Chemical repellents for reducing blackbird damage:

Further evaluation of an anthraquinone-based repellent on mature sunflowers

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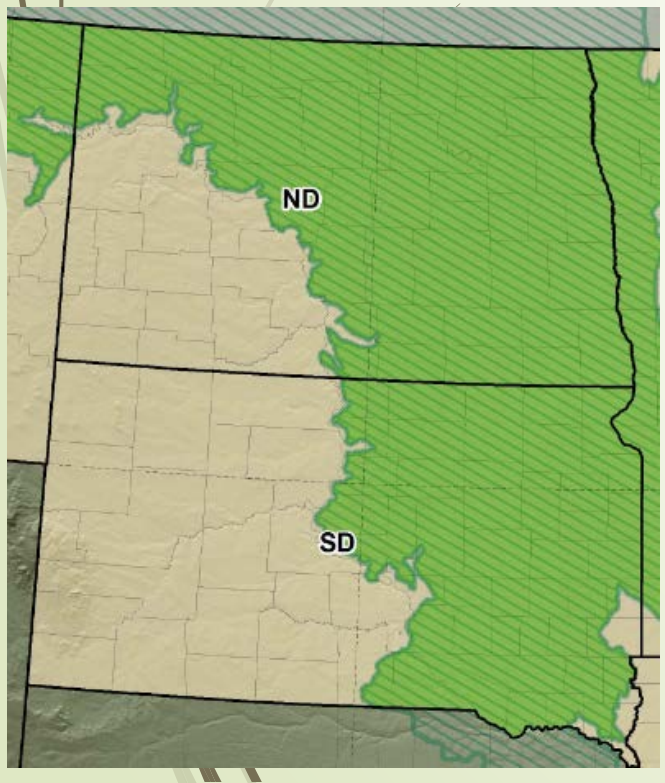
Sunflower Industry

- Majority of 1.37 million acres planted within the Dakotas



- Blackbirds are a problem for the industry
  - Ample roosting habitat
  - Diet change from insects to seeds
  - Damage often localized


2016-10-10 12:20:00 PM T
53°F


2016-10-06 4:28:00 PM T
45°F
CEDW8

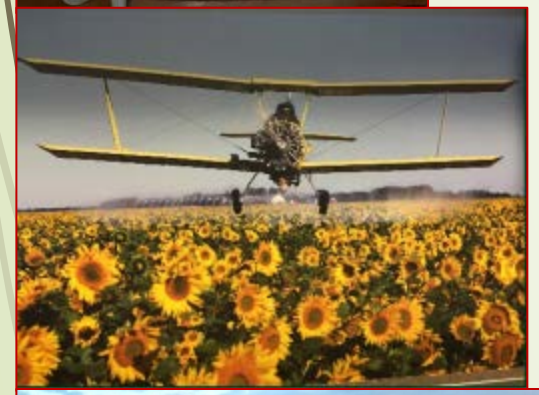

2016-10-08 11:35:00 AM T
38°F


2016-10-11 8:22:00 AM T
35°F


2016-10-06 8:13:00 AM T
29°F
PC900 PROFESSIONAL


2016-10-06 4:31:00 PM T
45°F
CEDW8

Anthraquinone(AQ)-based repellent



- Lab Studies
  - Dry, loose achenes
  - Evenly coated with repellent

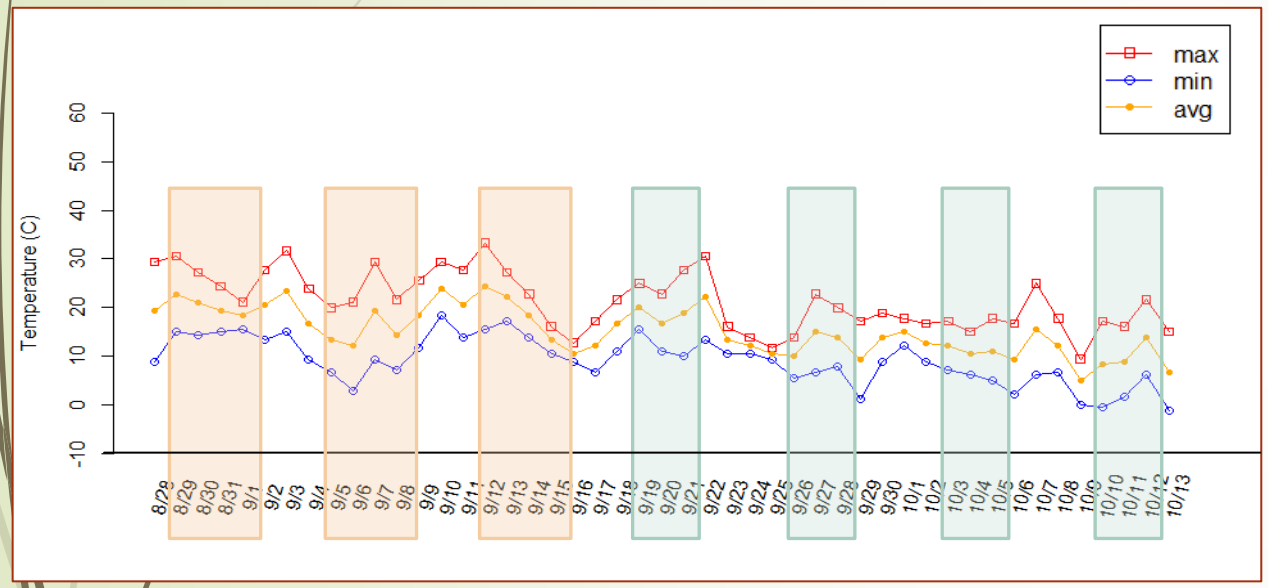
- Field Application
  - Foliar application shortcomings

- Field Studies
  - Applied to back of heads (no success)
  - Applied to the face (success*)

(Avery et al. 2005; Werner et al. 2009,2011,2014)

Study Layout

- Red River Zoo Baviary
  - Maintained 130 male red-winged blackbirds



- **Preference test**
  - 3 weeks
  - 38 naïve blackbirds
- **Concentration response**
  - 4 weeks
  - 50 naïve blackbirds
- **Sunflower plots**
  - Staggered plant dates

May 18th

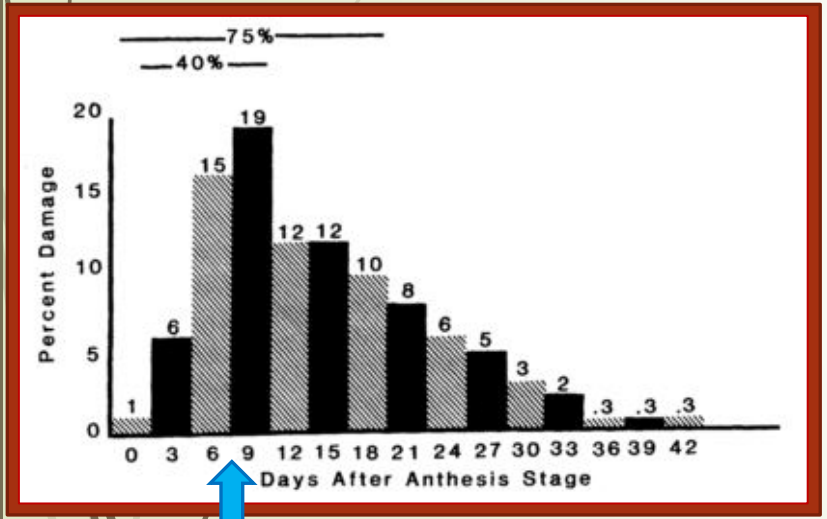
May 31st

June 17th

June 29th

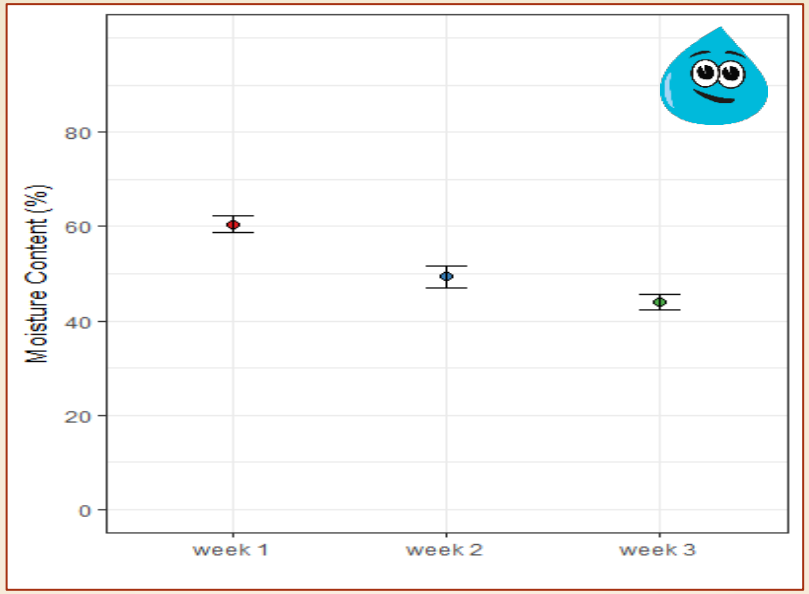
July 7th

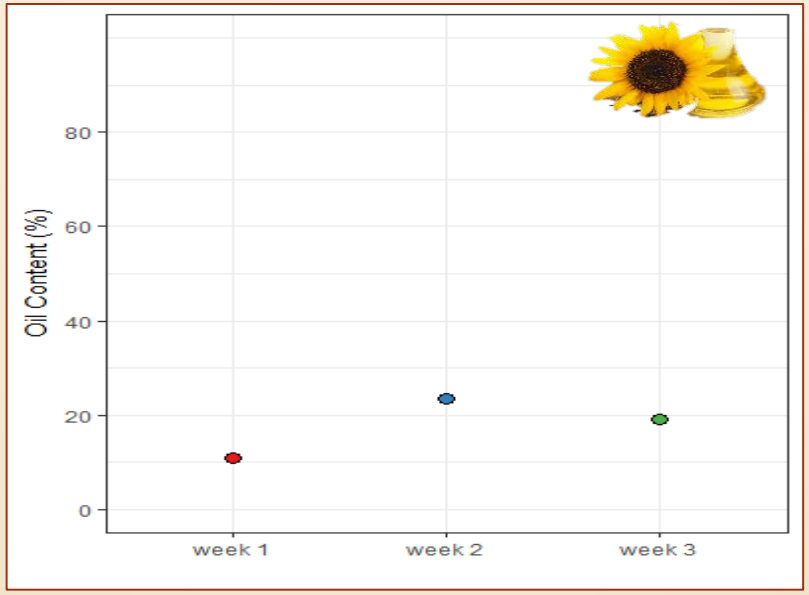
Moisture & Oil



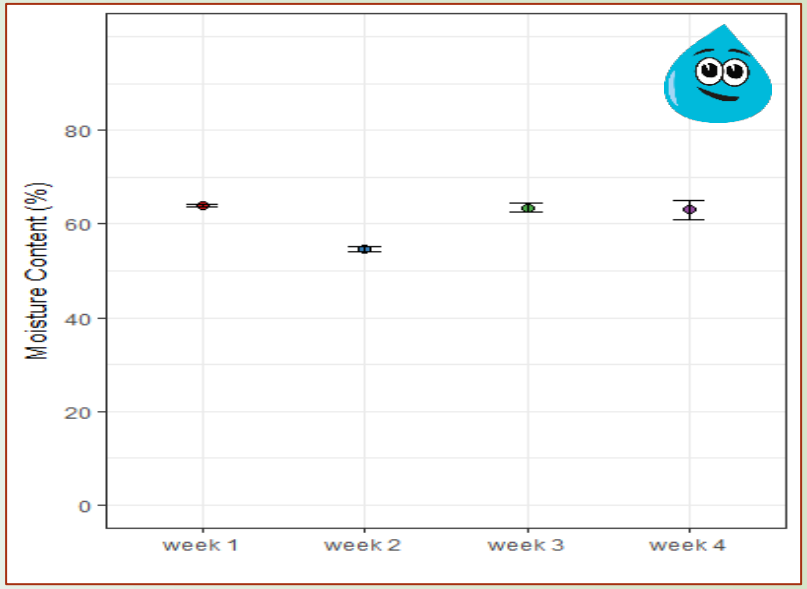
Cummings et al. 1989

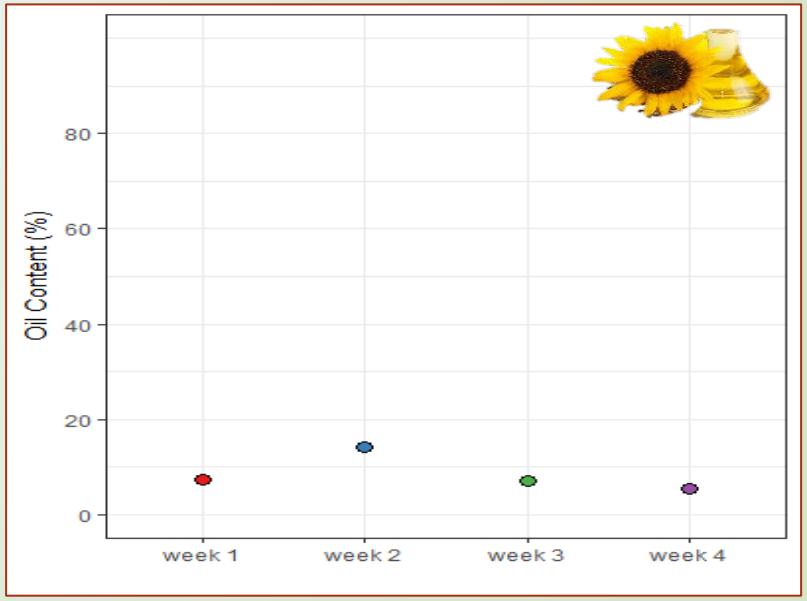
Preference Test





Concentration Response



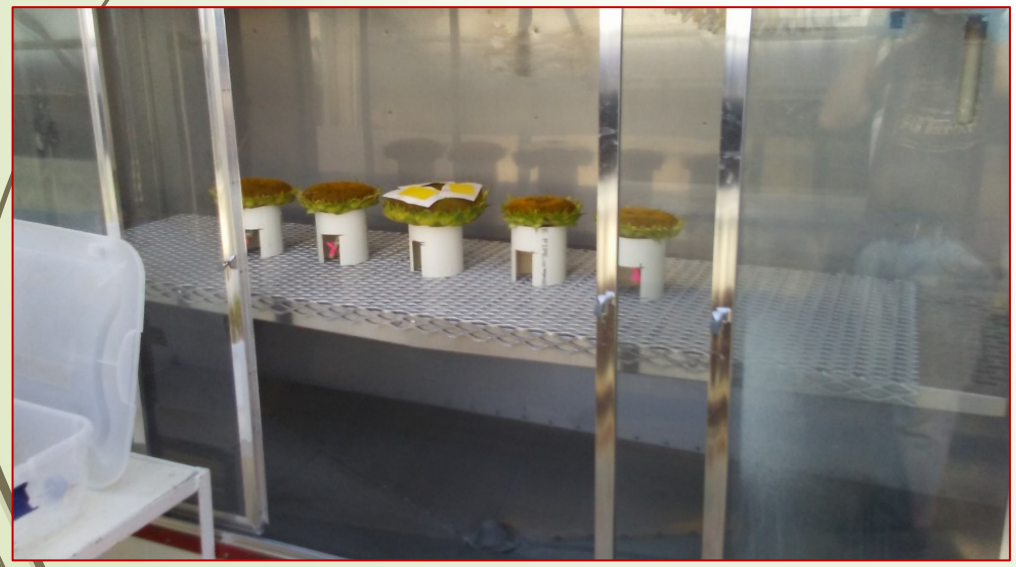


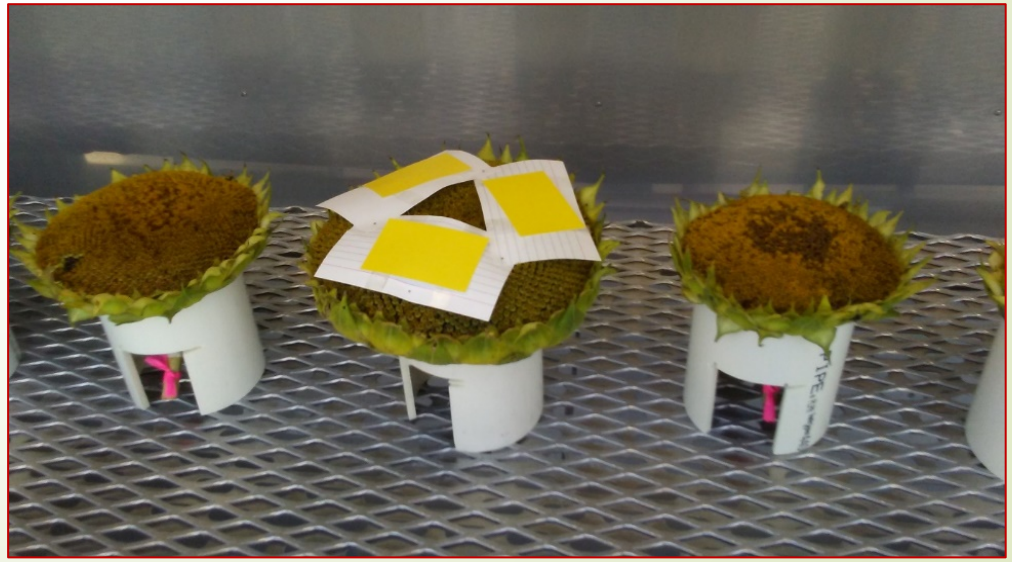
Repellent Application

Treatment	Repellent (gal/acre)	AQ (gal/acre)
LO	0.34	0.044
ML	0.68	0.088
MH	1.35	0.176
HI	2.70	0.351

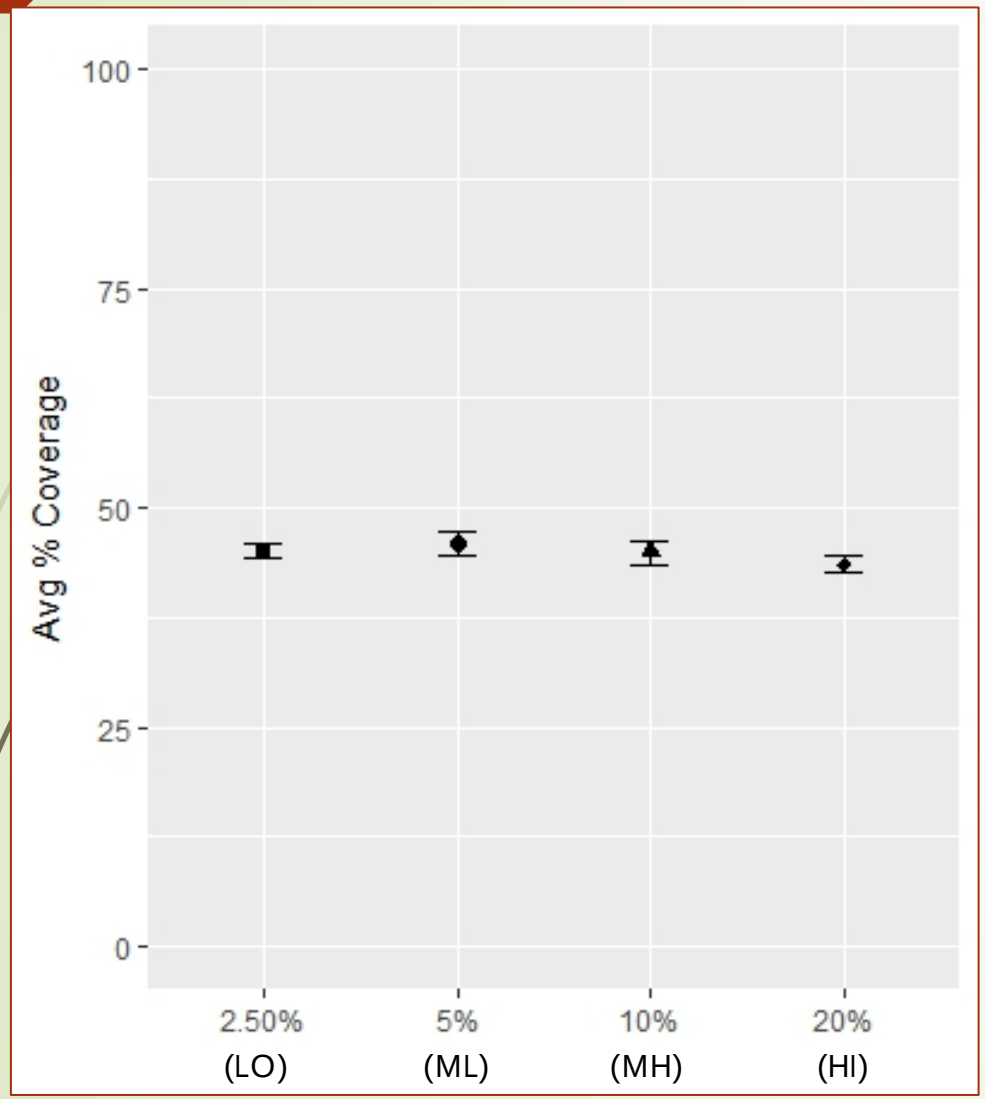
* All mixtures contained 0.25% R11 sticker agent

- Mixtures applied at 13.5 GPA:
  - Speed (2mph)
  - Nozzle output (0.1GPM)
  - Height (13in)
  - Bandwidth (22in)

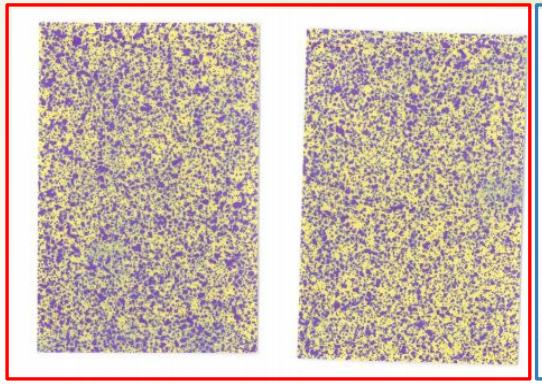




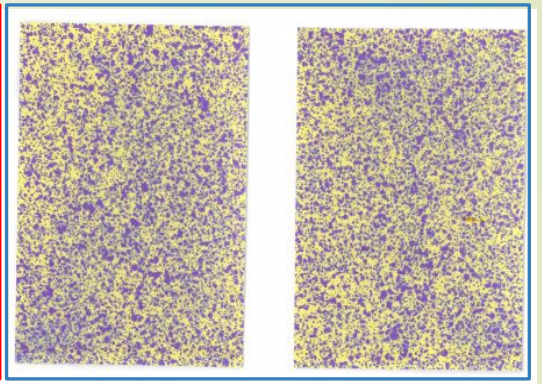
Repellent Application



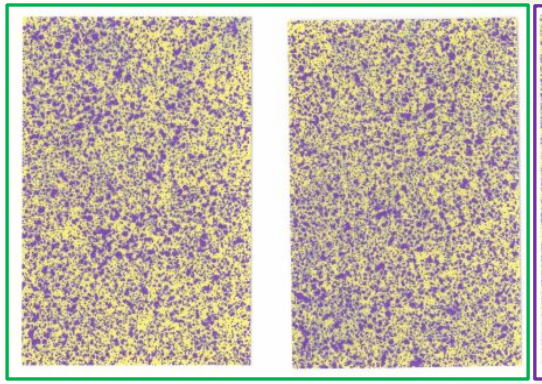
LO (2.5%)



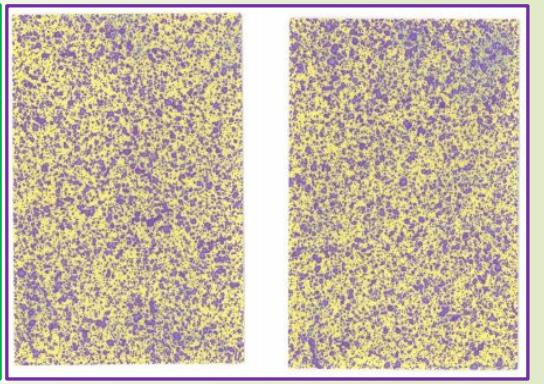
ML (5%)



MH (10%)

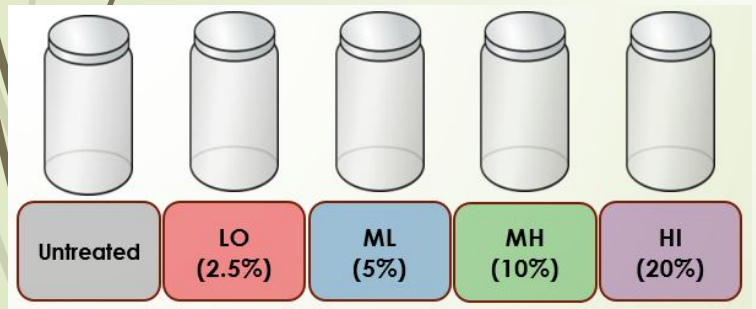


HI (20%)

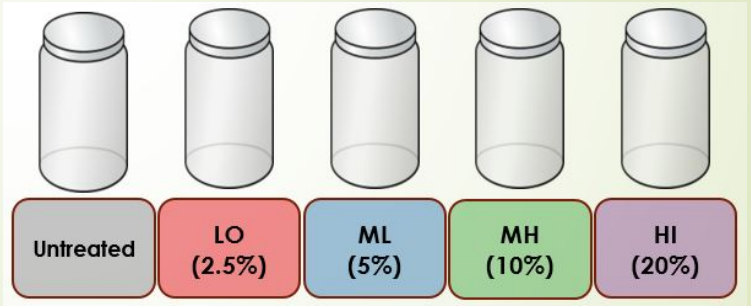


Treatment (% Repellent)	Mean % Coverage (±SE)
LO (2.5%)	45.08 ± 0.88
ML (5%)	45.86 ± 1.32
MH (10%)	44.92 ± 1.35
HI (20%)	43.59 ± 0.89

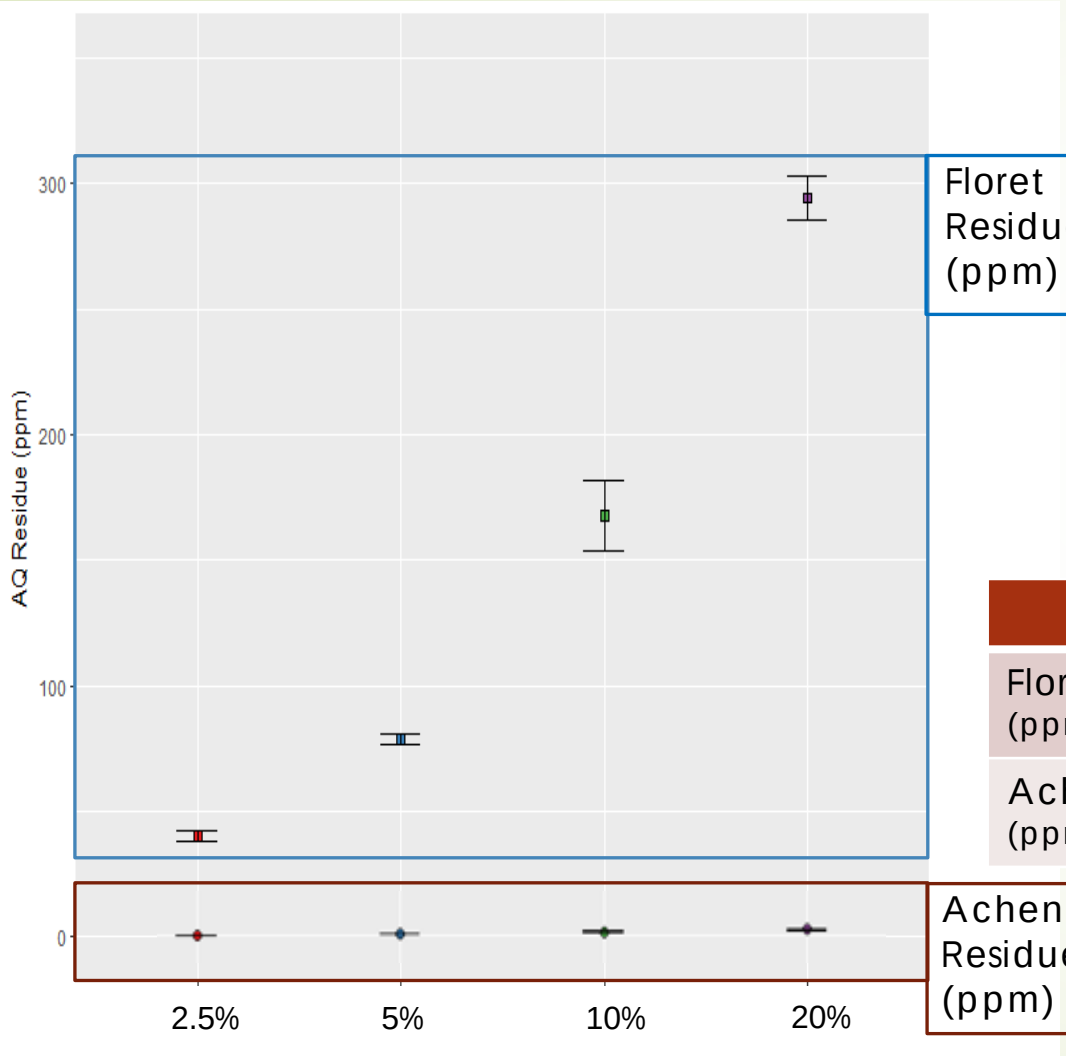
Florets

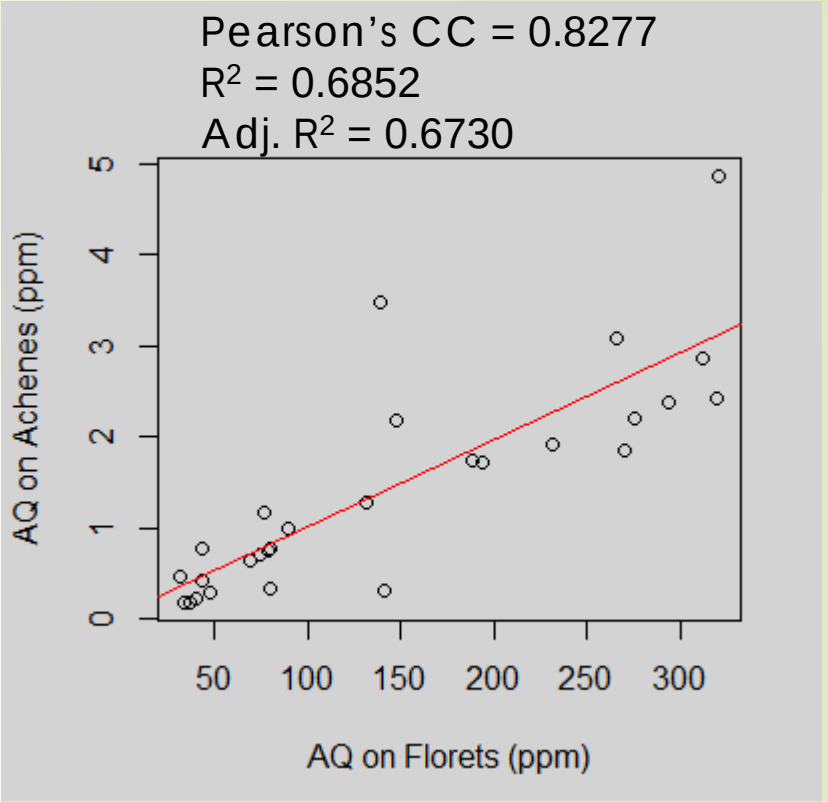


Achenes



Residue Analysis



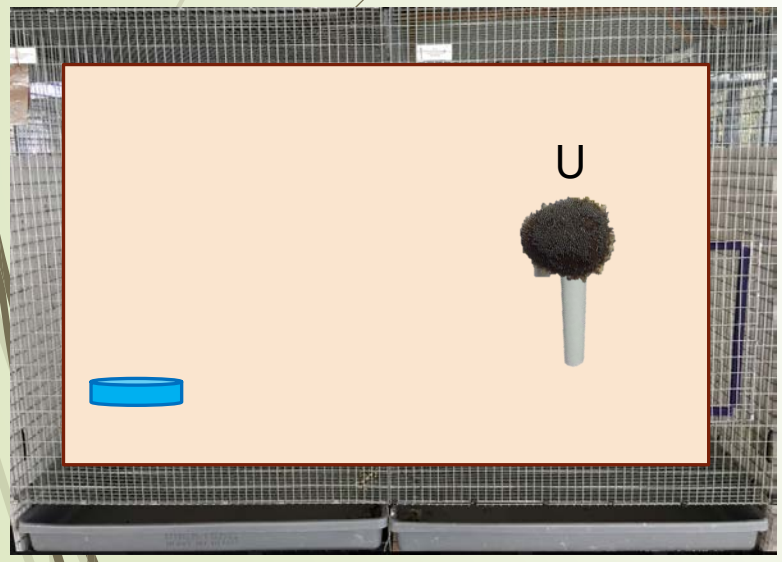


	LO	ML	MH	HI
Floret Residue (ppm ± SE)	39.97 ± 2.20	78.71 ± 2.31	167.71 ± 14.10	294.14 ± 9.01
Achene Residue (ppm ± SE)	0.36 ± 0.08	0.77 ± 0.10	1.80 ± 0.36	2.81 ± 0.38

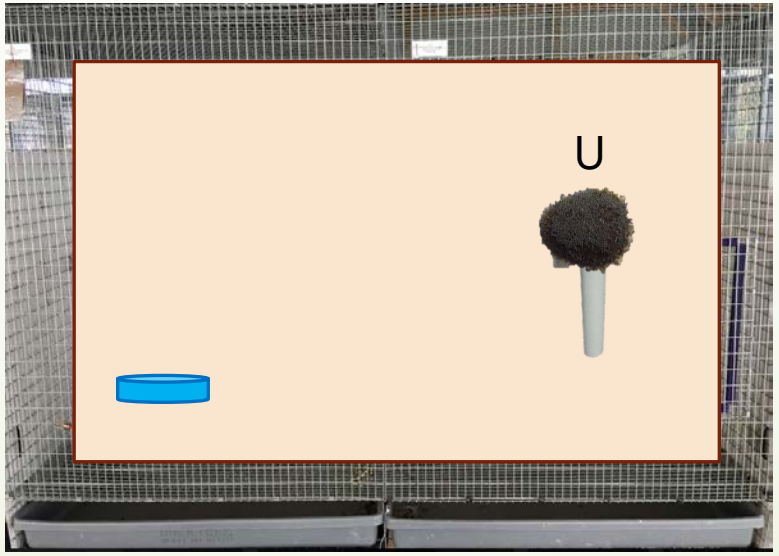
Concentration Response(N=50)

- Response variables
  - **Consumption** ((Δ in sunflower mass) - spillage)
    - *Corrected for desiccation

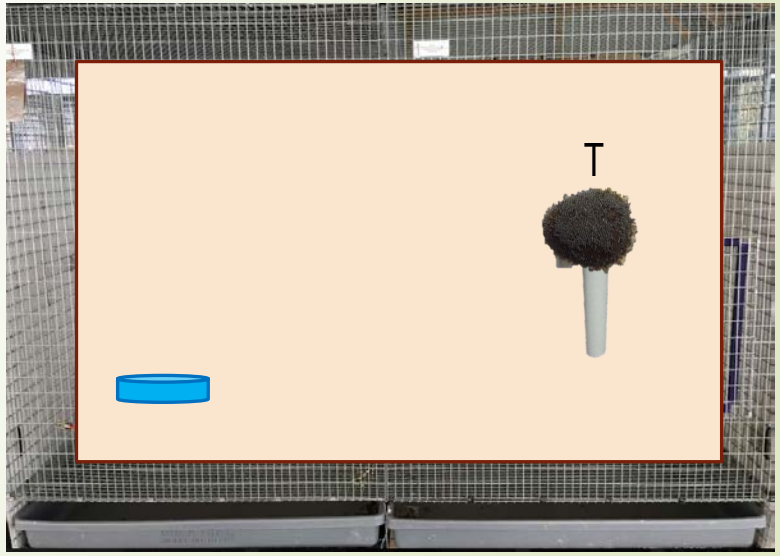
Acclimation (Day 1) | Pretest (Days 2 & 3) | Treatment (Day 4)



1 Untreated sunflower



1 Untreated sunflower

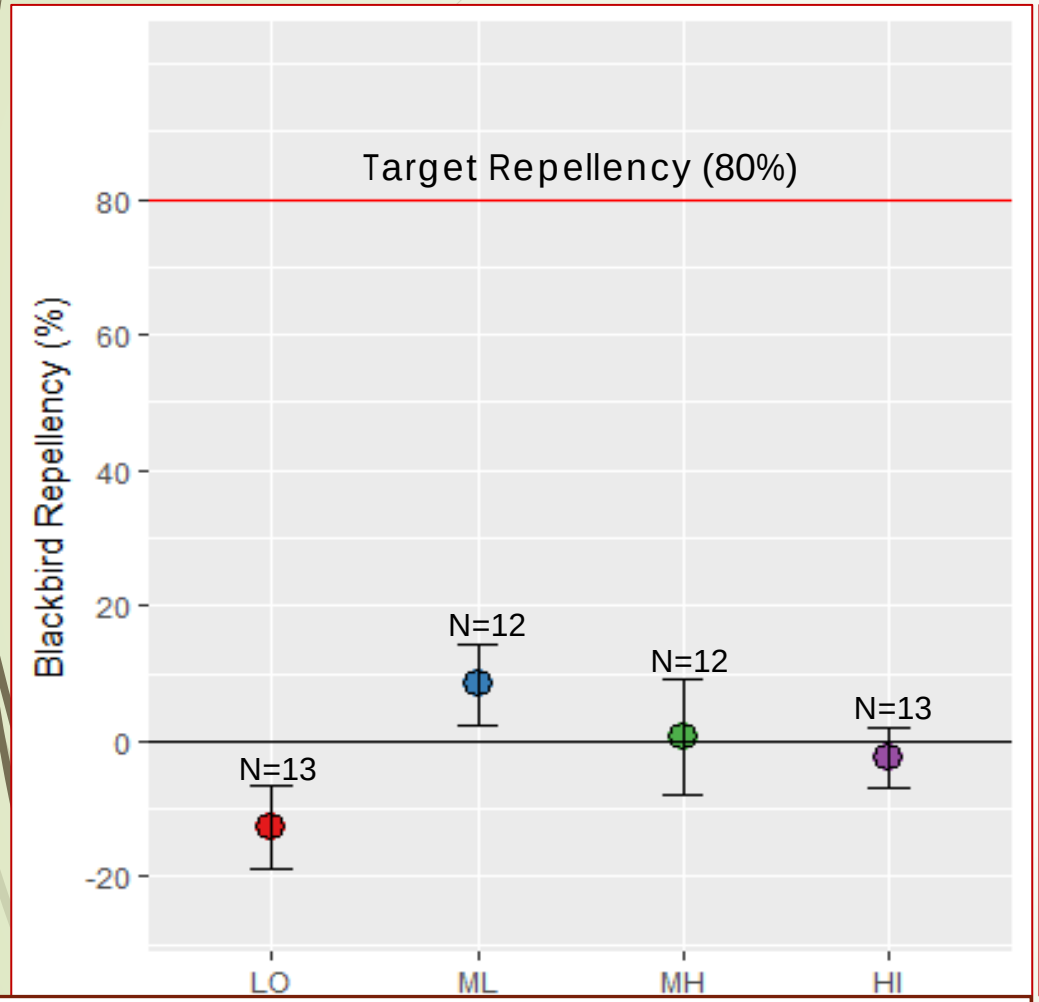


1 Treated sunflower

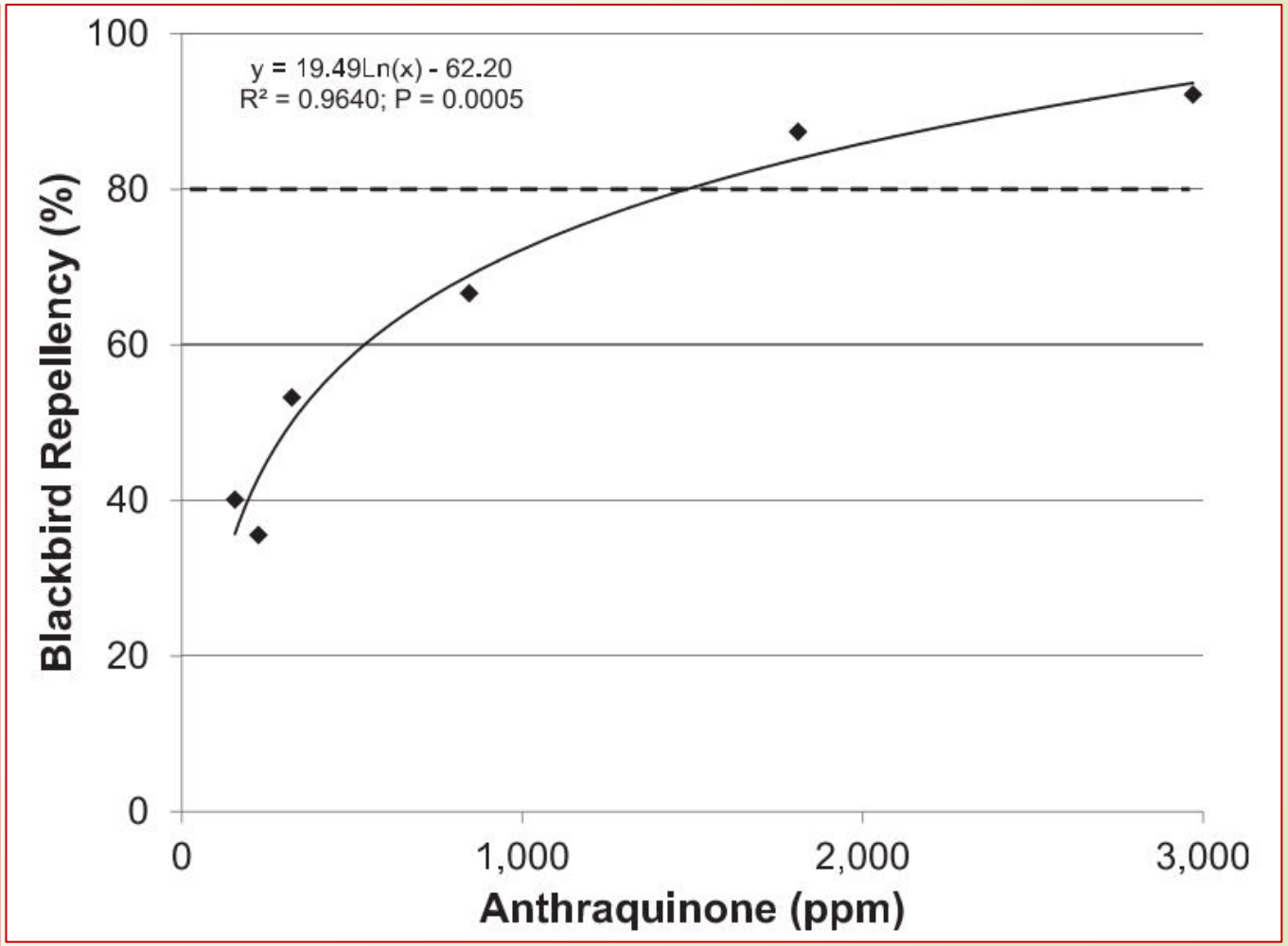
* Water provided *ad libitum*

Concentration Response

% Repellency = ((1-(Treated Consumption/Untreated Consumption))*100)



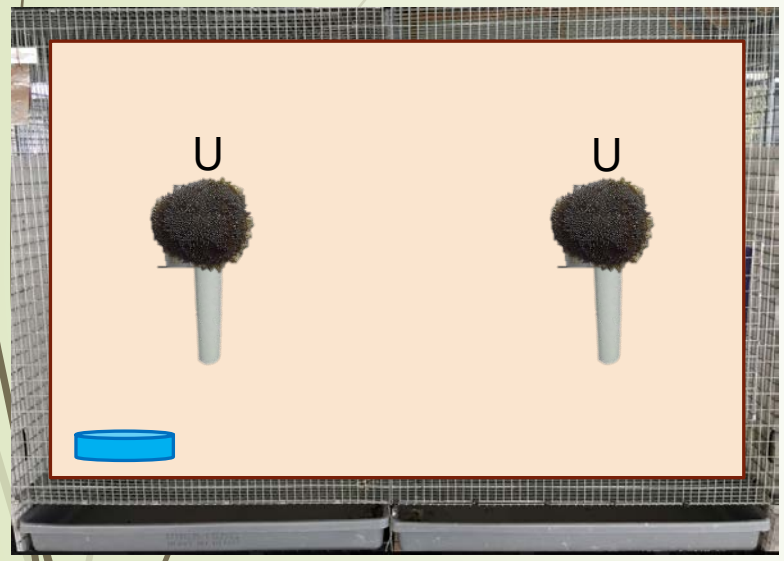
Achene ppm	(0.36)	(0.77)	(1.80)	(2.81)
Floret ppm	(39.97)	(78.71)	(167.71)	(294.14)



Werner et al. 2009

Preference Test (N=38)

Acclimation (Day 1)

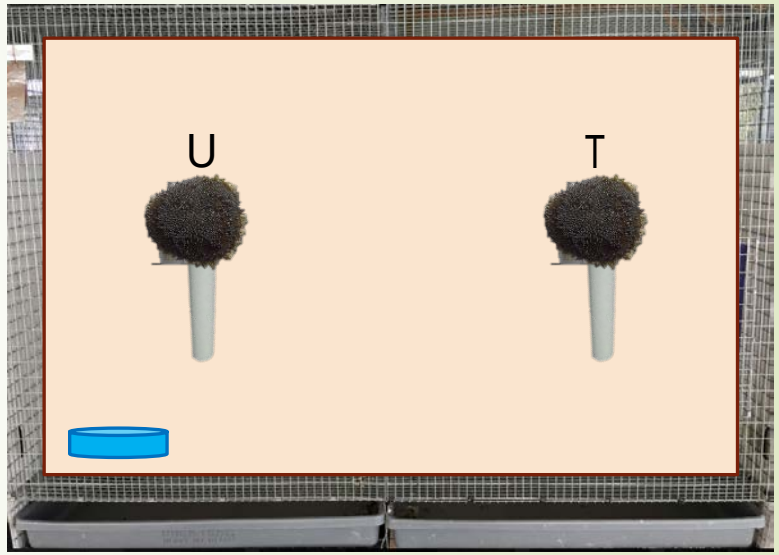


2 Untreated sunflowers

Pretreatment (Days 2 & 3)

2 Untreated sunflowers

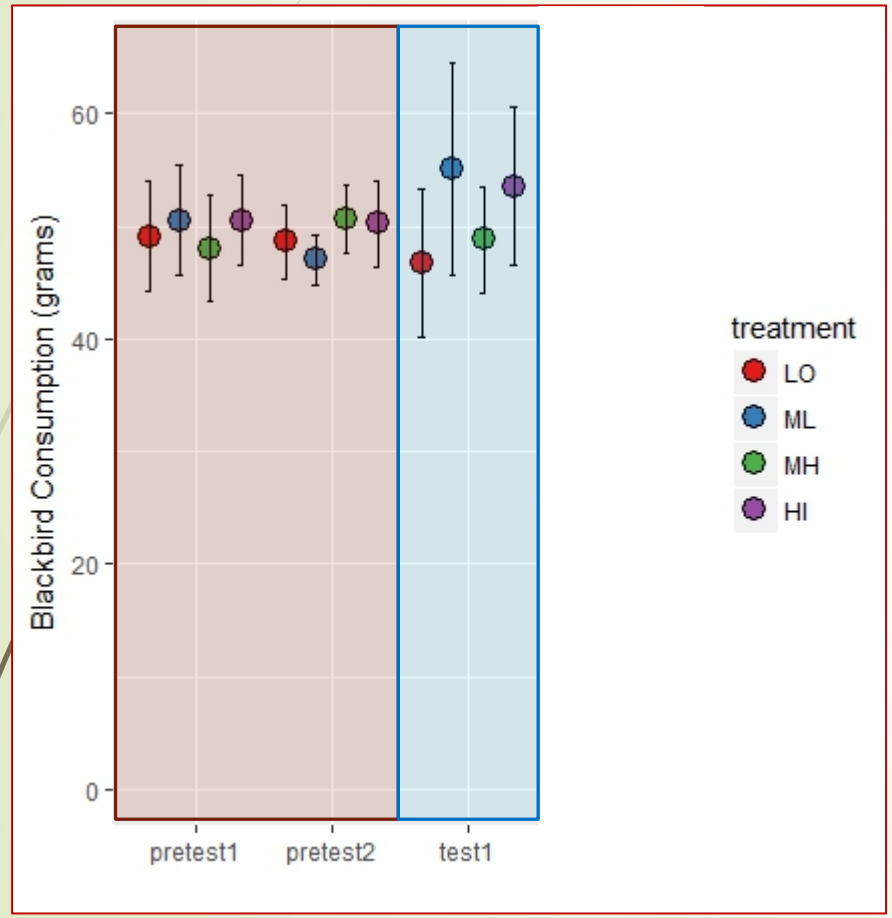
Treatment (Days 4 & 5)



1 Untreated sunflower
1 Treated sunflower
* Treated sunflower alternated sides

* Water provided *ad libitum*

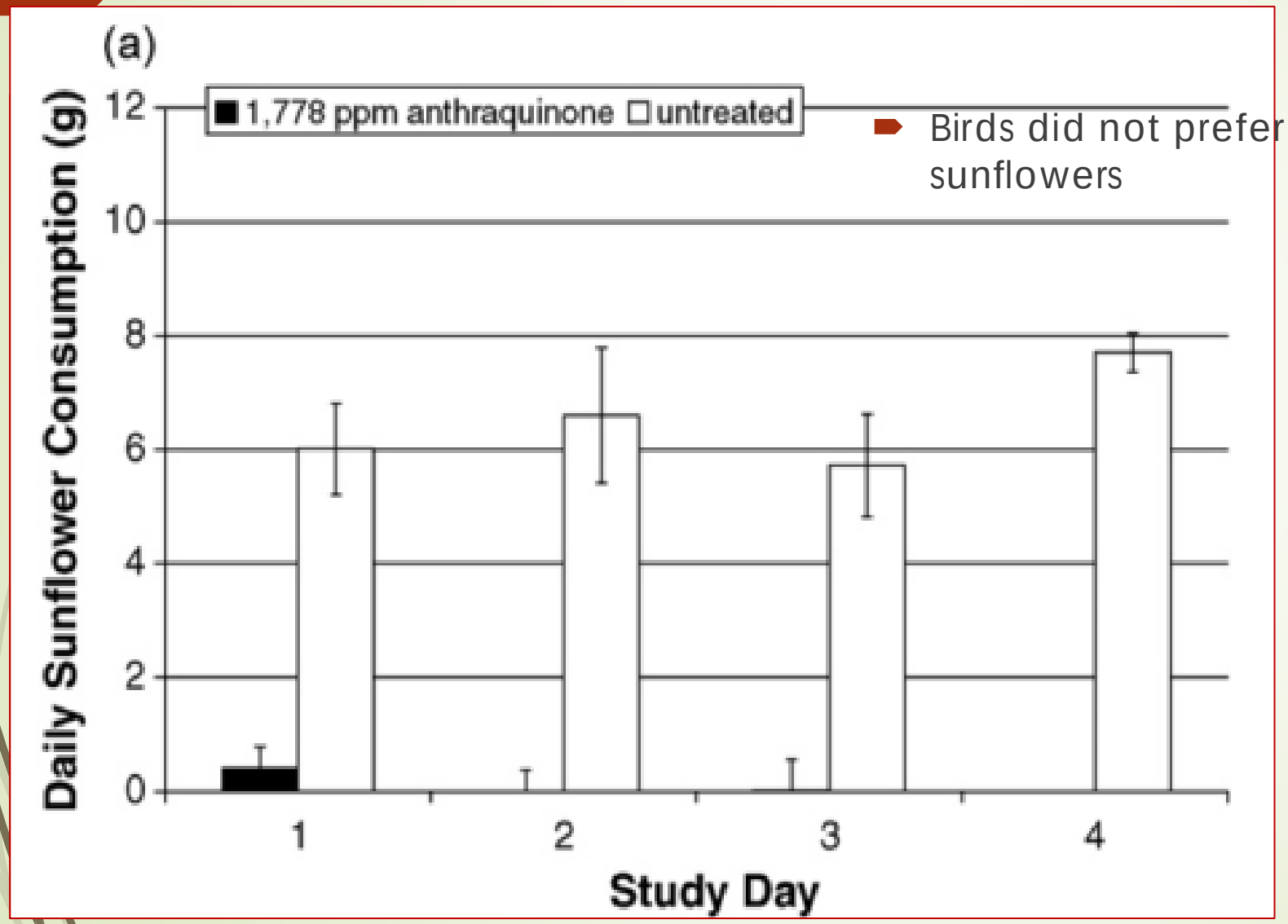
Preference Test (N=38)



Consumption (grams)					
Treatment	N	Pretest1	Pretest2	Test1	Test2
LO	10	49.11	48.65	46.74	26.29
ML	9	50.51	47.05	55.07	33.56
MH	9	48.00	50.63	48.78	29.41
HI	10	50.51	50.20	53.56	33.66

Treatment	Consumption Reduction (%)
LO	46.22
ML	31.20
MH	40.36
HI	33.15

Preference Test (N=38)



- Birds did not prefer untreated over treated sunflowers

Werner et al. 2009

Ending Points

- Formulation AV-5055 could be an effective repellent on mature sunflower
  - Further evaluation of application strategies
- Repellency results less promising when applied to mature sunflowers
  - Focus needs to be on improving formation for mature sunflowers and not loose achenes
  - Birds did not seem to prefer untreated over treated sunflower
- Future work should explore the importance of different stages
  - Birds may consume more at earlier stages
  - How much repellent needs to be consumed?

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National Sunflower Association

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