

AGRICULTURAL GUIDE

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Corn Insect Control

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Corn cutworm control

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This guide recommends management practices and insecticides for reduction of injury caused by the various cutworms attacking corn in Missouri. It also discusses the life cycles of the more common species which feed at and below ground and those species which are primarily above ground foliage feeders.

Subterranean or species feeding below ground

Numerous species of cutworms may attack corn by feeding on the leaves, and as the larva increase in size, they cut the young plants at or below the ground line. Listed in order of importance, the more common species attacking corn are the black cutworm, dingy cutworm, claybacked cutworm and sandhill cutworm. The species occurring most frequently and in the largest numbers is the black cutworm.

Life cycles

All cutworm species have four distinct stages of development: egg, larva, pupa and adult. In the adult stage, they are moths. Both sexes have two pairs of wings, enabling them to migrate considerable distances, from a few to 100 or more miles. After mating, the female deposits single to small clusters of eggs on or very near the base of preferred larval host plants, on or under surface crop residues, or on exposed soil after flooding.

Depending upon the temperature, eggs hatch from within a few days up to three to four weeks. From the egg comes the larva (caterpillar or worm stage). This is the destructive stage of these insects.

Cutworms, like all other immature insects, increase in size by shedding their external body covering (skin) several times before assuming the next stage of development. Depending upon the cutworm species, there are from five to seven larval instars (stages between successive molts) before a larva is mature. Depending upon the species, a full grown cutworm larva will measure from 1¼ to 1¾ inches in length.

When mature, the larva transforms into a pupa (third developmental stage) while in the soil. Within two to eight weeks, the adult moth emerges from the pupa.

During the larval stage of black, dingy, and claybacked cutworms, they appear quite similar in color patterns, shape, type of feeding damage and circular curling of body when disturbed. These species are gray, dark brown, and black in varying amounts and arrangements. All have a mid-dorsal, longitudinal stripe or band, varying in width and usually of a lighter tan or gray.

Black cutworm

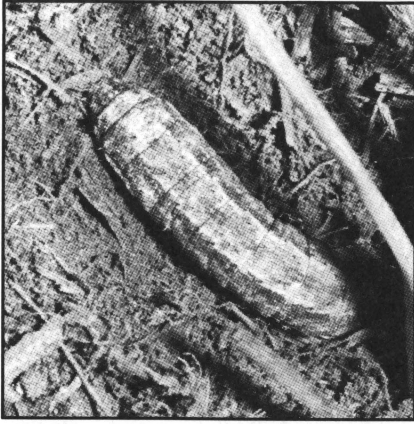
No one knows how this species overwinters in Missouri. Moths can be captured in light traps from late February to early December. This species probably overwinters as either partially grown larvae or pupae or possibly as adults.

Egg laying occurs during the warm nights of late March and April. Female moths place their eggs on the soil near the base of a plant or on the soil after flooding. Newly hatched larvae feed on almost any green vegetation available until spring tillage begins. Depending upon the type of tillage, partial or total destruction of green vegetation forces the small larvae to forage on any available source of vegetation, including plant residues. By the time corn germinates, these larvae are hungry and feed heavily on the emerging or emerged corn plants. Upon completion of larval growth, pupation occurs in the soil, and the adult moths emerge about two weeks later.

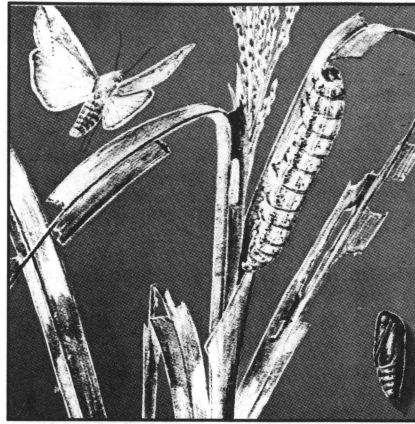
The black cutworm may have several overlapping or continuous generations per year. Laboratory reared black cutworms have either six or seven larval instars, but we believe six larval instars are more common under natural field conditions. Under ideal laboratory conditions, a generation may be completed in as little as 21 to 23 days. Under field conditions, a minimum of four weeks is required for the completion of a generation.

Dingy cutworm

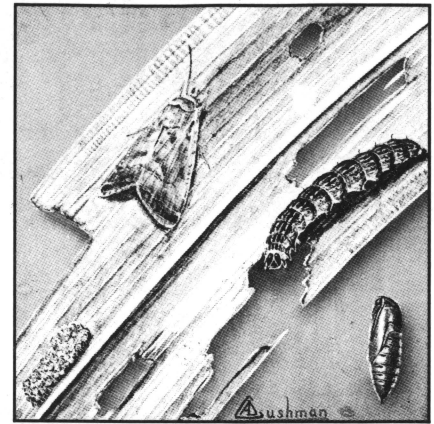
This species overwinters as partially grown larvae and resumes feeding in early spring. They complete their



Cutworms may attack corn by feeding on leaves or by cutting the young plants at or below the ground line.



Armyworm adult, larvae, pupa and feeding injury.



Fall armyworm, hatched egg mass, adult, larva, pupa and feeding injury.

larval development by late May or early June. Pupa- tion occurs in the soil, and adult moths emerge in late August or September. Eggs are deposited in weedy or grassy fields and hatch in about a week. In lower temperatures, newly hatched larvae feed sparingly and grow slowly. They are usually less than one-half inch in length by the time they enter winter hiberna- tion.

The dingy cutworm has only one generation a year. This species appears to be a problem in corn following clover, soybeans, and over-grazed grasslands.

Claybacked cutworm

These cutworms also overwinter as partially grown larvae, which resume feeding in early spring. Larval development is completed by late May or early June. These mature larvae enter the soil and prepare pupa- tion cells but do not transform into the pupa for six to eight weeks. Adult moths emerge during September or early October. Eggs are deposited around the base of favored host plants. Newly hatched larvae feed as long as temperatures allow for green vegetation. Then, they hibernate for the winter.

The claybacked cutworm has only one generation a year and does not occur in damaging numbers every year. Its feeding habits are somewhat different from the other species discussed. Small larvae pull the corn leaf down into the burrow entrance and eat from leaf tip to base. Larger larvae feed in much the same manner by cutting entire leaves or plants at or just above the soil line. Then, they drag the food into the burrow entrance where feeding continues under- ground at their leisure. If you observe a newly germinated field in early morning, you may have the impression that the corn was seeded broadcast be- cause of cut plants standing in the burrow entrances scattered between the rows.

Sandhill cutworm

As the name implies, this species occurs almost exclusively in sandy soils. Unlike the other three species, the larvae of this species rarely, if ever, feed

or are seen above ground. It has not to date been an economic problem in Missouri corn, but during past seasons has damaged a potato field in the bootheel area and a seedling soybean stand in Holt County. Another distinguishing feature is the color of the larvae. Sandhill cutworm larvae have a cream-white body and a dull, reddish-brown head.

This species overwinters as partially grown larvae. They resume feeding in May and complete larval growth by early June. These full grown larvae estivate in underground cells until early August, then change into the pupal stage. The adult moths emerge and are present during late August and September. There is a single generation annually.

Factors affecting subterranean cutworm infestations

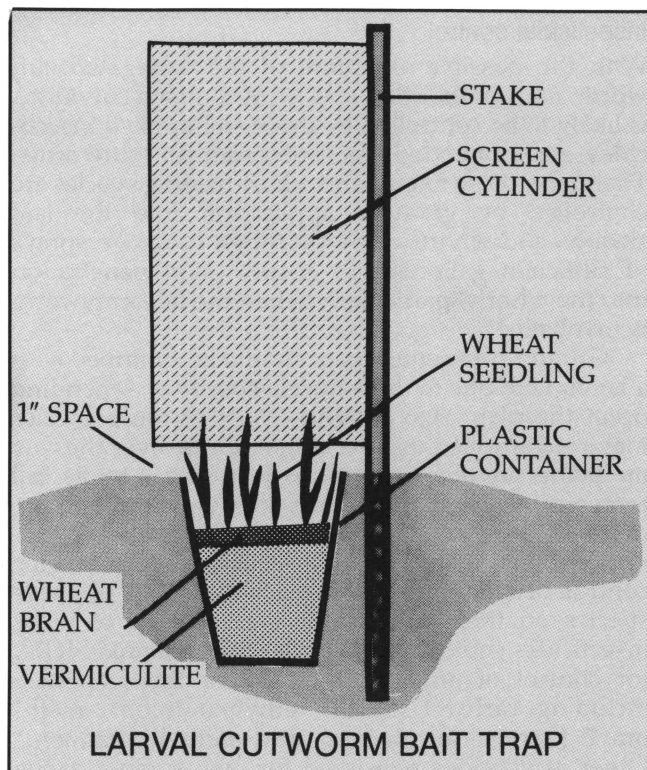
Black cutworm infestations usually follow flooding. This species also occurs more commonly on heavy, blackland soils (river bottoms) and around low, wet spots in fields.

Another factor is above normal temperatures, particularly warm nights during late March and April. Such conditions are favorable for egg laying by black cutworm moths. An early spring allows early weed growth that may influence cutworm egg laying and larval survival.

Tillage practices allowing crop residue and living vegetation to remain on or near the soil surface are more favorable to egg laying and larval survival for several of these species of cutworms. Reports during the past several years indicate an increase in the frequency of black cutworm infestations in corn following soybeans, particularly in those fields where reduced tillage practices were used and where soy- bean harvest residues were unevenly spread.

Cutworm management practices

Cutworms are among the insects that continue to defy most efforts at pest management. Although a few cultural practices reduce the intensity of the problem, in some years nothing works.



LARVAL CUTWORM BAIT TRAP

Practices that may prove advantageous to some growers are:

- Avoiding planting corn in fields with a known history of cutworm problems.
- Avoiding planting of corn following longstanding pastures, meadows, alfalfa or red clover.
- Fall plowing and using shallow tillage to keep down late fall and early spring vegetation where conservation practices allow.
- Cutworm bait trapping.

Larval cutworm bait trapping

Missouri entomologists developed, tested and simplified a cutworm trap for use by farmers and pest management personnel.

Weeds are the primary host of cutworms. Early season weeds are usually eliminated following land preparation, fertilizer and pesticide application, and planting. So in the absence of succulent weeds and grasses, this trap provides wheat, wheat bran, and a screen cylinder to attract cutworms.

These traps attract several species of cutworms, including black, claybacked, dingy, bristly, sandhill, spotted, and variegated cutworms. The black, claybacked, and dingy cutworms are the species found most often in Missouri cornfields.

How to construct traps

The bait trap consists of a 16-ounce plastic Dixie® cup with three to five ¼-inch holes drilled or cut in the bottom for drainage. Fill the cup two thirds full of moistened vermiculite (No. 4 Terra-light® is best). Place untreated wheat seeds (approximately 50) about 2 inches beneath the surface of the vermiculite. Prepare these cups seven to 10 days before use (or before planting your field to corn), and place them in a

sunny location for germinating. Wheat seedlings are attractive to cutworms from emergence to 6 inches in height. Seedlings should be emerged from the vermiculite before use.

To construct the cylinder for the trap cut a piece of aluminum screen 12 by 16 inches, and paint it green. When dry, staple the screen in the form of a cylinder to one end of a wood slat 2 feet in length. The extra length of slat provides an anchor for holding the cylinder above the trap. Research shows the green color acts as a visual attractant and helps guide the cutworms to the trap.

Just before placing the traps in the planted field, place a ½-inch layer of moistened wheat bran on top of the vermiculite. Do not add the bran until the day you will use the traps. It is important to water the traps before transferring them to the field. Also, there must be at least a 2-inch space between the top layer of bran and the top lip of the cup. That way the cutworms entering the traps cannot escape.

How to use the traps

Place at least 10 traps in each 40 acres of corn where cutworm infestations have been a problem in previous years or in fields selected for monitoring. More than 10 traps per 40 acres increase your chances of trapping cutworms, and you will get a more accurate assessment of population pressure.

Research has shown that cutworms are randomly distributed over most fields except on steep slopes. But they are most often associated with weedy or grassy areas and flood plain soils.

Here are the suggested procedures for locating traps:

1. Locate traps at random over the entire field. They should be at least 30 feet apart.
2. Place five traps in each of two areas of the field. Place them in straight lines 30 feet apart.
3. Place all traps in an area of the field where cutworms have been a frequent problem. They should be no closer than 30 feet apart.

The traps should be inserted into the soil so that the top of the cup containing seedling wheat and bran is set in a slightly elevated mound. This prevents the flow of mud and water into the trap during periods of heavy rain.

Place stake for the screen cylinder close to the lip of the cup, and push it into the soil so that the bottom of the cylinder is within 1 inch of the cup lip.

Leave the traps in the field for a minimum of three and a maximum of six days. Remove the trap and dump the trap contents into a pan or other container (preferably white) for hand sifting and counting trapped cutworms.

Reading the results

Black and claybacked cutworms feed by cutting corn seedlings above and at the base of the stem. Both species can be very destructive and if you find a combined average of one or more per trap, plant cutting of economic proportions is likely. If fewer than an average of one half cutworm is found, economic losses are very unlikely.

Table 1. Chances of a corn seedling surviving cutworm damage and producing an ear of corn.¹

Leaf stage	Cut below ground	Cut above ground
	(%)	(%)
Coleoptile	50	80
1-leaf	38	80
2-leaf	21	80
3-leaf	0	80
4-leaf	0	80
5-leaf	0	70

¹Generally, an ear of corn produced by a cut plant is about 15% smaller than ears produced by uncut plants.

Dingy cutworms feed by cutting the leaves of corn seedlings, and, to a lesser extent, the stems. If you find no more than six dingy cutworms per trap, an economic loss is unlikely. (See Table 1.)

Base your decisions for rescue treatment on the following:

- **No cutworms in traps.** Check field for cutting once corn has emerged. Research results have shown that if no cutworms are found in traps, economic damage does not occur. A small amount of cutting (non-economic) may develop, as well as a very few localized *hot spots*.

- **Fewer than one black and claybacked cutworm per trap.** Economic damage is unlikely although some cutting will occur. Cutting will be gradual, and you should scout the field periodically as a safeguard. If you observe more than 6 to 8 percent cutting above ground or 2 to 3 percent cutting below ground, the field should be treated.

- **One to two black and claybacked cutworms per trap.** Economic damage is probable. Monitor the field carefully on a daily basis until the corn is up to a stand, and then monitor frequently until corn reaches the four-leaf stage. If you observe more than 6 to 8 percent above ground cutting or 2 to 3 percent below ground cutting, the field should be treated immediately.

- **More than two black and claybacked cutworms per trap.** Economic damage is very likely, and, if there are more than three per trap, it is almost a certainty. Treat or check the field carefully on a daily basis for cutting. Economic damage may occur within a short period of time when there are more than three per trap. If the field is not treated before corn emergence, apply a treatment when the above ground cutting reaches 6 percent or when below ground cutting reaches 2 percent.

Insecticidal control of subterranean cutworms

During outbreak years, cutworms may still be difficult to control even with the use of insecticides registered for this purpose.

Postemergence or rescue application

The timing for this cutworm control method makes the best use of insecticides and your investment. However, you must be willing to make the effort to detect the problem developing within each of your fields. The timing of such application is based upon need, which may or may not occur.

To determine the need for postemergence cutworm control, begin scouting for cutworm feeding damage when corn is emerging from the soil (spike) and continue scouting until lay-by or mid-June. Insecticidal control efforts would be justified when 6 to 8 percent of seedling plants are being fed upon or cut above ground or when 2 to 4 percent are cut below ground. Use the lower percentage figure with lower plant populations (12,000 to 16,000 range) and gradually increase to the higher percentage figure with higher plant populations (18,000 to 22,000 range).

As **bait** use a 20 percent carbaryl (Sevin) prepared bait applied broadcast or banded over the row at the rate of 5 pounds or 20 pounds 5 percent bait per acre.

As **broadcast spray**, use 1.0 to 1.5 pounds chlorpyrifos (Lorsban 4E), 0.1 to 0.15 pounds fenvalerate* (Pydrin 2.4EC) or permethrin* (Ambush, Pounce) at 0.1 to 0.2 pound per acre applied in a minimum of 2 gallons of water for aerial application and 20 gallons for ground application. Use maximum rates when soil surface crop residues are heavy. Do not use broadcast nozzles with ground equipment because of large droplet size and uneven distribution of spray pattern.

As **basal directed spray**, use 2 pounds carbaryl (Sevin) per acre. Apply a minimum of 20 gallons of diluted spray per acre during late afternoon or evening. Concentrate the spray at the base of plants and soil on both sides of plants, making a band 10 to 12 inches wide.

- A cutworm problem may not develop; therefore, crop production costs are lowered through savings on insecticides.

- Scouting for detection of cutworms provides opportunities for evaluation of stand, early season performance of herbicide and fertility programs, and development of other pest problems such as diseases, weeds and insects.

The disadvantages of postemergence application for cutworm control are:

- It requires scouting ability and time once or twice a week for a month or more for cutworm detection and evaluation of infestation.

- Weather conditions may delay prompt application. This may result in additional stand loss.

- A crusted or dry top 2 to 3 inches of soil usually reduces insecticide performance.

- Unexpected, heavy rainfall may increase erosion and result in runoff water contaminated by soil and insecticide.

Planting time application of some granular rootworm insecticides

Planting time application of certain insecticide granules appear to be the most economical method under

the following conditions: continuous corn, fields subject to annual or frequent cutworm problems, and reduced tillage fields with considerable crop residues on or near the soil surface. Such application to very early plantings (before mid-April) probably will not provide residual control of heavy infestations. Under these conditions, stands may be reduced to the point that rescue treatment or even replanting is required.

Apply the granular insecticide as a row band application at the recommended rootworm rate (1 pound active ingredient per acre on 40-inch rows). Cover and incorporate to a depth of 0.5 to 1 inch. Use either chlorpyrifos (Lorsban 15G), ethoprop (Mocap 15G), fonofos (Dyfonate 10G or 20G). Compounds registered for suppression are carbofuran (Furadan) and terbufos (Counter). Remember that label claims for these products state that they are "aids in the control of" or that they "reduce damage from light to moderate infestations." If there is a heavy cutworm infestation, a rescue application of bait or spray will help. But you must detect and evaluate the need before excessive cutting and while cutworm larvae are less than half grown.

The advantages of planting time application of some granular rootworm insecticides are:

- Application with the planting operation reduces the use of petroleum energy.
- It provides control of some other soil insect problems such as seed corn maggot and seed corn beetle. When applied after mid April, it reduces damage from wireworms, corn rootworms and annual white grubs.

The disadvantages of planting time application of some granular rootworm insecticides are:

- Application may not protect stand under conditions of heavy cutworm infestation.
- There must be moisture to activate granules.
- Granular insecticide expenditure, solely for cutworms, may or may not be justified.

Preplant, broadcast, incorporated application

The increased insecticide rates and their costs make this method of application the least attractive to producers. These compounds are:

- 1) Chlorpyrifos (Lorsban 4E) 1.0 to 2.0 pounds active ingredient per acre.
- 2) Diazinon (14G, 50W or AG500) 4.0 pounds active ingredient per acre.
- 3) (RU) Fonufos (Dyfonate 4EC) 4.0 pounds active ingredient per acre.

These compounds give better performance when applied no more than three weeks before the expected appearance of cutworm larvae, which is usually mid to late May. Lorsban and Dyfonate are compatible with liquid fertilizers and with most of the incorporated corn herbicides. However, the compatibility of each mixture of pesticides should always be checked before tank mixing.

Preplant, broadcast, NOT incorporated application

- 1) (RU) Use 0.1 to 0.2 pound fenvalerate (Pydrin

2.4 EC) applied in a minimum of 2 gallons of water for aerial application and 20 gallons for ground application.

- 2) (RU) Use 0.1 to 0.2 pound permethrin (Ambush 2E, Pounce, 3.2EC) applied in a minimum of 2 gallons of water for aerial application and 20 gallons for ground application.
- 3) (RU) Use 0.1 to 0.2 pound permethrin granules (6 to 13.3 pounds of Pounce 1.5G).

It should be reemphasized that the best use of insecticides for cutworm control would be scouting for early detection of cutworms or damage and post-emergence or rescue application of recommended compounds. Read and follow label instructions and precautions.

Climbing or species feeding above ground

Several of our common whorl and foliage feeding insect pests of corn are larvae of climbing cutworms. Included under climbing cutworms are variegated cutworm, armyworm, yellow-striped armyworm and fall armyworm.

Life cycles

Like the subterranean cutworm species, all of the climbing cutworms have four separate developmental stages: egg, larva, pupa, and adult. During the adult stage these species are moths capable of flying long distances. They usually migrate northward through the state.

Eggs of these species are deposited on the lower leaves or stems of hosts. Egg masses of climbing cutworms vary considerably in their appearance. Egg masses range from one or more short rows of closely packed eggs (armyworm) to tightly packed, exposed masses (variegated cutworm) to tightly packed masses covered by body scales (fall armyworm and yellow-striped armyworm). Eggs hatch in three to seven days.

Larvae feed by chewing foliage above ground throughout this stage of development. Three to five weeks are required to complete larval development. Pupation occurs in the soil, usually within the top inch.

Adult moths emerge from the pupae and soil within two to three weeks. Thus, a complete cycle may require from six to nine weeks. There may be two or three generations annually, but normally only one of the generations causes extensive injury.

During mild winters, the armyworm and variegated cutworm may successfully overwinter in Missouri as either partial to full grown larvae or as pupae. The fall armyworm and yellow-striped armyworm are not known to overwinter in Missouri. Therefore, infestations of all these species are dependent upon or are supplemented by moth migration from the southern states.

Climbing cutworm management practices

Because of the migratory habits of the adults and the above-ground feeding of the larvae, tillage practices and variety selection offer little or no opportunity for control. Thus, early detection of infestations and insecticidal control are the viable alternatives. However, there is some information about timing and egg laying preferences that should aid you in detection.

1. Both armyworms and variegated cutworms rarely deposit eggs within clean tilled fields. Both species prefer dense, green vegetation for egg laying sites. The armyworm chooses small grains and grasses, and the variegated cutworm prefers clovers and alfalfa. This means that if extensive damage to corn is to occur, it must come from larval movement from a bordering host into the corn or with no-tilled planting into these hosts. Both species are in the larval stage from mid May to early June.

2. Yellow-striped armyworm larvae may be found feeding in or near the whorls of corn from late May through June. This species rarely reaches the economic injury level in corn.

3. Fall armyworms migrate into southern Missouri in late June and July. Whenever larvae of this species are found in June, this is a good indicator of economic problems developing in late planted, pre-tassel corn throughout the remainder of the growing season.

Economic injury levels

Economic thresholds have not been established for each of these climbing cutworm species on corn. It is, therefore, easier and more useful to categorize those species with similar feeding habits as follows:

1. Insecticidal control is justified when any one or combined populations of armyworm, variegated cutworm or yellow-striped armyworm average two larvae per plant on 25 to 30 percent of plants with four to six fully extended leaves, or an average of one larva per plant on 75 percent of the plants.

2. Insecticidal control would be justified when 20 to 25 percent of plants less than 3 feet in height show leaf or whorl feeding caused by fall armyworm.

Insecticidal control

With the possible exception of the variegated cutworm, none of the other species of climbing cutworms is likely to be controlled by those soil-applied insecticides recommended for subterranean cutworms. Therefore, these foliage and whorl-feeding species are controlled by granular application into the leaf sheaths and whorls or by thorough coverage sprays of sufficient gallonage to ensure good penetration into the whorls, particularly when the fall armyworm is involved.

Ground spray equipment should be equipped with a boom with one to three nozzles per row, depending upon the plant size (height). Most of these species may be controlled using a single nozzle over the row on plants in the four- to six-leaf stage, while fall armyworm control on 30-inch corn will require three nozzles per row.

Very few, if any, of the insecticides registered for control of climbing cutworms will list all of these species on their labels. However, several of these insecticides could be used under the amended FIFRA for control of any, most, or all of these species, including carbaryl (Sevin), ethylparathion*, methomyl* (Lannate or Nudrin), and methyl parathion.* Other insecticides registered for one or more of the climbing cutworm species, but not for all species, include chlorpyrifos (Lorsban), diazinon, fenvalerate* (Pydrin), malathion and trichlorfon (Dylox). Please consult specific product labels for required dosage, other application information, safety precautions, and required time before harvesting.

Illustrations from BFC Chemicals, Inc.

An asterisk () following any insecticide means that all or some uses of the product have been restricted by the Environmental Protection Agency. Applicators must be certified and licensed before they may purchase restricted products.

Missouri insect control recommendations are revised annually and are subject to possible change during the growing season.