

Weather challenges to corn production

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Weather Challenges to Corn Production

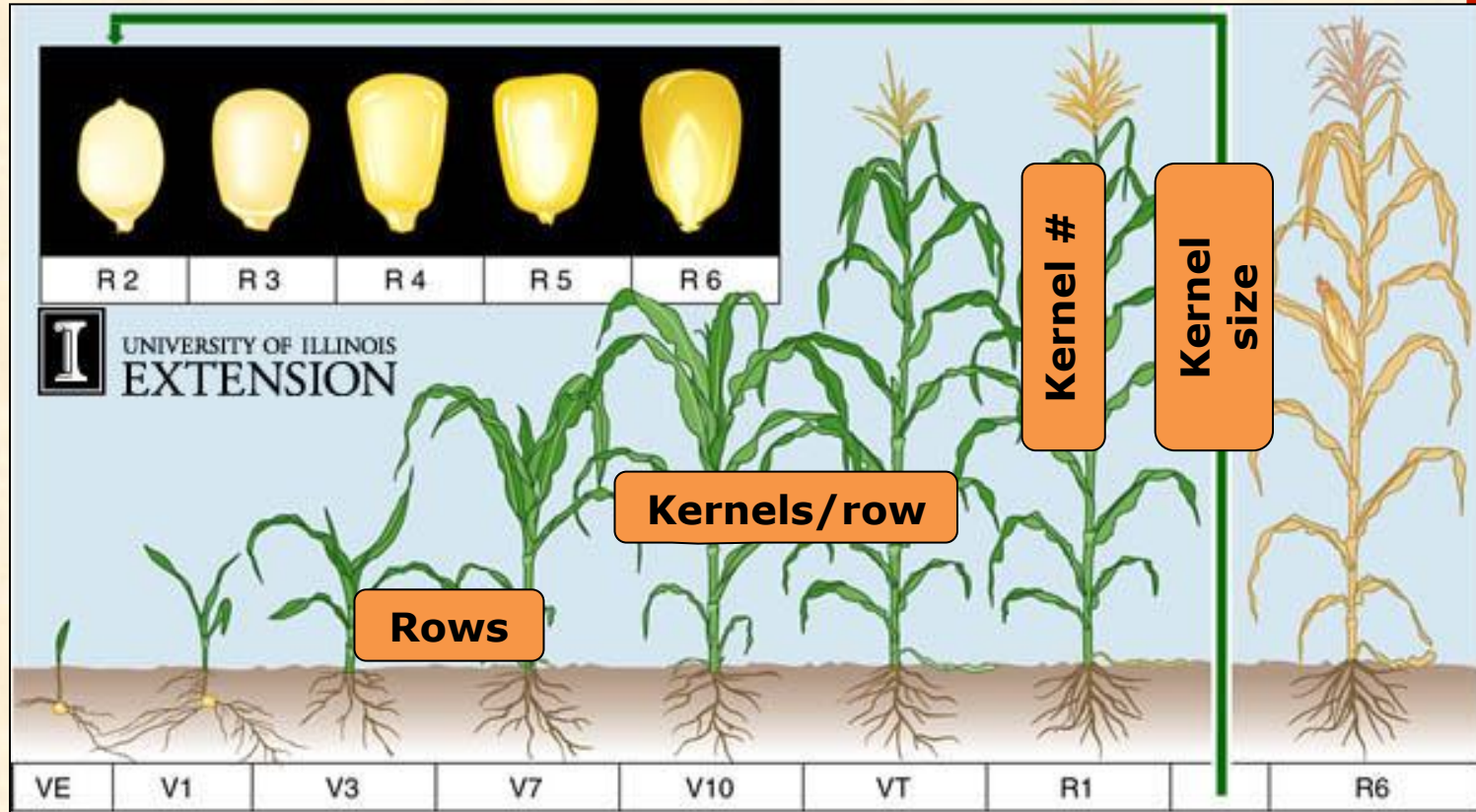
- **Frost**
- **Inhibitional freezing**
- **Flooding and Ponding**
- **Hail**
- **Wind**
- **Drought**

Weather Challenges to Corn Production

Corn is a resilient crop!

Corn Growth and Development

Ear size determined at different stages



Early Season Frost Injury – May 22, 2002



Imbibitional Chilling and Cold Injury



Cold Imbibition Results in Seedling Damage





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Impact of Persistent Rains and Saturated Soils



*Drought stress
in corn
NW Ohio
late June 2012*



Drought Effects on Development



Wind Related Problems in Corn

1. “Rootless Corn” - early season stalk lodging
2. Mid-season stalk breakage (“greensnap” or “brittlesnap”)
3. Root lodging – early to late season
4. Stalk lodging at harvest maturity

2013 Rootless Corn (“Floppy Corn”)



Root Lodging – July 10, 2013



Stalk Lodging at Harvest Maturity



Greensnap Resulting from Wind Storms



Hail Damage in Corn



Yield Losses in Corn Due to Defoliation (Hail) During Vegetative Stages

Growth Stage	% Defoliation			
	25	50	75	100
7-leaf* (V5)	0	2	5	9
14-leaf (V7)	3	13	25	44
19-21 leaf	8	27	57	96
Tassel (VT)	9	31	62	100

***Based on Horizontal Leaf Method**

OSU Corn Research Update – Weather Stress

- National Crop Insurance Service
Second Losses Study (Response of
corn to multiple defoliation losses)

- Impact of Root Lodging on Corn
Performance (Dupont-Pioneer)

NCIS Second Losses Study - Objectives

1. To determine effects of multiple defoliation losses on grain yield in corn across three Corn Belt locations.
2. To compare these “actual yield losses” with those estimated by the current NCIS Corn Loss Instructions.

Hail damage appraisal method

- For corn between the 7-leaf & milk stages
- Yield loss estimated from direct & indirect damage
 - Direct damage = stand loss, crippled plants, ear/stalk damage
 - Indirect damage = loss of leaf area
- Indirect yield loss estimated from total leaf loss & corn stage at the most recent appraisal using a table. Losses from earlier storms are adjusted using a second table

LEAF LOSS CHART

Stage of Growth	Percent Leaf Area Destroyed																			
	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	
7 Leaf	0	0	0	0	0	0	1	1	2	3	4	4	5	5	6	7	8	9	9	
8 Leaf	0	0	0	0	0	1	1	2	3	4	5	5	6	6	7	8	9	10	11	
9 Leaf	0	0	0	1	1	2	2	3	4	5	6	6	7	7	9	10	11	12	13	
10 Leaf	0	0	0	1	2	3	4	5	6	7	8	8	9	9	11	13	14	15	16	
11 Leaf	0	0	1	1	2	3	5	6	7	8	9	10	11	12	14	16	18	20	22	
12 Leaf	0	0	1	2	3	4	5	7	9	10	11	13	15	16	18	20	23	26	28	
13 Leaf	0	1	1	2	3	4	6	8	10	11	13	15	17	19	22	25	28	31	34	
14 Leaf	0	1	2	3	4	6	8	10	13	15	17	20	22	25	28	32	36	40	44	
15 Leaf	1	1	2	3	5	7	9	12	15	17	20	23	26	30	34	38	42	46	51	
16 Leaf	1	2	3	4	6	8	11	14	18	20	23	27	31	36	40	44	49	55	61	
17 Leaf	2	3	4	5	7	9	13	17	21	24	28	32	37	43	48	53	59	65	72	
18 Leaf	2	3	5	7	9	11	15	19	24	28	33	38	44	50	56	62	69	76	84	
19-21 Leaf	3	4	6	8	11	14	18	22	27	32	38	43	51	57	64	71	79	87	96	
Tassel	3	5	7	9	13	17	21	26	31	36	42	48	55	62	68	75	83	91	100	
Silked	3	5	7	9	12	16	20	24	29	34	39	45	51	58	65	72	80	88	97	
Silks Brown	2	4	6	8	11	15	18	22	27	31	36	41	47	54	60	66	74	81	90	
Pre-Blister	2	3	5	7	10	13	16	20	24	28	32	37	43	49	54	60	66	73	81	
Blister	2	3	5	7	10	13	16	19	22	26	30	34	39	45	50	55	60	66	73	
Early Milk	2	3	4	6	8	11	14	17	20	24	28	32	36	41	45	50	55	60	66	
Milk	1	2	3	5	7	9	12	15	18	21	24	28	32	37	41	45	49	54	59	
Late Milk	1	2	3	4	6	8	10	12	15	18	21	24	28	32	35	38	42	46	50	
Soft Dough	1	1	2	2	4	6	8	10	12	14	17	20	23	26	29	32	35	38	41	
Early Dent	0	0	1	1	2	3	5	7	9	11	13	15	18	21	23	25	27	29	32	
Dent	0	0	0	1	2	3	4	6	7	8	10	12	14	15	17	19	20	21	23	
Late Dent	0	0	0	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
Nearly Mature	0	0	0	0	0	0	0	0	1	2	3	4	5	5	6	6	7	7	8	
Mature	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	

Source: NCIS Corn Loss Instructions

CORN – MULTIPLE DEFOLIATION LOSS TABLE

PERCENT OF PRIOR LOSS EARNED																							100	NM																									
																							44	100	LD																								
																							36	64	100	D																							
																							26	53	74	100	ED																						
																							21	42	63	79	100	SD																					
																							14	32	50	68	82	100	LM																				
																							15	27	42	58	73	85	100	M																			
																							11	24	35	49	62	76	86	100	EM																		
																							10	20	32	41	54	66	78	88	100	B																	
																							9	18	27	38	47	58	69	80	89	100	PB																
																							10	18	26	34	44	52	62	72	82	90	100	SB															
																							7	17	24	31	39	48	56	65	74	83	91	100	S														
																							7	14	22	29	36	43	52	59	67	76	84	91	100	T													
																							3	10	17	25	32	38	45	53	60	68	77	85	92	100	19/21												
																							3	6	13	19	27	34	40	47	55	61	69	77	85	92	100	18											
																							5	8	11	17	23	31	37	43	49	57	63	71	78	86	92	100	17										
																							4	9	12	15	21	26	34	40	46	51	59	65	72	79	87	93	100	16									
																							4	8	13	15	18	24	30	37	42	48	54	61	66	73	80	87	93	100	15								
																							4	8	12	16	19	22	27	32	39	45	50	55	62	68	74	81	88	93	100	14							
																							4	8	12	16	19	22	25	30	35	42	47	52	57	64	69	75	82	88	94	100	13						
																							4	8	11	15	19	23	25	28	33	38	44	49	54	59	65	70	76	83	89	94	100	12					
																							4	7	11	14	18	22	25	28	30	35	40	46	51	55	60	66	71	77	83	89	94	100	11				
																							3	7	10	14	17	21	24	28	30	33	37	42	48	52	57	62	67	72	78	84	90	94	100	10			
																							3	7	10	13	16	20	23	26	29	30	33	35	39	44	49	54	58	63	69	73	79	84	90	94	100	9	
																							3	6	9	13	16	19	22	25	28	32	33	35	37	41	46	51	55	60	64	70	74	79	85	90	95	100	8
																							3	6	9	13	16	19	22	25	28	32	35	37	39	43	47	53	57	61	65	71	75	80	85	91	95	100	7
7	8	9	10	11	12	13	14	15	16	17	18	19/21	T	S	SB	PB	B	EM	M	LM	SD	ED	D	LD	NM	M																							

Stage
At
Prior
Storm

Second losses study

- **Locations:**

- S. Charleston, OH: 2014-15
- Lamberton, MN: 2012-14
- Urbana, IL: 2012-14



Emerson Nafziger, University of Illinois

Jeff Coulter, University of Minnesota

Peter Thomison, The Ohio State University



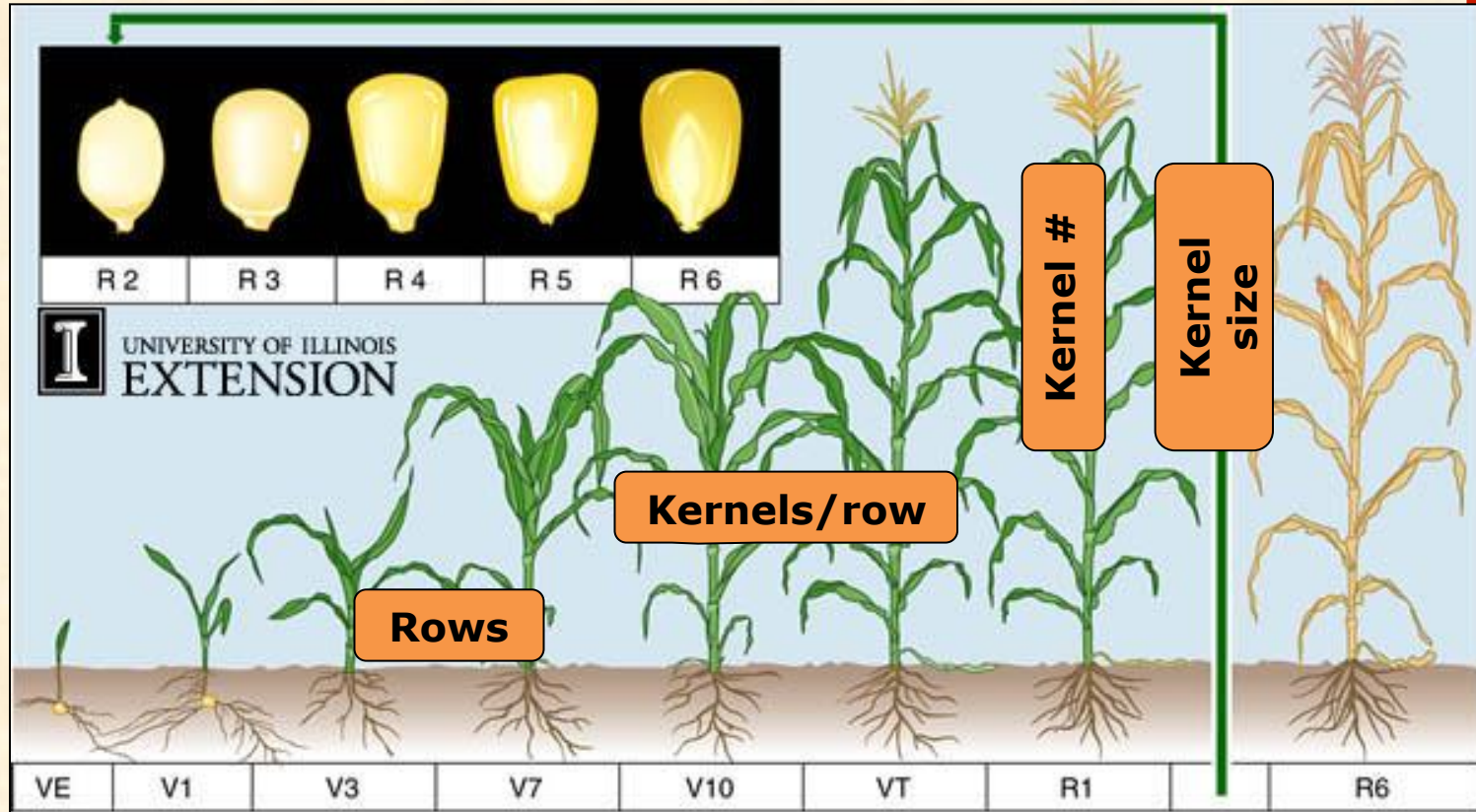
Second losses study

- 36,000 seeds/acre
- Planted DKC61-88 VT3Pro
- Corn followed soybean
- Managed for high yield
- Leaf loss treatments applied at:
 - 10-leaf stage (V8)
 - 15-leaf stage (V13)
 - Tassel stage



Corn Growth and Development

Ear size determined at different stages



Leaf loss treatments

- | | | |
|-----------------|---|--|
| Control | { | <ul style="list-style-type: none">• None |
| 1 Loss | { | <ul style="list-style-type: none">• 50% at 10-leaf• 100% at 10-leaf |
| | | <ul style="list-style-type: none">• 50% at 15-leaf• 100% at 15-leaf |
| | | <ul style="list-style-type: none">• 50% at Tassel |
| | | <ul style="list-style-type: none">• 50% at 10-leaf + 50% at 15-leaf• 50% at 10-leaf + 50% at Tassel |
| | | <ul style="list-style-type: none">• 100% at 10-leaf + 50% at 15-leaf• 100% at 10-leaf + 50% at Tassel |
| 2 Losses | { | <ul style="list-style-type: none">• 50% at 15-leaf + 50% at Tassel• 100% at 15-leaf + 50% at Tassel |
| | | <ul style="list-style-type: none">• 50% at 10-leaf + 50% at 15-leaf + 50% at Tassel |
| | | <ul style="list-style-type: none">• 100% at 10-leaf + 50% at 15-leaf + 50% at Tassel |
| 3 Losses | { | <ul style="list-style-type: none">• 50% at 10-leaf + 50% at 15-leaf + 50% at Tassel |

**100% leaf loss
at 10-leaf stage**

**50% leaf loss
at 10-leaf stage**



100% defoliation at 10-leaf stage



Leaf removal methods

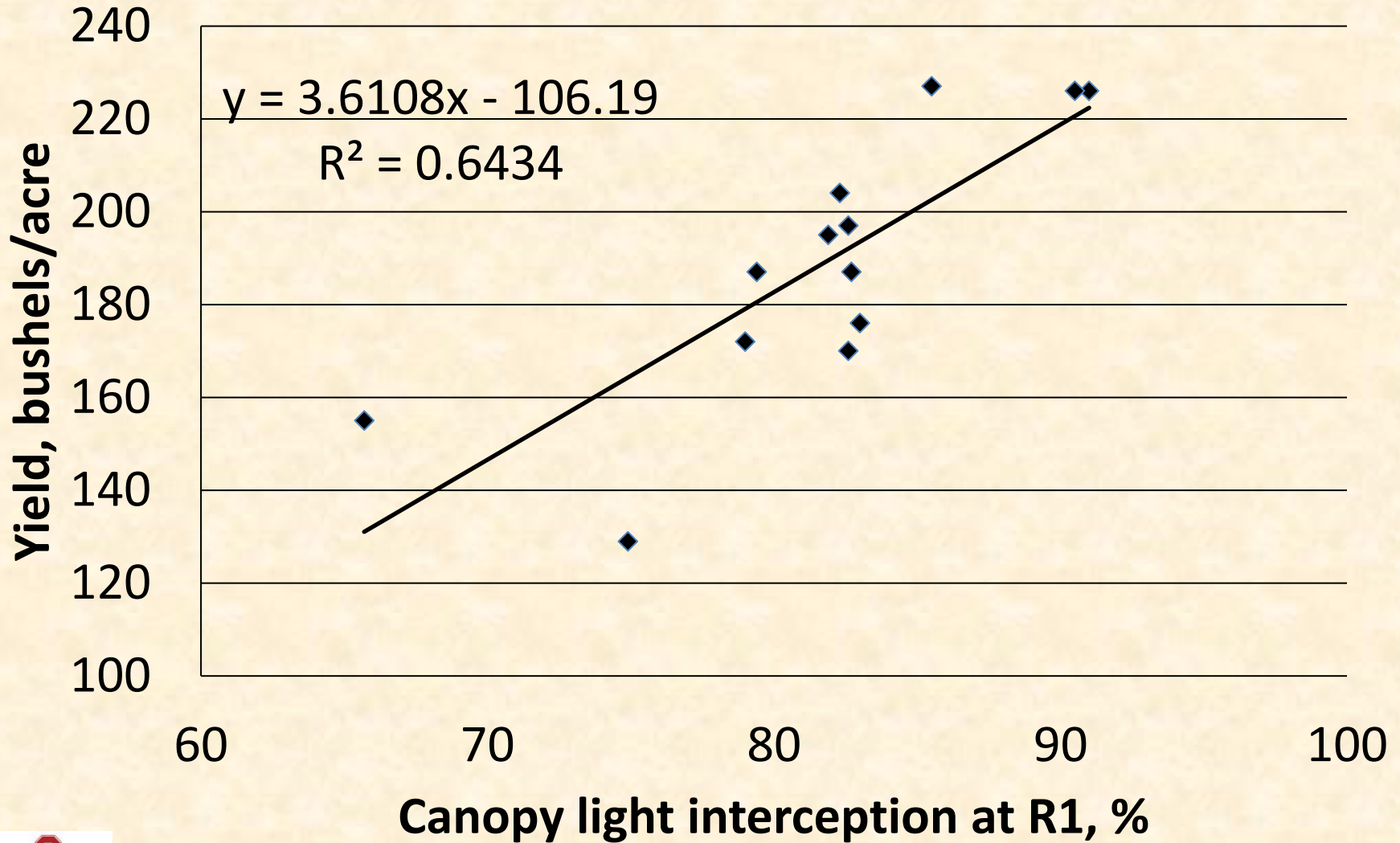
- Leaves removed by hand & with scissors
- 50% leaf removal involved...
 - Cutting the end off every other leaf
 - Stripping the leaf area from one side of the mid-rib on the remaining leaves
- Subsequent leaf removal only treated leaves that were not previously damaged



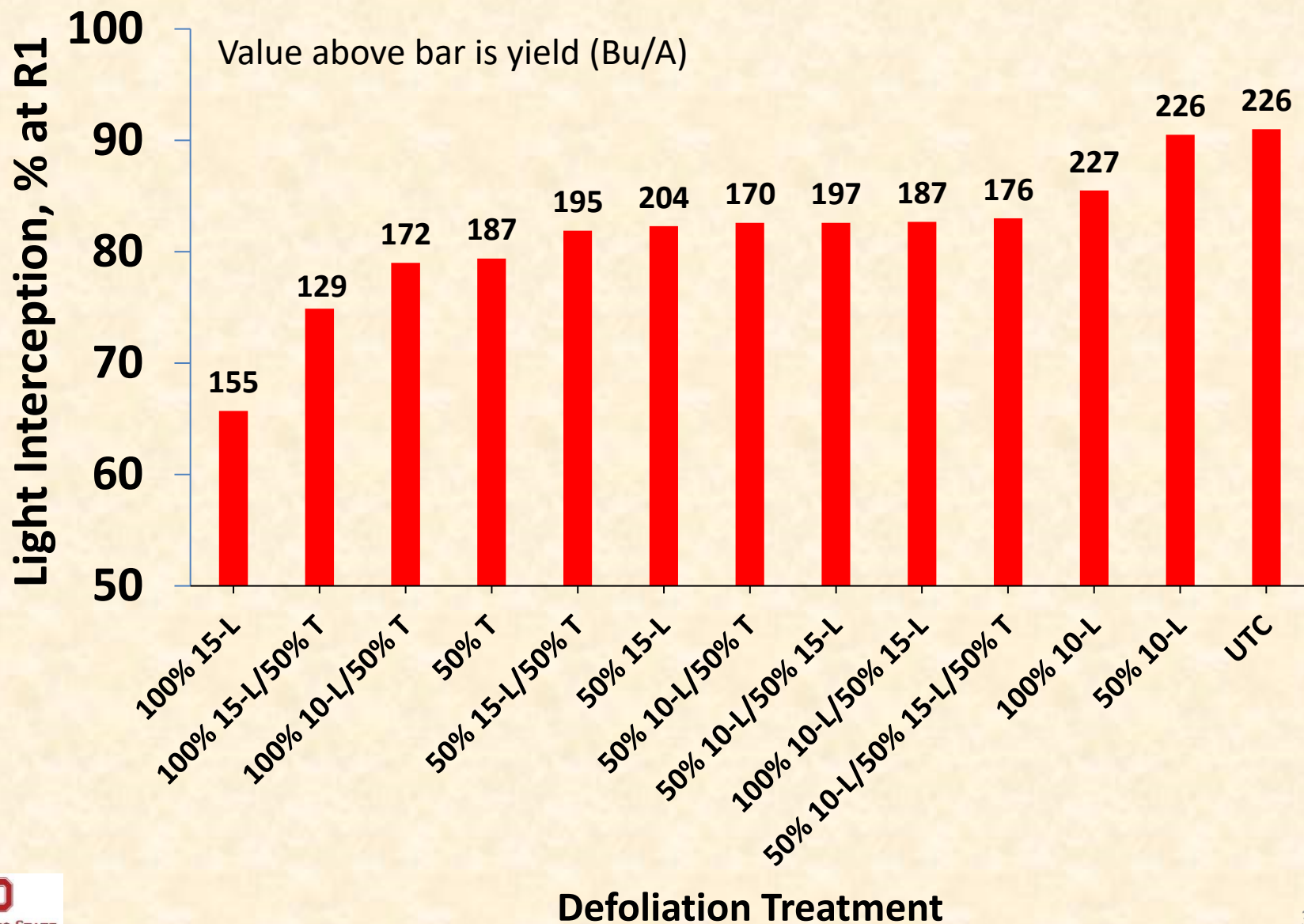
Identify the ears corresponding to the following defoliation treatments:

1. 50% at 10-leaf
2. 100% at 10-leaf
3. 100% at 15-leaf
4. 100% at 10-leaf + 50% at 15-leaf
5. 100% at 10-leaf + 50% at Tassel
6. 100% at 15-leaf + 50% at Tassel
7. 50% at 10-leaf + 50% at 15-leaf + 50% at Tassel

Corn 2nd loss S. Charleston, OH 2015



Corn 2nd loss S. Charleston, OH 2015

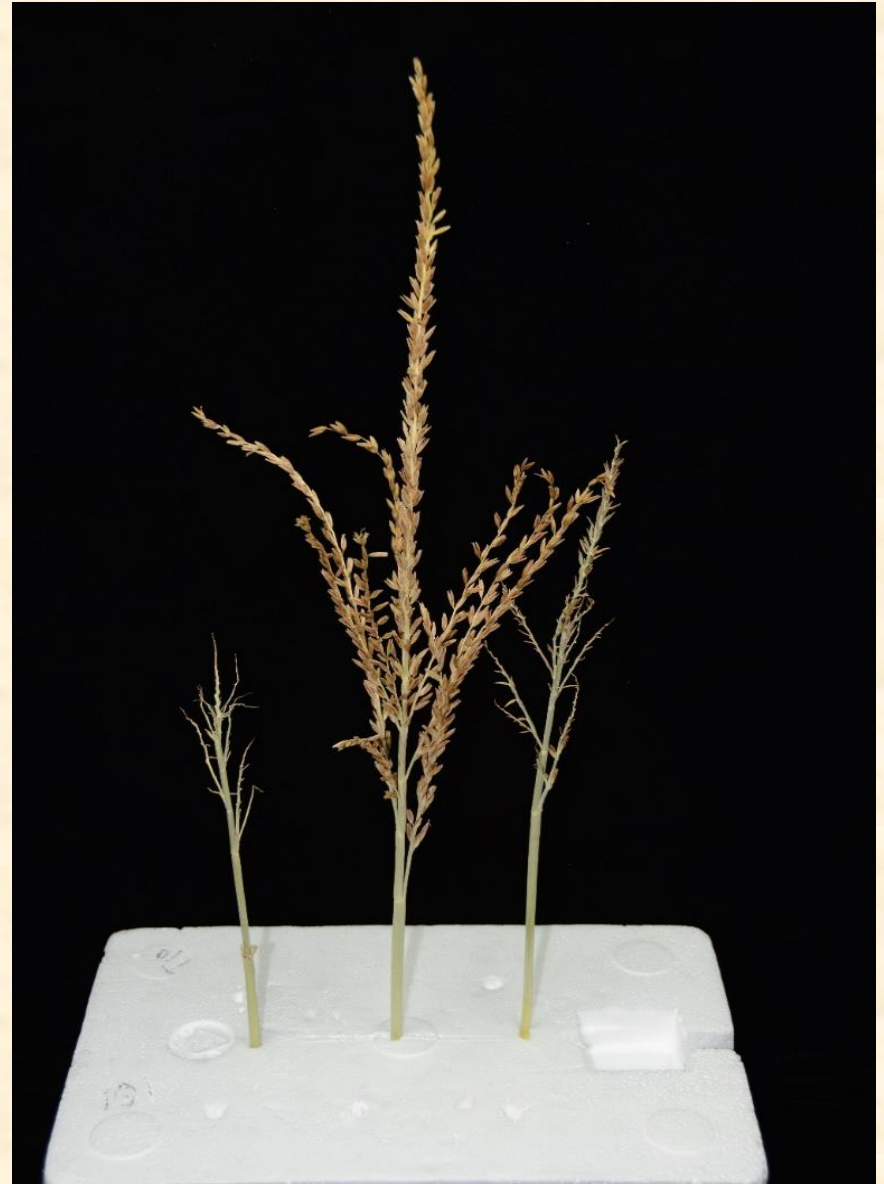


Corn 2nd loss study - Summary

- Actual losses and NCIS chart loss estimates were generally similar for treatments involving leaf removal only at the vegetative stages.
- Treatments that involved leaf removal at tassel were consistently lower than estimated chart losses.
- Treatments with 50% leaf loss at tassel resulted in yield loss averaging only half of estimated chart loss.

Corn 2nd loss study - S. Charleston, OH 2014-15

- 100% leaf removal at the 10-leaf stage resulted in tassel deformity
- Deformity associated with skeletal tassels w/no anthers
- Tassel in the middle from the UTC
- Tassels on the left and right are from the 100% leaf removal treatment at the 10-leaf stage.



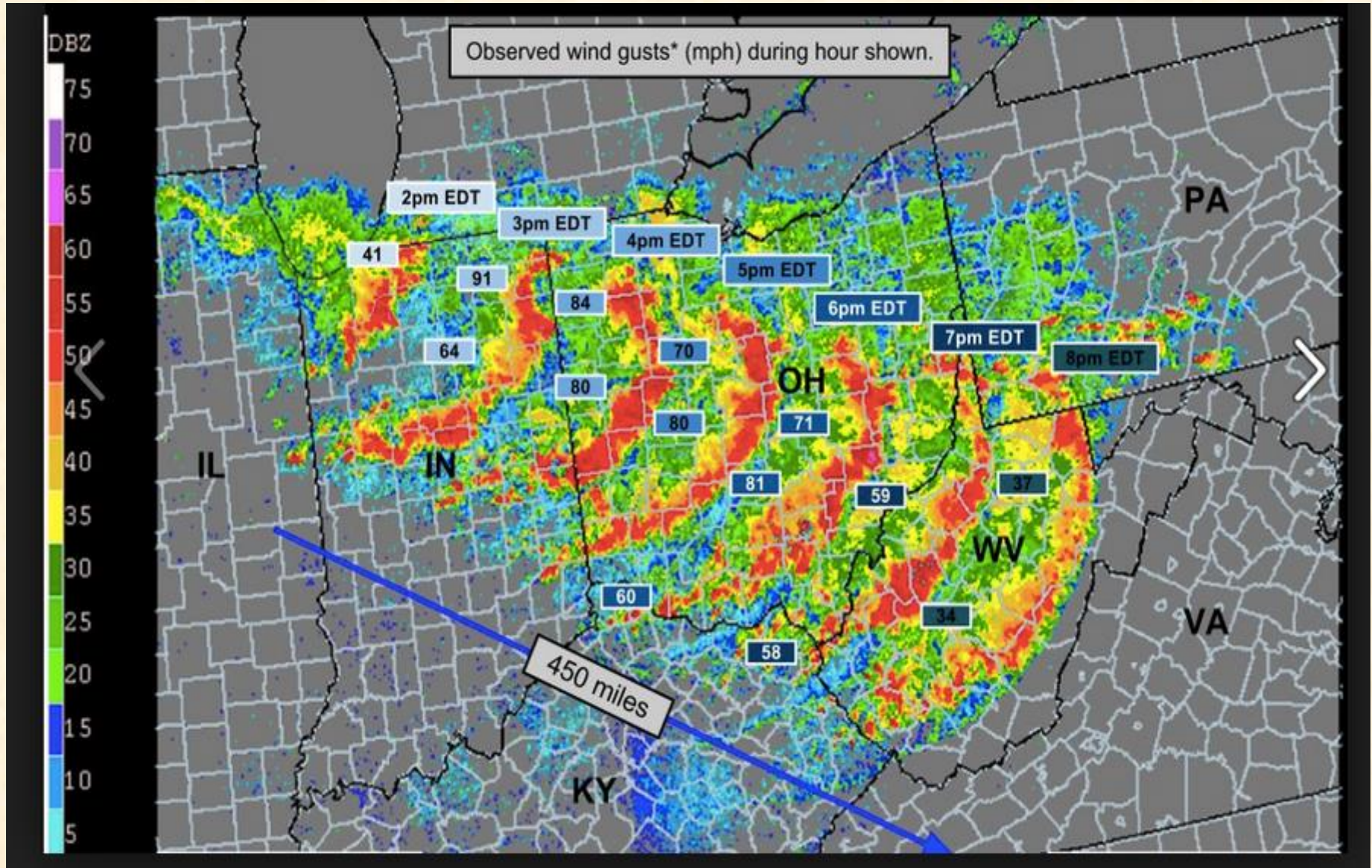
Impact of Root Lodging on Corn Performance - Objectives

- To evaluate effects of root lodging on corn development and grain yield using contemporary hybrids and seeding rates.
- To determine underlying physiological factors causing yield decreases due to root lodging.

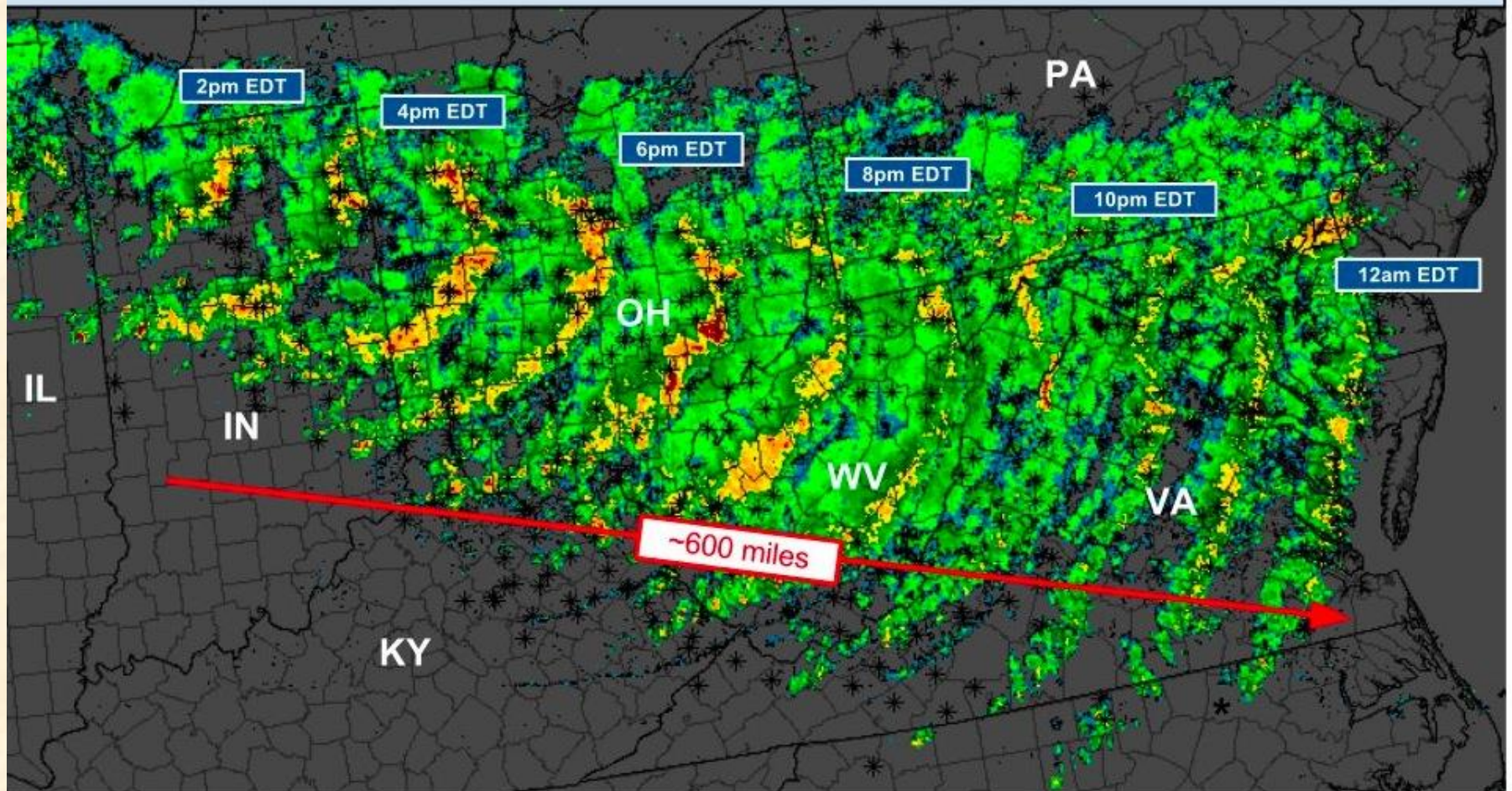
Derechos – A recent midseason problem in Ohio

- A derecho (də-reh-choh) is a widespread, long-lived, straight-line wind storm that is associated with a land-based, fast-moving band of severe thunderstorms.
- Recent derechos have been characterized by winds of 70 mph and higher

Derecho – July 11, 2011



June 29, 2012 Midwest to East Coast Derecho
Radar Imagery Composite Summary 18-04 UTC
~600 miles in 10 hours / Average Speed ~60 mph



Over 500 preliminary thunderstorm wind reports indicated by *
Peak wind gusts 80-100mph. Millions w/o power.

Summary Map by G. Carbin
NWS/Storm Prediction Center

Weather Trends and Derechos

According to Dr. Jeff Rodgers, state climatologist and a professor in OSU's Department of Geology.....

- Based on weather trends, Ohio farmers should plan to deal with warmer temperatures all year and wetter weather in the spring, summer and fall.
- Increased moisture in the air may also lead to more severe storms like last summer's [2012] derecho. "They could very well become more frequent"

Root Lodging

- Root lodging accounts for most of the mid-season wind damage
- Characterized by stalks *leaning 30 degrees or more* from the center.
- Occurs as early as the mid-late vegetative stages and as late as harvest maturity.

Corn Root Lodging Study- S. Charleston, OH 2018-2021

<u>HYBRIDS</u>		<u>TREATMENT</u>	
H1=	P1283AM	T1=	UTC
H2=	P1298AM	T2=	V10
H3=	P1311AM	T3=	V14
		T4=	VT
		T5=	R3
NOTE: 8 ROW PLOTS			
PLANTED NORTH-SOUTH, LODGED EASTERLY			

One day after corn “root lodged”



Four days after corn “root lodged”



Prospects for recovery of “downed corn”

- If root lodging occurs before grain fill, plants usually recover at least partly by “kneeing up”.
- Results in the characteristic gooseneck bend in the lower stalk with brace roots providing above ground support.
- Usually little effect on yield if the stalk bending occurs before pollination.

Root Lodging – “Goosenecking”



Corn Root Lodging Study

AirScout Imagery

6-25-2018 (V14)

7-8-2018 (VT)



Root Lodging Impact on Yield

- When root lodging occurs later in the season, some yield decrease due to partial loss of root activity and reduced light interception may occur.
- If root lodging occurs shortly before or during pollen shed and pollination, it may interfere with effective fertilization, thereby reducing kernel set.

Prospects for Recovery of “Downed Corn”

Influence of Simulated Wind Lodging on Corn Grain Yield

Leaf Collar Stage

Grain Yield Decrease

-----%-----

V10-12

2-6

V13-15

5-15

V17-R1

13-31

Derived from Carter and Hudelson, Univ. of Wisconsin 1988



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THANK YOU
Any questions or
comments?

