Crop Profile for Corn (Sweet) in Delaware

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Production Facts

- In 2002, 692,819 acres of sweet corn were harvested for sale in the United States. Of that, 423,494 acres were for processing (1).
- In 2005, 10,300 acres of sweet corn were harvested for sale in Delaware. Of that, 7,300 acres were for processing and 3,000 acres were for fresh market (2).
- In 2005, the value of production in Delaware was $6,600,000 for fresh market sweet corn and $3,823,000 for processing sweet corn (2).

Production Regions

Sweet corn is grown throughout Delaware

Cultural Practices (3)

Sweet corn is a warm-weather crop. It can be planted in early spring, with successive plantings in later spring and summer. However, in Delaware, corn planted later suffers much higher earworm damage. Corn germinates best in soil temperatures above 55 degrees F. The four major variety groups are white, yellow, bicolor, and supersweet varieties. Hybrids or varieties resistant to Stewart's wilt should be used. Seed should be treated with a fungicide. Some varieties that grow well in Delaware include:

Yellow: Northern Belle and Gold Cup
White: Quick Silver and Silver Queen
Bicolor: Sweet Sue

Sweet corn varies in days to maturity and is divided into early-, mid- and late-season maturing varieties.

Good soil fertility is important in growing high-quality sweet corn. The soil pH should be within a range of 6.0 to 6.8. Add lime to soil to maintain this pH range--generally 50 pounds of ground limestone per 1,000 square feet every 3 to 4 years. Broadcast fertilizer rates are 2 to 3 pounds of 5-10-10 or 10-10-10 per

100 square feet. A sidedressing of 10-10-10 or ammonium nitrate when the corn is 10 inches high can help to increase the yield and quality.

Sweet corn is planted at a depth of 1 to 2 inches in rows 30 to 36 inches apart, with 10 to 12 inches between seeds. Too many seedlings in a row act like weeds, choking out the crop. Since pollen is carried across the rows by wind, sweet corn is never planted adjacent to field corn. They will cross-pollinate, resulting in sweet corn with poor flavor and quality.

Sweet corn requires a continuous supply of water for a high-yielding, quality product. If rainless periods last more than 2 weeks in the early growth stages, irrigation is used. As corn begins to tassel, continuous water supply becomes critical. Water is needed--about 1 inch per week from tasseling through harvest.

Sweet corn is harvested when the silks from the ear are brown and dry beyond the end of the husks. The ear should fill the husk so that the husk feels tight around the ear. Mature, kernels are soft, tender, and filled with a milky juice. After harvest, sweet corn begins to lose quality very quickly.

Worker Activities and Timing (4, 5)

Seeding – Seed is sown with plateless planters as early as the last week in March. Successive plantings can be made into early July.

Cultivation/ weed control – Weed control is accomplished primarily through use of clear plastic mulch and herbicides.

Harvest – 45 to 60 days after planting. Some fresh market sweet corn is harvested by hand. All processing sweet corn is harvested mechanically

Insect Pests

The most important pests in sweet corn are those which invade and damage corn ears, primarily European corn borer, corn earworm, and fall armyworm. Another important early season pest is the black cutworm, though cutworm infestations tend to be more sporadic than the ear-invading pests. The corn flea beetle can be a problem on some varieties, as a vector of Stewart's bacterial wilt disease early in the season.

European corn borer (Ostinia nubilalis)

Damage and Life Cycle
The European corn borer is a serious pest of sweet corn. Female moths lay their eggs on the underside of corn leaves from mid-May to early June. Eggs hatch in 3 to 7 days, depending upon temperature. The emerging larvae feed on leaves within the inner whorl of the plant. Larvae damage the whorls, which may affect

yields for certain varieties, depending on the timing of the damage. During tassel development, larvae tunnel into the stalk, where extensive tunneling sometimes causes breakage. Eventually, larvae outgrow the stalk and move to the developing ear, where they may feed on the silks. Larvae enter the ear via the silks, or from the shanks or side by burrowing through plant tissues. They feed on kernels throughout the cob, causing extensive damage to the ear and reducing marketable yields. European corn borer generally has 2 to 3 generations in Delaware. It overwinters as a larva in its burrow in the sweet corn stalk or in the stem of a different host plant. Larvae pupate from late April to early May, and adults emerge after 2 weeks to continue the next cycle.

Frequency of Occurrence
European corn borer is present and affects sweet corn yields every year; however, the percent of ears damaged and the timing of the damage can fluctuate from year to year. Annual fluctuations in moth populations affect insecticide applications for European corn borer.

Corn earworm (Helicoverpa zea)

Damage and Life Cycle
Corn earworm is the most destructive pest of sweet corn. In the mid-Atlantic, pupae overwinter in the soil, but only survive in areas where the frost line is less than an inch below the soil surface. Surviving moths emerge and mate, and females deposit eggs on sweet corn foliage. The early-season larvae that hatch from these eggs may feed on the whorls or undeveloped tassels, but this feeding rarely affects corn production or quality. Adult corn earworms are highly mobile, and moth populations invade the Mid-Atlantic region from the south by mid-summer. Migrant females lay eggs singly on fresh corn silks during July and August. These larvae hatch in 3 to 5 days and begin feeding on the silks, working their way into the ear, where they continue feeding on kernels. Larvae feed and develop for 10 to 21 days, then cut through the husk as they exit the ear. They drop to the soil, where they pupate for about 14 days, after which adults emerge to begin the next generation.

Frequency of Occurrence
The severity of winter temperatures and the amount of snowfall greatly influence the overwintering range of corn earworm from year to year. Adults produced from this first generation plus those migrating from southern states produce the larval generations which invade the ear. The timing and magnitude of these summer broods vary considerably from year to year and from region to region, and are influenced by winter and spring weather conditions.

Fall armyworm (Spodoptera frugiperda)

Damage and Life Cycle
The fall armyworm overwinters in Florida and the Gulf Coast. Each year, adult

moths migrate into the Mid-Atlantic region, usually in late June. Eggs are deposited on the underside of corn leaves. Plants can compensate for feeding damage in the whorl stage, although extensive feeding during the early whorl stage may stunt the corn and reduce yields. Larvae also feed on undeveloped tassels. Larvae feed and develop for 2 to 3 weeks, then pupate in the soil. A new brood of moths emerges within 2 weeks to continue the life cycle. There are 2 or 3 generations per season in Delaware. Late in the season, when whorls are not available, larvae may enter ears through the silk tube and feed on kernels, causing severe damage to the ear. Fall armyworm becomes such a problem late in the season that it is a limiting factor in the production of late season sweet corn maturing after August 21.

Frequency of Occurrence

Fall armyworm is considered a sporadic but important pest throughout the Northeast. It moves into the Mid-Atlantic region from the south, and the timing of its arrival is dependent on weather patterns. Also, moths are generally more numerous along coastal regions. A cold, wet spring in the south can promote fall armyworm survival.

Normally, fall armyworm starts to cause economic damage in late July and then infestations steadily increase through the remainder of the growing season, however, moths can arrive as early as late June, at which time they lay eggs on whorl stage corn. The timing of moth arrival as well as the population level will influence the number of insecticide applications.

True armyworm (*Pseudaletia unipuncta*)

Damage and Life Cycle

True armyworms overwinter in soil or debris as partially developed larvae, completing their development in early spring and then pupating. Moths emerge from late April to early May and deposit eggs on corn and other grasses. Larvae feed on seedling and early whorl stage corn during late May and June. Feeding results in characteristically ragged leaves. Later plantings of sweet corn may also be damaged by a second generation of larvae. This pest typically produces 3 generations a year.

Frequency of Occurrence

True armyworm is a sporadic and minor pest of sweet corn. Infestations can occur in fields bordering small grains, which often harbor this pest. In addition, significant damage can also occur when corn is planted no-till into small grain cover crops. Larval damage can be significant in no-till situations.

IPM Program

Whole field scouting is needed for fields planted no-till into small grain covers. Field edges bordering small grains are routinely scouted for armyworm infestations. Occasionally, edges of sweet corn fields and small grain fields are treated to prevent migration of armyworms into sweet corn. The need for treatment is based on the percent and severity of damaged plants and the average larval size.

Worm Pests

Loose husked varieties and ears with short or no silk tubes are more susceptible to worm damage.

Bacillus thuringiensis--Attribute® insect protection varieties are available that provide control of worm pests that infest corn. For more information, visit www.rogersadvantage.com. Bt sweet corn hybrids provide virtually 100% protection against European corn borers, thus no insecticides are needed during the whorl or tasseling stages, or even during silking if this pest is the only concern. However, corn earworms and fall armyworms are more tolerant to the expressed Bt protein, and unsprayed corn is also exposed to silk feeding by corn rootworm adults which can reduce pollination, thus insecticide sprays may be needed to ensure fresh market quality when these pests are active. Under moderate moth activity and good growing conditions, one and sometimes two applications may be warranted, depending on the ear quality standards required for marketing. When moth activity is high (late August-early September), many eggs are laid later in ear development after the expressed protein has degraded in wilted/brown silk tissue. This loss of Bt activity is also accelerated by hot, dry conditions, which cause rapid desiccation of the silk tissue. As a result, earworms and armyworms have a greater chance of surviving and invading the ear. Under these conditions, up to 40% of the ears can become infested with small earworm or fall armyworm larvae, which may pose a quality problem. Spray regimes of three or four applications spaced 3-4 days apart may be required when moth activity is high. The first insecticide application in Bt sweet corn should be directed at the ear zone at 100% silking (usually 3-4 days later than the first silk spray in non-Bt corn), and applications repeated if high moth activity continues.

Corn rootworm adults, Japanese beetles, other silkfeeders, and sap beetles also can cause ear quality problems in Bt corn, because the expressed protein is not active on these insects. High rates of silk feeding prevent adequate pollination. On farms with a known history of sap beetle problems, an insecticide spray should be applied when 50 to 75% of the ears have wilted silks (the time when sap beetle larvae begin to hatch on silks). Usually one spray is enough for sap beetle control, especially for hybrids that exhibit good tip coverage. When more than 50% of ears have fresh silks cut back by rootworm adults and the plants are still pollinating, an insecticide spray is recommended.

European Corn Borer (ECB)
Thorough spray coverage in whorls and on plants is essential. Granular formulations, if applied over the whorl, are generally more effective than liquid formulations for ECB control.

- Asana XL--5.8-9.6 fl oz 0.66EC/A
- Avaunt--2.5-3.5 oz 30WDG/A (whorl application only)
- Baythroid XL--1.6-2.8 fl oz /A
- Entrust--0.5-2.0 oz 80W/A
- Mustang MAX--2.8-4.0 fl. oz/A
- Intrepid--4-8 fl oz 2F/A (for early season whorl treatment)
- Lannate--1.5 pt LV/A
- Larvin--20-30 fl oz3.2 F/A, or
- Penncap-M--2-3 pt 2FM/A. Do NOT use Penncap-M during tasseling and pollen shed as it will seriously reduce bee populations
- permethrin--4-8 fl oz 3.2EC/A
- SpinTor--1.5-6 fl oz 2SC/A
- lambda-cyhalothrin (Warrior;generics available)--2.56-3.84 fl oz/A

Corn Earworm (CEW)

- Asana XL--5.8-9.6 fl oz 0.66EC/A
- Baythroid XL--1.6-2.8 fl oz/A
- Entrust--2.0 oz 80W/A
- Mustang MAX--2.8-4.0 fl. oz/A
- Lannate--1.5 pt LV/A
- Larvin--20-30 fl oz 3.2 F/A
- permethrin--4-8 fl oz 3.2EC/A
- SpinTor--3-6 fl oz 2 SC/A
- lambda-cyhalothrin (Warrior;generics available)--2.56-3.84 fl oz/A

Fall Armyworm (FAW)
For whorl applications, direct spray over the plants so that it penetrates leaf whorls when FAW first appears and repeat application, if necessary. For foliar spray applications, high spray gallonage (50 to 75 gallons per acre) is necessary for effective FAW control.

- Avaunt--2.5-3.5 oz 30WDG/A (whorl application only)
- Baythroid XL--2.8 fl oz /A (first and second instar only)
- Entrust--1.0-2.0 oz 80W/A
- Lannate--1.5 pt LV/A
- Larvin--20-30 fl oz 3.2 F/A
- Spintor--1.5-6.0 oz 2SC/A
- lambda-cyhalothrin (Warrior;generics available)--2.56-3.84 fl oz/A

True Armyworm

- Asana XL--5.8-9.6 fl oz 0.66EC/A
- Baythroid XL--1.6-2.8 fl oz /A

- Entrust--1.0-2.0 oz 80W/A
- Intrepid-4-8 fl oz 2F/A (for early season whorl treatment)
- Mustang MAX--2.8-4.0 fl. oz/A
- Lannate--1.5 pt LV/A
- Penncap-M--2-3 pt 2FM/A
- Spintor--1.5-6.0 oz 2SC/A

Insect Control--Decision Making
Fresh Market

Whorl/Tassel Infestation

In general, insect larval feeding (ECB and FAW) during the whorl stage of sweet corn development has a greater impact on early planted, short-season varieties. For ECB on early plantings, apply first spray when 15 percent of the plants show fresh feeding signs. Additional applications may be necessary if infestation remains above 15 percent. An early tassel treatment is usually more effective than a whorl treatment because larvae are more exposed to the chemicals.

The impact of infestation on mid- and late-season plantings depends on the stage of the plants when the infestation occurs. Treat for FAW during the early whorl stage when more than 15 percent of the plants are infested. During mid- to late-whorl stages, treatment for both FAW and ECB may be necessary if more than 30 percent of the plants are infested. Treat fields in early tassel stage if more than 15 percent of the emerging tassels are infested with ECB, FAW, or young CEW larvae.

Ear Infestation

Direct sampling for CEW, FAW, and ECB during silking is not practical because of the low thresholds of ear damage. Begin treatment when ear shanks are first visible. Silk sprays should continue on a schedule based on area blacklight and pheromone trap counts, geographical location, and time of year. Early in the season, silk sprays may be required on a 3- to 6-day schedule. When CEW populations are heavy, it may be necessary to treat on a 2- to 3-day schedule.

Applications during the low populations can be terminated up to 5 days before last harvest. During heavy populations and high temperatures, treatments will need to be made according to the legal "days to harvest" of the chemical. For best control during heavy populations, maximize the gallonage of water per acre, use a wetting agent, and make applications during the early morning. If irrigation or rains wash off the spray within 24 hours after an application, repeat treatment as soon as the foliage dries.

Processing

Whorl/Tassel Infestation

The ECB is the major whorl pest in early planted corn. Larvae that hatch prior to tassel emergence feed on the whorl leaves and cause yield losses. Decisions to treat whorl infestations are based on the percentage of "infested" plants with light

(LD), moderate (MD), or heavy (HD) feeding damage.

"Infested" plants are classified as: light damage (LD less than 10 percent of the leaf area is affected), moderate damage (MD = 10 to 50 percent of the leaf area is affected), and heavy damage (HD = all leaves are dam-aged).Treat if the market value of the expected yield loss exceeds twice the cost of a whorl application. Expected yield loss is calculated as 0.08 x LD + 0.24 x MD + 0.44 x HD. Count only damaged plants with live larvae.

Ear Infestation

The four insects that normally infest the ears of corn grown for processing are the ECB, CEW, SB, and FAW. Decisions to treat are based on the percent-age of ears that are potentially damaged by a combination of these pests that occur during the silking period. A primary ear on a plant is potentially damaged if: (1) the plant has one or more ECB or FAW egg masses on it, (2) there are one or more CEW or SB eggs in the silk of the primary ear, or (3) young larvae of any of the four species are feeding in the silk of the ear.

When 50 percent of the corn in a field is silking, treat if 5 percent of the plants in silk meet one or more of the above criteria. At 100 percent silking (about 16 to 18 days before harvest), treat if 10 percent of the plants fall into one or more of the above categories. At 100 percent brown silking (10 to 12 days from harvest), treat if 20 percent of the ears have larvae feeding on the silks or in the silk tube.

When overall moth activity is high, fixed-treatment schedules according to blacklight trap catches should be used. Moth units are calculated by multiplying the average number of CEW moths in a region over 5 days times 5 and adding the value of the average number of corn borer moths in a region over 5 days. If moth units fall between 75 and 150 per 5 days, fixed schedules of 1 to 2 insecticide treatments are recommended. Fixed schedules of 2 to 5 insecticide treatments applied 3 or 4 days apart are recommended if the average number of moth units for a region exceeds 150 per 5 days.

Other Major Insect Pests in Delaware

Cutworms

Damage and Life Cycle

Cutworms are a sporadic but potentially serious early-season pest of sweet corn in the Northeast. Black cutworm (*Agrotis ipsilon*), the most damaging cutworm species in sweet corn, also feeds on a broad range of other vegetable crops. The life cycle is not completely known for this pest in the Mid-Atlantic states. It may overwinter as a mature larva or a pupa, or perhaps adults are carried on the wind from the South. Females deposit eggs on debris or dense weeds in moist soil during April and early May. Eggs hatch in 7 to 14 days, and young larvae feed on

the leaves of young corn plants. Larger larvae bore into plant stems or cut stems at or below ground level**.** Larvae develop through 7 instars, feeding for 4 or 5 weeks before pupating in the soil. Two more generations appear in the summer, but are not damaging to corn.

Frequency of Occurrence

Cutworms are a sporadic but serious pest of sweet corn. In many cases, infestations are lower on sweet corn than field corn, because most fields are conventionally-tilled and rotated with other crops, and thus do not possess the field characteristics that favor cutworms. However, sweet corn growers who use no till or minimum tillage practices, or those who rotate with small grain rather than vegetable crops, typically have more cutworm problems.

IPM Program

Sweet corn fields are scouted for cutworm damage from April through early June, and blacklight and pheromone traps are used to monitor adult populations. Treatment is recommended at the 1 to 2 leaf stage if more than 10% of plants show larval feeding damage or 3% cut plants. Corn in the 3 to 4 leaf stage is treated if 5% of plants have been cut and 4 or more cutworms are found per 100 plants. However, stand count has an influence on management decisions, since it will affect the amount of damage that can be tolerated. Generally, growers only treat areas that have a history of cutworm infestation, or when a problem occurs.

Chemical Controls

Preplanting Treatment

- Lorsban--2-4 pt 4E/A in minimum of 10 gallons of water. Apply as a broadcast spray and incorporate into top 2 to 4 inches of soil

Planting Treatment

- Force--3-4 oz 3G/1,000 ft of row banded, T-banded, or infurrow (first year corn only)
- Fortress--6-7.5 oz 2.5G/1,000 ft of row in a T-band or infurrow
- Lorsban--8 oz 15G/1,000 ft of row. Apply as a 6- to 7-inch wide band behind the planter shoe and incorporate into top 1 inch of soil.

Postplanting Treatment

- Asana XL--5.8-9.6 fl oz 0.66EC/A
- Baythroid XL--0.8-1.6 fl oz/A
- Lorsban--1-2 pt 4E/A as an aerial or ground equipment broadcast application
- Mustang MAX--2.24-4.0 fl oz/A
- permethrin--4-8 fl oz 3.2EC/A
- Sevin Bait--30-40 lb 5% bait/A
- lambda-cyhalothrin (Warrior;generics available)--1.92-3.0 fl oz/A

Alternative Controls

None available

Corn flea beetle (*Chaetocnema publicaria*)

Damage and Life Cycle

Corn flea beetles overwinter as adults in litter and debris around fields and feed on weeds until early corn seedlings become available in late April or May. Eggs are scattered in the soil at the base of young corn plants. Larvae hatch in 10 to 14 days and feed on the roots for 3 to 4 weeks before tunneling into the soil to pupate. Three or more generations are completed annually. Direct damage due to adult feeding on leaves is insignificant except in the most severe infestations of slow-growing sweet corn varieties; however, feeding can transmit Stewart's bacterial wilt (also known as bacterial wilt disease) to susceptible varieties. Some of the processing varieties and many of the fresh market varieties are susceptible to Stewart's wilt. The disease appears in late May and becomes progressively worse throughout the season. Incidence of bacterial wilt on sweet corn has been shown to be directly related to the size of corn flea beetle populations. Control of the flea beetle is the primary means of preventing the disease.

Frequency of Occurrence

In recent years corn flea beetle has become an increasingly important pest where annual populations justify preventive control of the beetle to discourage the spread of Stewart's bacterial wilt. The most severe infestations occur when a mild winter is followed by a cool spring.

IPM Program

Flea beetles are an important component of IPM programs in Delaware. Scouting for beetles throughout the fields during the spike stage on calm sunny days can give an indication of the level of beetle activity. Treatment is recommended if 5% of plants or more are infested with beetles. Fields are scouted following preventive insecticide application, since sometimes systemics provide insufficient control when beetle pressure is high.

Chemical Controls

Corn Flea Beetle

Soil-applied insecticides may be ineffective if soil temperatures are cool. Foliar applications of an insecticide may be necessary during this period.

- Asana XL--5.8-9.6 fl oz 0.66EC/A
- Baythroid XL--0.8-1.6 fl oz/A

- Counter--6-8 oz 15G/1,000 ft of row in the seed furrow or 8-16 oz 20CR/1,000 ft of row if banded
- Cruiser 5FS (thiamethoxam)--1.28-5.1 fl oz/100 lbs of seed. Available only as a commercially applied seed treatment. (Restrictions: treated areas may be replanted immediately following harvest or as soon as practical following the last application with any crop on this label or to cucurbit vegetables, fruiting vegetables, tuberous and corn vegetables, and tobacco. For all other crops, a 120-day plantback interval must be observed.)
- Furadan--2.5 fl oz 4F/1,000 ft of row in the seed furrow at planting
- Mustang MAX--2.24-4.0 fl oz/A
- Gaucho 480--8 oz/cwt seed. Available only as a commercially applied seed treatment. (Restrictions: A 30-day plant back restriction should be observed for buckwheat, millet, oats, popcorn, rye, soybeans, beans [except succulent shelled and edible podded], and peas.)
- Lannate--1.5 pt LV/A
- Lorsban--1-2 pt 4E/A
- permethrin--4-8 fl oz 3.2EC/A
- Poncho 600 (clothianidin)--1.13 fl oz/80,000 units of seed. Available only as a commercially applied seed treatment. (Restrictions: Areas planted with treated seed may be replanted immediately with field corn, popcorn, sweet corn, rapeseed and canola. These areas may also be replanted after 30 days with cereal grains, grasses, nongrass animal feeds, soybeans, dried beans, root and tuber vegetables. Any crop without an earlier plant back interval has a 4-month plant back interval.)
- Sevin--1.25-2.5 lb 80S/A
- lambda-cyhalothrin (Warrior;generics available)--2.56-3.84 fl oz/A

Pesticide Use Issues

On the Eastern Shore, the loss of systemic soil insecticides for control of flea beetle would result in a significant increase in the number of foliar applications. Also, these products give a broad spectrum of control with a single economical application, suppressing populations of soil pests such as wireworms and grubs in addition to controlling flea beetles. Flea beetle control is critical to prevent outbreaks of bacterial wilt, which in extreme cases have resulted in up to 80% yield loss in some fields. Typical annual yield loss from bacterial wilt in fresh market sweet corn in Delaware is about 2-3% yield loss.

Alternative Controls

Most processing varieties show some level of resistance to bacterial wilt. Where possible, growers use cultivars resistant to bacterial wilt disease, especially for early plantings during cool springs following mild winters. However, market demands often require that growers choose susceptible varieties with other characteristics over varieties with bacterial wilt resistance.

No biological control strategies are available to control this pest.

Dusky sap beetle (*Carpophilus lugubris)*

Damage and Life Cycle

Adult and pupal stages of the dusky sap beetle overwinter in corn refuse in the soil or in protected places above ground. Adults are first noticed at about the time tassels appear on the earliest sweet corn. They invade corn borer tunnels and feed on frass. They also feed on the pollen as it ripens on the tassels and later as it lodges in the leaf axils. Mating and egg laying begin when the females are 5 to 6 days old. Eggs are deposited on worm frass and wet accumulations of pollen, which are suitable for larval development if these sites remain moist for 10 to 14 days. Sap beetle activity increases as the corn matures, and adults usually invade the ear when the silks begin to turn brown. The majority of eggs are laid on worm frass at the ear tip or scattered through the silk strands. As the larvae hatch, they move deeper into the ear where they penetrate and hollow out the developing kernels. Full-grown larvae leave the ear and burrow into the soil to pupate. At least 2 or 3 overlapping generations occur each year in the mid-Atlantic region.

Frequency of Occurrence

Dusky sap beetle is a sporadic but important pest of sweet corn. Previously, this pest was controlled by chemical applications made for key pests. It is an emerging problem in Bt sweet corn where these chemical applications have been reduced. Winter survival is an important factor in determining the spring population. Many overwintering adults are killed by freezing temperatures during December and January. Sap beetle problems are most severe during late June, July, and into August, particularly if corn is damaged by other pests, such as European corn borer or corn earworm. Sap beetle problems are most likely to occur on farms producing a variety of fruit and vegetable crops. The number of beetles present each year affects management decisions, which are based on thresholds.

IPM Program

Loose-husked varieties and ears damaged by other insects are more susceptible to sap beetle attack. Varieties with long, tight silk tubes can reduce SB damage by 50%. Corn is sampled when fresh green silking is complete and wilted silks are present. The silk area at the tip of 20 primary ears at each of 5 sites per field are inspected to determine the percent of ears infested with adult beetles, eggs, or larvae. Begin sampling at pollen shed and treat when 5 percent of the ears have adults and/or eggs. Insecticides used for worm control at silk may not control SB infestations. *Bacillus thuringiensis* sweet corn will NOT control SB.

Chemical Controls

- Asana XL--5.8-9.6 fl oz 0.66EC/A,
- diazinon--2.5 pt 4EC/A
- Lannate--0.75-1.75 fl oz LV/A
- Mustang MAX--2.24-4.0 fl oz/A
- Penncap-M--2-5 pt 2FM/A
- lambda-cyhalothrin (Warrior;generics available)--2.56-3.84 fl oz/A

Note. Use Penncap-M 2FM and Sevin only after pollen shed is complete to prevent bee loss.

Alternative Controls

Most growers minimize sap beetle problems by using tight husk varieties with good husk extension. Deep tillage in the fall to destroy overwintering stages and use of crop sanitation practices during the growing season minimize alternative food sources and help to reduce the build-up of sap beetle populations on a farm.

No biological control strategies are used to control this pest.

Minor Insect Pests in Delaware

Minor Soil Insect Pests: Seedcorn Maggot, wireworm and white grubs

Seedcorn maggot, wireworms, and white grubs are minor pests of sweet corn, and rarely cause major economic damage. These pests are generally controlled by chemical applications directed at important pests such as flea beetles.

Seedcorn maggot (*Delia platura*)

Damage and Life Cycle

Seedcorn maggot is a common insect throughout the Northeast. Adult flies emerge from overwintering puparia during spring planting time and females lay eggs just below the surface of the soil. Eggs hatch in 4 to 7 days, and emerging larvae feed on decaying organic matter. Maggots may burrow into the corn seed and consume the germ, preventing germination. Larvae feed for 21 days, then pupate in the soil. There are 4 to 5 generations per season, but only the first and second generations are a problem, since they coincide with planting times. When damage occurs, it is often extensive, covering much of the field.

Frequency of Occurrence

Seedcorn maggot is a rare pest of sweet corn, since insecticide seed treatments are used by nearly all growers. Injury is most severe in cool wet springs when

germination is delayed. Fields high in crop residue and other organic matter are more susceptible to high levels of infestation.

Wireworms

Damage and Life Cycle

Wireworms are the larvae of click beetles (Elateridae). Several species attack corn and a variety of other grasses. Eggs are deposited on host plants in late spring. Larvae infest the soil, hollowing out seeds and pruning roots, making them susceptible to rot. They may also tunnel into or feed on the underground portion of seedling stems, causing wilting, distorted growth, and often plant death. Larvae feed and develop for 3 to 5 years before pupation.

Frequency of Occurrence

Wireworms are rarely a problem in sweet corn. They are most commonly found in corn fields where the preceding crop was pasture, hay, or sod. They do the most damage during cool, wet springs.

White grubs (Scarabidae)

Damage and Life Cycle

The adult scarab beetles which produce white grubs prefer to lay their eggs in fields which have extensive weed growth during mid-summer. Larvae hatch during late-summer and move through the soil where they feed on the roots of sweet corn, causing wilting, stunting and eventually death of young plants if infestations are heavy. Damage is usually localized. White grubs feed and develop as larvae for 1 to 4 years, depending upon the species.

Frequency of Occurrence

White grubs are rarely a problem in sweet corn. Like wireworms, white grubs are most commonly found in corn fields where the preceding crop was sod or other grasses. They thrive best in cool, wet soils.

IPM Program for minor soil pests

Seedcorn maggot, wireworms, and white grubs are not a major focus of IPM programs in sweet corn. Feeding by all of these pests can result in wilted or stunted plants that often die. In addition, reduced germination is characteristic of seedcorn maggot and wireworms. Damage from grubs and wireworms tends to be localized within a field, while seedcorn maggot damage can cover most of a field. These symptoms can be recognized by an IPM scout. In areas where plants have failed to emerge, sampling may be done to determine the pest

species present. Since damage occurs in the early growth stages, rescue treatments are ineffective for these pests. If damage is extensive enough to warrant replanting, seed treatment or soil insecticide is applied to prevent reinfestation.

Wireworm infestation levels of a field can be determined prior to planting, but few growers sample fields routinely. Growers may sample fields where preventive insecticide treatments are not used if wireworms have been a problem in the past, to determine if preventive treatment is warranted.

Grubs uncovered in the soil during spring tillage and planting operations are the best indication of a potential infestation. It is important to determine the species of grub, since not all white grubs cause significant damage to sweet corn. Annual white grubs and Japanese beetle grubs rarely cause economic damage unless the corn is planted extremely early.

Chemical controls for minor soil pests

Seed Corn Maggot (SCM), Wireworms (WW)
Seed corn maggot is controlled with planter-box seed treatments, commercially treated seed, or in-furrow treatments. Rescue treatments applied post-planting are not effective.

Seed Treatment:

- Cruiser 5FS (thiamethoxam)--1.28-5.1 fl oz/100 lbs of seed. Available only as a commercially applied seed treatment. (Restrictions: treated areas may be replanted immediately following harvest or as soon as practical following the last application with any crop on this label or to cucurbit vegetables, fruiting vegetables, tuberous and corm vegetables, and tobacco. For all other crops, a 120-day plantback interval must be observed.)
- diazinon 50W--0.5 oz/bu seed. (SCM only) Planter-box treatment. Existing stocks in the market place with old labels can be used.
- Gaucho 480 (imidacloprid)--2-8 fl oz/cwt seed. Available only as a commercially applied seed treatment. (Restrictions: A 30-day plant back restriction should be observed for buckwheat, millet, oats, popcorn, rye, soybeans, beans [except succulent shelled and edible podded], and peas.)
- Latitude (imidacloprid)--1.5 oz/42 lbs of seed. A 30-day plant back restriction should be observed for buckwheat, millet, oats, popcorn, rye, soybeans, beans (except succulent shelled and edible podded), and peas,
- Lorsban 50SL(chlorpyrifos)--2 oz/100 lb seed. (SCM only) Available only as a commercially applied seed treatment.
- Poncho 600 (clothianidin)--1.13 fl oz/80,000 units of seed. Available only as a commercially applied seed treatment. (Areas planted with treated seed may be replanted immediately with field corn, popcorn, sweet corn,

rapeseed and canola. These areas may also be replanted after 30 days with cereal grains, grasses, nongrass animal feeds, soybeans,dried beans, root and tuber vegetables. Any crop without an earlier plant back interval has a 4-month plant back interval.)

Soil-Applied Treatment:

- Counter--8 oz 15G/1,000 ft of row in seed furrow (SCM only)
- Force--4-5 oz 3G/1,000 ft of row in- furrow
- Fortress--6-7.5 oz 2.5G/1,000 ft of row
- Furadan--2.5 fl oz 4F/1,000 ft of row in the seed furrow at planting
- Lorsban--8 oz 15G/1,000 ft of row in furrow or 4 pt 4E/A (SCM only) preplant broadcast incorporated

Grubs

- Counter--6-8 oz 15G/1,000 ft of row in seed furrow
- Force--4-5 oz 3G/1,000 ft of row in- furrow
- Fortress--6-7.5 oz 2.5G/1,000 ft of row
- Lorsban--8-12 oz 15G/1,000 ft of row in furrow or 13.5 lb 15G/A preplant broadcast incorporated or 4 pt 4E/A preplant broadcast incorporated

Additional Minor Insect Pests

Corn leaf aphid (*Rhopalosiphum maidis*)

Damage and Life Cycle

Corn leaf aphids overwinter on small grains as either eggs or females that give birth during early spring. Wingless females produce offspring without mating for numerous generations. During late May and June, winged aphids migrate to corn and wild grasses where they spend the summer. Aphids injure sweet corn by removing plant sap with their needle-like mouthparts. They also excrete a sugary liquid, called honeydew, which can coat tassels and interfere with pollen shed as well as causing cosmetic damage to the ears. Corn leaf aphids reproduce rapidly, and populations can increase dramatically in a very short time. As aphid numbers rise, colonies usually begin to appear on the leaves, tassels, and between the husk leaves on the ear.

Corn leaf aphid is one of several species of aphids that transmit maize dwarf mosaic virus to sweet corn, however, this is only a potential problem for non-resistant varieties planted after July 1. The virus can be spread to sweet corn by aphids from neighboring infected grasses, particularly johnsongrass (*Sorghum halepense*). The most important management strategies for maize dwarf mosaic virus are the use of virus-tolerant varieties and control of weeds that are potential host plants for the virus, especially johnsongrass.

Frequency of Occurrence

Aphids are rarely a problem because infestations either build up too late to cause significant damage or they are controlled by natural enemies.

Chemical Controls

- Asana XL--5.8-9.6 fl oz 0.66EC/A
- diazinon--1-2 pt 4EC/A
- Lannate--1.5 pt LV/A
- Thionex--1.33 qt 3EC/A
-

Insecticide	REI	PHI	% Crop Treated
esvenvalerate (Asana XL)	12	1	< 5%
indoxacarb (Avaunt)	12	3 – ear harvest 35 – fodder	<5%
cyfluthrin (Baythroid XL)	12	0	5%
imidacloprid (Concur)	24	-	0%
terbufos (Counter)	48	18	10%
diazinon 4E	24	7 – will vary with formulation used	<2%
spinosad (Entrust)	4	1	<1%
tefluthrin (Force)	0	-	5%
chlorethoxyfos (Fortress)	48	-	0%
imidacloprid (Gaucho)	24	-	0%
methoxyfenozide (Intrepid)	4	3 – ears 21 – dry fodder	0%
lambda-cyhalothrin (Warrior)	24	1	80%
methomyl (Lannate)	48	0	20%
thiodicarb (Larvin)	48	0	<5%
imidacloprid (Latitude)	24	-	5%
chlorpyrifos (Lorsban 4E)	24	35	<2%
chlorpyrifos (Lorsban 15G)	12	35	<2%
zeta-cypermethrin	12	3	20%

(Mustang MAX)			
methyl parathion (Penncap-M)	48	3	<1%
permethrin	12	1	<5%
carbaryl (Sevin/ Sevin Bait)	12	2- ears 14 – grazing or forage	<1%
spinosad (SpinTor)	4	1	<5%
endosulfan (Thionex)	24	1	<1%

Diseases

Infectious diseases of sweet corn are caused by fungi, bacteria, viruses, and nematodes, and some are vectored by insects. Successful and cost-effective disease management requires accurate identification of pathogens and timely application of control measures. Some diseases are controlled mainly by management of insect vectors, while for others, cultural or chemical controls may be necessary, at least in some years.

Bacterial Diseases

The most important bacterial disease in Delaware is Stewart's bacterial wilt, which is seen to a greater or lesser extent every year. Bacterial stalk rot also occurs, but is rare and limited to fields under irrigation or those watered from streams. Unlike Stewart's wilt, stalk rot rarely results in important economic losses.

Stewart's bacterial wilt

Life Cycle and Damage: *Erwinia stewartii*, the bacterium that causes Stewart's wilt, or bacterial wilt, overwinters in the digestive tract of flea beetles and is transmitted by beetles feeding on the leaves. Although flea beetles are not the only insects known to vector this disease to sweet corn, transmission by other insects is not of economic importance. Epidemics of bacterial wilt may follow warm winters, which favor flea beetle survival. As many as 40% of overwintering flea beetles carry the bacterium in spring, and this percentage climbs as the season progresses. When young plants are infected, brown discoloration, and sometimes cavities, form in the center of the stem. These plants may die. In older plants, infection results in streaked leaves and growth may be stunted.

Frequency of Occurrence: Bacterial wilt is an important disease throughout the Eastern United States, but its occurrence and severity depend on the winter weather conditions and the susceptibility of the sweet corn variety. The extent of

bacterial wilt damage depends on the growth stage of corn infected, the bacterial strain, host susceptibility, and nutritional factors. Younger plants are most severely affected. In Delaware, some bacterial wilt damage is seen annually on susceptible varieties. Bacterial wilt infection rate is typically about 10% in fresh market sweet corn and 1% in processing sweet corn, however, the disease is not severe and generally causes no more than 5% yield loss when it occurs. In extreme cases where susceptible varieties are used and other controls have failed, up to 80% yield loss from bacterial wilt has been reported.

Management: Use of bacterial wilt resistant varieties is an important management strategy employed by most growers of processing and fresh market sweet corn, although the level of resistance varies among varieties. Also, lower quality and yield of many resistant varieties combined with competition and other market factors compels many growers to select more susceptible varieties. Management of bacterial wilt is achieved by control of the flea beetle vector. When beetle populations are high, a single foliar rescue treatment is also applied to reduce transmission of bacterial wilt. Such foliar treatments are not typically needed every year, but may be applied to as much as 40% of early planted corn during bad years

Chemical Controls: There are no chemical controls that work directly on bacterial-wilt infected plants. The disease is managed by chemical control of the flea beetle vector.

Cultural Controls: Most processing varieties show some level of resistance to bacterial wilt. Where possible, growers use cultivars resistant to bacterial wilt disease, especially for early plantings during cool springs following mild winters. However, market demands often require that growers choose susceptible varieties with other characteristics over varieties with bacterial wilt resistance.

Maize dwarf mosaic virus

Life Cycle and Damage: Maize dwarf mosaic virus has a large host range. It can be spread by aphids from neighboring infected grasses to sweet corn. The virus overwinters in perennial grasses, and johnsongrass (Sorghum halepense) is an important overwintering host. The disease is spread by at least 12 species of aphids, and transmission occurs within the first few seconds of feeding.

Frequency of Occurrence: The virus only occurs in Delaware on sweet corn planted after July 1, because the build up of disease titer in host weeds becomes sufficient in late summer to overwhelm the genetic resistance of many varieties. Very little sweet corn is planted in Delaware after the first of July and the virus occurs on less than 5% of these acres.

Management: The most important management strategy for maize dwarf mosaic virus is the use of virus-tolerant varieties. Tolerance is usually adequate to

prevent yield loss in the sweet corn varieties developed in the last 20 years. If it weren't for the dwarf mosaic resistant varieties, growers couldn't plant sweet corn after mid-May without significant yield losses. Control of weeds that are potential host plants for the virus, especially johnsongrass, is an important management strategy.

Chemical Controls: There are no chemical controls that can kill the virus in an infected plant.

Fungal Diseases

The only significant fungal diseases in Delaware are common smut, southern corn leaf blight, northern corn leaf blight, common rust, and southern rust. Nearly all sweet corn seed comes pre-treated with fungicides from the seed companies.

Common smut

Life Cycle and Damage: Common smut (*Ustilago maydis*) is the most frequently occurring disease of sweet corn in Delaware. It is easily recognized by large galls that form in the ears, leaves, and tassels of the plant. Galls are silvery-white when formed, but later produce masses of powdery dark brown to black spores. The disease overwinters on top of the soil as teliospores, which develop into airborne basidiospores in the spring. In favorable climatic conditions, these basidiospores can infect susceptible plant tissues which have been damaged by mechanical injury or insect feeding.

Frequency of Occurence: Common smut is a widespread and economically important disease in Delaware, for which there is no chemical control. It is most common when weather conditions are hot and dry.

Management: There is a variable range of smut resistance among sweet corn varieties and the more resistant varieties are used as often as possible, particularly for processing. Most varieties are at least moderately resistant. Early cultivation can reduce infection rates by reducing mechanical damage to corn roots and stems and lowering transmission rates. This is practiced by most growers in Delaware. Crop rotation, which is practiced for a variety of reasons, also helps reduce smut transmission to sweet corn. Controlling European corn borer as soon as the tassels appear may reduce the risk of smut transition, but this strategy doesn't eliminate the disease in Delaware.

Chemical Controls: There are no fungicides available for control of smut in Delaware sweet corn. Control of European corn borer during the tassel stage may be helpful in reducing the spread of the disease.

Leaf blights

Two important leaf blight diseases occur in Delaware: southern corn leaf blight (*Bipolaris maydis*) and northern corn leaf blight (*Exserohilum turicum*). Both are minimal and sporadic, and their occurrence depends upon the resistance level of the variety used and environmental conditions.

Life Cycle and Damage: Leaf blights cause spots or lesions on the leaves. When lesions are numerous, the leaf may die. Spores are the overwintering stage for both fungi. Spores of *Bipolaris* overwinter in infected leaf tissue in crop debris in the field. The spores of *Exserohilum* turicum can survive with or without plant debris. Overwintering spores may be spread by wind to susceptible plants in the spring. Southern corn leaf blight requires 4 or more hours of moist conditions for transmission and spreads quickly during extended periods of moisture when temperatures are between 75oF and 95oF. Infection of northern corn leaf blight requires leaf surfaces to be moist for 5 hours when temperatures are about 70oF. Sporulation for both species occurs under moist conditions when temperatures are favorable.

Frequency of Occurence: Both southern corn leaf blight and northern corn leaf blight are most likely to develop in poorly drained sites or areas adjacent to woods or other wind breaks. Southern corn leaf blight and northern corn leaf blight are minimal and sporadic in Delaware.

Management: Resistant varieties are available for both blight diseases. Crop rotation and plowing under of corn stubble are important means of reducing inoculum sources for both species. Fungicide sprays are effective against these diseases but are rarely needed. Growers using susceptible cultivars can monitor weather conditions to determine if the spread of southern corn leaf blight is favored; however, sprays will not be necessary unless sufficient inoculum is present. There are no differences in management practices between fresh market and processing sweet corn.

Chemical Controls: In most years chemical control is not needed for control of blight diseases in Delaware sweet corn. For optimal control begin sprays before symptoms appear. Apply on a 7- to 14-day schedule.

Alternate:

- chlorothalonil (Do not apply to corn to be processed.)--0.75-2 pt 6F/A (7-day schedule)
- mancozeb--1.5 lb 75DF/A (5- to 7-day schedule)
- maneb--1.5 lb 75DF/A (5- to 7-day schedule)

With:

- azoxystrobin (Quadris 9.2-15.4 fl oz 2.08F/A or Amistar at 3-5 oz 80WDG/A)
- Headline 9-12 fl oz 2.1EC/A (7-14 day schedule)

- Tilt--2-4 fl oz 3.6 EC/A (7- to 14-day schedule)

(Do not make more than 2 consecutive applications of one of the above fungicides without alternating with another fungicide.)

Rusts

Life Cycle and Damage: Spores of rust fungi overwinter in the Southwest and are reintroduced to our region each year, carried on the wind. All exposed plant tissues are susceptible to infection, but leaves are most often affected. Brown spots occur on both sides of the leaves and darken as they age. In severe cases the leaf may die. The worst infestations may lead to economic losses due to smaller ear production and cosmetic injury from pustule development on the ears.

Frequency of Occurrence: Common rust is widespread and occurs throughout Delaware. Its severity can fluctuate considerably from year to year, but it is most severe during warm, humid weather. Common rust has been occurring more regularly over the last five years, but is only an economic problem on susceptible cultivars.

Management: Resistant cultivars are used by more than 80% of fresh market and processing sweet corn growers. They are particularly important to growers making successive plantings of fresh market corn in the same field. Fields are monitored for rust during the early growth stages. If infection occurs prior to the whorl stage, a fungicide is applied. One pustule per leaf on 80% of the leaves prior to tasseling is the threshold for moderately susceptible fresh market varieties. A lower threshold is used for highly susceptible cultivars. Thresholds are not used in processing sweet corn, where cosmetic damage to the husk is unimportant.

Chemical Controls:

Rust occasionally can become troublesome with some varieties. In most years chemical control measures are not warranted. However, corn warrants spraying if infection occurs prior to the whorl stage. Observe fields on a regular basis, and if lesions are observed prior to the whorl stage, apply one of the following:

- azoxystrobin (Quadris at 6.2-9.2 fl oz 2.08F/A or Amistar 2-3 oz 80WDG/A) Apply on a 7- to 14-day schedule and do not make more than 2 consecutive applications without alternating with another fungicide (FRAC group)
- chlorothalonil (Do not apply to corn to be processed.)--0.75-2 pt 6F/A (7-day schedule)
- Headline--6-9 fl oz 2.1EC/A (7-14 day schedule)
- mancozeb--1.5 lb 75DF/A (5- to 7-day schedule)
- maneb--1.5 lb 75DF/A (5- to 7-day schedule)
- Tilt--4 fl oz 3.6 EC/A (7- to 14-day schedule)

Nematodes

Several genera of nematodes (Pratylenchus, Longidorus) are pathogenic to corn in the Northeast, and some of these are found in Delaware soil samples; however, the population levels present are usually insufficient to cause economic damage to sweet corn. Nematicides are recommended on a prescriptive basis for specific problems identified by soil sampling. Needle nematodes (Longidorus) has caused economic damage by reducing stands and stunting plants during sproadic occurances.

Table. Fungicides in Sweet Corn: REI, PHI

Fungicide	REI (hours)	PHI (days)
azoxystrobin (Amistar; Quadris)	4	0
chlorothalonil	12	14
pyraclostrobin (Headline)	12	7
mancozeb	12/ 24	7
maneb	12	7
propiconazole (Tilt)	24	14

Weeds

Weed management is an important issue in sweet corn, since weeds account for about a third of all crop losses. Weeds result in economic losses in sweet corn in several ways, including: 1) reducing yield due to competition for water, nutrients, and light; 2) increasing production costs or reducing yields by interfering with harvest; 3) reducing effectiveness of insect and disease control measures due to weed interference; 4) serving as refuge for insects and pathogens; and 5) reducing yield due to crop injury resulting from weed control measures. An integrated approach, including a combination of cultural and mechanical methods, crop rotation, and herbicides, provides the most economical and effective weed management in sweet corn. This integrated approach focuses on proper herbicide selection and optimal timing of application in combination with cultural practices to increase the competitive ability of the crop relative to weeds.

Pest Life Cycles: A wide range of annual and perennial weed species is present in sweet corn fields in DE. Some of the more common annual broadleaf weeds are: smooth pigweed, common lambsquarters, common ragweed, velvetleaf, nightshade, common cocklebur; common annual grasses are: fall panicum, giant

foxtail, and crabgrass; and common perennial species include: yellow nutsedge, Canada thistle, horsenettle, and johnsongrass.

Cultural Control Practices: Cultivation is useful in sweet corn weed control, and is frequently practiced.

Post-Harvest Control Practices: Application of herbicides and/or cultivation after harvest can be useful in controlling perennial weeds, but has no impact on reducing yield loss in the current crop.

Chemical Controls Herbicides are the most important component of weed management programs in sweet corn. Proper timing of herbicide application is essential for good weed control and reducing the risk of crop injury.

No-Till

Paraquat *plus* residual herbicides --0.3-0.6 lb/A. 1.2 to 2.4 pints per acre Gramoxone Inteon 2SC. Add surfactant as indicated on the Gramoxone Inteon 2SC label. Gramoxone Inteon 2SC will control existing vegetation, Dual II Magnum, Lasso, or Outlook will provide residual annual grass control, and atrazine will provide residual annual broadleaf weed control. (See atrazine restrictions under the "Early Emergence" section).

Glyphosate *plus* residual herbicides--0.75-1.5 lb acid equivalent/A. Apply the appropriate acid equivalent rate of Glyphomax Plus, Roundup products, Touchdown products, or other glyphosate formulation. Use this combination when existing vegetation includes dense, well-established annual weeds and/or perennial weeds. Roundup Ultra Max will control existing vegetation in 1 to 3 weeks. Perennial weeds must be treated at the proper growth stage to obtain effective control. A residual herbicide such as Dual II Magnum, Lasso, or Outlook will provide residual annual grass control, and atrazine will provide residual annual broadleaf control. (See atrazine restrictions under the "Early Emergence" section.)

Conventional Tillage

Preplant Incorporated
Butylate--3-6 lb/A. Apply 3.75 to 7.33 pints per acre of Sutan+ 6.7EC. Immediately, incorporate Sutan+ 2 to 3 inches deep by disking twice with disk blades set to run 4 to 6 inches deep to prevent Sutan+ loss by volatility. The second disking may be delayed for up to 8 hours. Corn may be planted immediately after herbicide incorporation. Primarily controls annual grasses, yellow nutsedge, and certain broadleaf weeds. Combine with atrazine to improve broadleaf weed control.

Preplant Incorporated or Preemergence

Alachlor--1.5-3 lb/A. Apply 1.5 to 3 quarts Micro-Tech or 2.3 to 4.6 lb Partner 65DF. Primarily controls annual grasses and certain broadleaf weeds, including pigweed, nightshade, and galinsoga, and suppresses yellow nutsedge when preplant incorporated. Combine with atrazine to improve control of other broadleaf weeds. Alachlor is also available as a jug-mix with atrazine sold as Bullet. (5% of acreage treated)

Dimethenamid-p- 0.47-0.98 lb/A. Apply 10 to 21 fluid ounces per acre Outlook 6E. Primarily controls annual grasses and suppresses certain broadleaf weeds. Combine with atrazine to improve control of most broadleaf weeds. Dimethenamid-p is also available as a jug-mix sold as Guardsman Max. (5% of acreage treated)

S-metolachlor--0.96-1.91 lb/A. Apply 1 to 2 pints per acre Dual II Magnum 7.64E (or OLF). Primarily controls annual grasses, controls or suppresses yellow nutsedge, and suppresses certain broadleaf weeds. Use preplant incorporated to improve yellow nutsedge control. Combine with atrazine to improve control of most broadleaf weeds. S-metolachlor is also available as jug-mixes with atrazine sold as Bicep II Magnum and Bicep II Magnum Lite. (85% of acreage treated)

Atrazine--1-1.5 lb/A. Apply 1 to 1.5 quarts atrazine 4FL (or OLF). Primarily controls broadleaf weeds. Combine with Micro-Tech, Partner, or Dual II Magnum to improve control of annual grasses. Also sold as jug-mixes, with alachlor sold as Bullet, with s-metolachlor sold as Bicep II Magnum and Bicep II Magnum Lite, and with dimethenamid-p and sold as Guardsman Max. Do not double-crop the season atrazine or any atrazine-containing products are used. Grass cover crops can be established after corn harvest provided the recommended rate of atrazine was not exceeded. Moldboard plowing before planting a crop sensitive to atrazine will minimize the risk of injury from atrazine residue. (75% of acreage treated)

Preemergence

Mesotrione—0.094 lb/A. Apply 3 fluid ounces of Callisto 4SC per acre. Primarily controls common lambsquarter, pigweeds, and many other annual broadleaf weeds, including triazine resistant biotypes, but Callisto is weak on ragweed and morninglory species. Combine with Micro-Tech, Partner, or Dual II Magnum to control annual grasses. Temporary injury, appearing as whitening of the foliage after emergence, may occur. Rainfall or irrigation after planting and treatment, but before emergence increases the likelihood of crop injury. Cold weather that slows corn growth will also retard recovery from injury following preemergence treatments. Sweet corn varieties differ in sensitivity to mesotrione. The majority of varieties exhibit slight injury symptoms when weather conditions after application are favorable. Certain varieties are tolerant, while others exhibit injury that is more noticeable. Although no variety was severely injured by the recommended rate, postemergence application is preferred when weather

conditions that favor injury occur at planting. Severe crop injury may occur if an organophosphate or carbamate insecticide is applied within 7 days of Callisto. Lexar and Lumax are labeled jug-mixes that contain mesotrione and s-metolachlor. (15% of acreage treated)

Spike

Pendimethalin--0.75-1.0 lb/A. Apply 1.8 to 2.5 pints Prowl 3.3EC per acre or OLF (Other Labeled Formulations). Primarily controls certain annual grasses, and certain annual broadleaf weeds, including triazine resistant common lambsquarters. Combine with atrazine to improve the control of other broadleaf weeds. Cold wet conditions after application increase the risk of crop injury. Choose a different weed control program when cold wet conditions after application are anticipated. Plant the sweet corn seed a minimum of one and one-half inches deep. Shallow planting increases the risk of crop injury. Do NOT use Prowl 3.3EC when planting sweet corn varieties that do not tolerate planting depths of greater than one and one-half inches. Sweet corn tolerance to Prowl 3.3EC is due to placement. DO NOT mechanically incorporate or attempt to replant a sweet corn field treated with Prowl 3.3EC. The risk of crop injury will be increased by moving the herbicide into the root zone of the crop by the tillage. (5% of acreage treated)

Early Emergence

(Annual grass control will be minimal.)

Atrazine--1-2 lb/A. Apply 1 to 2 quarts per acre Atrazine 4L (or OLF). Primarily controls broadleaf weeds. Apply postemergence when weeds and corn are up to 2 inches tall. Add oil concentrate to be 1% of the spray solution. DO NOT exceed the maximum rate per acre per year listed on the label for your soil's erodibility class. Atrazine is also sold as a jug-mix with bentazon sold as Laddok S-12. When this and other atrazine treatments are used, do not double-crop during this season. Cover crops after corn are satisfactory providing the recommended rate of atrazine is not exceeded. Mold-board plowing before planting grain or vegetables the following spring will minimize the risk of atrazine residue injury. (10% of acreage treated)

Halosulfuron--0.023-0.031 lb/A. Apply 0.5 to 0.66 dry ounces Sandea 75WG to control yellow nutsedge and broadleaf weeds, including common cocklebur, redroot pigweed, smooth pigweed, ragweed species, and velvetleaf. Spray before corn reaches 8 inches in height, or use drop nozzles when corn is over 8 inches tall to avoid spraying the foliage and into the whorl. Sandea applied postemergence will not control common lambsquarter or eastern black nightshade, and will only suppress morningglory species. Always add nonionic surfactant to be 0.25 percent of the spray solution (1 quart per 100 gallons of spray solution). Susceptible weeds usually exhibit injury symptoms within 1 to 2 weeks of treatment. Corn varieties may vary in sensitivity to Sandea. Use caution when treating new varieties. DO NOT apply to Jubilee. Sandea is an ALS inhibitor. Herbicides with this mode of action have a single site of activity in

susceptible weeds. The risk of the development of resistant weed populations is high when herbicides with this mode of action are used continuously and exclusively to control a weed species for several years or in consecutive crops in a rotation. ALS-resistant biotypes of common ragweed and pigweeds species have been identified in Delaware. Integrate mechanical methods of control and use herbicides with a different mode of action to control the target broadleaf weeds when growing other crops in the rotation. DO NOT use if organophosphate (OP) insecticides have been applied to the crop, or the risk of crop injury may increase. (Less 5% of acreage treated)

Carfentrazone--0.008 lb/A. Apply 0.33 dry ounce per acre Aim 40WG before corn reaches 8 inches in height to control seedling broadleaf weeds including pigweed species, common lambsquarter, morningglory species, eastern black nightshade, and velvetleaf. Aim will not control ragweed species. Tank-mix with atrazine at reduced rates or another broadleaf weed herbicide to increase the spectrum of weeds controlled. Always add nonionic surfactant to be 0.25 percent of the spray solution (1 quart per 100 gallons of spray solution). Expect to see speckling on the crop foliage after application. Initially the injury may appear to be substantial, but it is not systemic and corn outgrows the injury rapidly. Variety sensitivity to Aim may vary. Use caution when treating new varieties. Weather conditions may affect the degree of injury observed. Injury may be more severe during periods of warm, cloudy weather with high humidity and plentiful soil moisture when corn growth is rapid and "soft." To reduce the risk of crop injury, use drop nozzles when corn is over 8 inches tall, avoiding spray on the foliage and into the whorl. (5% of acreage treated)

Postemergence
(Annual grass control will be minimal.)
Atrazine--1-2 lb/A. Apply 1 to 2 quarts per acre Atrazine 4L (or OLF). See Atrazine in Early Postemergence section. (5% of acreage treated)

Bentazon--0.75-1 lb/A. Apply 1.5 to 2 pints per acre Basagran 4SC. See label for susceptible broadleaf weeds; results are better when weeds are young. Basagran will provide partial control of yellow nutsedge. Grasses will NOT be controlled. Cultivation within 10 to 14 days will increase control. Basagran is also sold as a jug-mix with atrazine sold as Laddok S-12. (Less than 5% of acreage treated)

2,4-D Amine--0.25-0.5 lb/A. Use 0.5 to 1 pint 4EC. Apply after corn and weeds emerge. Use drop nozzles when corn is over 8 inches tall to avoid spraying the foliage or into the whorl of the corn. Warm, wet weather at application may increase the possibility of crop injury. Use the lower recommended rate when these conditions prevail. Delay cultivation for 8 to 10 days after treatment to avoid damaging corn due to temporary brittleness sometimes caused by 2,4-D. Sweet corn varieties differ in 2,4-D tolerance. Super sweet varieties may be more sensitive than other varieties. Injury will be less when the minimum

recommended rate is used. Use with caution on new varieties. Do not apply from tasseling to dough stage. At high rates, 2,4-D may cause temporary injury to corn. Do not use a sprayer to apply 2,4-D that will be used to spray sensitive crops postemergence. Ester formulations, although labeled, are more subject to volatilization and movement to sensitive crops and, therefore, are not recommended. (Less than 5% of acreage treated)

Clopyralid--0-.047-0.25 lb/A. Apply 2 to 10.5 fluid ounces of Stinger 3A per acre in one or two applications to control certain annual and perennial broadleaf weeds when sweet corn is less than 18 inches tall. Stinger controls weeds in the Composite and Legume plant families. Common annuals controlled include galinsoga, ragweed species, common cocklebur, groundsel, pineappleweed, clover, and vetch. Perennials controlled include Canada thistle, goldenrod species, aster species, and mugwort (wild chrysanthemum). Stinger is very effective on small seedling annual and emerging perennial weeds less than 2 to 4 inches tall, but is less effective and takes longer to work when weeds are larger. Use 2 to 4 fluid ounces to control annual weeds less than 2 inches tall. Increase the rate to 4 to 8 fluid ounces to control larger annual weeds. Apply the maximum rate of 10.5 fluid ounces, in one or split into two applications to suppress or control perennial weeds. Do not exceed 10.5 fluid ounces in one year. Spray additives are not needed or required by the label, and are not recommended. Observe a minimum preharvest interval (PHI) of 30 days. Stinger is a postemergence herbicide with residual soil activity. Observe follow crop restrictions or injury may occur from herbicide carryover. (Less than 5% of acreage treated)

Mesotrione—0.094 lb/A. Apply 3 fluid ounces of Callisto 4SC per acre. Primarily controls common lambsquarter and many other annual broadleaf weeds, including triazine resistant biotypes, but Callisto is weak on ragweed and morningglory species. Always add nonionic surfactant to be 0.25% of the spray solution (1 quart per 100 gallons of spray solution), but DO NOT add oil concentrate, liquid fertilizer, or AMS, or tank-mix Callisto and bentazon (Basagran), or severe crop injury may be observed. Temporary minor injury, appearing as whitening of the new foliage may occur. The crop will quickly outgrow minor injury with no effect on yield or earliness. Sweet corn varieties differ in sensitivity to mesotrione. The majority of varieties may exhibit slight injury symptoms. Certain varieties are tolerant while others exhibit injury that is more noticeable. No variety was severely injured by the recommended rates applied with nonionic surfactant. Tank mix Callisto with 0.25 to 1 lbs ai/A of atrazine for improved control and to broaden the spectrum of weeds control. Local university data supports the use of at least 0.5 lb ai/A of atrazine. Do not apply tank-mixes of Impact and atrazine to corn greater than 12 inches tall. Do not use postemergence if Callisto, Lumax, or Lexar was used preemergence. DO NOT tank-mix Callisto with organophosphate or carbamate insecticides, or apply if the crop was treated with Counter or Lorsban, or severe crop injury may occur**.** (10% of acreage treated)

Nicosulfuron—0.031 lb/A. Apply 0.66 dry ounces of Accent 75DF per acre as a broadcast or with drop nozzles as a directed spray as an early postemergence rescue treatment to control emerged annual grasses. Treat sweet corn with a broadcast spray or with drop nozzles as a directed spray up to 12 inches tall or up to and including 5 leaf collars, or as a directed spray with drop nozzles only to sweet corn up to 18 inches tall. Do not treat sweet corn more than 18 inches tall to contol many annual grasses and certain annual broadleaf weeds. Tank-mix with atrazine to increase the spectrum of weeds controlled. Add nonionic surfactant to be 0.25% of the spray solution (1 quart per 100 gallons of spray solution). Accent is safe to apply to certain varieties, injures others, and kills certain sweet corn varieties. Crop injury may be apparent within 1 to 2 weeks of application as yellowing and death of sweet corn foliage, beginning with the youngest leaves first, or the injury may not be observed until harvest. Injury at harvest is seen as a constriction at the top, middle, or bottom of the ear, depending on application timing. Late postemergence applications are more likely to result in ear injury than early postemergence applications. Accent is an ALS inhibitor. Herbicides with this mode of action have a single site of activity in susceptible weeds. The risk of the development of resistant weed populations is high when herbicides with this mode of action are used continuously and exclusively to control a weed species for several years or in consecutive crops in a rotation. ALS-resistant biotypes of common ragweed and pigweeds species have been identified in Delaware. Integrate mechanical methods of control and use herbicides with a different mode of action to control the target broadleaf weeds when growing other crops in the rotation. DO NOT use if organophosphate (OP) insecticides have been applied to the crop, or the risk of crop injury may increase. (Less than 5% of acreage treated)

Topramezone—0.016 lb/A. TRIAL USE ONLY! There is limited experience by local university researchers with Impact. Apply 0.75 fluid ounces of Impact 2.8SC per acre postemergence to control many annual broadleaf weeds and certain annual grasses, except crabgrass species. Add oil concentrate (COC) to be 1% of the spray solution (1 gallon per 100 gallons of spray solution). In addition, the label requires nitrogen fertilizer (liquid or AMS). Tank mix Impact with 0.25 to 1 lbs ai/A of atrazine for improved control and to broaden the spectrum of weeds control. Local university data supports the use of at least 0.5 lb ai/A of atrazine. Do not apply tank-mixes of Impact and atrazine to corn greater than 12 inches tall. Do not use postemergence if Callisto, Lumax, or Lexar was used preemergence. Do not tankmix with Callisto. Impact will control/suppress crabgrass and other annual grass species, but is not effective for fall panicum control. Most broadleaf weeds should be treated before they are 6 inches tall and grass weeds should be treated before 3 inches in height. Impact has an 18 month replant restriction for most vegetables.

Postharvest

Paraquat--0.6 lb/A. A Special Local-Needs 24(c) label has been approved for the use of Gramoxone Inteon 2SC for postharvest desiccation of the crop in

Delaware. Apply 2.4 pints per acre Gramoxone Inteon 2SC as a broadcast spray after the last harvest. Add nonionic surfactant according to the labeled instructions. Use to prepare plastic mulch for replanting, or to aid in the removal of the mulch.

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