HOW DO YOU MANAGE A CORN CROP AFTER STRESS?

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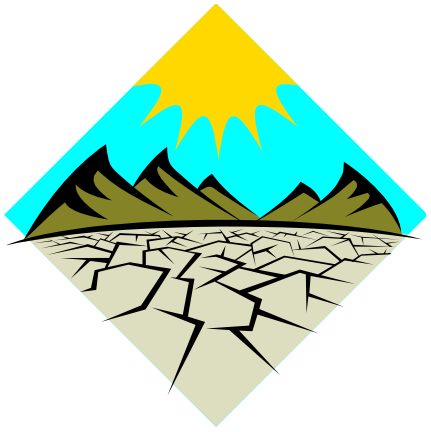
Overview

- **Objective: "Usually making the best of a bad situation"**
  - ✓ Agronomic: In-season management options
    - ❑ Re-planting
    - ❑ Irrigation
    - ❑ Preventative / Prophylactic
  - ✓ Farmer: Is it peace of mind or stress or revenge?
- **When is yield determined?**
  - ✓ Yield implications
- **Management decisions following crop stress**

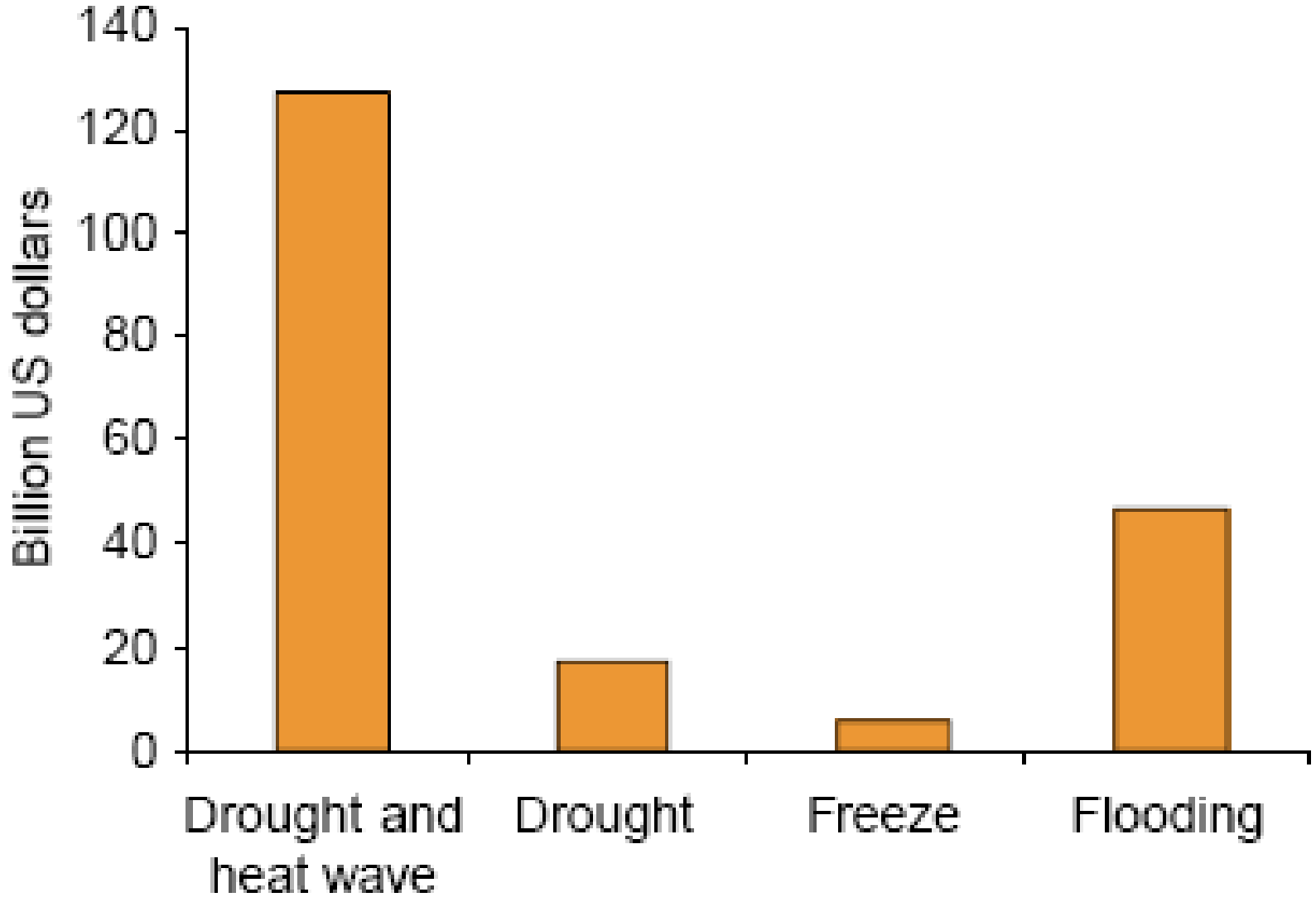
Plants are usually subjected to a combination of stresses. Stresses are researched intensely individually; combinations are less so…

- **Abiotic**
  - ✓ Cool, wet soils
  - ✓ Chilling and Freezing
  - ✓ Heat
  - ✓ Water (Flood and Drought)
  - ✓ Wind
  - ✓ Hail
  - ✓ Nutrients
  - ✓ Ozone
  - ✓ UV
  - ✓ Salinity
- **Biotic**
  - ✓ Neighbors (competition)
    - ❑ Inter- and Intra-plant
  - ✓ Diseases
  - ✓ Insects
  - ✓ Weeds



In a field, even more combinations of stresses can be occurring due to "patchiness" of abiotic and biotioc stresses interacting with soil and micro-climate.

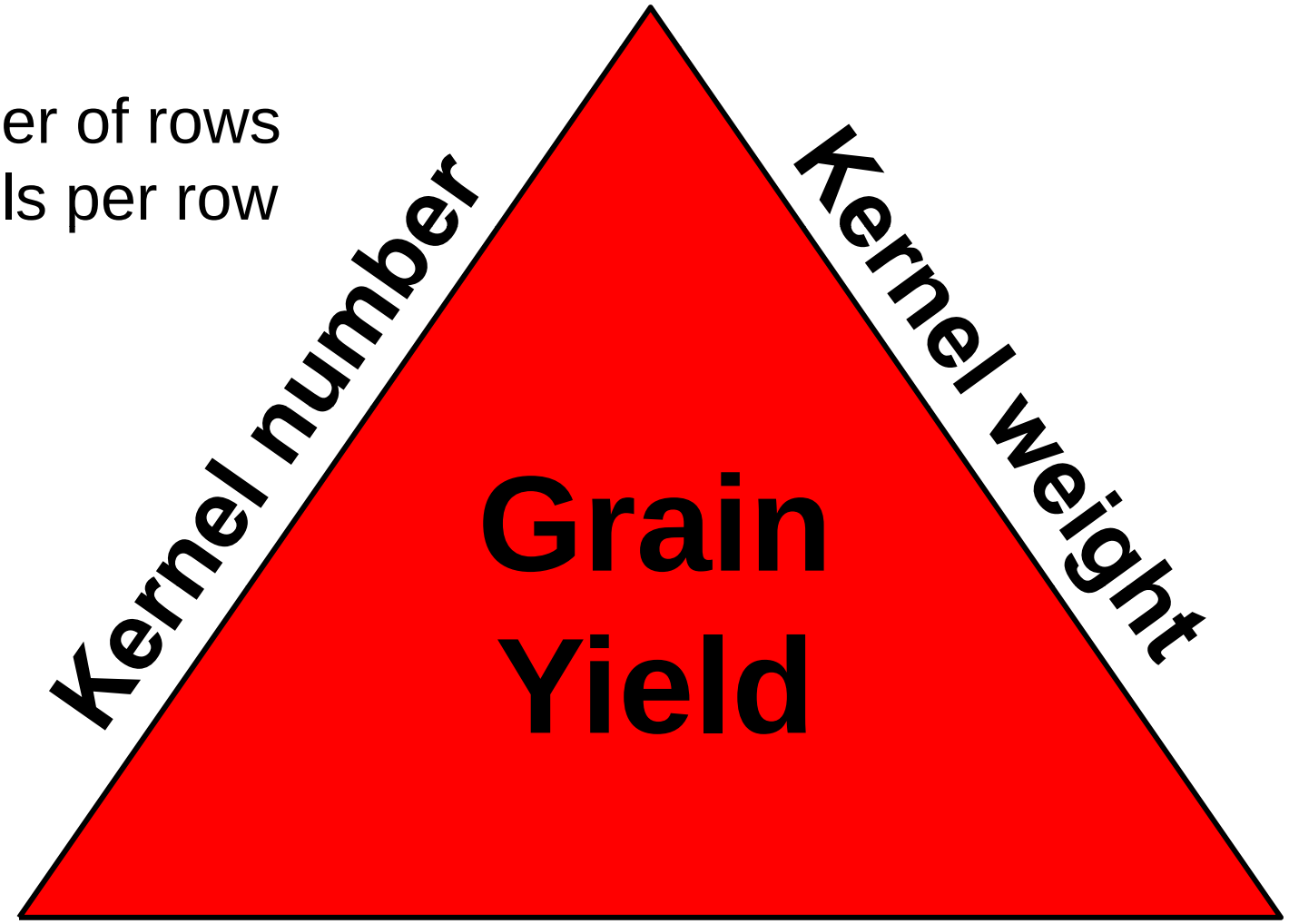
Total of all US agriculture weather disasters costing $1 billion or more between 1980 and 2004



Source: Mittler, 2006 and NOAA (http://www.ncdc.noaa.gov/oa/reports/billionz.html)

What is Yield?
Yield Components of Corn

Number of rows
Kernels per row

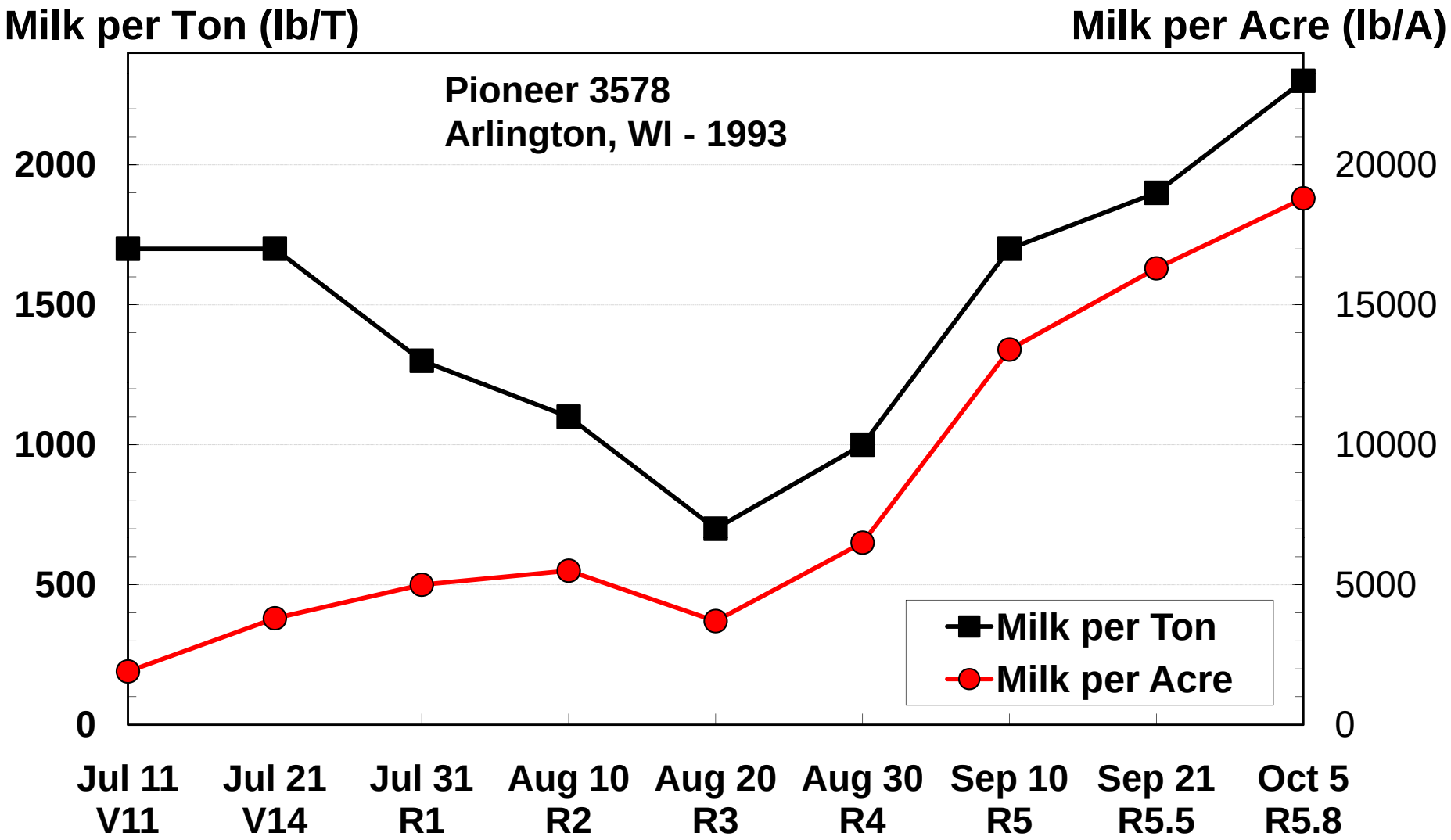


Ears per area

Critical times in the life of a corn plant

		Yield Components	
Stage	**GDUs**	**Potential**	**Actual**
VE (Emergence)	125	Ears / area	---
V6 (Six leaf collars)	470	Kernel rows / ear	"Factory"
V12	815	---	Kernel rows / ear
V18	1160	Kernels / row	---
R1 (Silking)	1250	Kernel weight Ears / area	Kernel number
R6 (Black layer)	2350	---	Kernel weight

Corn Silage Yield and Quality Changes During Development



Source: Lauer, 1994

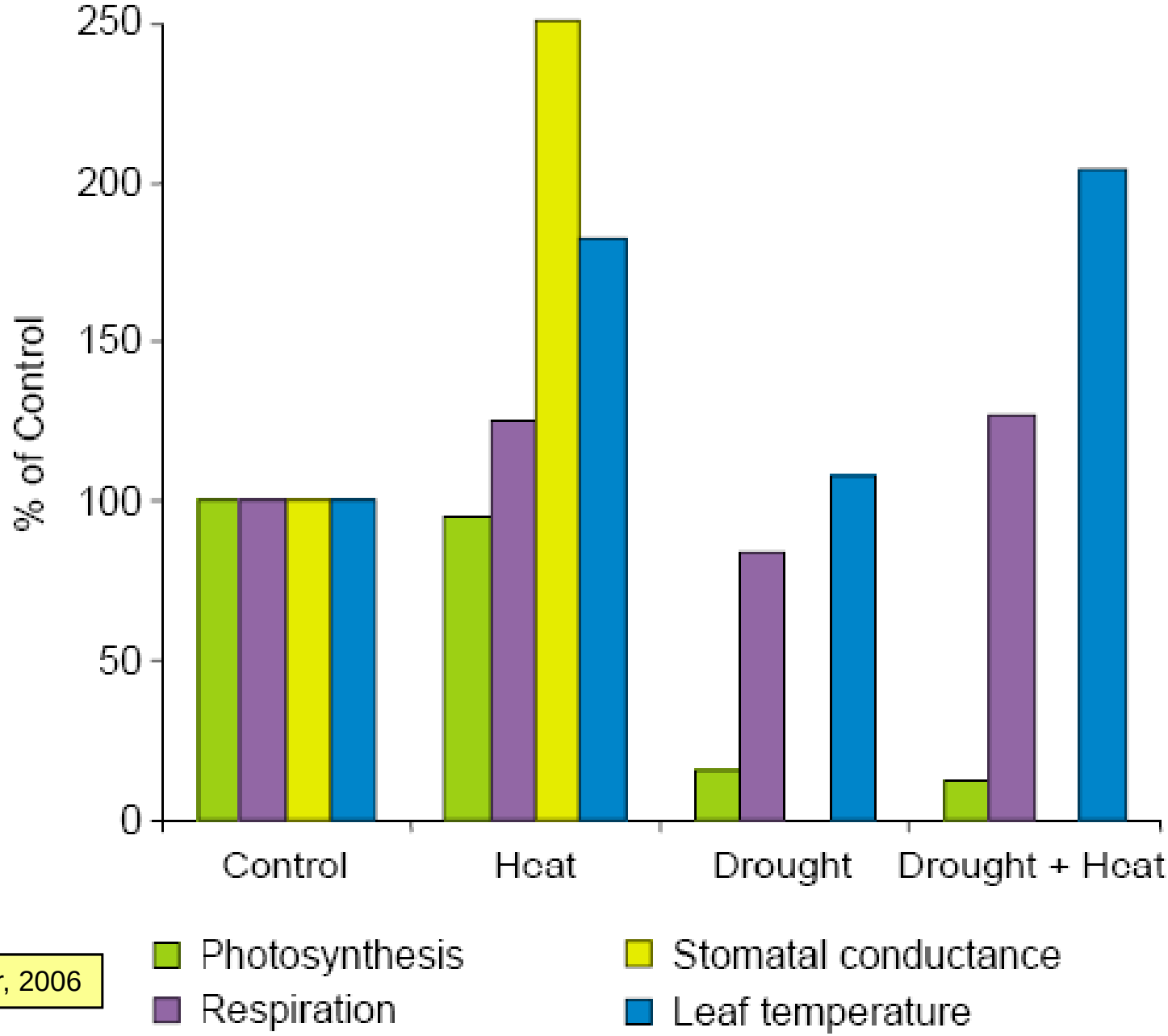
Expected corn grain yield (percent) for planting dates and harvest populations in Relative Maturity zones of 95-115 d.

Harvest population	Planting date													
	April 20		May 1		May 10		May 20		June 1		June 10		June 20	
36000	96	*91*	99	*95*	95	*93*	85	*87*	63	*71*	40	*55*	8	*32*
34000	97	*92*	100	*96*	96	*94*	85	*87*	63	*72*	40	*56*	8	*32*
32000	97	*92*	100	*96*	96	*94*	86	*87*	63	*72*	40	*56*	8	*32*
30000	96	*92*	100	*96*	96	*94*	85	*87*	63	*72*	40	*56*	8	*32*
28000	96	*91*	99	*95*	95	*93*	84	*86*	63	*71*	40	*55*	8	*32*
26000	94	*89*	97	*93*	93	*92*	83	*85*	62	*70*	39	*54*	8	*31*
24000	92	*87*	95	*91*	91	*89*	81	*83*	60	*68*	38	*53*	7	*31*
22000	89	*85*	92	*88*	89	*87*	79	*81*	58	*66*	37	*51*	7	*30*
20000	86	*82*	89	*85*	85	*84*	76	*78*	56	*64*	36	*49*	7	*29*
18000	82	*78*	85	*81*	82	*80*	72	*74*	54	*61*	34	*47*	7	*27*
16000	78	*74*	80	*77*	77	*76*	68	*70*	51	*58*	32	*45*	6	*26*
14000	73	*69*	75	*72*	72	*71*	64	*65*	47	*54*	30	*42*	6	*24*
12000	67	*64*	69	*66*	67	*65*	59	*60*	44	*50*	28	*38*	5	*22*
10000	61	*58*	63	*60*	60	*59*	54	*55*	40	*45*	25	*35*	5	*20*

Figures for shorter-season hybrids are in italics.

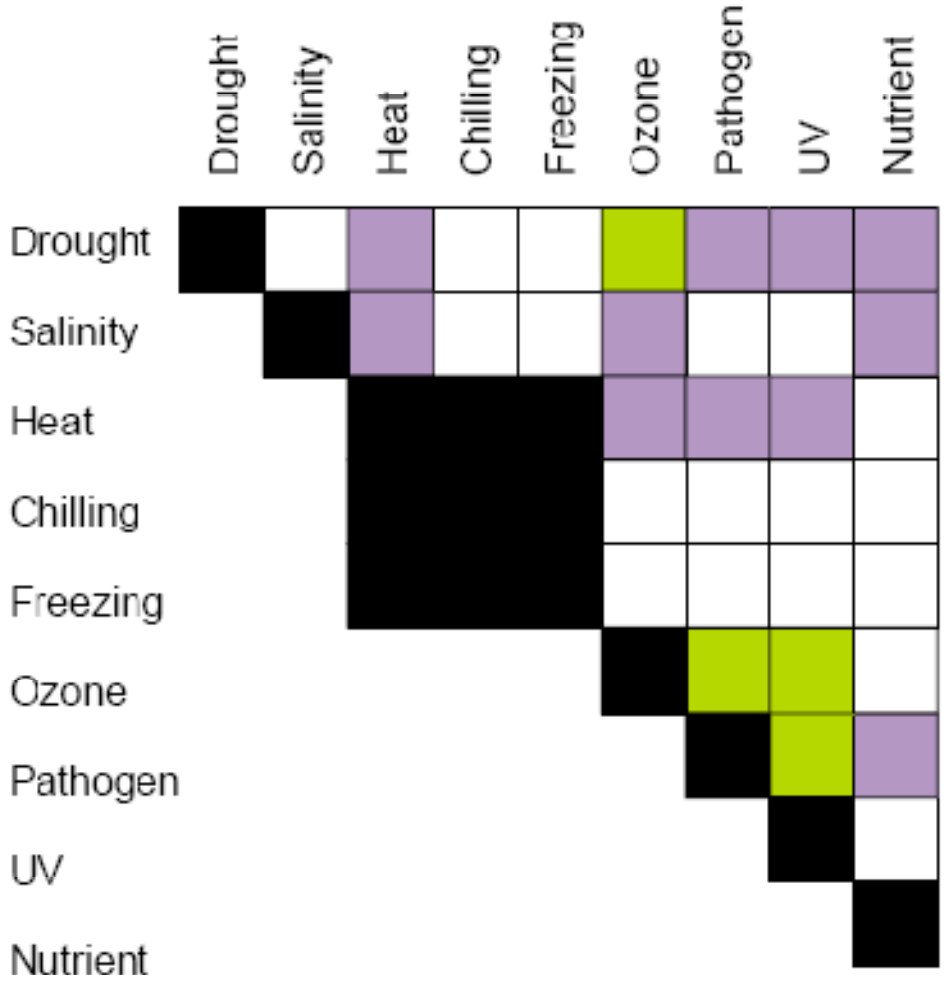
Source: Lauer, 1997

Physiological Characteristics Of Drought And Heat Stress Combination



Source: Mittler, 2006

Agriculturally Important Stress Combinations



Source: Mittler, 2006

Management after Abiotic Stress

Know the health and position of the growing point …

- Frost
- Flooding

- Re-planting

Determining Success of Pollination

- **Shake test**
  - ✓ Carefully unwrap ear and shake
  - ✓ Silks on fertilized ovules fall off

or

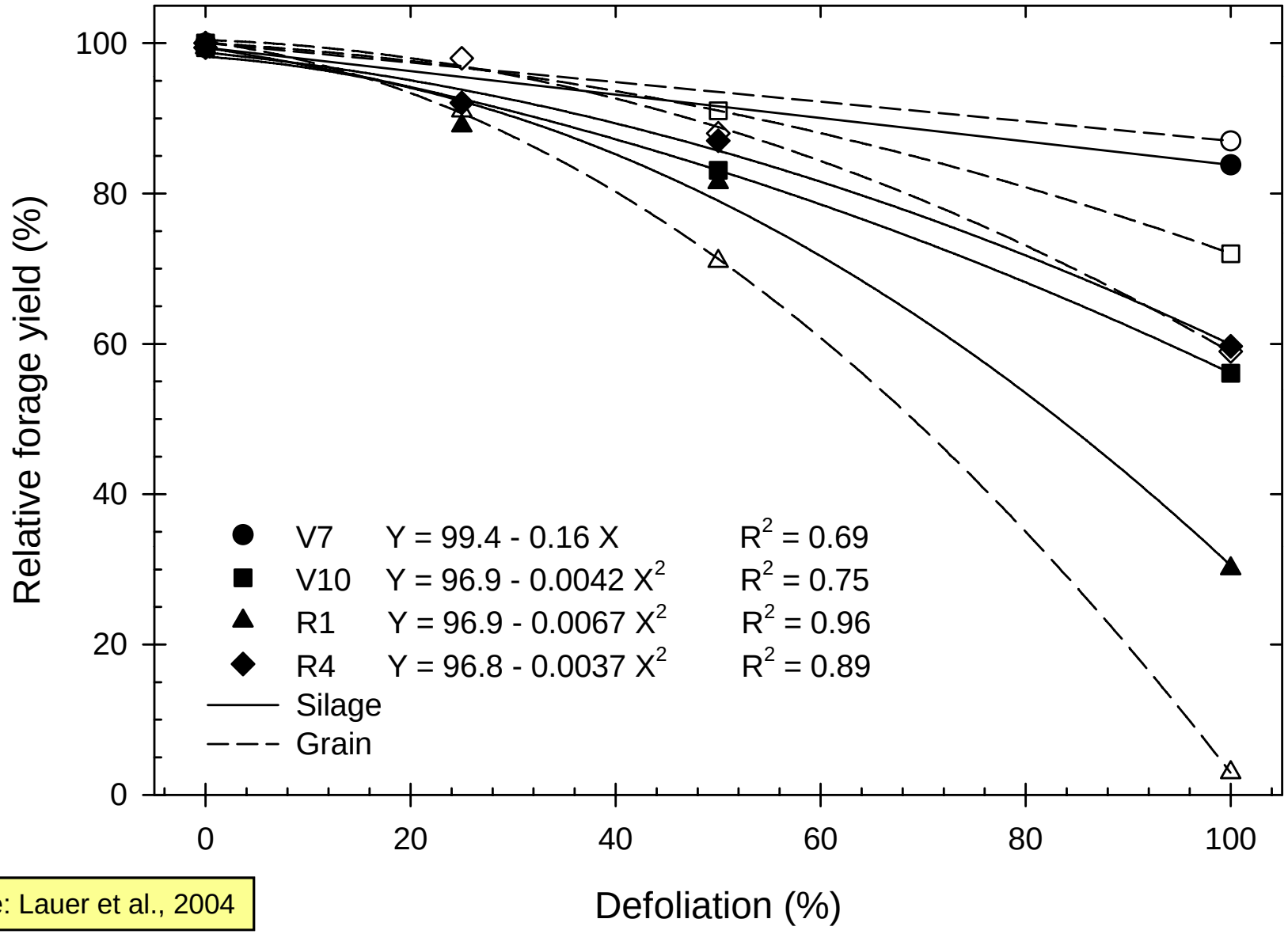
- **Wait 10 d and developing ovules will appear as watery blisters.**

Corn Grain Yield Loss Due to Defoliation

	Percent leaf area destroyed				
	20	40	60	80	100
7 Leaf Stage	0	1	4	6	9
12 Leaf Stage	1	5	11	18	28
17 Leaf Stage	4	13	28	48	72
Tassel	7	21	42	68	100
Silked	7	20	39	65	97
Blister	5	16	30	50	73
Milk	3	12	24	41	59
Dough	2	8	17	29	41
Dent	0	4	10	17	23
Black layer	0	0	0	0	0

Source: derived from National Crop Insurance Service Bulletin

Corn Grain and Silage Yield Loss Due to Defoliation



Source: Lauer et al., 2004

Grain yield loss after plants killed or defoliated

Corn Development Stage	Plants Killed	Plants Defoliated
	percent yield loss	
R4 (Soft dough)	55	35
R5 (Dent)	40	25
R5.5 (50% kernel milk)	12	5
R6 (Black layer)	0	0

Source: derived from Afuakwa and Crookston, 1984

Estimated corn evapotranspiration and yield loss per stress day during various stages of growth

Growth stage	Evapotranspiration	Percent yield loss per day of stress (min-ave-max)
	inches per day	%
Seedling to 4 leaf	0.06	---
4 leaf to 8 leaf	0.10	---
8 leaf to 12 leaf	0.18	---
12 leaf to 16 leaf	0.21	2.1 - 3.0 - 3.7
16 leaf to tasseling	0.33	2.5 - 3.2 - 4.0
Pollination (R1)	0.33	3.0 - 6.8 - 8.0
Blister (R2)	0.33	3.0 - 4.2 - 6.0
Milk (R3)	0.26	3.0 - 4.2 - 5.8
Dough (R4)	0.26	3.0 - 4.0 - 5.0
Dent (R5)	0.26	2.5 - 3.0 - 4.0
Maturity (R6)	0.23	0.0

Source: derived from Rhoads and Bennett (1990) and Shaw (1988)

Corn forage yield and quality with differing amounts of pollination

Ear fill	Forage yield	Crude protein	NDF	ADF	IVTD	NDFD
%	% of control	%	%	%	%	%
0	81	8.5	57	30	74	52
54	93	8.0	54	28	76	52
100 (control)	100	7.5	49	26	77	54
LSD (0.05)	6	0.3	1	1	1	1

Source: derived from Coors et al., 1997

Summary

Abiotic Stress		Corn Growth Stage					
		VE	V6	V12	V18	R1	R6
		Grain Yield Loss (%)					
Frost <28F		0	100	100	100	100	0
Hail (max)		0	53	81	100	100	0
Drought/Heat (%/day)		--	--	3	4	7	0
Flooding<48h	Severe	0	0	0	0	0	0

What about interactions with

fertility, disease, insects, weeds and pesticides?

Summary continued …

- **Crops rarely have one stress; usually a combination of stresses occur**
  - ✓ "All bets are off" as to what will happen
  - ✓ Modern hybrids seem to be able to withstand more stress
- **Early stress**
  - ✓ Determine whether to Re-plant:
    - ❑ Determine plant population
    - ❑ Assess the unevenness of stand
    - ❑ Calculate replanting costs

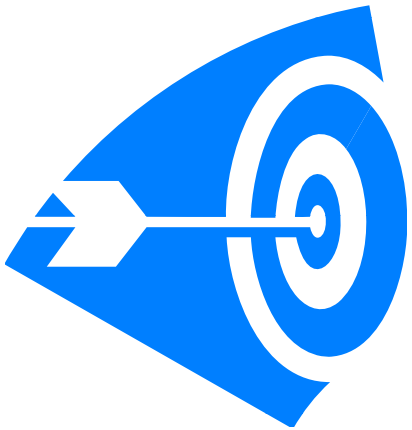
    Evaluate plant health

    Compare yield of reduced to re-planted stand

    Factor risks of re-planting
- **Late stress**
  - ✓ Determine success of pollination
    - ❑ Good: harvest in normal fashion for either grain or silage
    - ❑ Bad: some kernels developing, leave for corn silage harvest
    - ❑ Ugly: harvest as close to flowering as possible, but must be concerned about moisture of forage

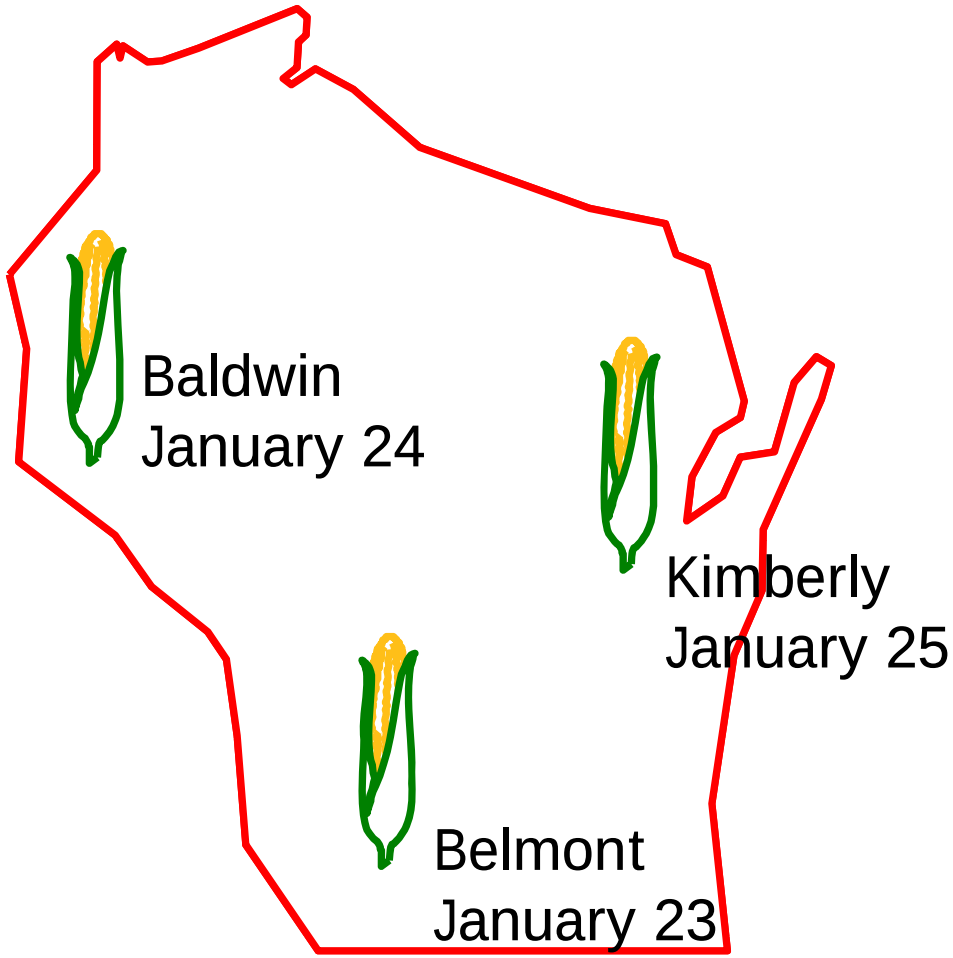
Summary continued …

- **Problems to be aware of:**
  - ✓ Harvest timing and influence of moisture on storage as silage, HMC, or dry grain
  - ✓ Raising the cutter bar
  - ✓ Nitrate poisoning
- **Estimating yield impact of stress**
  - ✓ Grain yield method
  - ✓ Plant height method
- **Accurately calculate the economics and value of grain v. silage**
  - ✓ Difficult under best of circumstances



Thanks for your attention!
Questions?

2007 Corn Conferences



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