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Are glyphosate and glufosinate antagonistic?

- Contact vs translocating
- Different nozzle/GPA configurations
- GR vs GS weeds

Experiments – Ostlie, Ikley, Jenks

- Comparison of gly + glu combinations
  - RoundUp Powermax + Liberty
  - Including the addition of Enlist products
    - Extend products are not labeled for glufosinate tank-mixtures
- 4 site years
- Applied using 15+ GPA
  - All treatments contained AMS, except Enlist only

The similarities

- In many cases, there were no treatments differences
  - i.e. no detectable antagonism
  - Shepard's purse, common ragweed (non GR), and redroot pigweed were equally controlled by all combinations

The differences

Treatment	Rate		W. buckwheat	W. buckwheat	G. foxtail	Kochia
			7 DAT	21 DAT	21 DAT	48 DAT
Check			0.0	0.0	0.0	0
Liberty	32	FL OZ/A	80.0	60.0	60.0	41.7
RoundUp Powermax	28	FL OZ/A	31.3	83.8	93.8	45.0
Liberty + RoundUp Powermax	32 + 28	FL OZ/A	85.0	86.3	75.0	32.7
Liberty + RoundUp Powermax	32 + 21	FL OZ/A	82.5	85.0	87.5	30.0
Liberty + RoundUp Powermax	43 + 21	FL OZ/A	87.5	88.8	72.5	30.0
Liberty + Enlist Duo	32 + 64	FL OZ/A	91.3	91.3	95.0	38.3
Liberty + Enlist One	32 + 32	FL OZ/A	90.0	90.0	37.5	38.3
Enlist Duo	4	PT/A	32.5	75.0	93.8	50.0
Enlist One	2	PT/A	25.0	27.5	0.0	10.0
LSD (0.05)			6.1	6.2	3.5	9.4

The outlier

- Common lambsquarters
  - 2 sites in 2019 had good control with all treatment combinations
  - 1 site in 2018 there was notable antagonism
    - 10% drop when combining gly + glu compared to separate
    - When glyphosate rate was dropped from 28 to 21 oz/a, control increased back to the level of either product alone

Moral of the story

- Antagonism existed at times, but was less than expected
  - The presence of antagonism may be species and/or environment specific
  - Sequential applications can be used to avoid antagonism
    - In some cases it may save $, if multiple passes are expected anyway
    - i.e. Lead with Liberty, RoundUp the rest
  - Liberty + Enlist was mostly good, some species are of concern

Dicamba injury to soybeans

- 2017-2018 summary
  - Soybean varieties (conv, LL, RR) differ in their sensitivity to dicamba
  - In ND, it appears that injury affects yields less than further south
  - There are severe delays in soybean maturity, reduced plant height, and growing point injury at yield-affecting rates
  - Very low dicamba exposures are not likely to increase yields

Check

Equal to 0.014 oz Clarity

Equal to 0.14 oz Clarity

Equal to 1.4 oz Clarity

Leaf tissue tests – 20 DAT

Treatment	Clarity	Dicamba
	oz/a	ppb
Check		5.5
Dicamba R1 fb R2	0.14	65.1
Dicamba R1 fb R2 fb R3	0.14	25.8
Dicamba + Class Act Rideon	0.14	16.9
Dicamba	0.014	4.1
Dicamba	0.14	16.0
Dicamba	1.4	112.4
Glyphosate + dicamba	0.025 + 0.014	7.1
Glyphosate + dicamba	0.25 + 0.14	14.5
Glyphosate + dicamba	2.5 + 1.4	258.3
LSD (0.05)		66.9

Seed response to dicamba

Treatment	Injury	Injury	Yield	Germination	Protein	Oil	Dicamba
	10 DAT	20 DAT	bu/a	%	%	%	ppb
Check	0.0	0.0	35.5	81.0	36.6	17.6	2.8
Dicamba low	3.3	2.1	31.9	80.2	36.7	17.7	2.4
Dicamba med	10.0	14.6	34.2	81.8	37.1	17.5	9.4
Dicamba high	35.4	51.3	11.4	86.3	38.8	16.2	58.7
LSD (0.05)	6.8	5.7	9.1	NS	0.9	0.5	33.7

Sequential exposures of dicamba

Treatment	Injury	Injury	Injury	Injury
0.14 oz dicamba	10 DAT	20 DAT	30 DAT	40 DAT
Check	0.0	0.0	0.0	0.0
R1	27.6	28.8	25.0	26.3
R1 + R2	26.3	27.5	23.8	26.3
R1 + R2 + R3	25.0	26.3	25.0	28.8
LSD (0.05)	2.7	4.0	6.0	6.3

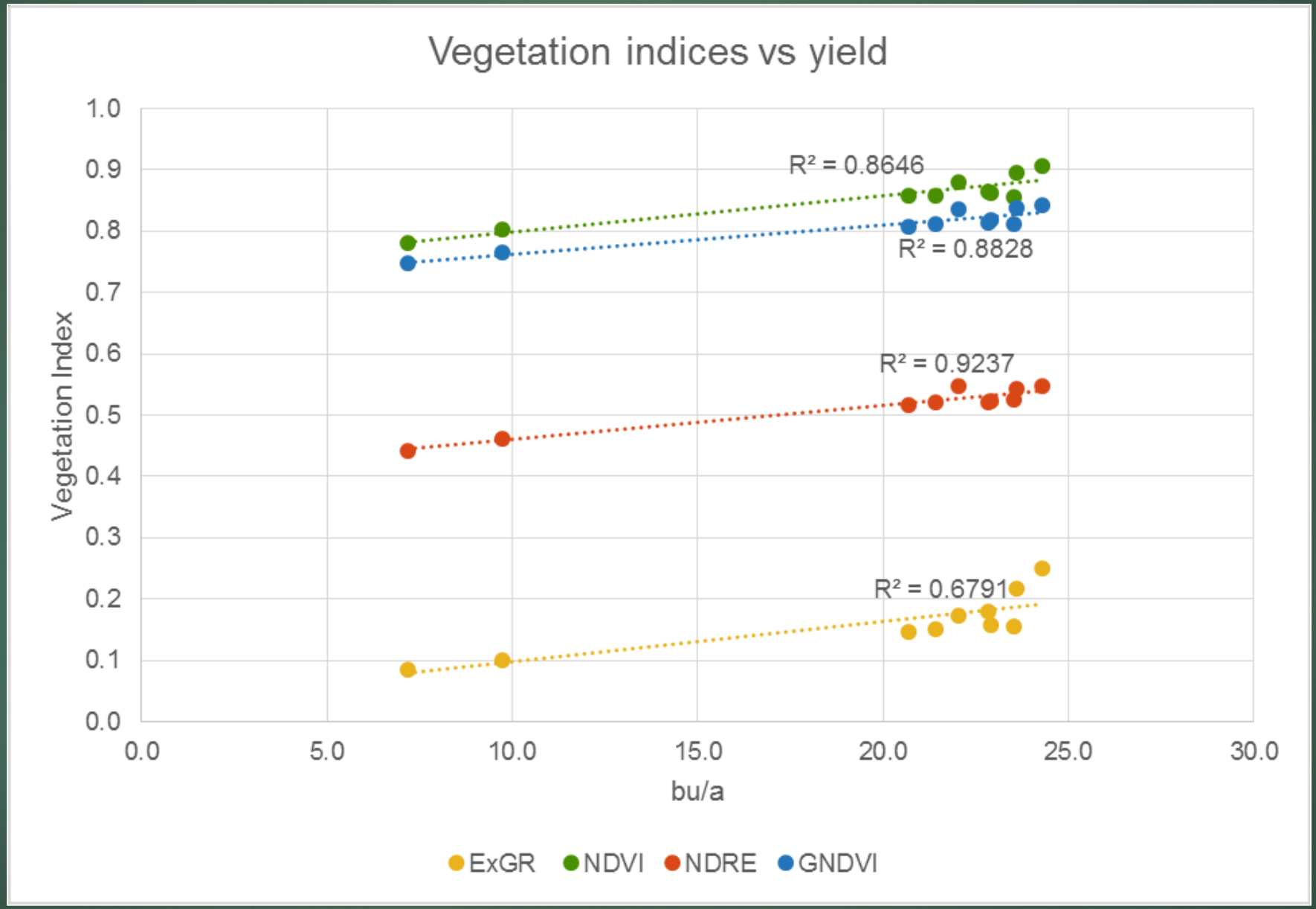
Sequential exposures and yield

Treatment	PM	Pod Height	Plant Height	Test Weight	Yield
0.14 oz dicamba	days	cm	cm	lb/bu	bu/a
Check	106.8	11.5	59.5	54.8	24.3
R1	107.0	8.3	44.0	55.2	22.9
R1 + R2	106.8	8.5	48.0	56.3	23.5
R1 + R2 + R3	106.8	8.0	42.5	54.4	21.4
LSD (0.05)	NS	3.4	6.1	NS	NS

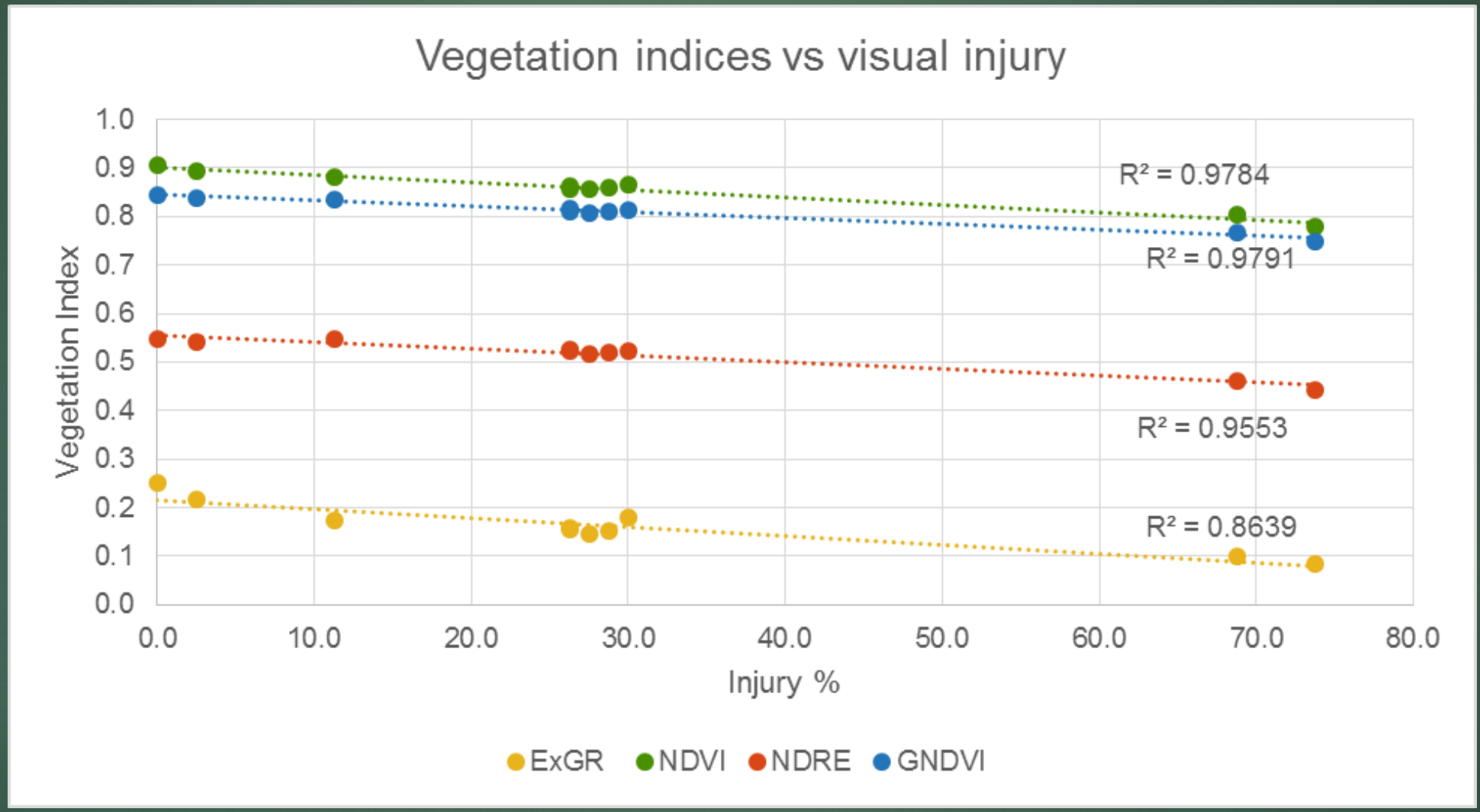
Sequential Exposures - final

Treatment	Germination	Vigor	Dicamba
0.14 oz dicamba	%	1-5	ppb in leaf
Check	88.5	3.0	5.5
R1	88.5	3.4	15.9
R1 + R2	87.3	3.3	65.1
R1 + R2 + R3	88.3	1.8	25.8
LSD (0.05)	NS	1.6	29.1

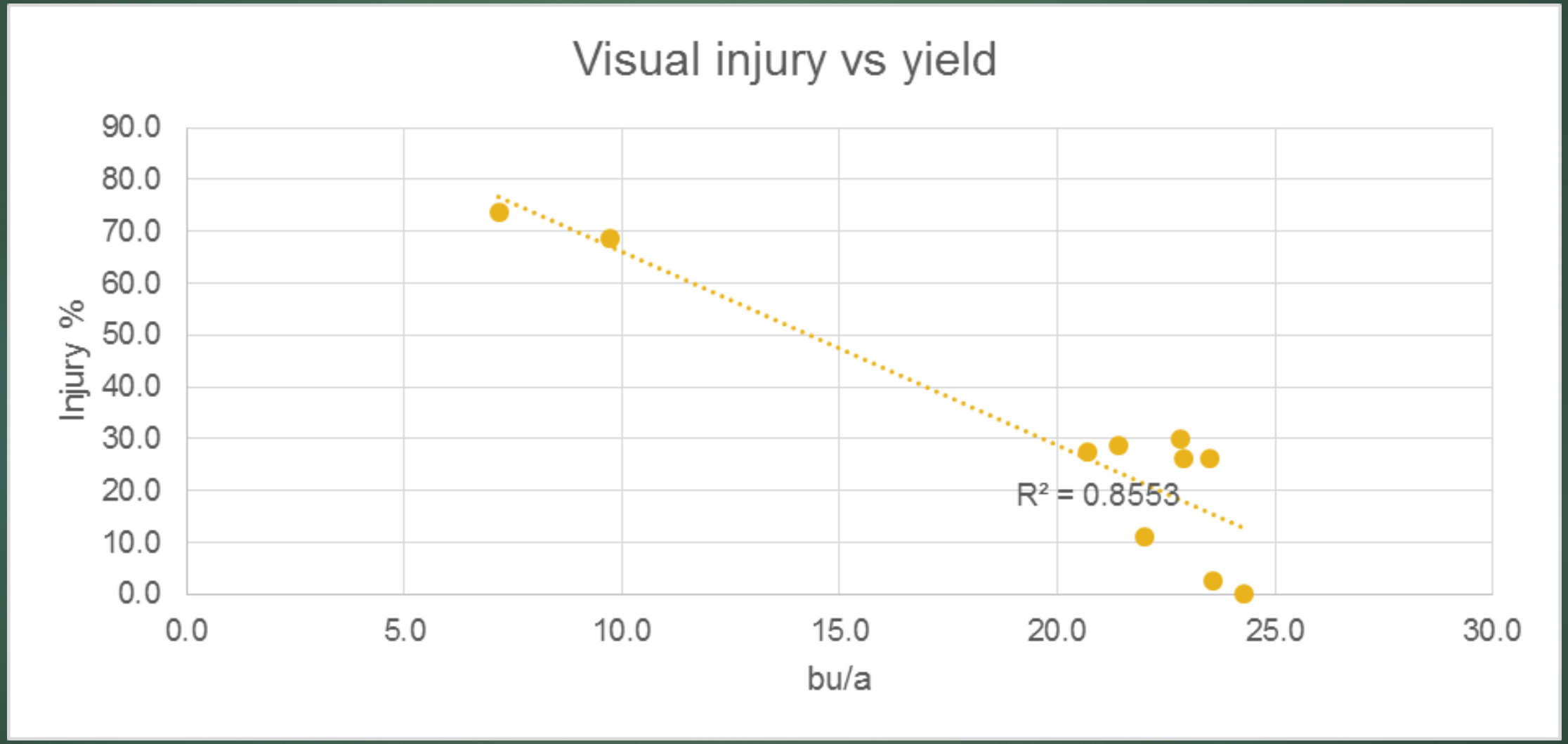
Can UAVs detect dicamba injury



Can UAVs detect dicamba injury



Relationship between visual injury and yield



UAV summary

- Excess Green can be collected with a standard camera
  - I.E. Phantom 4 drone
  - Higher resolution, lower cost
  - Compared to specialized sensors it was the least predictive, but still had very reasonable results
- Overall, vegetation indexes were very predictive of a yield response and to determine the area affected, but ground-truthing is required

The effect of blocked nozzles

		----------Pre-Harvest----------					
		Common Lambsquarters		Redroot Pigweed		Green Foxtail	
PRE herbicide	POST herbiicide	Standard	Blocked	Standard	Blocked	Standard	Blocked
		%	%	%	%	%	%
Spartan	Flexstar	96.8	95.8	98.0	84.8	77.5	68.8
Spartan 50% block	Flexstar	99.0	87.0	99.0	77.5	56.3	51.3
Spartan 100% block	Flexstar	96.8	52.5	93.3	73.8	53.8	51.3
Spartan	Flexstar 50% block	99.0	89.8	97.0	77.5	86.3	72.5
Spartan	Flexstar 100% block	95.5	88.3	98.0	88.8	62.5	53.8
Spartan	RoundUp Powermax	99.0	94.3	99.0	99.0	99.0	99.0
Spartan 50% block	RoundUp Powermax	99.0	99.0	99.0	99.0	99.0	99.0
Spartan 100% block	RoundUp Powermax	99.0	99.0	99.0	99.0	99.0	99.0
Spartan	RoundUp Powermax 50% block	96.5	99.0	99.0	99.0	99.0	99.0
Spartan	RoundUp Powermax 100% block	99.0	99.0	99.0	91.8	99.0	86.0
LSD (0.05)		NS	17.3	4.5	12.3	17.8	14.9

Questions?