Early Season Fertilization Basics and Irrigation Management

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In New England, sweet corn is grown on more farms than any other vegetable. Farm stands often build their reputation on the quality of their sweet corn and use that as a way to ensure customer loyalty. Unfortunately, it's not easy to grow corn in our climate known for its cool, wet springs and what seems like increasingly droughty summers (this summer being the exception). A proper fertilizer program and timely irrigation can go a long way to ensure the best crop you can have.

I. Irrigation

Sweet corn seed, especially supersweet types, can pose a big challenge when it comes to uniform emergence. At temperatures below 55F, seed emergence will be spotty and stands poor. We like to see a minimum soil temperature of 60F, so that seed will emerge uniformly. If the early market requires you to plant earlier, mulches and row covers to enhance soil temperatures and germination are essential. Remember, however, that the cost of these materials will be between $300 - $400 dollars per acre. Your market will determine if the return on early corn will pay for the increase in expenses.

Typically, in the spring, the biggest problem with soil moisture is soils that are too wet. Wet soils also tend to be cool as it takes much more energy to warm a wet soil than a cool soil. There is little a grower can do to overcome a wet soil. Planting more shallow will be helpful as the soil nearer the surface will be warmer and moist, perfect conditions for germination. Planting on ridges will help too.

Over the last ten years, we've experienced two or three where conditions were very dry in the spring. We have found that sprinkling a small amount of water PRIOR to planting is more effective than irrigating after planting. About 0.1 to 0.2 inches of irrigation, a day prior to planting, makes the soil moisture ideal for planting. Irrigation after planting can result in soil crusting and a cool down of the soil for a day or two – conditions you are trying to avoid. If you must irrigate after planting but prior to seed emergence, do so first thing in the morning so that soils will warm through the day.

Once the sweet corn has emerged, it's important to maintain uniform soil moisture. Allow the soil to dry out in the first couple of inches to encourage deeper rooting and more drought tolerant plants. The most critical time to avoid drought in sweet corn is during silking and tasselling and ear development. Generally, dry conditions early in the plant's development (4-10 leaf stage) leads to smaller ears while later in the season (silking) results in poor kernel development and tip fill.

Monitoring soil water status directly is often the best way to determine when to irrigate. This does not have to be complicated or expensive, but it does involve checking soil moisture at the roots because looking at the top inch or two of surface soil is not informative. In addition, parts of the field with different soil type, slope, and drainage characteristics must be monitored separately.

Several sensors are available that can be placed in the field at various depths and locations to monitor soil water status. Tensiometers, which usually cost between $30 and $50, measure soil dryness using a vacuum-based system. Units of measurement are centibars (cb) - the dryer the soil, the greater number of centibars. The texture of the soil influences the soil tension range measured by tensiometers. The placement of tensiometers in the field is extremely important. They should be placed where plant roots are actively growing, usually at a depth of 6 to 12 inches and within 6 to 12 inches from the plant's base. It may be useful to place them at various depths to determine if irrigation or rainfall has reached that depth. One caution when using tensiometers. They go off scale easily if the soil dries (above 80 cb), and they must be refilled with water and vacuum pumped by hand to become functional again.

Gypsum blocks and ceramic moisture sensors operate on an electrical principle. They are not expensive, but a voltmeter-type device (usually $150 to $250) is required to use them. They are placed in the root zone as are tensiometers. Ceramic sensors have a narrower operating range than gypsum blocks and therefore tend to be more accurate. A disadvantage of both electrical types is that their calibration may lose accuracy with time, particularly if used for more than one season.

Another approach to scheduling irrigation, usually referred to as the “water budget” method, is much like balancing a checkbook and involves keeping track of “deposits” (rain and irrigation) and “withdrawals” (crop water use). Weather records or evaporation pan data can be used to derive useful approximations of potential crop water use. This is known as “potential evapotranspiration” or “ET.” During the months of July and August, expect ET rates of 1 to 1.5 inches of water per week with lower values during other months. Maximum water use can be much lower (e.g., 50 to 60 percent of potential ET) if temperatures are cool and humidity high.

Light irrigation is needed more frequently at early seedling stages because the plant has only a small soil water reservoir. Later in the season, less frequent but deeper irrigations are used to replenish a larger rooted volume. Information on water-holding capacity is important so as to avoid adding more water at any one time than the soil can hold. Light-textured soils hold less water than do heavy clay (and most muck) soils; thus a grower with a sandy soil will irrigate more frequently and apply less at each irrigation.

II. Fertilizer

High quality sweet corn begins with a soil test, something that should be done on all fields every three years. Growing any crop without reliable soil test results is risky and just not worth it.

For under $20 a soil test can give you the pH, organic matter content, cation exchange capacity, and the levels of most of the nutrients needed for plants.

Let's start with the pH. Sweet corn, like most vegetable crops, does best in a slightly acid soil, from 6.0 to 6.7. If the pH is below 5.5, it's best to apply limestone in the fall so that it has time to react with the entire plow layer (at least two plowings). If a fall application is not possible or more than four tons per acre need to be added, a split application is recommended. Plow down half and apply the rest to the surface and disk in. This will provide a pH favorable for seedling development.

Once you have the pH adjusted, it's time to plan your fertilizer program. In New York, we recommend the following;

Table 2. Recommended rate of nutrients to apply to sweet corn based on soil tests.

N	P_2O_5			K_2O			
pounds/Acre	pounds/acre			pounds/acre			Comments
	Soil Test Level			Soil Test Level			
	low	med.	high	low	med.	high	
120-140	120	80	40	120	80	40	Total Recommended
40	80	40	0	80	40	0	Broadcast and disk in[1]
40	40	40	40	40	40	40	Band place with planter
40-60	0	0	0	0	0	0	Sidedress when corn is 6" to 12" high

[1]A second sidedressing could replace the preplant, broadcast application of nitrogen if applied when corn is 12" to 18" tall. This is preferable on leachable soils.

Starter fertilizer

Cool soils will tie-up some of the nutrients needed for plant growth. Nitrogen, normally slowly released from soil organic matter, becomes available only as the soil warms up. Phosphorus too is bound in the soil at temperatures 60F and below. Only about 1/3 is available at 60F compared to 70F. We can see early season P deficiencies even in soils that are very high in P.

To get corn off to a good start, a starter fertilizer is recommended. Typically, a banded fertilizer is placed no closer than two inches to the side and two inches below the seed furrow as it is planted. The fertilizer should stay far enough from the seed to avoid burning but close enough to provide nutrients. Never apply more than 80 – 100 pounds of the combined N and potassium (K) in the band or you risk burning the seedlings. The level of P in the band is not as critical as P is normally less likely to burn.

Another option for starter is using a pop-up fertilizer. Pop-up are fertilizers used in very low amounts that are placed in the seed furrow. Of concern with pop-ups is the potential for burning and significant stand reduction since the fertilizer is so close to the seed. To reduce this risk, no more than 5 to 8 pounds of N and K per acre should ever be applied (5 lbs/A on lighter soils and 8 lbs/A on heavier soils.

I have not seen any reliable information that indicates that pop-ups provide advantages to the traditional 2x2 placement. I have seen several studies that show that in some years, usually when soils are dry and fertilizer salt damage is more likely, pop-ups in the furrow can cause stand reductions. The idea that plants will benefit from closer proximity to the fertilizer seems to make sense until you look at the seed itself. For the first two to three weeks, after planting, the pant relies on the nutrients in the seed, not the fertilizer. By the time these reserves are depleted, root development should be adequate to reach the 2x2 band. The greatest benefit for pop-ups may be in using low amounts of P in the seed furrow in soils that already have plenty (at least they will have plenty once the soil warms). Growers should stay away from any pop-ups that include ammonia (urea, mono or diammonium phosphate) as the ammonia can cause problems.

Once the corn is up and growing, a sidedressing of 40 to 60 ponds per acre is recommended. This should be done when the corn is between 6 and 12 inches in height. Soils high in organic matter (from manure or cover crops) may not require the sidedressing. There are several soil tests that can be performed prior to sidedressing (pre-sidedress nitrate tests or PSNT) to measure the available nitrate. Normally, soils with nitrate levels above 25 to 30 PPM, will not respond to additional nitrogen.