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Effects of Flooding or Ponding on Young Corn

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Recent intense rainfall events (technically referred to as "toad stranglers" or "goose drownders") in southern Indiana have caused flooding of low-lying corn fields or ponding in poorly drained swales within fields. Other areas within fields, while not technically flooded or ponded, may remain saturated for lengthy periods of time. What are the prospects for recently planted or emerged corn?

For corn that has been recently planted, but is not yet emerged, the obvious risk is with surface soil crusts that may develop following a severe downpour. The risk is particularly high for conventionally tilled fields. Corn emergence can be especially challenging when a dense surface crust "sets up". The resistance of a crust to coleoptile penetration often results in corkscrewed mesocotyl elongation below the surface and eventual leafing out underground if coleoptile emergence is delayed long enough.

Monitor high-risk fields where corn emergence has not yet occurred and be prepared to use a rotary hoe if necessary to break up the crust and aid emergence. Don't dawdle on using the rotary hoe until the crust has baked dry into "concrete". Operate the hoe at a good speed and do not worry about the occasional corn seedling that is flipped out of the soil. A side benefit to breaking a dense soil crust is the resulting enhanced soil aeration.

The "wet feet" caused by flooding or ponding creates other risks for corn that has already emerged, primarily because soil oxygen is depleted after about 48 hours of soil saturation. Without oxygen, the plants cannot perform critical life sustaining functions; e.g. nutrient and water uptake is impaired and root growth is inhibited.

The growth stage of a corn crop greatly influences whether ponding or saturated soils kills, severely stunts, or mildly stunts the corn plants. Plants younger than V6 (six visible leaf collars) are susceptible to damage for two reasons. First of all, the growing point is at or below the soil surface from VE to about V6 (Nielsen, 2004) and therefore is directly subject to the stress of oxygen-depleted conditions. In plants older than V6, the growing point may be above the water level and the likelihood for survival improves greatly.

Secondly, plants younger than V6 are in the process of trying to successfully establish a vigorous root system. Stunting or death of roots by oxygen-depletion can be a major stress for a plant that is not yet fully established.

Prior to leaf stage V6, corn can survive only two to four days of flooded or ponded conditions. If temperatures are warm during that time (mid-70s F or higher) such young plants may not survive 24 hours. Cooler temperatures prolong survival.

The likelihood of crop injury is less where the flooded or ponded conditions last less than 48 hours. To confirm plant survival, check the color of the growing point and look for new leaf growth three to five days after water drains from the field. Healthy growing points will be firm and yellowish-white, not mushy and discolored.

Plants older than V6 will tolerate ponding or saturated soils longer for essentially the opposite reasons. As plants develop beyond V6, rapid stalk elongation elevates the growing point region above the soil surface and, thus, away from the direct stress of flooded soils. Secondly, an older crop's root system will simply be larger and consequently the crop can tolerate a certain amount of root death without dying or dramatic stunting.

Nonetheless, extended periods of saturated soils plus warm temperatures will take their toll on the overall vigor of the crop. Some root death will occur and new root growth will be stunted until the soil dries to acceptable moisture contents. As a result, plants may be subject to greater injury during a subsequently dry summer due to their restricted root systems.

Concomitant (I found a new word in the dictionary!) with the direct stress of saturated soils on a corn crop, flooding and ponding can result in significant losses of soil nitrogen through the processes of denitrification and leaching of nitrate N. Significant loss of soil N will cause nitrogen deficiencies and possible additional yield loss. Brouder & Joern (1998) offer guidelines in estimating the amount of nitrogen loss due to saturated soils and making decisions on application of additional nitrogen fertilizer to fields once ponded.

Lengthy periods of wet soil conditions favor the development of seedling blight diseases, especially those caused by *Pythium* fungi (Ortiz-Ribbing, 2001). Poorly drained areas of fields are most at risk for the development of these diseases and so are also at most risk for potential replant operations if significant stand loss occurs due to seedling blight outbreaks.

Certain diseases, such as common smut and crazy top, may also become greater risks due to flooding and cool temperatures (Bissonnette, 2002). The fungus that causes crazy top depends on saturated soil conditions to infect corn seedlings. The common smut fungal organism is ubiquitous in soils and can infect young corn plants through tissue damaged by floodwaters. There is limited hybrid resistance to either of these two diseases and predicting damage is difficult until later in the growing season.

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