agKnowledge Spotlight
Shedding light on the concerns of your fields.

Considerations for Corn Stand Establishment

- Corn stand establishment is a critical early step toward maximizing potential yield and profitability.
- Soil conditions and fertility, weather, pest pressure, and planting speed should be considered prior to and during stand establishment.
- Decisions made in regards to equipment maintenance, monitoring weather and soil conditions, and checking planting accuracy can greatly affect potential yield.

Soil Conditions

Soil conditions at planting play an important role in stand establishment. Regardless of the type of tillage used, the soil should be sufficiently dry prior to equipment passage to reduce compaction. Soil compaction occurs when pressure is applied to soils at capacity, or when water displaces air pore space in the soil. Water can act like a lubricant between soil aggregates, forcing them to become tightly packed together. Soil compaction can lead to poor root development and limited nutrient and water availability. Sidewall compaction can occur in the seed furrow if the soil contains too much moisture at planting (Figure 1). This can prevent the primary root or seed radical from penetrating through the compaction into surrounding soil and nutrients. Ultimately, the seedling may die or result in a "non-productive" plant.

Corn seed requires a minimum soil temperature of 5 0° F for uniform germination. A f our-inch long temperature probe used midday can provide a good idea of the temperature the soil will achieve for the day. Variable soil moisture and temperature in the seed zone can make a big difference in the amount of time it takes coleoptiles to emerge. Seeds will not germinate until they have absorbed about 30% of their weight in water.[1]

Soil Fertility

Starter fertilizers may help mitigate decreased mineralization and reduced nutrient mobility found in cool, wet soils typical during planting. Starter fertilizers can help establish a uniform stand that may pollinate earlier and have a higher tolerance to heat stress. Precautions should be taken to avoid injury to seedling roots from applied fertilizers. Planting too quickly after an anhydrous ammonia application could result in root burn. General recommendations are to wait approximately 7 to 10 days to plant after an anhydrous ammonia application.[2] However, there is no definitive waiting period as injury to spring-planted seedlings has occurred from fall-applied anhydrous ammonia. Anhydrous applications should be applied diagonally across the field to avoid the potential of placing a corn row directly into a previous anhydrous knife slot. Anhydrous ammonia application into wet soils may result in soil smearing as the knives pass through the soil profile. Consequently, ammonia cannot dissipate from the soil-smeared slots.

Figure 1. Limited root growth due to sidewall compaction.

The most common recommended placement for starter fertilizer is 2 inches to the side and 2 inches below the kernel at planting. This placement reduces seed injury, especially under dry soil conditions on light or sandy soils. According to information from Pennsylvania State University, starter fertilizer rates should be below ten pounds of nitrogen and potassium (K_2O) per acre and should not contain urea or Diammonium phosphate (DAP).[3]

Weather Conditions

Temperature, precipitation, and wind are important aspects of weather to consider prior to planting. For uniform germination at a soil temperature of at least 5 0° F, using weather forecasts, in addition to soil temperature probes, can be useful to determine optimal time to plant. Forecasts with warm air temperatures and sunny days are typically favorable for planting, whereas cool, cloudy days are not, especially if frost may occur.

Figure 2. Corn seedling damaged by chilling injury.

Wet soils with a temperature below 50° F may cause chilling injury during germination (Figure 2). Imbibitional chilling injury happens when a dry corn seed takes in cold water from rain or melting snow. The germinating corn absorbs the water like normal, but the cold water causes cell membranes to become rigid and rupture, which can result in serious damage including: aborted radicals, proliferation of seminal roots, and delayed seedling growth.

Wind may also be problematic at planting. Windy conditions can dry soil out around planted seed. Without moisture, the roots may not be able to continue growth and seedlings may die or become stunted.

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Planting Depth and Speed

Seeds should be planted at a consistent depth into adequate moisture and with good seed-to-soil contact to help establish uniform emergence. Normally, planting depth should be 1.5 to 2 inches. A depth of less than one inch may result in the nodal root system developing too near the soil surface. Consequently, rootless corn syndrome can develop in seedlings. Birds and other animals are more likely to feed on shallow-planted seeds. Planting depth and spacing should be checked regularly during planting to ensure proper placement. Emergence delays of around 10 days scattered throughout the field may result in yield losses of up to 9%, and delays around 21 days may result in yield losses of up to 22%.[4] Plant spacing variability evaluated in 350 commercial corn fields suggested that yield may be improved by up to 6.5 bushels per acre in 60% of fields and more than 7.5 bushels per acre in 24% of fields with improving plant spacing uniformity.[5]

Plant spacing uniformity and accuracy may be improved by adjusting planter speed. In a study completed by the University of Nebraska, seed spacing accuracy was reduced as planting speed was increased.[6] The study measured spacing accuracy for speeds of 2, 4, and 6 mph. In this study, yield was not significantly affected by increased accuracy. However, in another study at the University of Nebraska, yield was negatively affected when speeds increased from 5 mph to 7.5 mph. The study reported a profit loss of more than $20 an acre with corn priced at $3.50/bu.[7]

A planting trial conducted by twenty-two farmers in Indiana, Illinois, and Iowa planted corn at 4, 5, 6, and 7 mph. The study was replicated on each farm three times. Results indicated a yield loss of 3 bu/acre at 6 and 7 mph compared to speeds of 4 and 5 mph.[8] In the same study, seven of twenty-one planters showed yield decreases of 1.6 to 4.7 bu/acre for each 1 mph increase in planting speed. A three mph increase from 4 to 7 mph would provide per acre dollar losses of $19.20 and $56.40 with corn priced at $4.00/bu.

Pest Pressure

Soil insects such as wireworm, seedcorn maggot (Figure 3), white grub, and grape colaspis can feed on seed kernels and destroy germinating seeds. Seed treatment products may not only help provide protection against these and other labeled soil insects, but also help protect seed from soil and seed borne diseases including Fusarium, Rhizoctonia, and Pythium. Protection may be enhanced with additional premium seed treatment products to further help protect seed from black cutworm and corn nematode pressure after root development initiation.

Figure 3. Seedcorn maggot injury to corn kernel.

Management Role

The decisions of when to plant, when and how to apply fertilizer, herbicides, and insecticides, how deep to plant, speed of planting, and other decisions are ultimately determined by the grower.

Establishing the desired stand is a factor of many interactions that can to some extent, be regulated through management. Overseeing equipment maintenance, checking weather forecasts, determining soil conditions, and ensuring timely checks of planting accuracy during planting, are a few of the elements that growers can actively manage.

Sources

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