

## ORGANIC SWEET CORN PRODUCTION

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Whether you are a longtime sweet corn grower transitioning to producing corn by organic methods, or a longtime organic producer expanding into producing sweet corn or aiming to improve your sweet corn crop, you will need to solve specific challenges in order to produce a high quality product using organic methods. The good news is that it can be done, and that the tools and techniques are being used successfully by an increasing number of growers throughout in the Northeast. The most difficult challenges seem to be, 1) providing adequate fertility at an affordable cost 2) achieving a good plant stand especially early in the season 3) managing weeds economically and effectively and 4) preventing ear damage from the three major caterpillar pests.

### **Fertility**

The major nutrients removed by sweet corn (for a 250 bushel/acre yield) are 155 lb/acre N (55 lb in the ears), 20 lb/acre P<sub>2</sub>O<sub>5</sub>, and 105 lb/acre K<sub>2</sub>O. There are many ways to provide for this: broadcast manure or compost; legume or legume/grass mix cover crops; broadcast or banded bagged soil amendments or prepared fertilizer; long term organic matter enhancement in the soil. One of the most cost-effective, short term methods is a hairy vetch cover crop (mixed with oat or rye) planted in early fall and allowed to grow enough in spring to fix N for the crop. Use available figures on the NPK contribution of organic soil amendments, along with your soil test, to be sure that fertility is adequate.

The largest nitrogen demand is 30-75 days after planting. The pre-sidedress nitrate test (PSNT), taken when the corn is 12 inches tall, is a useful tool to determine if the crop needs more nitrogen in order to produce a full yield. Many University soil labs do this test. More N is needed if nitrate-N is below 25 ppm. Blood meal or Chilean nitrate can provide a more rapid release of N. There is a slower release from soybean meal, cottonseed meal, and alfalfa meal. Adequate nitrogen, when it's needed, will not only support full sized ears with good tip cover but will keep the crop growing through a variety of stress conditions.

### **Crop establishment**

Sources for organically grown seed are increasing but the variety choice is still limited. Many seed companies will provide untreated seed, but it is important to order early to ensure that they have untreated seed in stock. With no fungicide or insecticide seed treatments, achieving good emergence can be difficult, especially in cold soils. One way that growers are dealing with this is the use of transplants. Once considered out of the question in sweet corn, transplants are being more widely used for organic sweet corn in New England. The cost of trays and soil, 14-16 days in the greenhouse, and labor for transplanting is worthwhile, when it guarantees high level of germination, a full, healthy, even-aged crop stand that is three weeks ahead of the weeds, and a gain of one to two week on the harvest date. Some growers transplant only in the early season, some throughout the planting of their whole crop. Some combine this with row cover, to achieve even earlier harvest and protect from European corn borer. For direct seeding, use a seed depth as shallow as appropriate for the time of year and wait for the soil to reach 65F.

### **Weed Management**

Final field preparation should be done immediately before planting, to give the seed (or transplant) as much of an advantage over the weeds as possible. Some growers use a very shallow and light 'blind cultivation' with a Lely, Einbock or equivalent flex-tine weeder, when the seed has started to germinate but has not extended its growth tip, or when the corn is spiking. Avoid this when the shoot is just underground, because it is easily broken. The next cultivation is as close as possible to the crop, without throwing soil onto the plant. A final cultivation is usually done as late as your equipment allows and can throw soil onto the base of the crop to bury weeds (as long as they are not too tall). Any time you have to send in a hand crew for hoeing or pulling weeds it is a costly move, but it may be worth it if you are aiming for a clean field for the next crop, or if you have problem weeds like velvetleaf or bindweed, or you are planning to apply oil directly to the silk for corn earworm control later in the season.

### **Insect Management**

In the Northeast three major caterpillar pests -- corn earworm (CEW), European corn borer (ECB), and fall armyworm (FAW) -- invade ears and cause ugly feeding damage. Except for certain direct markets, presence of caterpillars above about 5% is generally unacceptable. The severity of each pest in each planting of corn varies with location, time of year, and the particular events of the season. To maintain worm-free corn all season long, it is critical to have an integrated strategy for controlling these three caterpillar species. The strategy should be flexible and quick to react to changes. This is where integrated pest management and organic management come together, because most of the sweet corn IPM techniques apply to organic corn. This strategy may include the following components: 1) Monitoring to determine pest pressure and need for treatment, 2) applications of allowed insecticides (Bt or spinosad), using effective spray equipment, for fall armyworm or European corn borer, or corn earworm at moderate levels, 3) direct treatment of each ear with Bt or spinosad carried in vegetable oil to control corn earworm, and 4) releases of *Trichogramma ostriniae*, a tiny parasite of ECB eggs.

**European corn borer.** Monitoring networks for European corn borer (ECB) are maintained by Extension systems in many states and can be used to determine when flight begins in your region for each ECB generation. ECB flight can also be monitored on-farm. Once flight is detected, blocks of sweet corn with newly emerging tassels should be scouted weekly by inspecting the tassels of 50-100 plants for the presence of ECB larvae and fresh feeding damage. In New England we use a threshold of 15% infestation for recommending a spray, ideally just before or during tassel emergence. Scout again in 3-5 days, and use a second spray if the infestation is still over 15%. We worked with many growers -- both organic and conventional -- using Bt sprays, before spinosad was registered in an organic formulation. Spinosad is more effective, but Bt does work and is less expensive.

Trichogramma are tiny parasitic wasps that insert their eggs into the egg masses of host insects, where the wasp larvae feed and pupate, killing their host. *Trichogramma ostriniae* wasps lay their eggs in ECB egg masses. To a certain extent they are used 'like a pesticide', to give immediate control, but they also reproduce and disperse during the season, so these wasps will be present in later corn as well. When the release timing and quantities are right, Trichogramma can reduce ECB larval infestations low enough to avoid spraying. They are commercially available from IPM Laboratories in NY. They should be released just as ECB moths start to lay eggs, or as soon as a given block corn is 12-18 inches tall if ECB are already active. Based on several years of work with colleagues in New York and other states, our current recommendations are to make at least two successive weekly releases per block, at a rate of 30,000 to 60,000 per acre. We believe that the 60,000 rate gives higher levels of control.

**Corn earworm.** Corn earworm has been the greatest barrier to success in organic sweet corn and is still a challenge, but with the options of spinosad sprays and direct silk treatments with corn or soy oil mixed with Bt or another allowed insecticide, it is now more possible to have clean organic corn all season. Spinosad (in the Entrust formulation) is used on a similar spray schedule as conventional materials, and depends on monitoring for flight as in any IPM sweet corn system. For moderate earworm pressure, it seems to work well. For organic growers with many succession plantings, without a corn sprayer, or who just don't want to be tied to an intensive spray schedule, an effective way to control corn earworm infestation in corn ears is to apply a small amount of *Bacillus thuringiensis* (Bt) or spinosad in corn or soybean oil directly to the silks of developing corn ears. The mixture (0.5 ml per ear) penetrates the silk channel, and acts as a barrier and a toxin that lasts throughout the silking period. Using a hand-held applicator such as the Zealater, labor is 6-8 hours per acre for the single application; cost per acre is \$100-125/acre for labor and materials. The application should be just after pollination, when silk starts to wilt. Materials used need to meet FIFRA and your own state pesticide guidelines (e.g., corn and soy oil are exempt from a tolerance and from registration under FIFRA, but state regulations may be more strict) as well as NOP and certifiers' guidelines for allowed materials. Using cultivars with long and tight husk coverage at the ear tip enhances the effectiveness of this method.

**Fall armyworm.** Like corn earworm, fall armyworm moths are migratory and should be monitored with pheromone traps to detect local and regional flights. Watch whorl-stage corn for signs of ragged feeding damage and scout for larvae in the whorl and the emerging tassel. The scouting method and threshold for FAW is similar to that for ECB. Spinosad and *Bt kurstaki* or *Bt aizawi* products are options, with spinosad showing higher levels of efficacy against this pest.

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