Ecology of *Dectes texanus* on sunflowers and novel tactics for mitigating yield losses

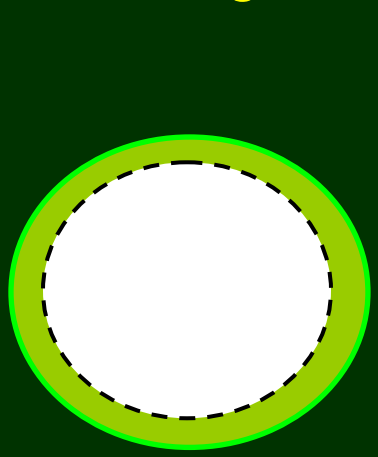
J.P. Michaud
Kansas State University

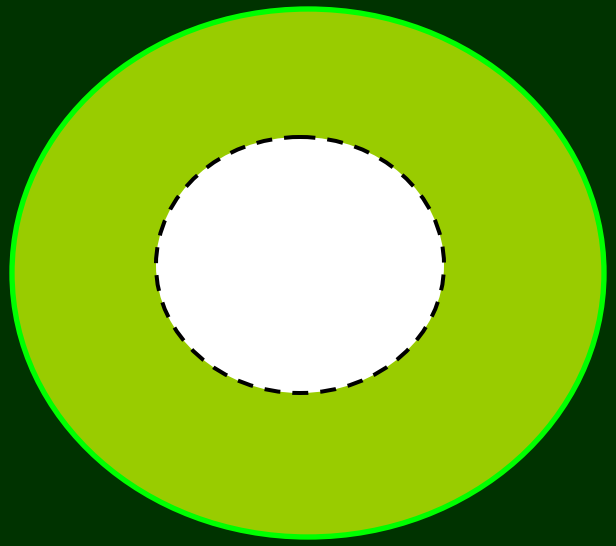
Dectes texanus - Background Information

- One generation per year, skewed emergence, long-lived adults
- No effective biological or chemical controls
- No measurable impact of larval feeding on plant productivity
- Unique ‘girdling’ behavior of larvae causes pre-harvest lodging
- Even though commercial fields may be 80-90 % infested, infestation of wild *H. annuus* is extremely rare

Stalk diameter matters !

Maximum girdling radius of *Dectes* larvae is ~ 0.5 inches



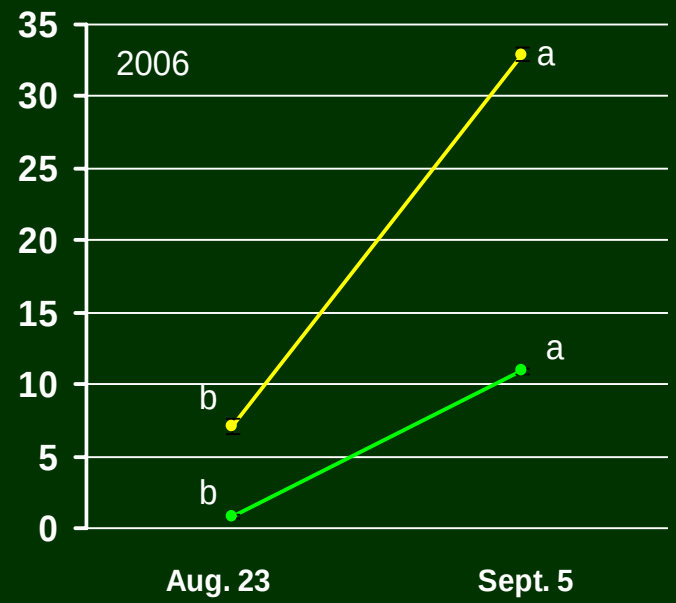


PLUS – large stalks get girdled later

Cultural Management 101:
(oilseed SF's grown without irrigation)

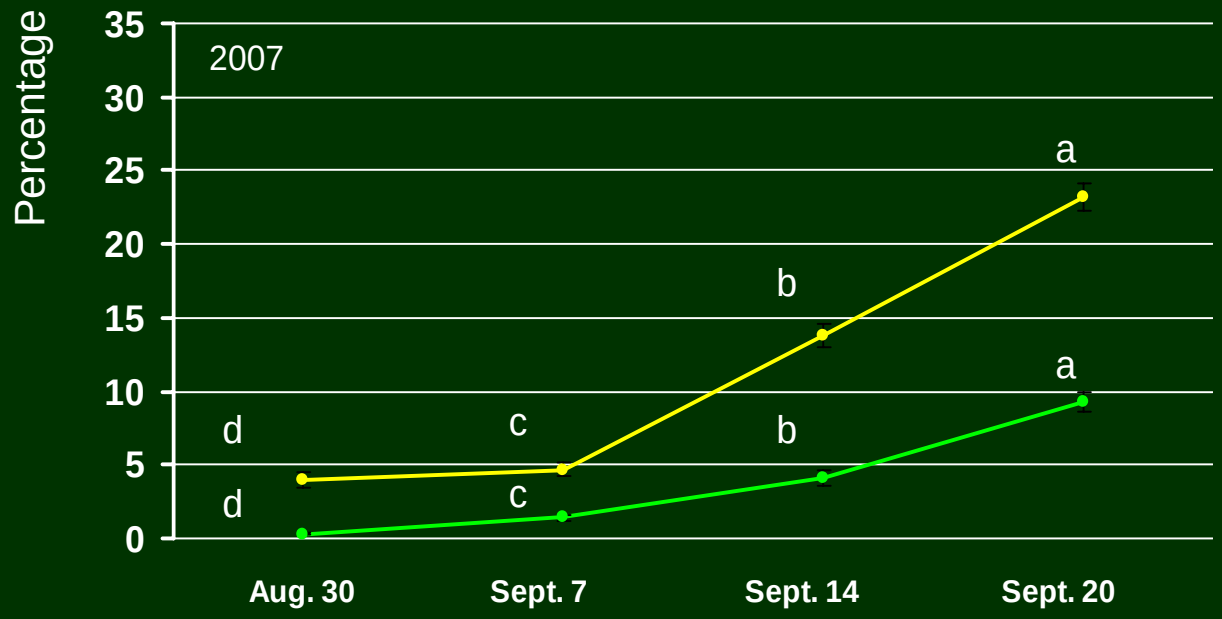
Reduce plant populations to increase plant size

- various studies show little change in yield between 10,000 – 20,000 plants per acre
- seed treatments improve stand establishment
- no oil penalty for large flowers unless > 9-10 inches
- best oil content is obtained with hot dry weather during seed fill – the same conditions that trigger early girdling by *D. texanus*

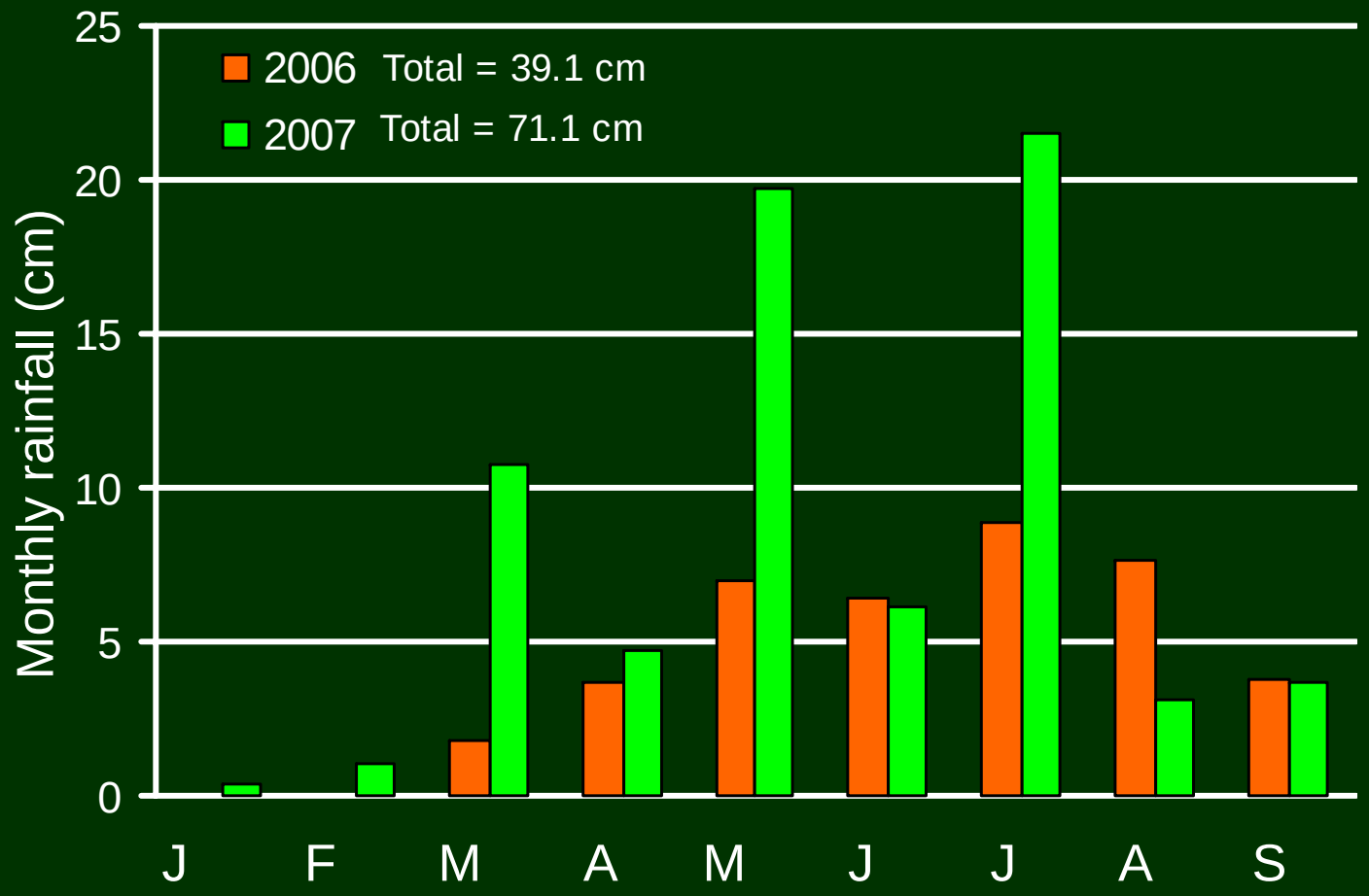


Progression of larval girdling in low density (10,000 ppa) and high density (15,000 ppa) plots in each of 2 years

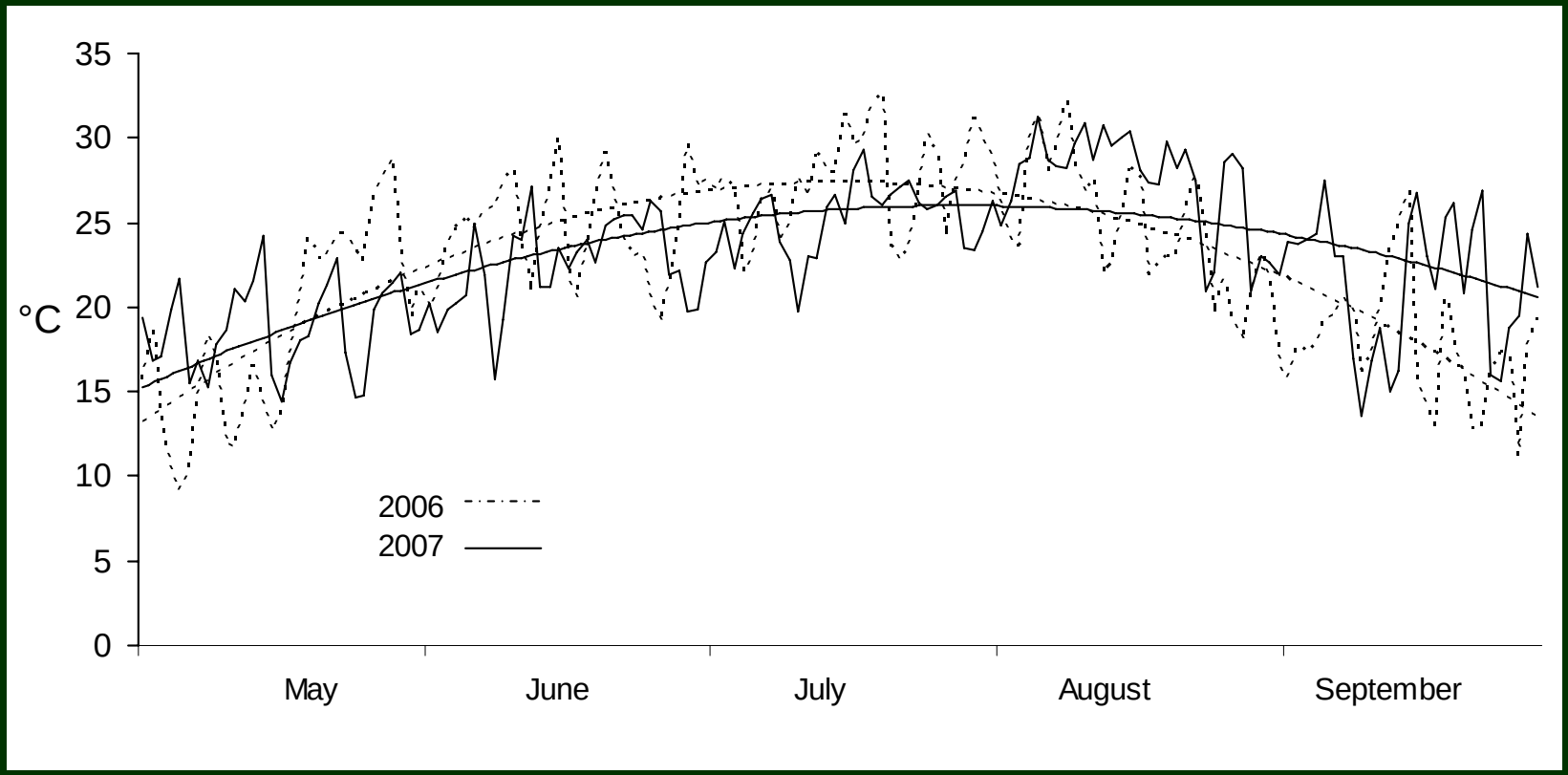
(Triumph 660CL)



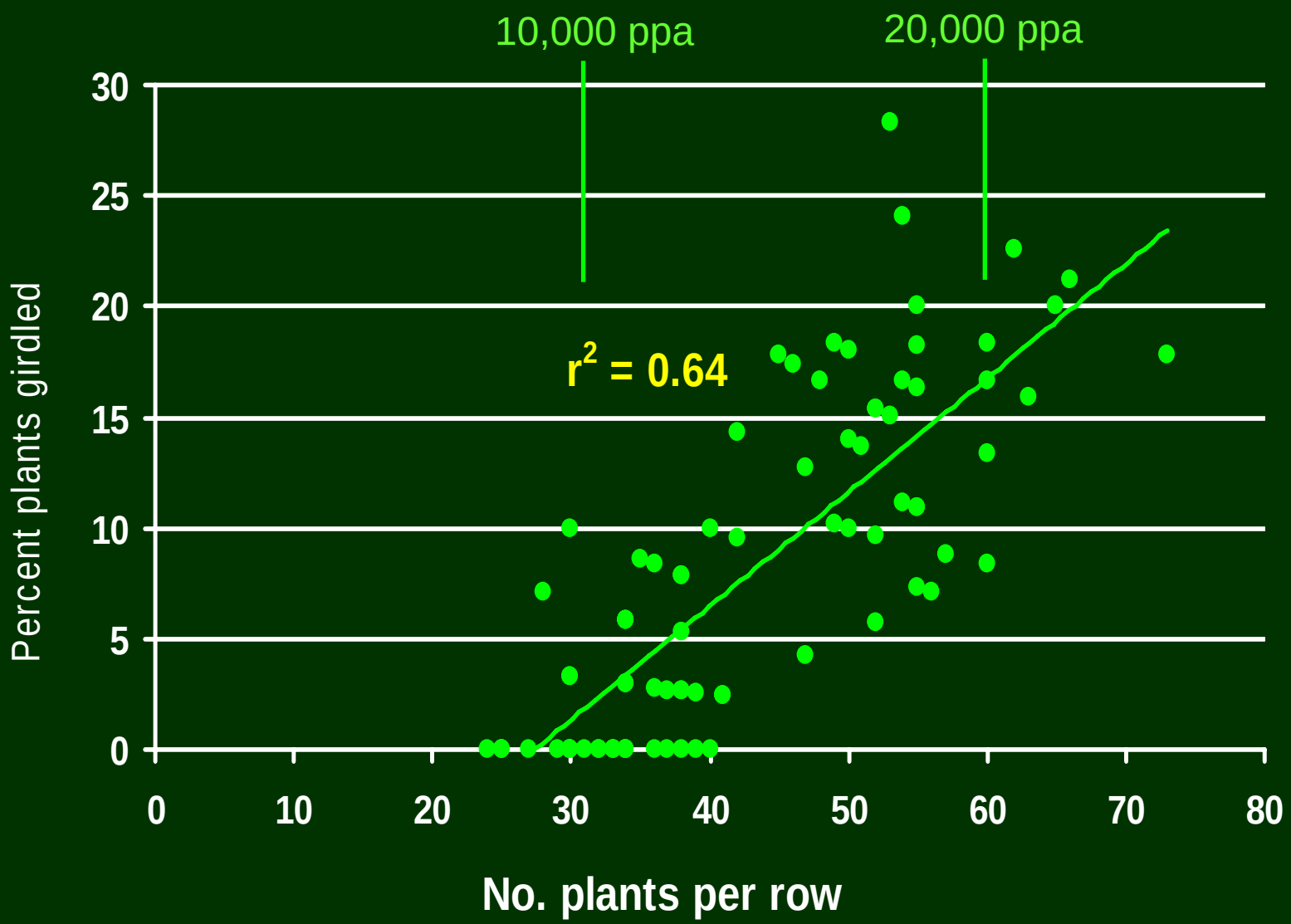
Rainfall at Hays, 2006 versus 2007

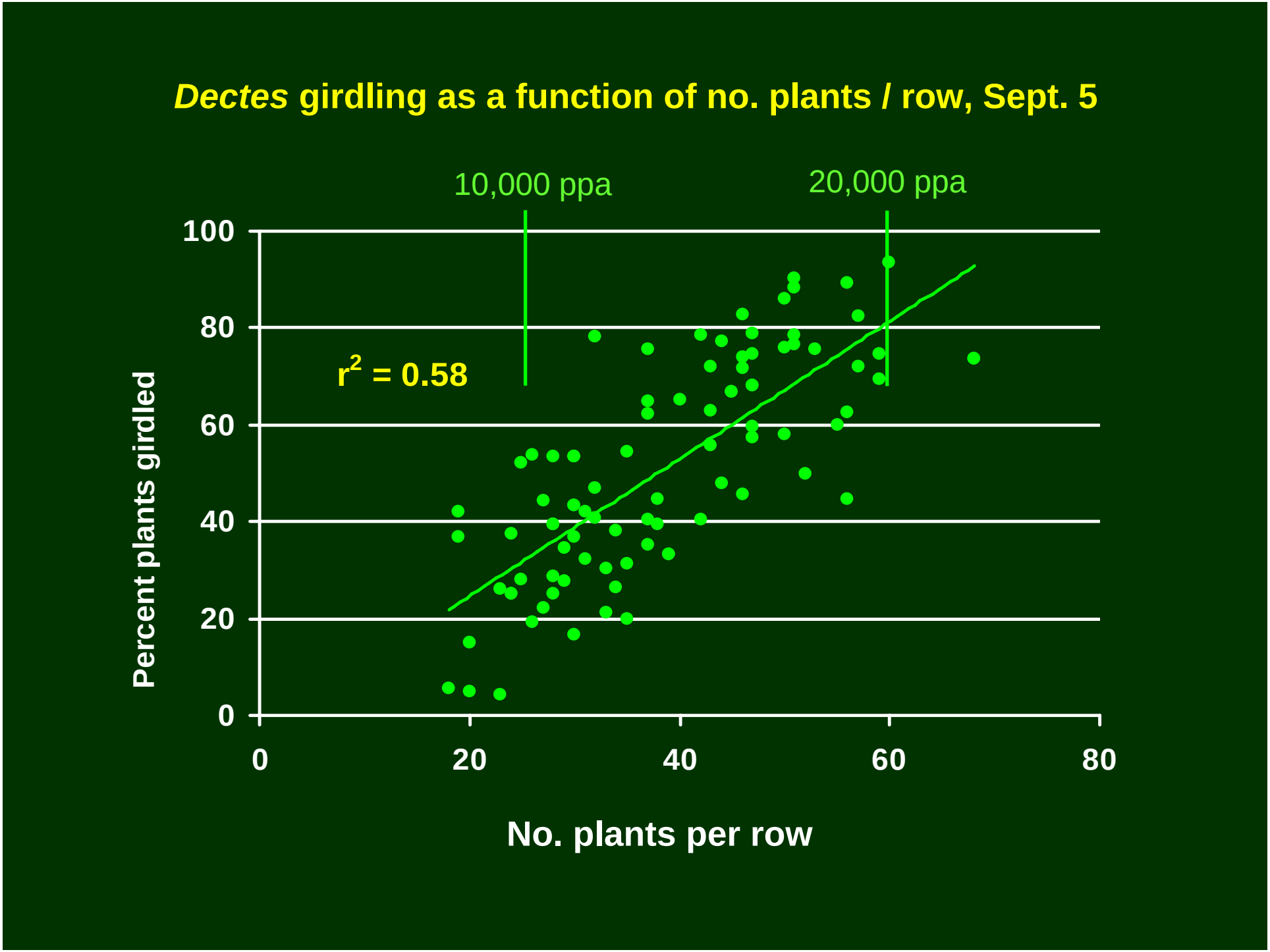


Daily mean ambient temperatures at Hays, 2006 versus 2007



Dectes girdling as a function of no. plants/row on Aug. 13, 2006



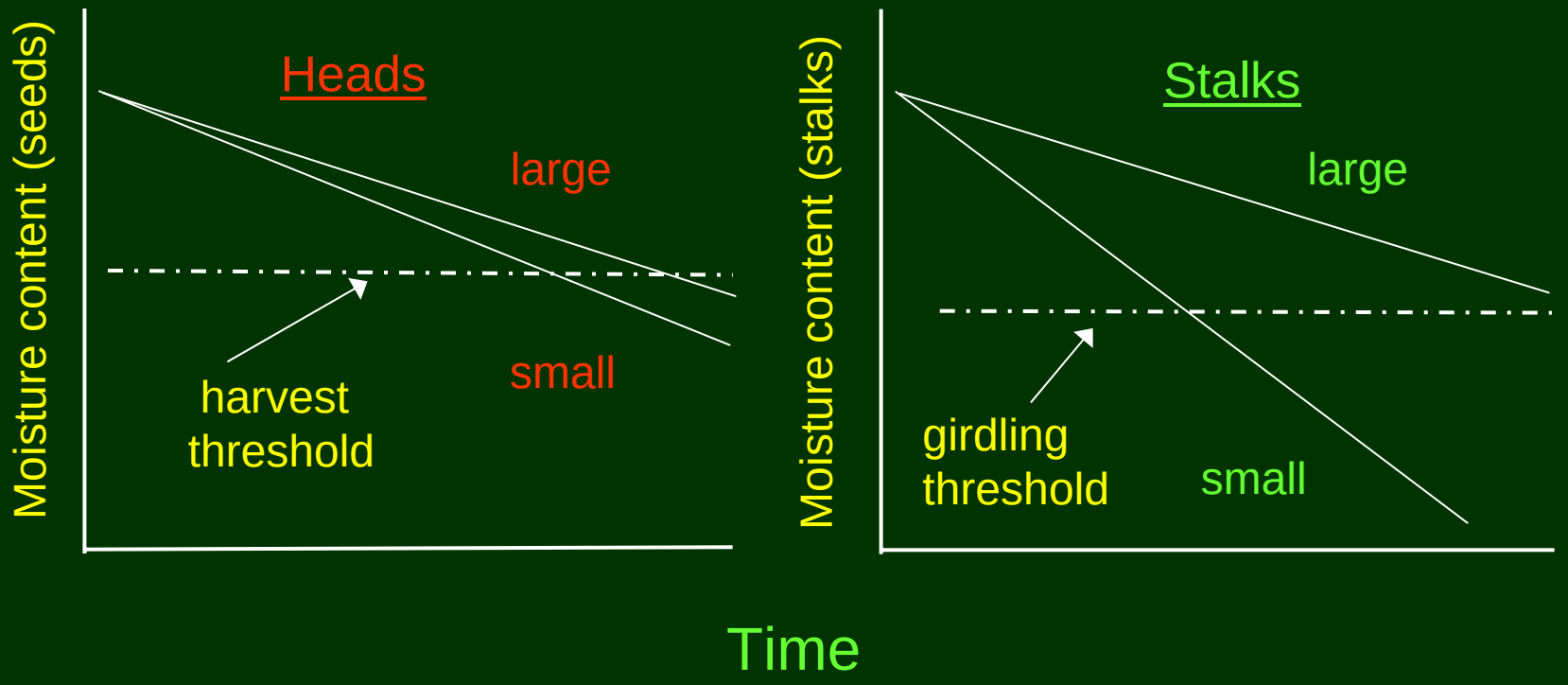

Dectes girdling as a function of no. plants / row, Sept. 5
10,000 ppa
20,000 ppa
$r^2 = 0.58$
Percent plants girdled
100
80
60
40
20
0
0
20
40
60
80
No. plants per row

Assumption: stalk desiccation triggers girdling

Harvest date – determined by seed moisture content

Girdling date – determined by stalk moisture content

HYPOTHESIS:



Hypothesis: Onset of girdling is triggered by stalk desiccation

Q1: How might we accelerate desiccation of seed ?

Q2: How might we delay the desiccation of stalks ?

Avenues we are exploring :

- light irrigation pulse after crop maturity
  (should delay girdling, but not seed drying)

- ‘stay-green’ stalks
  (should extend the period of larval feeding
  and delay girdling until after harvest is complete)

BUT – wild sunflowers are almost completely resistant to *D. texanus*
WHY ?

Resistance to *D. texanus* in wild *H. annuus*

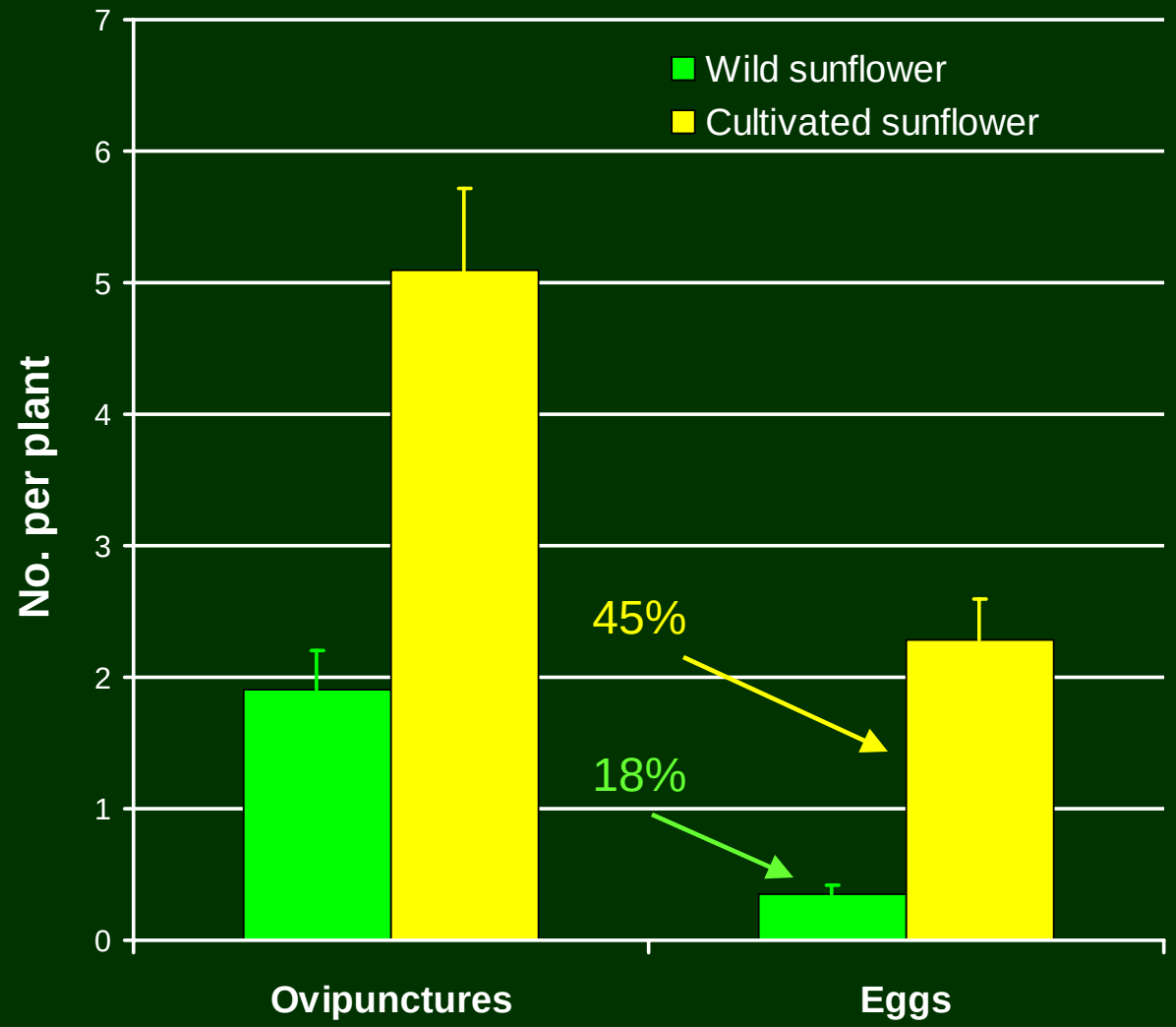
Infestation rate of wild plants ~ 0.1 %

What is the nature of resistance?

Antixenosis versus Antibiosis

We caged mated *D. texanus* females on field-grown plants for 48h
– 1st wild *H. annuus*, 2nd cultivated *H. annuus*

Resistance to *D. texanus* in wild *H. annuus*



Resistance to *D. texanus* in wild *H. annuus*

	Wild	**Cultivated**	
Force required to puncture petiole with pointed probe (kg)	1.3 ± 0.05	0.8 ± 0.05	(60% more)
Percent water content	86.5 ± 0.7	92.6 ± 0.3	(6% less)
Weight of resin exuded from severed petiole after 10 min (gm / cm petiole diameter)	4.2 ± 0.17	1.0 ± 0.07	(400% more)

Conclusion: We have inadvertently bred for susceptibility to *D. texanus* in cultivated varieties

Tactics for mitigating losses to *D. texanus*

1. Cultural Management

   - plant population
   - limited late-season irrigation

2. Plant Breeding

   - stay-green stalks
   - transfer of resistance traits from wild plants

Further research is required to evaluate and integrate these tactics


QUESTIONS ?