AGRONOMIC Spotlight

Technology Development & Agronomy by MONSANTO

Establishing a Desired Corn Stand

Establishing the desired corn stand is a key element of maximizing potential yield and profitability. Many factors can play a role in stand establishment including: equipment, soil conditions, fertility, weather, pests, planting speed, and operator decisions.

Equipment

Planting equipment should be properly maintained and adjusted to help establish a desired and uniform corn stand. Equipment that has been through a planting season should be washed to remove dust and other residue so that wear and any breaks are more easily detected. Worn parts should be replaced and breaks repaired to reduce potential down time during the planting season and help improve the potential for desired seed spacing and depth.

Planters should be level in relationship to the tractor. This helps keep the planting units parallel with the ground. Improper leveling may make it difficult to place the seed at the desired depth.

Regardless of planter type or manufacturer, seeding mechanisms should be inspected for wear, residue, mouse nests, air leaks, and other abnormalities. These steps can help reduce the chance of doubles, triples, and skips occurring. Double eliminators may already be standard on row units. Older equipment may be upgraded with this small change to improve seed spacing.

For finger pickup units, an inspection should include the evaluation of wear on the back plate and brushes, and proper tension on each of the fingers. A feeler gauge can be used to check tension on the fingers and adjustments should be made if necessary. Finger pickup plateless seed meters are available for some row unit models. These meters help provide consistent corn seed spacing and population control. Seal integrity, baffle settings, brush quality, and disc contact with the housing for vacuum meters should also be inspected.

Replacement of seed tubes may be necessary if they are worn at the bottom. Seed may come into contact with the disk if there is wear at the bottom of the boot and cause seed to be deflected onto the soil surface. Positive locking seed tube guards can protect the seed tubes. Flush face seed tubes may be available for some planters and can improve consistency in spacing because seeds drop uninterrupted through tubes for more even spacing.

There should be good contact between double disk openers (Figure 1). A sharp 'V' trench is needed for good seed placement. The manufacturer's manual should be referenced for the diameter at which the disk should be replaced.

Figure 1. Double disc openers with the appropriate amount of contact.

Closing wheels should be aligned with the double disk opener. If out of alignment, check for wear on the closing wheel supports. Wheels should be checked for turning freely and the down-pressure on the soil should be checked to be sure it is appropriate for the soil type and/or conditions. Pneumatic down force systems can provide variable down-pressure per row to match conditions.

Soil Conditions

Planting-time soil condition plays an important role in stand establishment. Regardless of the amount of tillage planned (minimum tillage vs. conventional), the soil should be sufficiently dry for equipment passage without causing compaction. Compacted soil may not allow for a proper seed bed because it is compressed so much that soil particles have little pore space between them. Sidewall compaction can occur in the seed furrow if the soil contains too much moisture (Figure 2). 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 become a "non-productive" plant.

Figure 2. Results of sidewall compaction at planting time.

Deep compaction into the root zone can cause issues later into the season as roots grow into the soil profile. Root restriction can cause nutrient and moisture deficiencies.

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Variable soil moisture and temperature in the seed zone can make a big difference in the amount of time it takes coleoptiles to emerge. When seeds have absorbed about 30% of their weight in water, germination begins.[1]

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 will result in the nodal root system developing too near the soil surface, which can result in rootless corn syndrome. Shallow planted seed is also subject to feeding by animals and birds. During the planting season, depth should be checked routinely to observe for proper placement. Emergence delays of about 10 days scattered throughout the field can result in yield losses up to 9%. Delays of about 21 days can result in yield losses up to 22%.[2] An evaluation of 350 commercial corn fields for plant spacing variability suggested that yield may improve up to 6.5 bushels per acre in 60% of the fields and more than 7.5 bushels per acre in 24% of the fields by improving plant spacing uniformity within the rows[3].

Role of Fertility

Precautions should be taken to avoid injury to seedling roots from applied fertilizers. Planting too quickly behind an anhydrous ammonia application could result in root burn. General recommendations are to wait approximately seven to ten days to plant after an ammonia application.[4] However, there is no definitive waiting period as injury 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. Ammonia application into wet soils can result in the knives smearing the soil as the knives pass through the soil profile, which does not allow the ammonia to dissipate.

Pop-up fertilizers should be placed two inches below and two inches to the side (2 x 2) of the seed row to help avoid seed injury, especially under dry soil conditions on light or sandy soils. According to information from Penn State University, the starter fertilizer rate should be below ten pounds of nitrogen and potassium (K_2O) per acre and must not contain urea or DAP.[5]

Role of Weather

Corn seed requires a soil temperature of at least 50° F for germination and emergence to be uniform. If soil conditions are dry, seeding depth should be deep enough to meet soil moisture. Uneven soil moisture can lead to uneven emergence.

Wet soils with a temperature below 50° F may cause chilling injury during germination (Figure 3). Imbibitional chilling injury happens when a dry corn seed takes in cold water from rain or melting snow. As usual, the germinating corn seed takes in the water and swells. However, cold water can cause cell membranes to become rigid and rupture which may result in aborted radicals, proliferation of seminal roots, and delayed seedling growth.

Figure 3. Chilling injury to corn seedlings.

Utilizing a four inch long temperature probe around 11:30 a.m. should provide a good idea of the temperature the soil will achieve for the day (Figure 4). In addition, short term weather forecasts can provide clues toward soil warmth. A forecast with warm air temperatures and sunny days can be favorable for planting. Conversely, cool cloudy days can result in unfavorable planting conditions, especially if freezing temperatures occur.

Figure 4. Soil temperature and moisture are factors to consider when deciding when to start 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.

Role of Pests

Soil insects such as garden symphylan, seedcorn maggot, wireworm, and seedcorn beetle can feed on seed kernels and destroy the germ. Seed treated with Acceleron® Seed Treatment Products provides protection against these and other labeled soil insects. Though not usually a problem during germination, corn seed can be protected from corn nematodes with the addition of Poncho® VOTiVO® seed treatment.

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Role of Planting Speed

Speed of planting has been shown to have an impact on seed spacing accuracy. In a 2001 University of Nebraska study seed spacing accuracy was reduced as planting speed was increased.[6] The study measured spacing accuracy for speeds of 2, 4, and 6 mph. Though accuracy increased with the slower speeds, yield was not affected.

In another Nebraska study, yields decreased as speeds increased from 5 mph to 7.5 mph. The study reported a profit loss of more than $20 an acre at $3.50/bu.[7]

In a 1993 planting trial, 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 three bu/acre at 6 and 7 mph compared to speeds of 4 and 5 mph.[8] In the same study, seven of the twenty-one planters showed yield decreases of 1.6 to 4.7 bu/acre for each one mph increase in planting speed. A three mph increase from 4 to 7 would provide per acre dollar losses of $19.20 and $56.40 with corn priced at $4.00/bu,

Role of Operator or Manager

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 operator or manager. 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 on planting accuracy while planting, are a few of the elements that operators or managers can influence.

Sources: [1] Nielsen, R. L. 2000. Corn growth and development what goes on from planting to harvest? Purdue University. AGRY-97-07.

[2]Carter, P. R., et. Al. 1992. Effects of uneven seedling emergence in corn. National Corn Handbook. NCH-36. Purdue University.

[3]Nielsen, R. L. 1997. Stand establishment variability in corn. AGRY-91-01. Purdue University. http://www.agry.purdue.edu (verified 1/2/13).

[4]Schwab, G. 2009. Avoiding anhydrous ammonia seedling injury. Corn & Soybean News. Volume 9, Issue 4. University of Kentucky. http://www.uky.edu. (verified 12/31/12).

[5]Beegle, D. B., et. al. Starter fertilizer. Agronomy Facts 51. Penn State University. http://extension.psu.edu (verified 12/31/12).

[6]Elmore, R. 2002. How does planter speed affect plant spacing? CropWatch. University of Nebraska. (published in Corn Production, Iowa State University. http://www.agronext.iastate.edu) (verified 1/1/13).

[7]Jasa, P. 5/11/07. Increased planting speed can cost yields. Nebraska crop production & pest management information. CropWatch. University of Nebraska. http://cropwatch.unl.edu (verified 1/1/13).

[8]Nielsen, R. L. 1993. Planting speed effects on stand establishment and grain yield of corn. Summary of 1993 on-farm trials. AGRY-94-02. Purdue University.

Sawyer, J. E. 2003. Ammonia burn hits cornfields. Soil fertility. Integrated Crop Management. IC-490(12). Iowa State University. http://www.ipm.iastate.edu. (verified 12/31/12).

Nielsen, R. L. 2000. Planter maintenance: there's still time! Chat'n Chew Café. Corny News Network. Purdue University. http://www.agry.purdue.edu. (verified 1/2/13).

Larson, E. 2009. Corn planting suggestions. (PDF). Grain Crops Update. Mississippi State University.

Elmore, R. 2012. Imibitional chilling and variable emergence. Integrated Crop Management News. Iowa State University. http://www.extension.iastate.edu (verified 1/9/13).