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Hail Injury on Corn

By Roger W. Elmore and Lori Abendroth, Department of Agronomy

Hail pounded various parts of Iowa over the last two weeks. Storm systems continue to march aggressively across the state. Shredded, twisted corn lies in their paths (Figure 1). Corn across the state ranges from 6th to perhaps the 10th leaf stage. That means that corn growing points extend above the ground. Damage to the growing point compromises recovery and yield.



Figure 1. Corn field damaged by June 14, 2009, hail storm. Photo on June 18 near Bloomfield, Iowa. R. Elmore photo.

Hail decreases yields by reducing stands as well as destroying leaves. The severity depends on the crop's growth stage. Corn has an advantage over soybean early in the season when storms roll through since corn's growing point remains below ground until about the sixth-leaf stage. Young plants like this are not killed if only leaf or stem tissue is lost.

Before we go on though, remember that the staging method used by most agronomists differs from that employed by hail adjusters. The sixth-leaf stage of the ISU leaf-collar system correlates to the seventh-leaf stage used by hail adjusters. From V8 and following (ISU system), the hail adjuster method is about two leaves ahead. We will use the ISU leaf-collar system in this discussion.

Here are some points to keep in mind if your field has been hailed:

- 1) **Patience.** Call your crop insurance agent, hail adjusters are trained and equipped to assess hail damage losses. Wait at least three to five days after a hail storm to obtain an accurate damage appraisal. Allow recovery time for the plants.
- 2) **Evaluate crop growth stage.** Corn growth stage at the time of the storm is critical. If the plant has less than six collared leaves, yield will rarely be

affected. Expect re-growth. This is true regardless of the amount of defoliation if weather after the storm favors growth. As mentioned above though, most Iowa corn has more than six collared leaves - growing points are vulnerable.

3) Assess viable stands. Evaluate injured plants to determine the growing point's viability. Use a sharp knife and cut lengthwise down the stem. The growing point of a healthy plant is white to cream color. Plants with a healthy growing point should survive. Make assessments of plant survival three to five days after the storm allowing plants to recover. If weather is not conducive for plant growth for a prolonged period after the storm, assessing the remaining stand may require waiting up to a week.

Some plants in near Bloomfield damaged from a June 14 storm will not recover because of a rot that developed in the stalk. The rot was visible only when plants were cut lengthwise (Figure 2). Cool damp weather following the storm discouraged rapid plant recovery allowing the organisms to invade stems destroying (the plant's) opportunity to recover.



Figure 2. Corn plant damaged by hail on June 14, 2009, with base of stem cut lengthwise. Brown discoloration above growing point will likely kill the plant's growing point. Weather following the hail storm was not conducive for vigorous plant growth and recovery. Bloomfield, Iowa, June 18, 2009. R. Elmore photo.

4) Estimate yield losses from defoliation. As just mentioned, leaf loss or defoliation will rarely affect yield before the sixth leaf stage. Plants with six leaves or greater will experience yield losses depending on the extent of the defoliation - see Table 1.

Table 1. Estimated percent yield reduction from leaf loss caused by hail damage.

Stage [†]	Percent Leaf Area Destroyed									
	10	20	30	40	50	60	70	80	90	100
V7	0	0	0	1	2	4	5	6	8	9
V10	0	0	2	4	6	8	9	11	14	16
V13	0	1	3	6	10	13	17	22	28	34
V16	1	3	6	11	18	23	31	40	49	61
V18	2	5	9	15	24	33	44	56	69	84
VT - Tassel	3	7	13	21	31	42	55	68	83	100
R1 - Silk	3	7	12	20	29	39	51	65	80	97
R2 - Blister	2	5	10	16	22	30	39	50	60	73
R3 - Milk	1	3	7	12	18	24	32	41	49	59
R4 - Dough	1	2	4	8	12	17	23	29	35	41
R5 - Dent	0	0	2	4	7	10	14	17	20	23
R6 - Mature	0	0	0	0	0	0	0	0	0	0

Source: USDA
[†]Leaf-collar vegetative staging method.

Corn can withstand a substantial loss of leaf area without major yield losses. A reduction in leaf area less than 50 percent does not reduce yield if it occurs before V13. For example, at V13 - thirteen collared leaves - a 50

percent reduction in leaf area reduces yield by only 10 percent. However, when the crop is tasseled, VT, yield is reduced by 31 percent.

5) Estimate yield losses from stand reductions. Stand loss may occur following significant hail storms. Small reductions in plant survival do not impact yields much; for example a one-third reduction in stand will only reduce yield by 10 percent if it occurs before V8. Neighboring plants compensate to some extent for the lost plant.

However, after V8, yields are reduced by the same amount that the stand is reduced. A one-third reduction in stand will reduce the yield potential by one-third. We are conducting research in conjunction with the crop insurance industry to determine if this is still valid with modern hybrids and management.

Twisted whorl plants – a.k.a. tied or buggy whipped - may result from hail injury. A study on [twisted-whorl plants](#) by Thomison and Mangen at the Ohio State University found that in fields with major hail damage exhibited 36 to 61 percent twisted whorls. One month later that number was reduced to 0 to 9 percent; most plants grew out of it. The site that had the largest yield losses experienced major stand losses.

Once plant survival is established, use Table 2 to determine yield potential of the current stand based on the original planting date and plant population. Compare this to the yield potential of a replant. Replanting corn now is difficult to justify based on normal planting date responses.

Table 2. Relative yield potential of corn by planting date and population.

	Planting Date				
	April 20- May 5	May 5- 15	May 15-25	May 25- June 5	June 5-15
Population (Plants/Acre)	Percent Maximum Yield				
45,000	97	93	85	68	52
40,000	99	95	86	69	53
35,000	100	96	87	70	54
30,000	99	95	86	69	53
25,000	95	91	83	67	51
20,000	89	85	77	63	48
15,000	81	78	71	57	44
10,000	71	68	62	50	38

Note: Values based on preliminary Iowa research and modeling; 100% yield potential is estimated to occur with 35,000 plant population and early planting.

From: Iowa State University Extension, Corn Field Guide, CSI 001. 2009.

Overall, remember the key is to assess plant viability thoroughly once plants have had a good chance to recover. Contact your crop insurance company before destroying the crop or replanting.

For more information on replanting, see:

www.extension.iastate.edu/CropNews/2009/0514ElmoreAbendroth.htm

For an article on earlier season hail damage, see:

<http://www.agronext.iastate.edu/corn/production/management/early/hail.php>

For more information other corn issues, see our ISU Extension Corn

Production web site: <http://www.agronext.iastate.edu/corn/>

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