Spring 2007
No. 2

NC STATE UNIVERSITY

Corn Kernels
Corn Information for North Carolina Corn Growers

Vernon G. James Research and Extension Center, Plymouth, NC 27962

Assessing Freeze Damage to Corn

Ron Heiniger
Cropping Systems Specialist
North Carolina State University

The Situation

Record or near record low temperatures on April 7 and 8th have damaged corn seedlings. The key question is whether or not this damage was severe enough to destroy the seedling or to reduce yield potential. The following guidelines are to be used to try and assess the damage and to determine if the grower needs to replant. The key issue is the stage of development of the crop. Therefore, assessments differ based on the development of the seedling.

Seedlings – Germination Through Elongation of the First Internode

Corn that was planted in the last three days before the freeze event on Saturday night was most likely to be in this stage of development. From the period when the radicle and the small shoot first break through the seed coat to the time the crown is established approximately ½" below the soil line the seedling can be damaged by soil temperatures that are below 32 degrees F for 6 to 8 hours. In addition, chilling injury can occur with soil temperatures that remain below 35 degrees F for 24 to 48 hours. While this type of damage is extremely rare and, in most instances, soil temperatures did not remain below 32 for a long enough period to cause damage, there could be cases where the seed was shallow planted that this injury could be an issue.

To assess this type of damage: 1) Dig up the seedling and examine the small growing shoot. 2) Look for desiccated and brown tissue similar to what is found when a shoot dies (the shoot should be a bright yellow – turgid and moist). 3) If the shoot appears to be alive, look for wrinkling or roughness of the surface of the internode. This is a sign of chilling injury and while the plant may develop further yield will be affected.

If you find dead seedlings or signs of chilling injury, then you need to assess the extent of the crop damage. Dig up two to three sections of row representing 1/1000th of an acre. Table 1 shows the row length required for several different row spacings. Within this section, remove the dead plants and count those that remain. Multiply by 1000 and you have the remaining plant population.

Table 1. Row length needed to measure 1/1000th of an acre for determining plant populations at different row spacings.

Row Spacing (inches)	Length for determining 1/1000th of an acre (feet)
20	26.1
24	21.8
28	18.7
30	17.4
36	14.5
38	13.8
40	13.1

Given that there is a good chance of obtaining full yields from replanting, your plant stand should be within 90% of your target plant population (example: if you were trying to obtain 30,000 plants per acre then 90% would be a population of 27,000 plants per acre).

Emerged Seedlings – Coleoptile just below surface to plants with 2 to 3 leaves

Because the crown has been established corn in this stage of development is less sensitive to chilling or freeze injury. Soil temperatures below 25 degrees F for 6 hours would be required to kill the seedling completely. While the leaves or emerging coleoptile above the soil line may be damaged and/or dead new leaves will emerge from the growing point (crown) and replace these dead leaves.

To assess this damage: 1) dig up the seedling and examine the crown where the emerging coleoptile originated. You will need to cut into the crown and look at the growing point itself. 2) if the growing point is mushy and gray or black then damage has occurred and the seedling is lost. If the growing point is a light yellow with yellow-green leaf material surrounding it then it is still healthy. 3) If the growing point is still healthy then I would wait for 7 to 10 days to see how the plants recover from this damage. Growers should be able to see re-emerging leaves and from that determine stand losses. Again, I would use the 90% standard to determine if replanting is necessary.

The other important question is "What about yield from corn seedlings that recover from this type of damage?" Our experiences with early planting indicate that corn seedlings can be burned back once and do NOT experience significant reductions in yield potential. Seedlings that experience this type of cold on two or more occasions do lose vigor and yield potential. I would urge growers to be patient and assess the seedlings as they re-emerge to determine if yield potential has been affected. There is still plenty of time to replant and the loss of time waiting to see how the crop re-emerges would not be wasted. I believe that in MOST cases corn will re-emerge and produce normal yields.

Large plants with more than 3 Leaves

This is a difficult stage for corn to recover from significant damage. Even if the growing point is still healthy the damage to the leaf and sheath tissue can eventually damage the growing point. If the plant has suffered significant damage but the growing point is still healthy, it is best to wait four to five days and reassess the situation. Often these fields will end up being replanted even though the growing point was not initially damaged.

What is Gained or Lost

Patience is the key at this point in the process. There is still time to replant and still realize full yield potential. Research shows little yield loss from planting as late as the 5th of May. So, there is little downside to waiting and making sure replanting is necessary. If replanting is not necessary then there is a loss in time and money spent replanting. I would be most concerned about corn I have just planted. Check it carefully and make sure the shoot is growing normally. I would then turn my attention to corn that had emerged and assess it as it recovers from this weather event. Seedlings that do not show new green leaf material within 7 days should be considered lost or damaged enough to reduce yield potential. Only after determining remaining stand would I then consider the need for replanting.

How Should Replant Be Done?

If there has been a complete loss of stand (less than 5% of the stand remains) then it is possible to replant into the same row without destroying the remaining plants. This could be done by no-tilling into the same row. In these cases I would not use a starter fertilizer and rely on the plant contacting the starter band that was already there. I would not be concerned about planting into the starter band since there has been enough soil moisture to dissolve the starter resulting in reduced concentrations of salt.

If more than 5% of the original plants remain then care must be taken to either remove the remaining plants or to reduce seeding rates to take into account the remaining plants. Clearly there will be some loss of precision in plant spacing which will impact yield. If the remaining plants have more than two leaves there will be an issue of competition with the emerging seedlings. Often it is better to till the field or to use a herbicide to kill the remaining corn plants and start over than to create a situation where small corn plants compete with larger plants. While this entails more time and cost it is well worth the investment given the negative impacts of poor plant spacing and intraspecies competition.