AGR-193

COOPERATIVE EXTENSION SERVICE
UNIVERSITY OF KENTUCKY—COLLEGE OF AGRICULTURE

Evaluating Flood Damage in Corn

Chad Lee, James Herbek, Greg Schwab, and Lloyd Murdock, Plant and Soil Sciences

Corn survival after flooding depends on the duration of the flood and the soil temperature during the flood. When soil temperatures are greater than 70 degrees F, corn will survive about 24 hours of submersion, but survival can increase up to four days at cooler soil temperatures. Even with warm temperatures, water over the top of corn for only a few hours will do little harm to the crop.

Corn that was submerged and survived may be yellow and/or stunted. These symptoms are likely due to an inability to take up nitrogen (N) under saturated conditions. These symptoms will continue even after water has receded because the soil will remain saturated. The time required for the soil to dry out and allow oxygen back into the root zone will determine the rate of crop recovery. If mud and other debris stay on the corn leaves, recovery can be further delayed.

Replanting may be necessary if stand loss is significant. Taller corn that is flooded may be too late to replant. If water rises above the ear of corn, the grain should be analyzed for toxins before feeding to livestock.

Estimating Severity of Flood Damage

Wait two to three days after the flood to determine if the corn has survived. On small plants, cut the cornstalk to expose the growing point (at or below the soil surface on V6 and younger corn). Healthy growing points will be white or cream-colored; dead points will be dark and/or flaccid. Use Tables 1 and 2 to determine plant population and yield potential.

Surviving plants could suffer a yield loss. The lack of oxygen could stunt root and shoot development during critical stages of growth. Flooding at V6 growth stage could hinder ear development, and flooding at V12 could reduce kernel size and number. Yellowing and stunting are often a result from a lack of N. This does not mean that all available nitrogen has been lost from the soil, but that the corn cannot take up nitrogen under saturated conditions. Much of the nitrogen will be available to the corn once the soils dry out. "Estimating Nitrogen Losses from Wet Soils" on the next page provides more information on how much nitrogen may have been lost.

Multiple stand counts should be made in both injured and non-injured areas of the field. Use Table 1 to determine the length of row to count to estimate plant stand. Count the plants within a row and multiply that number by 1,000. The product is the estimated number of plants per acre. This process should be repeated throughout the field in injured and non-injured areas. If stands are erratic, counting 50 feet of a row may be a better way to estimate corn stands. Compare the estimated stand to the population numbers in Table 2 to help determine the remaining yield potential in the field.

Table 1. Estimating corn stand.

Row		Plants in Row	Multiply by:	Estimated Plants/A
Width	**Length**			
Uninjured areas of the field:				
15	34′ 10″		1,000	
20	26′ 2″		1,000	
30	17′ 5″		1,000	
36	14′ 6″		1,000	
38	13′ 9″		1,000	
Injured areas of the field:				
15	50′		696.96	
20	50′		522.72	
30	50′		348.48	
36	50′		290.40	
38	50′		275.12	

Table 2. Relative grain yields for various planting dates and plant populations.*

Planting Date	Thousand Plants/A						
	25+	**22.5**	**20**	**18**	**16**	**14**	**12**
	Yield Potential (%)						
May 6	100	98	95	92	88	83	78
May 11	99	98	95	92	88	83	77
May 16	98	96	93	90	86	81	75
May 21	95	94	91	87	83	78	73
May 26	92	90	87	84	80	75	69
May 31	87	85	82	79	75	70	64
June 5	81	80	77	73	69	64	59
June 10	75	73	70	67	63	58	52

* Expressed as a percent of the yield considered optimal for a given planting date and plant population. Plants are assumed to be uniformly spaced within the row.

Source: Adapted from the National Corn Handbook (NCH-30), "Guidelines for Making Corn Replanting Decisions." Also appears as Table 5 in *A Comprehensive Guide to Corn Management in Kentucky* (ID-139).

Table 2 contains older data from the Midwest but is still the best general guide available. Current research indicates that corn populations closer to 30,000 plants/A will provide maximum yield on better soils. When assessing corn stands on better soils, keep this factor in mind.

Example (refer to Table 2):

A full stand of corn (25,000 plants/A) was planted on May 6 in a field that normally yields 150 bu/A.

- If the yield potential for a plant population of 25,000 planted on May 6 is 100%, the anticipated yield at harvest is 150 bu/A:

  150 bu/A x 100% = 150 bu/A

- Frost damage on May 21 reduced stands to 16,000 plants/A.
- Since the yield potential for a plant population of 16,000 planted on May 6 is 88%, the anticipated yield at harvest is reduced from 150 bu/A to 132 bu/A:

  150 bu/A x 88% = 132 bu/A

Re-planting a full stand of corn on May 31 would result in 87% yield potential or 130.5 bu/A.

Crazy Top

When young corn is flooded for 24 to 48 hours soon after emergence, swimming zoospores of the crazy top fungus (*Sclerophthora macrospore*) can enter the whorl and infect the growing point. If infection occurs, the plant will produce tillers, a leafy tassel ("crazy top"), and no ears. The fungus that causes crazy top occurs in Kentucky and surrounding states, but it is not a widespread problem. The fungus also infects wheat, several turf grasses, and certain wild grasses, but is rarely important on these crops. Because the appearance of crazy top occurs once the corn plant is tasseling and the number of occurrences is extremely low, there are no management options for controlling crazy top.

Fertilizer Management

Estimating Nitrogen Losses from Wet Soils

Wet soils cause nitrogen losses, and determining how much nitrogen is lost is necessary to choose the proper management options. In cases where high intensity rain results in high runoff, leaching losses will probably be low. The primary nitrogen loss mechanism in saturated soils is denitrification, which occurs when soil nitrate nitrogen (NO_3-N) is converted to nitrogen gas by soil bacteria. Two to three days of soil saturation is required for bacteria to begin the denitrification process. Well-drained upland soils that have been wet from a series of rains probably have not experienced much denitrification. Soils in lower landscape positions that stay saturated longer will likely lose more N. Losses can be calculated by estimating 3 to 4 percent loss of fertilizer NO_3-N for each day of saturation. Use Table 3 to determine how much fertilizer NO_3-N was in the soil.

Table 3. Estimated NO_3-N remaining after fertilizer application.

	Weeks after application		
	0	*3*	*6*
	% of NO_3-N Remaining		
Anhydrous ammonia *(AA)*	0	20	65
AA with N-Serve	0	10	50
Urea	0	50	75
Urea with N-Serve	0	30	70
UAN *(solution 28 and 32%)*	25	60	80
Ammonium Nitrate	50	80	90

Nitrogen Broadcast Prior to Rain

Farmers sometimes broadcast fertilizer nitrogen on a field within 24 hours of a heavy rain. In most cases, very little nitrogen is lost to runoff, especially if the field was under no-till soil management. The nitrogen fertilizer begins to dissolve almost immediately after being applied to the soil surface and will dissolve completely in a short period of time. As rain begins, the first water that falls moves into the soil, taking most of the fertilizer nitrogen with it. Once in the soil, most of the fertilizer nitrogen is protected from runoff. The only exception is a very intense rain soon after application that also erodes topsoil from sloping areas. Even in this situation, the loss would probably be less than one third of the fertilizer applied.

Example: Determining the Amount of N Loss

A farmer applied 175 lb nitrogen (N)/A as urea to corn grown on poorly drained soil. Because of a series of heavy rains, three weeks after application the field became saturated for seven days. How much N was lost?

Step 1. *Determine the amount of applied N that was in the nitrate (NO_3-N) form.*

According to the table, 50% of the urea will be in the NO_3-N form three weeks after application. 175 lb N x 50% = 88 lb N.

Step 2. *Determine the amount of N lost.*

Remember that two days are needed for the bacteria to begin the denitrification process. Therefore, denitrification occurred for five days (seven days total saturation minus two days to start the process). With 4% lost each day for five days, 20% would have been lost. 88 lb N x 20% = 18 lb N lost and 60 lb N remaining.

The N loss calculated in this example is not as high as most people would assume. A soil N test can verify this estimation. The soil sample should be taken to a depth of one foot in several locations within the field. The samples should be mixed well and a subsample sent for nitrate analysis. If NO_3-N is 0-10 ppm, a full rate of N for the crop should be added. At 25 ppm, no additional N would be needed. One could interpolate between these two figures, keeping in mind the amount of NH_4-N left in the soil from the first fertilizer N application, based on the calculations made using Table 3.

References

Nafzinger, E. 1998. Water- and wind-damaged corn. *Illinois Pest and Crop Development Bulletin.* No. 15. http://www.ipm.uiuc.edu/bulletin/contents.php.

Thelen, K. 2001. Managing corn and soybean fields submerged by recent heavy rains. *Field Crop Advisory Team Alert.* Vol. 16 no. 6. http://www.ipm.msu.edu/field-cat.htm.