centers show tiny dark specs in which the spores of the fungus are produced. The spots are smaller and more numerous than those found in Early Blight. If a leaf develops many spots it usually dies and drops from the plant. As the disease spreads, there is a progressive

loss of leaves until only a few are left at the top of the plant and the fruit become exposed to sunscald. Wet weather favors fungus growth, spread, and subsequent disease development.

#### 4. **Bacterial Speck**

Bacterial Speck is caused by the bacterium *Pseudomonas syringae* pv. *tomato*. This bacterium overwinters on seed, in residues from infected plants or in the soil. But it can also be introduced to a field on transplants. Symptoms appear as small black specs on leaves, stems, fruit stems and fruit. Specks on the fruit are the most common. They occur on young green fruit and are superficial, slightly raised and approximately 1/16 inch in diameter. Often the area around the speck will remain green longer than the rest of the ripening fruit. Cool, wet weather promotes disease development while splashing rain and movement of machinery through the field helps the disease to spread.

#### 5. **Bacterial Spot**

The bacterium *Xanthomonas campestris* pv. *vesicatoria* causes the disease Bacterial Spot. It can survive for a year in diseased plant residues and can be seed borne. The symptoms for Bacterial Spot can appear on the leaves, stems and fruit. On the leaves and stems spots appear that are dark and greasy. The spots on the fruit are distinct, small, dark and raised, sometimes surrounded by a water-soaked margin. The spots eventually become larger, brown and scabby. The disease is promoted in wet weather, while splashing rain helps it spread.

#### 6. **Bacterial Canker**

*Corynebacterium michiganense* pv. *michiganens* is the bacterium that causes the disease Bacterial Canker. The bacterium may survive for a year in diseased plant residues, but it is also seed-borne and therefore can infect and spread to transplants. Symptoms of bacterial canker appear on tomato leaves, stems and fruit. The disease causes the wilting of leaflets on plants of any size, eventually wilting or killing the entire plant. The fruit spots first appear small and whitish but soon develop raised dark centers surrounded by a white halo which later turns brown.

#### 7. **Verticillium Wilt**

Verticillium wilt is caused by various species of the fungus *Verticillium* (in Ohio it is usually the species *V. dahliae*) and it is a common disease of many solanaceous crops. The fungus is soil-borne and can persist for many years and is more common in cool rather than warm climates. The symptoms first appear on the older leaves but will spread to all foliage. The leaves turn yellow, dry up and fall from the plant. Internal woody stem tissue, particularly at the lower part of the plant, distinctively darkens.

#### 8. **Buckeye Rot**

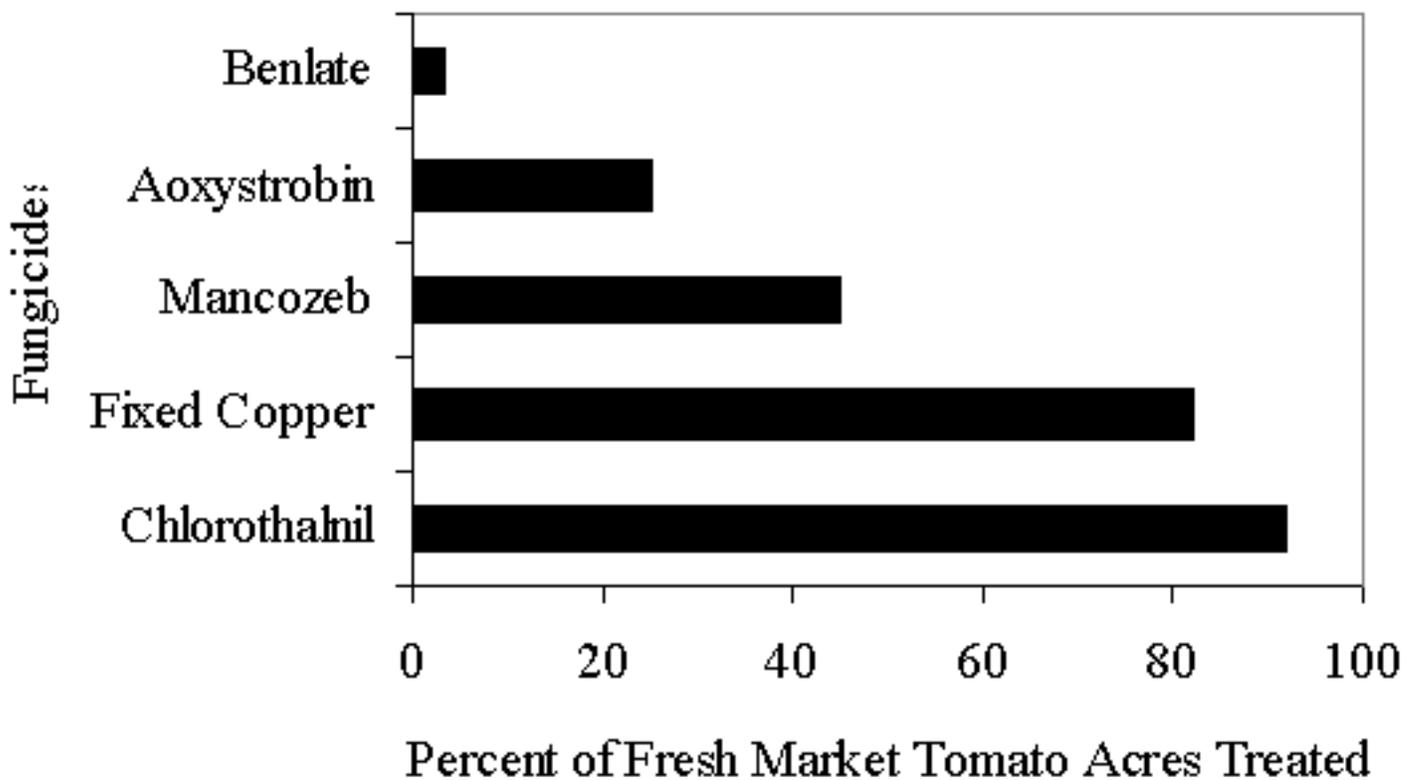
Various species of the fungus *Phytophthora* causes the disease Buckeye Rot. The fungus is soil-borne and is most common in poorly drained fields and in areas with long periods of warm wet weather. The symptoms first appear as a grayish green or brown water-soaked spot that usually occurs where the fruit touches the ground. The spots become large, dark brown lesions with

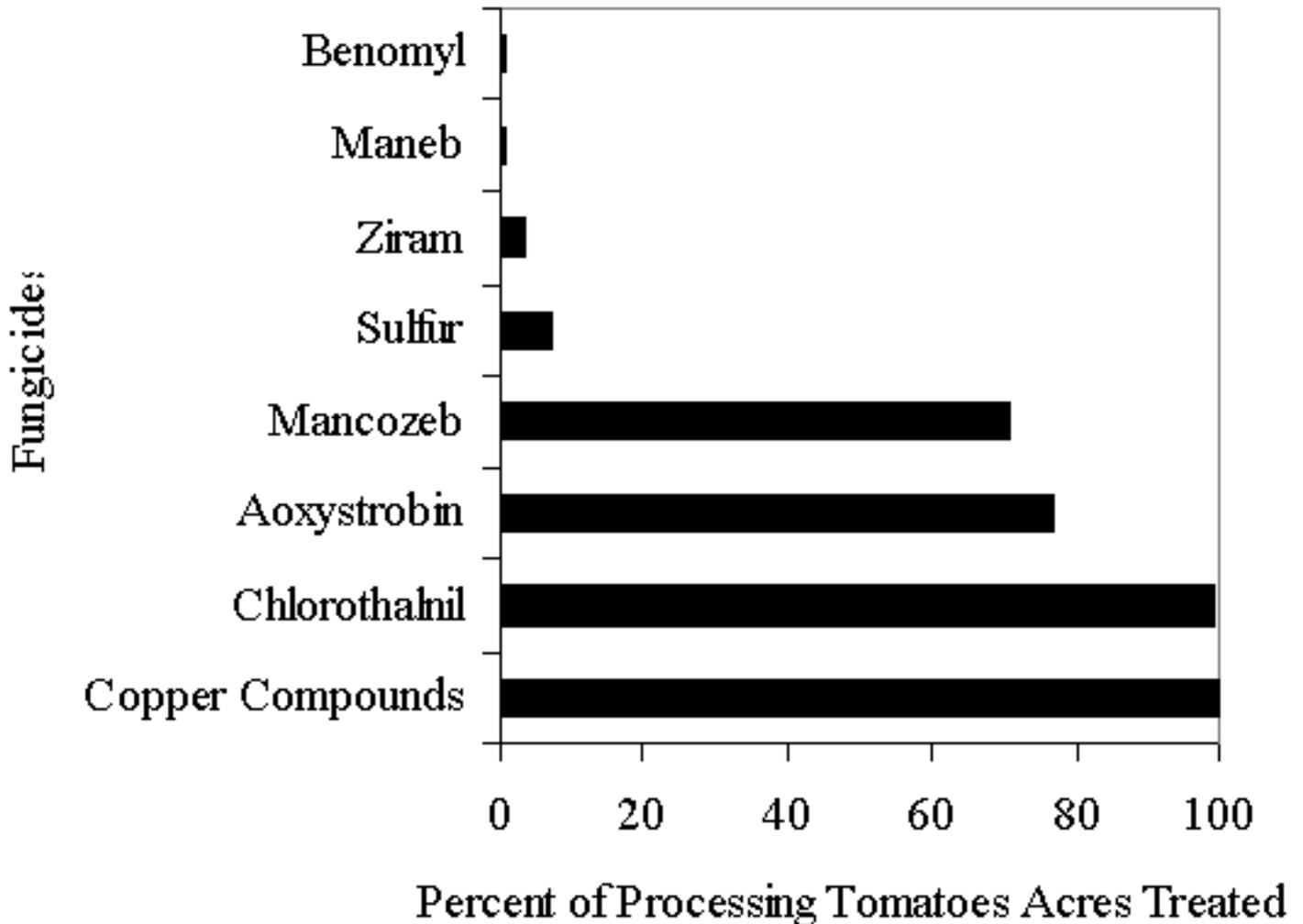
distinctive rings or "buckeyes." The rotted area is smooth and has no sharply defined margin.

## 9. Late Blight

Although not common, the fungus that causes Late Blight, *Phytophthora infestans*, can cause devastating damage to tomato leaves and fruit. On the leaves, the symptoms first appear as irregular greasy grayish areas. These areas expand quickly, especially during moist conditions, and a white downy mold appears at the margins of the affected areas on the underside of the leaves. On the green fruit, the symptoms of Late Blight appear as grayish green water-soaked spots which enlarge to indefinite size and shape. Affected areas become dark brown, hard, wrinkled and have a relatively definite margin. These symptoms distinguish Late Blight from Buckeye Rot. The disease can be introduced on transplants or may be wind-borne from diseased plants nearby. Development of the disease is promoted in cool wet weather.

### Chemical Disease Controls





Chlorothalnil (Bravo, Echo, Terranil)

- Target diseases: Early Blight, Late Blight, Anthracnose, and Septoria Leaf Blight (3)
- Percent acres treated: 92% (F), 99% (P) (6)
- Average rate and frequency of application: (6)
  - Bravo 720 - 2pts/A, 5 times (F) and 2.2 pt/A, 5-6 times (P)
  - Bravo Ultrex - 2 lb./A, 4 times (F) and 2 lb./A, 5-6 times (P)
  - Echo 720 – 1.5pts/A, 3 times (F)
  - Terranil 90DF – 1.4 lb/A, twice (P)
- PHI: 0 days (3)
- Efficacy rating: Good to Very Good (6)

Copper Hydroxide (Kocide, Champ, Tenn Cop)

- Target diseases: Bacterial Spot, Speck and Canker (7)
- Percent acres treated: 82% (F), 100% (P) (6)

- Average rate and frequency of application: (6)
  - Kocide LF– 1.5 qt/A, 5+ times (F)
  - Kocide 2000 – 1.8 lb./A, 4-5 times (P)
  - Champ 2 – 1 qt/A, 8+ times (F) and 2.4 qt/A, 7-8 times (P)
  - Champion WP – 1.8 lb./A, 5-6 times (P)
  - Nu-Cop 50WP – 2lb./A, 2-3 times (P)
- PHI: 0 days (7)
- Efficacy Rating: Good on Bacterial Spot, Speck and Canker; Not Effective on Early Blight and Poor on Late Blight(6)

### Mancozeb (Penncozeb, Manzate, Dithane)

- Target diseases: Early Blight, Late Blight and Anthracnose (3)
- Percent of acres treated : 45% (F), 71% (P) (6)
- Average rate and frequency of application: (6)
  - Penncozeb 75DF and 80WP – 2.2 lb./A, twice (P)
  - Manzate 75DF – 2.33 lb./A, twice (F) and 1.7 lb./A, twice (P)
  - Dithane 2lbs/A, 5+ times (F) and 1.6 lb./A, twice (P)
- PHI: 5 days (7)
- Efficacy rating: Good to Very Good (6)

### Aoxystrobin (Quadris)

- Target diseases: Late Blight, Septoria Leaf Blight, Early Blight and Anthracnose (3)
- Percent of acres treated: 25% (F), 77% (P) (6)
- Average rate and frequency of application: (6)
  - Quadris – 6 oz/A, 3 times (F) and 5.3 oz/A, 2-3 times (P)
- PHI: 7 days (however new label in 2000 will have a 0 day PHI) (3)
- Efficacy rating: Good to Very Good (6)

### Sulfur (Microthiol Special)

- Target disease: Powdery Mildew (7)
- Percent of acres treated: 7% (P) (6)
- Average rate and frequency of application: (7)
  - Microthiol Special – 2 lb./A, 3 times
- PHI: 0 days
- Efficacy rating: Average

### Ziram

- Target disease: Anthracnose, Early Blight and Septoria Leaf Spot (7)

- Percent of acres treated: 3.5% (P) (6)
- Average rate and frequency of application: (6)  
Ziram 76 DF– 2 lb./A, twice
- PHI: 7 days (7)
- Efficacy rating:

### Benomyl (Benlate)

- Target diseases: Botrytis Gray Mold and Septoria (3)
- Percent of acres treated: 3% (F), 1% (P) (6)
- Average rate and frequency of application: (6)  
Benlate – 8 oz/A, 3 times (FM and P)
- PHI: 1 day (3)
- Efficacy rating: Good (6)

### Maneb (Manex)

- Target diseases: Anthracnose, Septoria Leaf Spot, Early Blight, Late Blight (7)
- Percent of acres treated: 1% (P) (6)
- Average rate and frequency of application: (6)  
Manex (FL) – 2 pts/A (P)
- PHI: 5 days (7)
- Efficacy rating: Average

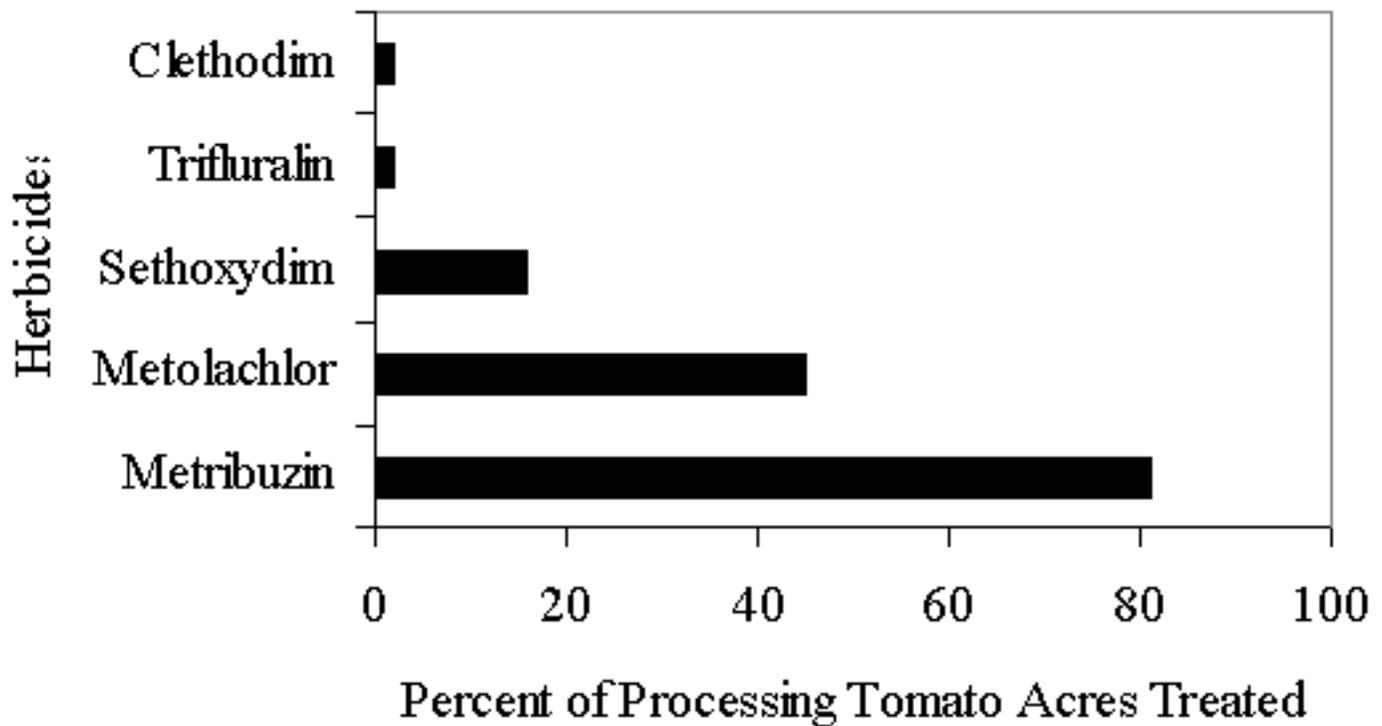
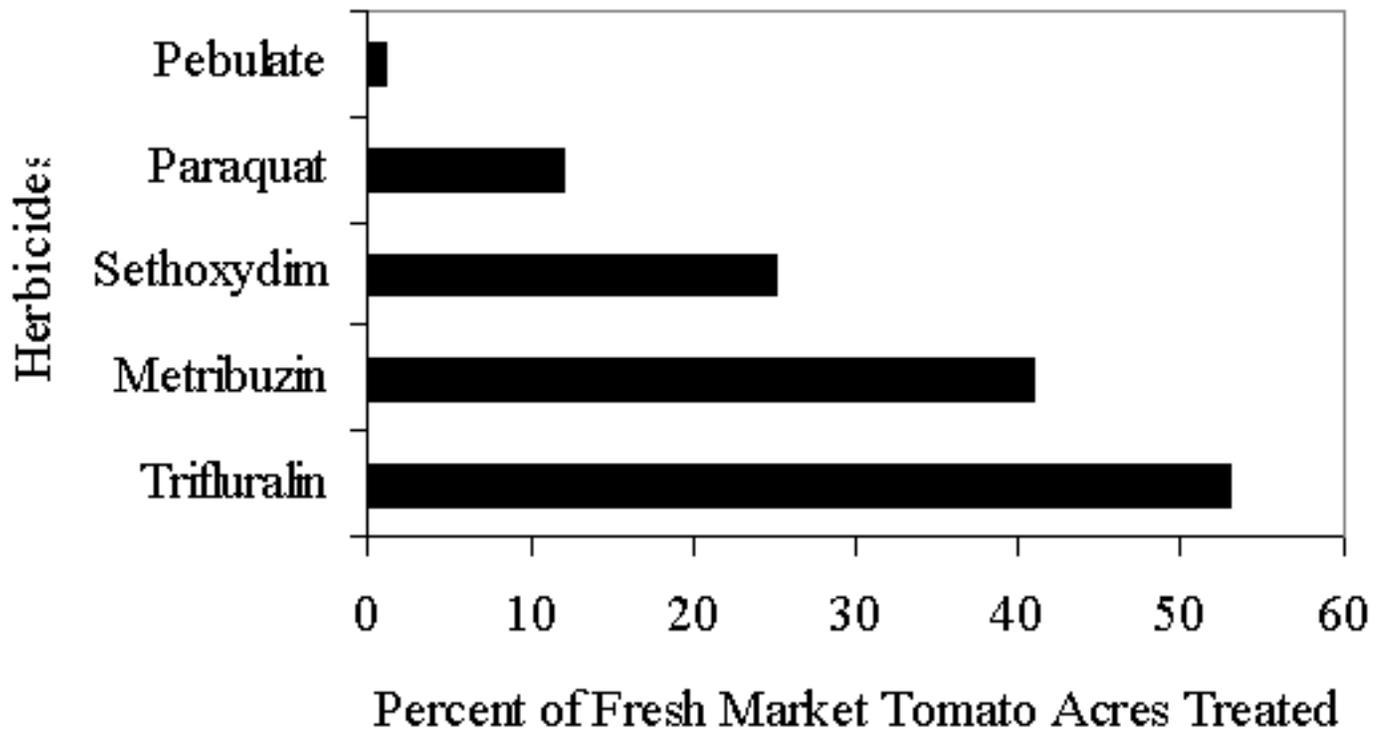
### **Cultural Controls:** (3)

Rotate crops and remove and destroy all diseased plant debris. Plant certified disease free seed and transplants in fields with good drainage and air circulation. Trellising or staking and the use of mulch can help minimize spread of soil borne pathogens in fresh market tomatoes. Avoid overhead irrigation if possible and minimize activity in wet fields. The use of TOMCAST, a computer model designed to predict problems with Early Blight, Anthracnose and Septoria Leaf Blight, helps growers manage disease pressure through better timing of fungicide applications.

## Weeds

Broadleaves and grasses

### **Chemical Controls:**



Trifluralin (Treflan)

- Target pests: Annual weed except ragweed (3)
- Percent acres treated: 53% (F), 2% (P) (6)
- Average rate and frequency of application (6)
  - Treflan 4EC – 2pts/A, once preplant (F)
  - Treflan 10G – 1 lb/A, once (P)
- Efficacy: Good (6)

### Metribuzin (Sencor, Lexone)

- Target pests: Broadleaf weeds (3)
- Percent acres treated: 41% (F), 81% (P) (6)
- Average rate and frequency of application (6)
  - Sencor DF – 0.5lb/A, once preplant (F) and 0.35 lb/A, 1-2 times (P)
  - Lexone DF - .33lb/A, once (P)
- Efficacy: Good (6)

### Sethoxydim (Poast)

- Target pests: Annual and perennial grasses (3)
- Percent acres treated: 25% (F), 16% (P) (6)
- Average rate and frequency of application: (6)
  - Poast – 1.5 pt/A, once (F) and 1pt/A, once (P)
- Efficacy: Good (6)

### Paraquat (Gramoxone)

- Target pests: Emerged annual weeds and top growth of perennial weeds (3)
- Percent acres treated: 12% (P) (6)
- Average rate and frequency of application: (6)
  - Gramoxone Extra – 1.5 pt/A
- Efficacy: Good

### Clethodim (Select)

- Target pests: Annual and perennial grasses
- Percent acres treated: 2% (P) (6)
- Average rate and frequency of application: (6)
  - Select 2EC – 8 oz/A, once
- Efficacy: Average to good

### Pebulate (Tillam)

- Target pests: Annual grasses (3)
- Percent acres treated: 1% (F) (6)
- Average rate and frequency of application (6)
  - Tillam 6E – 6 lbs a.i./A (4qts/A), once preplant
- Efficacy: Good (6)

### **Cultural Controls:**

Cultivation and mulching are used in addition to herbicide applications. In southeastern Ohio the use of black plastic has become increasingly common.

### **Critical Pest Controls Issues**

Important pesticides used which are organophosphates, carbamates or B2 carcinogens include:

- Benomyl (Benlate)
- Chlorothalonil (Bravo)
- Carbaryl (Sevin)
- Methyl Parathion (PennCap-M)
- Mancozeb (Penncozeb, Manzate and Dithane)
- Maneb (Manex)
- Dimethoate

### **Chemical or Nonchemical Alternatives and New Registrations**

There have been new insecticides registered for tomatoes. Spinosad (SpinTor), a naturally occurring substance, was registered in 1998 for control of Colorado potato beetle larvae, hornworms, loopers, fruitworms, armyworms, and European corn borer. None of the growers surveyed reported using this chemical. The registration for lambda-cyhalothrin (Warrior), a pyrethroid, was expanded to include tomatoes for the control of cutworms, hornworms, other caterpillars, stink bugs and Colorado potato beetle. The processing tomato growers have begun to use Warrior much more quickly than the fresh market growers, who reported little or no use of the chemical.

## Contacts

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## References

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