1. Diagnosing corn emergence and seedling growth problems

Few problems cause as much anxiety among crop producers as having a poor stand of corn, or corn plants that look sickly after emergence. The cost of planting corn is so high that failure is very expensive. When this happens, the first step is to start looking for the cause of the problem.

What are the most common causes of emergence problems or poor seedling growth? There can be several possible causes.

If there is poor seedling emergence, start by looking for patterns. Whether the emergence problems are occurring in small but regular skips across the field, uniformly throughout the field, only in localized areas, or in random scattered areas could be a clue to the cause. Here are just a few of the possible scenarios:

* A uniform pattern of skips suggests a clogged, jammed, or broken planter.
* If the field has an uneven pattern of emergence, you’ll have to do some digging in the areas with emergence problems. If there is a hole where the seeds were placed, an empty seed coat at the bottom of the hole, and a little pile of soil next to the hole, you might suspect rodent damage.
* Soil insects can also cause patterns of non-uniform emergence. Several insects attack planted seed, destroying the germ or feeding on the germinating tissue. When cool temperatures delay germination, the risk of damage increases as the seed is exposed to a longer feeding period by insects. Possible culprits include seed corn beetles, seed corn maggots, and wireworms. Check to see if the seed had been treated with a seed-applied or planting-time insecticide. If so, insect damage is less likely to be the cause of the problem. If not, soil insect damage is a possibility.
* Uneven patterns of emergence may also be caused by prolonged waterlogging in low-lying areas of the field.
* If emergence problems are relatively uniform throughout the field, you may find that soil surface crusting has prevented emergence. This can be easily verified by a little digging. If seedlings cannot push through the soil surface crust, you should find malformed seedlings just beneath the soil surface.

* Poor emergence or uneven emergence can result from planting early corn too shallowly, and not having all the seed planted into adequate moisture for germination. This seems to occur most often in no-till, where variation in residue cover causes variable surface moisture.

If the plants emerged in good fashion, but the seedlings then have problems maintaining adequate growth and development or leaf color, there may be several possible reasons. A few of the most likely causes include:

* White grubs or wireworms. These soil insects may be eating the roots, which will cause the plants to wilt.

* Herbicide injury. Corn is very susceptible to injury from carryover sulfonylurea herbicides which may have been applied to a previous crop, such as wheat. Carryover depends on soil pH, soil texture, application rates, rainfall, and other factors listed on the herbicide labels. Symptoms include stunting, chlorosis, and an overall sickly appearance. Corn will not grow out of this type of injury. Glyphosate drift can also cause seedling injury. Symptoms are not very precise, but the plants have an overall sickly appearance, and affected plants will be primarily on the edges of the field, depending on the direction from which the drift occurred. Plants usually do not grow out of glyphosate injury very well.

* Compacted soil or waterlogging. This can cause yellowed, wilting plants due to poor root growth, drowning, or a seedling blight infection. Seedling blight is often characterized by stem tissue near ground level that is discolored or water-soaked in appearance.

* Black cutworms. These insects, which can be found in the soil or on the surface, cause “window paning” of the leaves on young plants. Cutworms may also cut off seedling plants at the soil surface.

* Flea beetles. These tiny leaf-chewing insects can cause “scratches” on leaves. Eventually, the leaves may shrivel, turn gray, and die. Plants are more susceptible to flea beetle injury when temperatures are cold and seedling growth is slow. Seedling plants are often able to recover from flea beetle injury because the growing point remains below ground level until the fifth leaf emerges.

* Freezing temperatures. A freeze that occur after emergence can cause leaves to first appear watersoaked, then turn white within a few days. A freeze can kill leaves. Plants can recover from this if the freeze occurs before the fifth leaf emerges because the growing point is still underground. Plant roots are undamaged by a freeze. If the weather is favorable after the freeze injury occurs, chances of plant survival are increased.

* Free ammonia from an anhydrous ammonia application. This can injure roots and kill germinating seed if the ammonia was applied too shallowly (especially in coarser soils), too close to the time of planting, or if dry soil conditions slowed the conversion of ammonia to ammonium. One “trick” to minimize damage is to apply the ammonia
at a 10 to 15 degree angle from the direction of planting. If injury occurs then it is
more randomly distributed, reducing the multi-plant “skips,” and allowing the
unaffected plants to compensate.
*Ammonia injury can also occur when sidedressing anhydrous ammonia under dry soil
conditions. Root injury can occur if the plants get too big or the knives run too close
to the row. Ammonia injury resulting from poor soil sealing can cause leaves to
appear watersoaked or have dead margins. Roots may appear sheared off, or burned
off. Plants will normally recover from this injury, but yields can be reduced.
* Nitrogen (N) deficiency. This does not usually occur until a later stage of growth in
conventional tillage systems. But in no-till corn, especially in high residue situations,
N deficiency is common where producers haven’t applied nitrogen as a starter, or
broadcast a significant amount of N prior to or at planting. In early planting in very
cold soils where no N was applied close to the seed as a starter, seedlings may be N
deficient in conventional-till also. Nitrogen deficient corn seedlings will be spindly,
with pale yellow-green foliage. As the plants grow, the lower leaves will “fire,” with
yellowing starting from the tip of the leaf and progressing back toward the stalk.
* Phosphorus deficiency. This can result in stunted growth and purple leaves early in the
growing season. Phosphorus deficiency is often enhanced by cool, wet growing
conditions.
* Iron deficiency. This can cause upper leaves to be pale green between the veins. Iron
deficiency is more common on high pH and calcareous soils.
* Sulfur deficiency. This can result in stunted plants having pale green leaves, with no
distinct pattern on the leaves.

For more details, see “Diagnosing Corn Production Problems in Kansas,” K-State
publication S-54.

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2. Making stand counts and corn replant decisions

If corn doesn’t make a good stand, or if young seedlings start dying, producers will have
to decide what to do about it, if anything. The first step is to make a stand count.

To determine plant population in 30-inch rows, count the number of plants in 17.5 linear
feet of row and multiply the number of plants by 1,000. That equals the number of plants
per acre. For example, if there are an average of 15 plants in 17.5 feet of row, that would
equal 15,000 plants per acre. Producers should take counts at several locations within a
field to get an average stand count.

Deciding whether the stand is thin enough to replant is not easy. If it’s still early in the
window of optimal planting dates, it may be a good idea to replant when the stand gets
down to 70 percent of the desired population. But at the end of the window of optimal planting dates, you may not want to replant unless the stand is only 50 percent of what was desired since corn planted late will have reduced yield potential. Those percentages are only a starting point for making decisions, and apply best to eastern Kansas and irrigated fields. In areas where dryland corn seeding rates are only 15,000 to begin with, producers should not accept stands as low as 50 percent, for example. For dryland corn in western Kansas, producers should consider replanting wherever stands are less than 10,000 and planting dates are not too late. In central Kansas, producers should consider replanting wherever stands are less than 10-12,000 and planting dates are not too late.

Overseeding a stand of corn is not an option since that would result in variable corn development and heights at harvest. Producers who want to replant should destroy the poor stand of corn and plant again, using the same seeding rate.

Thin stands will very likely have lower yield potential, and can also lead to increased weed problems. Open areas in the field are susceptible to weed infestation. Postemergence herbicides can be used to control these weeds, but that adds extra expense.

One of the dilemmas that occurs often is irregular stands. What if there are parts of the field with adequate stands, and parts of the field with bare patches or poor stands? In that case, producers should resist the temptation to re-seed the bare spots only. That would again lead to the problem of a field with variable development and height at harvest. It would be best to either do nothing, or replant the entire field, depending on the average stand count over the entire field.

If corn is being replanted later than normal, producers should use earlier-maturing hybrids. It’s also best to use a Bt hybrid when planting late because late-planted corn is more susceptible to corn borers.

-- Dale Fjell, Northeast area Extension director and former Extension crop production specialist

3. Maximizing irrigated soybean yields

Typically, in a corn-soybean rotation, fertilizer is only applied during the corn phase of the rotation. On a per-bushel basis, soybeans remove twice as much phosphorus, and almost five times as much potassium, as corn. To capitalize on genetic improvements in soybean yield, plant nutrients must not be the limiting factor.

In 2004, a study was begun at the North Central Kansas Experiment Field to find ways to maximize soybean yields. This study was continued in 2005. Treatments included row spacing (30 and 7.5 inches), plant populations (150,000 and 225,000 plants per acre), and seven fertility treatments. Fertility treatments consisted of various combinations of nitrogen (N), phosphorus (P₂O₅) at a low and high rate, potassium (K₂O) at a low and
high rate, and manganese (Mn), as listed in the tables below. Soil test values were: pH = 6.9; Bray-1 P = 21 ppm; exchangeable K = 210 ppm. K-State soil test recommendations would call for 30 lbs P₂O₅ per acre at this location. The soil was a Crete silt loam, and the soybeans were sprinkler irrigated. The soybeans were planted on May 8 in 2004 and May 10 in 2005. The fertilizer was broadcast in mid-March.
### Irrigated soybean yields as affected by row spacing and plant population

(2004-2005 average)

<table>
<thead>
<tr>
<th>Row spacing</th>
<th>Yield (bu/acre)</th>
</tr>
</thead>
<tbody>
<tr>
<td>30 inch</td>
<td>77.5</td>
</tr>
<tr>
<td>7.5 inch</td>
<td>78.5</td>
</tr>
</tbody>
</table>

### Fertility and plant population effects on soybean yield

(averaged over row spacing)

#### 2004

<table>
<thead>
<tr>
<th>Fertilizer treatment (N-P₂O₅-K₂O)</th>
<th>Yield (bu/acre)</th>
</tr>
</thead>
<tbody>
<tr>
<td>None</td>
<td>53</td>
</tr>
<tr>
<td>0-30-0</td>
<td>61</td>
</tr>
<tr>
<td>0-30-60</td>
<td>73</td>
</tr>
<tr>
<td>0-30-120</td>
<td>77</td>
</tr>
<tr>
<td>0-80-60</td>
<td>85</td>
</tr>
<tr>
<td>0-80-120</td>
<td>85</td>
</tr>
<tr>
<td>20-80-120</td>
<td>86</td>
</tr>
<tr>
<td>LSD (0.05) = 2</td>
<td></td>
</tr>
</tbody>
</table>

### Fertility and plant population effects on soybean yield

(averaged over row spacing and population)

#### 2005

<table>
<thead>
<tr>
<th>Fertilizer treatment (N-P₂O₅-K₂O-Mn)</th>
<th>Yield (bu/acre)</th>
</tr>
</thead>
<tbody>
<tr>
<td>None</td>
<td>55</td>
</tr>
<tr>
<td>0-30-0-0</td>
<td>63</td>
</tr>
<tr>
<td>0-30-60-0</td>
<td>76</td>
</tr>
<tr>
<td>0-30-120-0</td>
<td>81</td>
</tr>
<tr>
<td>0-80-60-0</td>
<td>88</td>
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<tr>
<td>0-80-120-0</td>
<td>89</td>
</tr>
<tr>
<td>20-80-120-0</td>
<td>88</td>
</tr>
<tr>
<td>20-80-120-5</td>
<td>93</td>
</tr>
<tr>
<td>LSD (0.05) = 3</td>
<td></td>
</tr>
</tbody>
</table>

In 2004, neither plant populations nor row spacing affected yields. Increasing plant population in narrow rows reduced yield. Soybean yields did respond to fertilizer application. Applying 80 lbs/a P₂O₅ with 60 lb/a K₂O increased yield by 32 bu/acre over the unfertilized plot. Applying additional K₂O or adding N to the fertilizer did not increase yields. Increasing plant population at lower fertility rates decreased yield.
In 2005, soybean yield was again not affected by row spacing or plant population. Fertility treatments had a dramatic effect on soybean yield. Applying 80 lbs/a P$_2$O$_5$ with 60 lbs/a K$_2$O increased yield by 33 bu/acre over the unfertilized plot. Applying additional K$_2$O or adding N to the fertilizer did not increase yields. Addition of Mn to the mix did significantly increase yields.

In high-yield environments, soybean yields can be greatly improved by direct fertilization.

-- Barney Gordon, agronomist-in-charge, North Central Kansas Experiment Field
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These e-Updates are a regular weekly item from K-State Extension Agronomy. All of the Research and Extension faculty in Agronomy will be involved as sources from time to time. If you have any questions or suggestions for topics you'd like to have us address in this weekly update, contact Jim Shroyer, Research and Extension Crop Production Specialist and State Extension Agronomy Leader
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