Impact of water stress on dicamba dissipation in susceptible soybean

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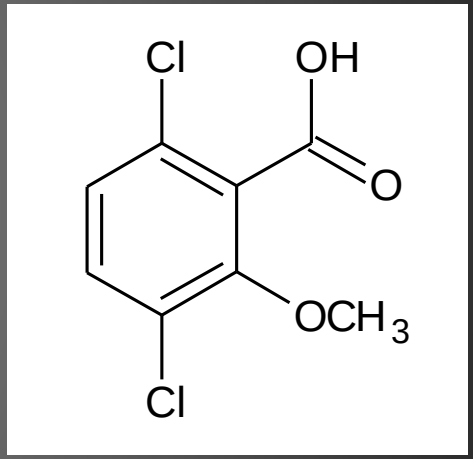
Recent Dicamba Events

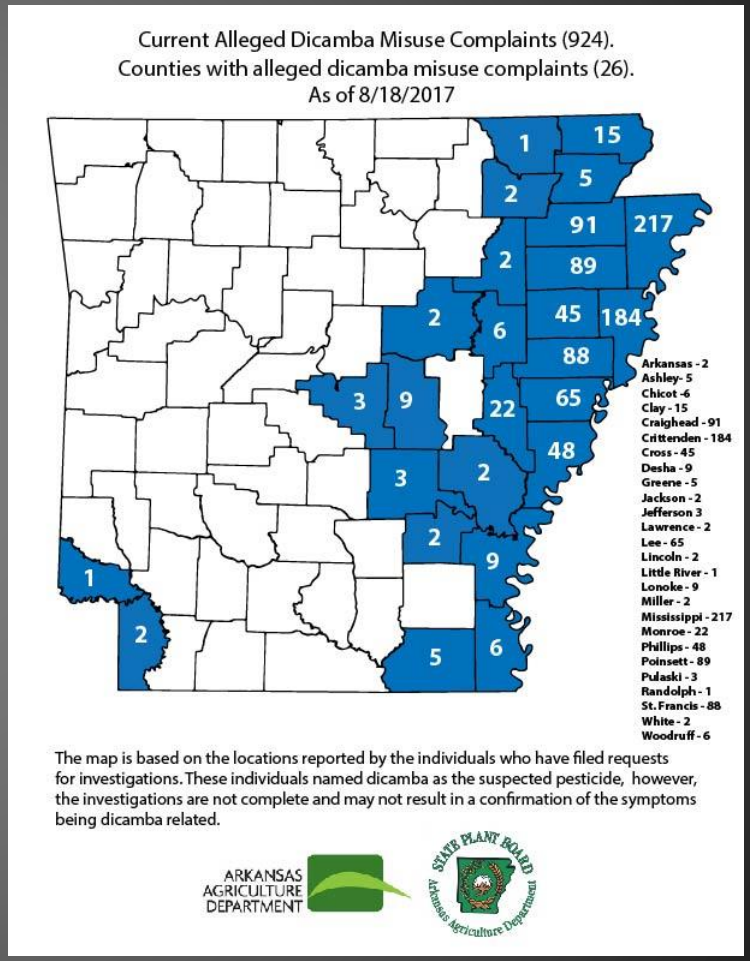
- 2016
  - Dicamba-resistant Xtend® soybean and cotton cultivars released
    - Response to multiple-herbicide resistant weeds
    - No dicamba use approved for row crops
  - 32 drift complaint cases in AR
    - Off-label applications



3,6-dichloro-2-methoxybenzoic acid (Dicamba)

Recent Dicamba Events

- 2016
  - Engenia® (Dec) approved for cotton and soybeans
- 2017
  - 40% AR soybean Xtend®
  - 924 drift complaint cases
  - July 11th temporary ban for rest of season



Impact of Dicamba Drift

- Non-Xtend soybeans are highly sensitive
- Dicamba drift is a deep concern
  - How will it effect my crop?
- Impact of abiotic factors unknown

Cupping of leaves
Epinasty of stems
Stacking of nodes
Pod malformation

Objective

- Determine the impact of soil moisture on dicamba dissipation in sensitive soybean exposed to simulated drift
  - Physical difference = biochemical difference

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Materials and Methods

- Greenhouse study
  - Grown to V1-V2
  - Simulated dicamba drift
  - Soil moisture:
    - wet or dry
  - Physical Data
    - Injury and height
    - Day 0, 1, 2,3 Weekly, 63 days

Materials and Methods

- Plant Collection
  - Shoots, roots, and soil
  - Stored -20°C
- Extraction
  - QuEChERS EN 15662
- Analysis
  - U of A Statewide Mass Spectrometry Facility
  - Shimadzu 8040 TQ MS with Shimadzu Nexera UPLC

Materials and Methods

Common name	Chemical name	m/z
Dicamba	3,6-dichloro-2-methoxy-benzoic acid	219.0 → 175.0
5-OH dicamba	2,5-dichloro-3-hydroxy-6-methoxy-benzoic acid	235
5-OH glucoside	Glucoside of 2,5-dichloro-3-hydroxy-6-methoxy-benzoic acid	397
DCSA	3,6-dichloro-2-hydroxy-benzoic acid	204.9 → 160.9
DCSA glucuronide	Glucuronide of 3,6-dichloro-2-hydroxy-benzoic acid	367
DCGA	2,5-dichloro-3,6-dihydroxy-benzoic acid	221
DCGA glucoside	Glucoside of 2,5-dichloro-3,6-dihydroxy-benzoic acid	383

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Results

12 days after dicamba drift

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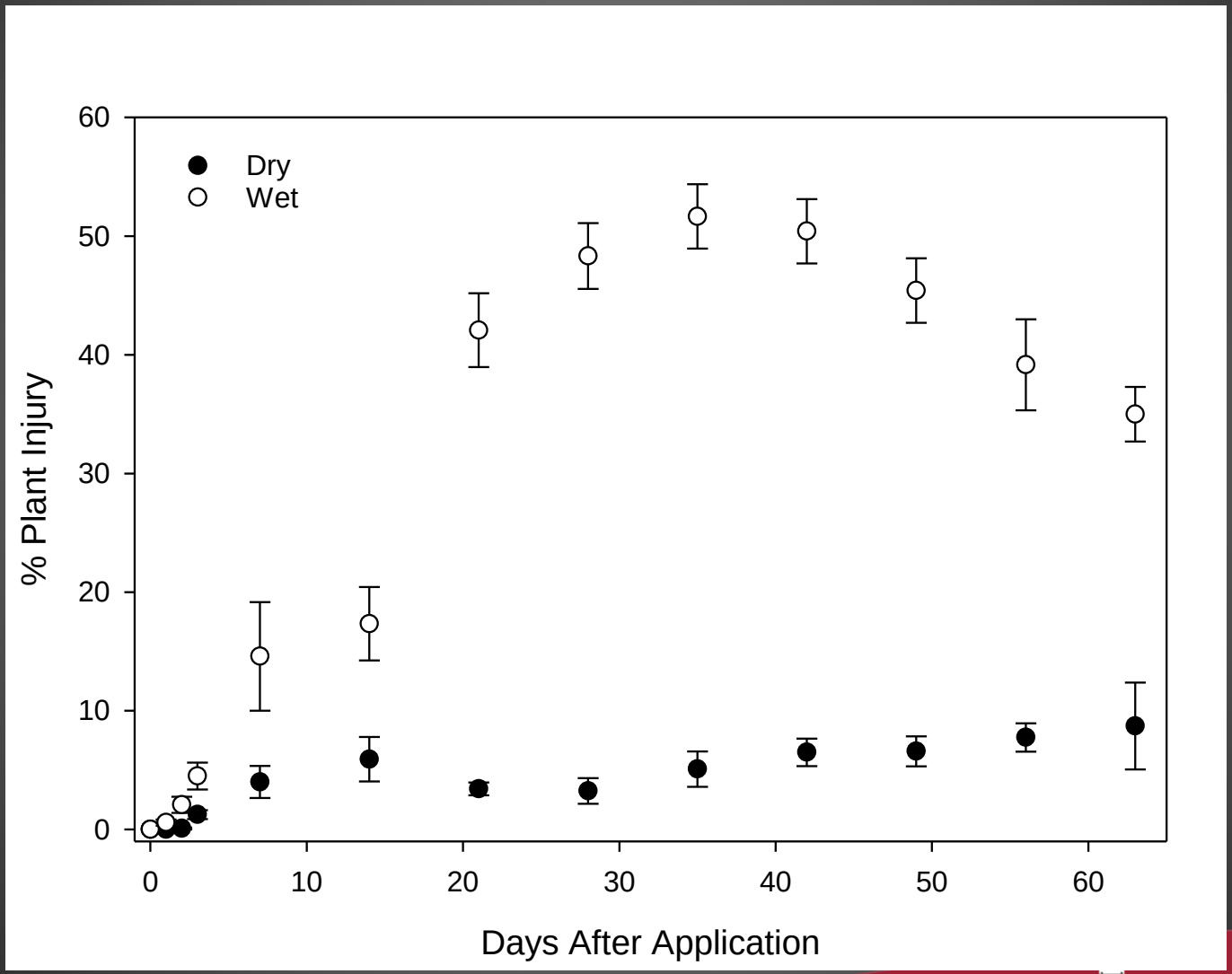
Results



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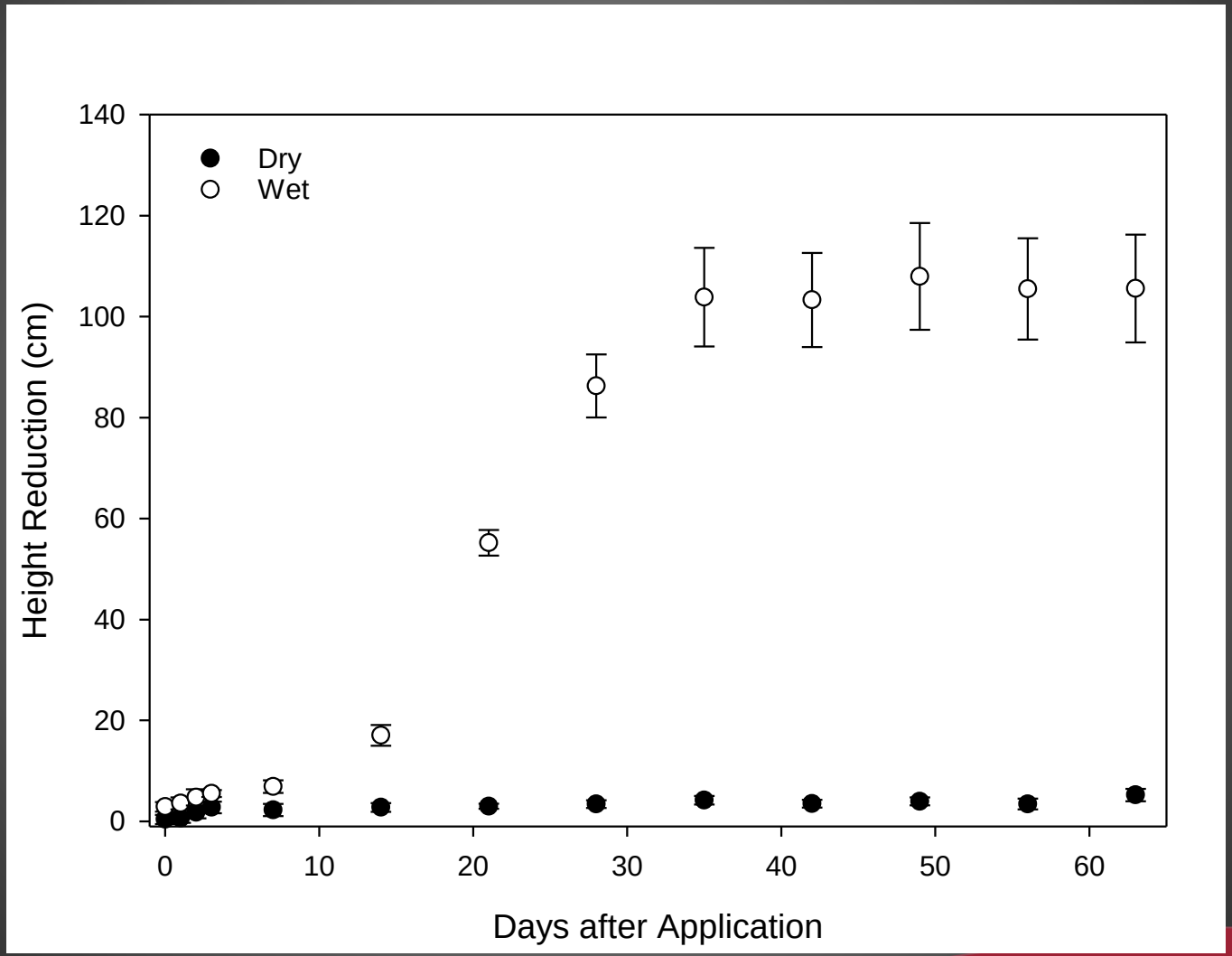
Results



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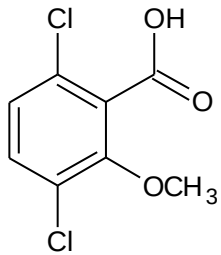
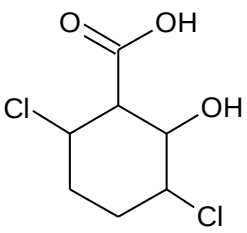
Results

- Preliminary LC/MS/MS results

Sample Day	Dicamba (mg kg^{-1})	DCSA (mg kg^{-1})
0	6.1	0.09
0	3.2	0.04
3	5.7	ND
3	1.4	ND
14	0.63	ND
14	0.27	ND
63	0.04	ND
63	0.02	ND
63	0.02	ND



Dicamba



DCSA

Results

- Preliminary LC/MS/MS results
  - Additional metabolite data collected
    - Suggests glucosides increase over time
    - Need standards to verify retention time and peak ID
      - Synthesis of glucosides is underway!

Conclusion

- Water stress impacts expression of dicamba injury in soybean
  - More accurate crop damage estimates
  - Effective drift mitigation measures
  - Better estimate of drift event timing

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