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Corn Breakage (greensnap) in 2006 Related to Cropping System and Inputs

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Abstract

Straight-line winds as high as 60 mph caused considerable plant breakage, or greensnap, in corn across north-central and northeast Iowa on July 1, 2006. Damage occurred more frequently and at greater severity along a narrow band running from eastern Cerro Gordo County along county road B60 and across several counties to the east and northeast, including the ISU Northeast Research and Demonstration Farm. Greensnap was reported at 20 to 80% in various fields. The last experience with a major greensnap event in northern Iowa was during 1998.

Keywords

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Introduction

Straight-line winds as high as 60 mph caused considerable plant breakage, or greensnap, in corn across north-central and northeast Iowa on July 1, 2006. Damage occurred more frequently and at greater severity along a narrow band running from eastern Cerro Gordo County along county road B60 and across several counties to the east and northeast, including the ISU Northeast Research and Demonstration Farm. Greensnap was reported at 20 to 80% in various fields. The last experience with a major greensnap event in northern Iowa was during 1998.

Corn is most susceptible to greensnap prior to tasseling when it is rapidly growing. Corn affected by the storm ranged from the 10 to 12 leaf stage (V10 to V12). The "prime time" for greensnap begins at V10; corn is more difficult to break prior to that growth stage. Breakage in 2006 most often occurred at the node just below the primary ear.

We have learned from previous greensnap events in Iowa and Nebraska that yield loss is directly related to the amount of stalk breakage. Plants that are not broken are unable to fully compensate for broken nearby plants when breakage occurs close to tasseling. Plants cannot adjust the number of harvestable ears per plant or ear girth or ear length late in the vegetative stages. Compensation can primarily occur only through greater starch accumulation leading to heavier kernel weights. Therefore, yield loss can be estimated by evaluating the amount of plants broken. For example, if 10% of the plants in a field were broken, expect yield reductions of 10%.

Previous research has clearly displayed a difference in hybrid susceptibility to greensnap. Several seed companies provide growers with greensnap ratings that may prove useful in selecting less susceptible hybrids. These hybrid ratings are useful although breakage is greatly affected by the growth stage of the plant. Any factor that increases early season growth tends to increase breakage susceptibility, such as: high N, P, and K rates; spring-applied N; tillage; and high organic matter.

Factors influencing susceptibility of a hybrid and a field to incur breakage are complex and further research is needed to develop ways risk can be mitigated. At this location, research trials existed that had various combinations of hybrids, cropping systems, seeding rates, and tillage systems which were partially damaged by the strong winds of July 1, 2006. This allowed us to evaluate greensnap damage and effects on yield.

Materials and Methods

Research Project 1: Cropping system and tillage. This trial was planted on April 25. Details of treatments included are shown in tables 1 and 2. Two hybrids were planted in two cropping systems (corn following corn and corn following soybean), four tillage systems, and four seeding rates. The cropping systems though were not replicated so conclusions are limited in regard to the amount of breakage related to whether corn followed corn or soybean. Individual plot sizes were three, 30-in. rows by 220 ft length. Harvest occurred on October 11.

Research Project 2: Corn hybrid and seeding rate. This trial was planted April 26. Details of treatments included are shown in Table 3. Four hybrids were compared at three seeding rates. Individual plot sizes were six, 30-in. rows by 58 ft length. Harvest occurred on October 13.

Results and Discussion

Research Project 1: Cropping system and tillage. The two hybrids differed in their susceptibility to greensnap ($P \leq 0.05$). The response of the DeKalb (DK) hybrid (DK 52-40) to greensnap and yield were both affected by seeding rate when averaged over the two cropping systems and four tillage systems (Table 1). A seeding rate of 36,100 seeds/acre for DK 52-40 resulted in the greatest amount of greensnap. Grain yield at the three lowest seeding rates was less than that of the 40,800 seeds/acre rate. Greensnap was less than 3% in the LG hybrid (LG 2540) and seeding rate did not impact breakage amounts. However, heavier seeding rates improved yield for this hybrid by up to 20 bushels/acre.

In the same study, the two hybrids responded differently to tillage systems when averaged over seeding rates (Table 2). In the continuous corn trial, DK 52-40 had higher levels of greensnap than the LG 2540 hybrid only with conventional and moldboard plow tillage systems. In the corn following soybean trial, DK 52-40 had consistently higher greensnap than LG 2540; these differences were especially greater again with the two more aggressive tillage systems, conventional and moldboard plow.

Research Project 2: Corn hybrid and seeding rate. Hybrids yielded differently (Table 3) yet all four hybrids responded the same to seeding rate. Yields were greater at the two higher seeding rates than at the lowest seeding rate. Greensnap was greater with NK 60-B6 than with the other hybrids at all seeding rates. In addition, the 31,300 seeds/acre rate resulted in the highest greensnap with this hybrid.

Conclusions

1. Hybrids have different tolerances for mid-season wind damage. This is consistent with previous research.
2. Seeding rates in the two studies reported affected greensnap in susceptible hybrids, but the results are a bit perplexing since the middle seeding rates had greater greensnap than either higher or lower seeding rates.
3. Corn following corn appeared to result in reduced greensnap with a susceptible hybrid. However, the corn following corn block used in this study is not replicated with the corn following soybean block; therefore systematic or soil differences may be occurring which are the real causes behind the noted differences. Thus, the response may be due to either the specific location of the trials or the cropping system. The experiment is not designed to measure this difference.
4. More aggressive tillage systems resulted in increased greensnap in both cropping systems. This may be related to more vigorous early season growth as reported in previous studies.

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Table 1. Research Project 1: Cropping system and tillage. Hybrid and seeding rate effect on greensnap and grain yield (averaged over two cropping systems and four tillage systems).

Hybrid[†]	Seeding rate[‡]	Greensnap		Grain yield adjusted to 15.5% moisture	
	plants/acre	percent		bu/acre	
DK	1	31	b[§]	140.0	e
DK	2	33	b	143.1	e
DK	3	41	c	137.5	e
DK	4	33	b	152.4	d
LG	1	2	a	202.5	c
LG	2	2	a	210.9	b
LG	3	3	a	220.4	a
LG	4	2	a	222.2	a

[†]DK = DeKalb C52-40 RR/YG+(cb/rw); LG = LG Seeds 2540 RR/CB/RW
[‡]Seeding rates: 1 = 26,700; 2 = 31,300; 3 = 36,100; 4 = 40,800 seeds/acre.
[§]Means followed by the same letter are not different, $P \leq 0.05$.

Table 2. Research Project 1: Cropping system and tillage. Crop rotation, tillage systems, and hybrid effect on greensnap and grain yield (averaged over four seeding rates).

Cropping system[†]	Tillage[‡]	Hybrid[§]	Greensnap		Grain yield adjusted to 15.5% moisture	
			percent		bushel/acre	
CC	C	DK	25	b[¶]	156.8	e
CC	MB	DK	35	c	145.4	f
CC	NT	DK	1	a	169.0	d
CC	RT	DK	1	a	168.9	d
CC	C	LG	1	a	199.8	b
CC	MB	LG	1	a	228.2	a
CC	NT	LG	0	a	183.3	c
CC	RT	LG	0	a	192.9	b
CSb	C	DK	75	D	79.2	E
CSb	MB	DK	53	C	133.5	D
CSb	NT	DK	40	B	151.5	C
CSb	RT	DK	44	B	141.7	D
CSb	C	LG	8	A	222.7	B
CSb	MB	LG	4	A	233.4	A
CSb	NT	LG	3	A	226.7	AB
CSb	RT	LG	3	A	224.8	B

[†]CC = continuous corn; CSb = Corn following soybean.
[‡]C = conventional tillage; MB = moldboard plow; NT = no tillage; RT = ridge tillage in years prior to 2006, NT in 2006.
[§]DK = DeKalb C52-40 RR/YG+(cb/rw); LG = LG Seeds 2540 RR/CB/RW.
[¶]Within a cropping system, means followed by the same letter are not different $P \leq 0.05$.

Table 3. Research Project 2: Corn hybrid and seeding rate. Hybrid and seeding rate effect on greensnap and grain yield.

Hybrid[†]	Seeding rate × 1000/acre	Grain yield adjusted to 15.5% moisture bushel/acre	
NK60B6		169.0	c[‡]
NK65C5		192.3	a
P34A16		183.5	b
P36B09		173.5	bc
	21.1	163.8	B
	31.3	185.2	A
	40.8	189.7	A

Hybrid[†]	Seeding rate × 1,000/acre	Greensnap percent	
	21.1	16	e
NK60B6	31.3	20	f
	40.8	11	d
	21.1	4	c
NK65C5	31.3	4	bc
	40.8	4	bc
	21.1	1	ab
P34A16	31.3	1	a
	40.8	2	abc
	21.1	0	a
P36B09	31.3	1	a
	40.8	1	abc

[†]NK = Northrup King; P = Pioneer Hi-Bred Int'l.

[‡]Within a hybrid, seeding rate, or their combination, means followed by the same letter are not different, $P \leq 0.05$.