

Crop Profile for Cabbage in Ohio

fresh market and processing
(*Brassica oleracea* L. var. *capitata* L.)

Prepared: October, 2000

General Production Information

- Acres in Ohio: 1749
- Percent of US Acreage/Rank: 2.1%/11th
- Number of Growers: 267

Location Of Production;(1)

Counties with the most acres in cabbages are primarily located in the Northwest region of the state. The following counties are the top cabbage producers in the state: Sandusky, Huron, Lucas, Greene, Fairfield, Wood and Ottawa.

Production Methods:(2)

Cabbage is a cool season biennial that is grown as an annual vegetable. Cabbage grows well on a variety of soil types but it does best on a well-drained sandy loam with a high organic matter content. Most fresh market cabbage is transplanted while most processing cabbage is direct-seeded. A precision seeder is used to place seeds $\frac{3}{8}$ to $\frac{1}{2}$ inch in moist soil. Seedlings are then thinned to one plant every 18 inches in rows 36 inches apart. Transplants are spaced between 24-36 inches apart. Row spacing for transplants is 24 – 36 inches. Cabbage grows best in soils with a pH of 6.0 to 6.8. Starter fertilizers are recommended for use with transplants while a band of fertilizer 1 inch to the side and 2 inches deep is often applied with direct seeded cabbage. Usually 75-150 lbs of nitrogen per acre is applied during the growing season. Potassium and phosphorus are applied according to spring soil tests. Fresh market cabbage is harvested when the heads reach full size. Processing cabbage is harvested when heads are mature and at maximum tonnage.

Insect Pests

Diamondback Moth

The diamondback moth adults are small, grayish-brown moths with a wingspan of about $\frac{1}{2}$ inch. Only

the males have the distinctive 3-diamond pattern on the top of the body. The moths may not survive a severe winter in the northern parts of the state but can overwinter as adults in protected areas. Migration and importation on transplants are other routes of entry for the diamondback moth into Ohio. In spring the flat, yellowish, oval eggs are laid singly or in small groups on cabbage leaves and stems. The larvae that emerge from the eggs are light-green and tapered at both ends. They are leaf miners initially, but in later stages are external feeders on leaves consuming all but the outer layer of tissue to produce a characteristic "windowpane" damage. If the damage is extensive, young plants can be killed or delayed in maturing. Feeding can also increase the plants susceptibility to diseases such as black rot. Depending upon temperature, development from egg to adult is roughly 3-4 weeks. There are usually 4-6 generations of diamondback moths per year.

Imported Cabbageworm

The adult imported cabbageworm is a white or yellowish-white butterfly with black spots on the wings and a two inch wingspread. The imported cabbageworm overwinters as a pupa in crop debris. The females singly lay bullet-shaped, ridged, yellow eggs on cabbage foliage. The velvet green larvae that emerge from the eggs are sluggish and feed on the upper leaf surface near the midrib producing large, irregular holes. The older larvae move into the center of the plant and tend to feed from the edges of the leaf, leaving the large veins intact. The interval from egg to adult lasts about 4-5 weeks. There are between 3-6 generations each year.

Cabbage Looper

Adult cabbage looper moths are about 1 inch long, grayish brown and have a small silvery figure "8" marking on the front pair of wings. Cabbage loopers cannot overwinter in Ohio but they do migrate there during mid-June to September. Domed-shaped white eggs with ridges are laid by females singly or in small numbers on the underside of leaves. The larvae are pale green with a narrow white stripe down each side. They grow to 1½ inches in length and move about the surface of the plant by "looping" or arching their bodies in the middle to bring the hind-end forward. The larvae eat large holes in the leaves and often burrow into the base of the head. Severe feeding damage after heading may cause head stunting or abortion. Development from egg to adult takes about 4-6 weeks. There are usually 2-3 generations of cabbage loopers in Ohio each year.

Onion Thrips

Onion thrips are a pest of a wide variety of vegetables and field crops. The adults are tiny, slender insects with fringed wings and yellow to brown color. The nymphs look like the adults but are smaller and lack wings. Both the adults and nymphs overwinter in crop debris and plant material near the field margins. The females lay their eggs on the plant tissue. Adults will develop in 20 to 40 days. Damage is done to the cabbage plant by feeding with rasping mouthpart that creates whitish scratches or brownish blisters on the leaf surface and reddish brown patches on the heads. In heavy infestations, damage to the head can be extensive rendering it unmarketable. Thrips prefer tight spaces, so they are usually found several layers deep within the developing cabbage head. There may be 5-8 generations of thrips per year in Ohio. Hot, dry weather often promotes thrips problems. They often invade vegetable crops after wheat is harvested in early July. There are consistent differences among cabbage varieties in susceptibility to thrips damage.

Cabbage Maggot

The cabbage maggot can cause significant damage to cabbage at the seedling or young transplant stage. The adult cabbage maggot looks like a small house fly while the legless maggot is white to yellowish-white and ½ to 1/3 inch long. The cabbage maggot adults lay eggs in cracks in the soil or on plant stems at soil level. The maggots feed for 3-4 weeks on the roots of the plant before pupating in the soil. The feeding by the maggots damages the root and provides entry points for diseases. Injured plants become purple-yellow or a sickly grayish green, wilt easily and have stunted growth. Seedlings can be killed quickly while transplants may last longer in a weakened condition before withering or dying from disease. There are several generations of cabbage maggots each year but they are usually pests of cabbage only during the first generation.

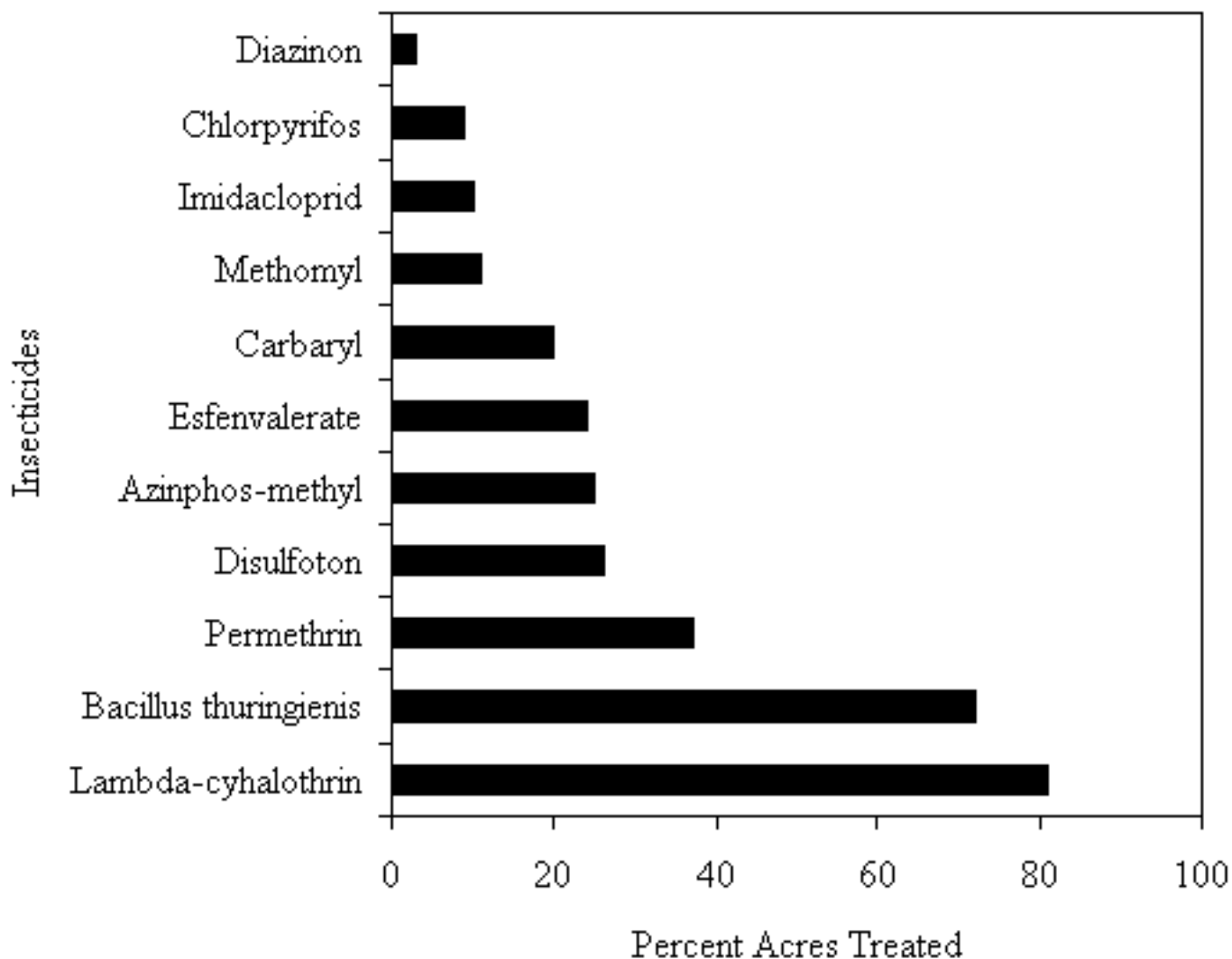
Flea Beetles

Flea beetles are small black beetles with enlarged hind legs that enable them to jump long distances when disturbed. They overwinter as adults in leaf litter, hedgerows, windbreaks and wooded areas. In the spring the beetles emerge and the females lay eggs on gnawed-out areas in roots or the surrounding soil. The small white larvae feed on the roots but cause little damage and then pupate in the soil. Damage is done by the adults which feed on cotyledons, stems and leaves. The beetles gouge out small pits in the leaves, exposing the tissue underneath and giving the leaf a "shothole" appearance. Under heavy flea beetle attack seedlings may wilt and die, especially during cool weather when plants are growing slowly. Feeding damage to the cotyledons and young leaves can cause uneven stand development. There are usually 1-2 generations of flea beetles per year.

Cabbage Aphid

Serious problems associated with cabbage aphid appear sporadically in Ohio but they can cause significant damage when populations are large. Cabbage aphids are grayish-green but appear white because of a thick waxy coating. They have short cornicles and can be winged or wingless. The cabbage aphid overwinters as an egg on plant debris. Injury is caused by feeding on seedlings or young transplants which can kill the developing plant or reduce the yield of those that survive. A heavy infestation of aphids on older plants can cause the leaves to curl and turn yellow, stunted growth and deformed heads. There are usually many generations of aphids per growing season.

Chemical Insect Controls:(2,4)



Lambda-cyhalothrin (Warrior)

Percent acres treated: 81%

Target pests and timing: Imported cabbageworm, cabbage looper, thrips and diamondback moth

Average rate of most common formulation and frequency of application:

Warrior 1EC – 3 .2 oz/A, 3 times

PHI: 1 day

Efficacy rating: Good to Very Good

***Bacillus thuringiensis* (DiPel, Agree, Javelin)**

Percent acres treated: 72%

Target pests and timing: Imported cabbageworm, cabbage looper & diamondback moth

Average rate of most common formulation and frequency of application:

DiPel 2X – 0.7 lb/A, 4 times

DiPel DF – 1.25 lb/A, 4 times

Agree WG – 1lb/A, 4 times

Javelin WG – 0.75 lb/A 4 times

PHI: 0 days

Efficacy rating: Good to Very Good

Permethrin (Pounce, Ambush)

Percent acres treated: 37%

Target pests and timing: Imported cabbageworm, cabbage looper, diamondback moths, and Flea beetles

Average rate of most common formulation and frequency of application:

Pounce 3.2EC – 4.3 oz/A, 3.75 times

Ambush 2EC – 7.4 oz/A, 3.5 times

PHI: 1-7 days

Efficacy rating: Good to Very Good

Disulfoton (Di-Syston)

Percent acres treated: 26%

Target pests and timing: Aphids

Average rate of most common formulation and frequency of application:

Di-Syston 8EC – 0.5 pt/A, once 14 days after planting

PHI: 42 days

Efficacy rating: Very Good

Azinphos-methyl (Guthion)

Percent acres treated: 25%

Target pests and timing: Cabbage Maggot

Average rate of most common formulation and frequency of application:

Guthion 50WP – 0.5 lb/A, twice

PHI: 21 days

Efficacy rating: Good

Esfenvalerate (Asana)

Percent acres treated: 24%

Target pests and timing: Imported cabbageworm, cabbage looper, diamondback moths, and flea beetles

Average rate of most common formulation and frequency of application:

Asana XL – 5.8 oz/A, twice

PHI: 7 days

Efficacy rating: Good

Carbaryl (Sevin)

Percent acres treated: 20%

Target pests and timing: Flea beetles and imported cabbageworm

Average rate of most common formulations and frequency of application:(4)

Sevin 80S – 1.1 lbs/A, twice

Sevin XLR Plus – 1 qt/A, once

Sevin 50WP – 1 qt/A, twice

PHI: 3 days

Efficacy rating: Good

Methomyl (Lannate)

Percent acres treated: 11%

Target pests and timing: Imported cabbageworm, cabbage looper, diamondback moth

Average rate of most common formulation and frequency of application:

Lannate LV – 1.75 pt/A, twice

Lannate 90SP – 1 lb/A, twice

PHI: 1-7 days

Efficacy rating: Good to Very Good

Imidacloprid (Provado)

Percent acres treated: 10%

Target pests and timing: Aphids

Average rate of most common formulation and frequency of application:

Provado 1.6F – 3.75 oz/A, once

PHI: 7 days

Efficacy rating:

Chlorpyrifos (Lorsban)

Percent acres treated: 9%

Target pests and timing: Cabbage maggot and wireworms

Average rate of most common formulation and frequency of application:

Lorsban 15G – 20 lb/A, once

Lorsban 4E – 2.5 pt/A, once at planting

PHI: 21 days

Efficacy rating:

Diazinon

Percent acres treated: 3%

Target pests and timing: Cabbage maggot and wireworms

Average rate of most common formulation and frequency of application:

Diazinon 14G – 20 lbs/A, once pre-plant

Diazinon AG500 – 1 pt/A, 3.5 times

PHI: 21 days

Efficacy rating: Good to Very Good

Cultural Controls: (3)

Do not plant in fields where animal manure has been freshly applied or cover crop residues recently turned under. Plant in well drained soil when temperature exceeds 50°C. If possible, grower should time planting to avoid peak cabbage maggot fly emergence and egg laying periods. Early planting in the spring may help avoid exposure to large populations of flea beetles and imported cabbageworms. Practice effective weed management in and around fields since more flea beetles are found in weedy areas. Avoid broad-spectrum insecticide sprays early in the season because they will kill population of beneficial insects that will help manage caterpillars later in the season. Choose varieties that display their leaves vertically because they have been shown to have less insect pest problems and varieties with low susceptibility to thrips.

Diseases

Alternaria Leaf Spot

Two species of fungus, *Alternaria brassicae* and *A. brassicola*, cause alternaria leaf spot on cabbage and many other cole crops. The disease is introduced on infected seed, by wind-blown spores from nearby crucifer weeds, old crop residues or cull piles, splashing rain and by machinery or workers when the plants are wet. The disease is favored by moist conditions late in the season. The first symptoms of the disease appear as tiny yellow specks on the oldest leaves of the more mature plants. The spots enlarge into circular, tan to dark brown spots, ¼ to 1 ½ inches in diameter. If conditions are favorable the leaf spots develop alternating light and dark concentric rings that give them a target-like appearance. Old leaf spots become papery in texture and may tear. When the dry tissue falls out, a shothole effect results. As the disease progresses, head leaves may become infected.

Black Rot

Black rot is a bacterial disease that affects many crucifers. It is caused by the bacterium *Xanthomonas campestris*. The bacterium enters the plant on the leaves during warm (80-86° F), wet weather. It spreads in the vascular system of the leaf and stem. The seed stalk and seed eventually become infected. The first symptoms of the disease are usually yellow to yellow-orange V-shaped lesions at the leaf margins. As the diseased area of the leaf expands and turns brown, the leaf veins in the affected area may turn

black. Eventually the leaf collapses. If infection occurs in young seedlings, the disease is more severe since the main stem becomes infected. These plants remain stunted and the veins in the stems are black. The heads from these plants deteriorate quickly after harvest.

Downey Mildew

Downey mildew is caused by the fungus *Peronospora parasitica*. The fungus overwinters on seed, in crucifer weeds and in the soil. Symptoms first appear as small spots on the leaves which are first yellow but later turn brown with bluish-black lace-like markings. In humid or moist weather, a white downy mold develops on the underside of the leaf spots and vascular tissue darkens. Downy mildew is promoted in cool, wet weather and will predispose plants to bacterial soft rot. The disease is most serious in seedbeds.

Chemical Disease Controls: (2,4)

Copper Hydroxide (Kocide)

Percent acres treated: 13%

Target diseases and timing: Black Rot

Average rate of most common formulation and frequency of application:

Kocide – 2 lbs/A, once

PHI: 0 days

Efficacy rating: Average

Mefenoxam+Chlorothalonil (Ridomil Gold/Bravo)

Percent acres treated: 10%

Target diseases and timing: Alternaria Leaf Spot

Average rate of most common formulation and frequency of application:

Ridomil Gold/Bravo – 1.7 lbs/A, 4 times

PHI: 7 days

Efficacy rating: Good

Mefenoxam (Ridomil Gold)

Percent acres treated: 5%

Target diseases and timing: Alternaria Leaf Spot

Average rate of most common formulation and frequency of application:

Ridomil Gold/Bravo – 1.7 lbs/A, 4 times

PHI: 7 days

Efficacy rating: Good

Chlorothalonil (Bravo)

Percent acres treated: 3%

Target diseases and timing: Alternaria Leaf Spot and Downey Mildew

Average rate of most common formulation and frequency of application:

Bravo 720 – 1.5 pt/A, 4 times

Bravo 500 – 2 pt/A, twice

Bravo Weather Stik – 1 pt/A, once

PHI: 14 days

Efficacy rating: Good

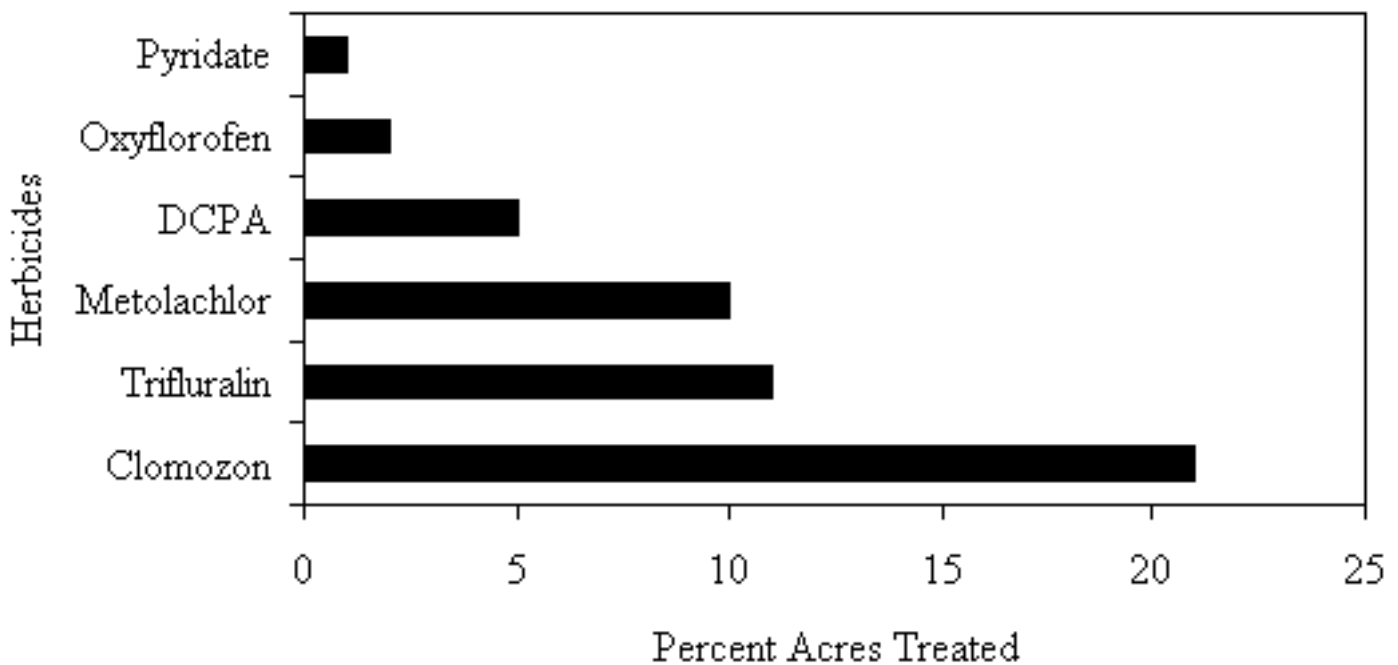
Cultural Controls:(2,5)

Plant cabbage in areas with good air circulation and soil drainage. Use a 3-year crop rotation that excludes crucifers. Use disease-free seeds or plants that have been grown under disease-free conditions. Remove and destroy all infected plants. Remove any plant debris. Fall tillage can help reduce the overwintering population of some pathogens.

Weeds

Broadleaves and grasses

Chemical Controls:(2,4)



Clomozone (Command)

Percent acres treated: 21%

Target weeds: Velvetleaf and other broadleaf weeds

Average rate of most common formulation and frequency of application:

Command 4EC – 1 pt/A, once prior to planting

PHI: 120 days

Efficacy rating: Good to Very Good

Trifluralin (Treflan)

Percent acres treated: 11%

Target weeds: annual grasses and some annual broadleaf weeds

Average rate of most common formulation and frequency of application:

Trifluralin 4EC – 1.7 pts/A, once

Treflan HFP – 1 pt/A, once

PHI: 60 days

Efficacy rating: Good

Metolachlor (Dual)

Percent acres treated: 10%

Target weeds: annual grasses and some annual broadleaf weeds

Average rate of most common formulation and frequency of application:

Dual 8E– 2 pt/A, once

PHI:

Efficacy rating: Average to Good

DCPA (Dacthal)

Percent acres treated: 5%

Target weeds: annual grasses and some annual broadleaf weeds

Average rate of most common formulation and frequency of application:

Dacthal – 3 lbs/A, once after transplanting

PHI: 120 days

Efficacy rating: Average

Oxyflurofen (Goal)

Percent of acres treated: 2%

Target Weeds: annual broadleaf weeds and grasses

Average rate of most common formulation and frequency of application:

Goal 1.6 E – 2 pts/A, once preplant

PHI: 75 days

Efficacy rating:

Pyridate (Lentigran)

Percent acres treated: 1%

Target weeds: broadleaf weeds and grasses

Average rate of most common formulation and frequency of application:

Lentigran 45WSB – 2 lbs/A, once postemergent

PHI:

Efficacy rating:

Cultural Controls:(3)

Shallow cultivation (2 inches or less) can be used as needed to help manage weeds. Hand hoeing can be used to remove weeds close to plants.

Contacts

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