HERBICIDE APPLICATION ADJUSTMENTS FOR DROUGHT CONDITIONS

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N EXTENSION

"If you know the enemy and know yourself, you need not fear the result of a hundred battles. If you know yourself but not the enemy, for every victory gained you will also suffer a defeat. If you know neither the enemy nor yourself, you will succumb in every battle."

– Sun Tzu, The Art of War

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METHODS OF WEED CONTROL

PREVENTION

- Certified weed free seed
- Only transporting hay that is weed free
- Making sure farm equipment is cleaned before moving from one location to another
- Screening irrigation water to prevent weed seeds from traveling along irrigation ditches

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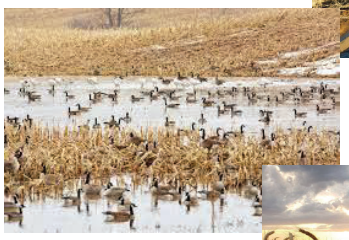
WEED SEED DISPERSAL

- Wind
- Surface water
- Animals
- Birds
- Humans
- Machinery



METHODS OF WEED CONTROL

Cultural

- Crop rotation
- Cover crops
- Avoiding overgrazing of pastures
- Delayed/early planting
- Narrow rows
- Flooding/drought

EXTENSION

CULTURAL CONTROL OF PALMER AMARANTH

EXTENSION

METHODS OF WEED CONTROL

Mechanical

- Tillage
- Mowing
- Pulling
- Hoeing
- Chaining

EXTENSION

Table 2. Downy brome plant density and winter wheat yield at the Sidney, NE, long-term tillage study for plowed (+pl) and undisturbed (−pl) plots 1, 3, and 5 yr after inversion tillage was used for downy brome control.

Tillage treatment‡	Downy brome density			Wheat grain yield		
	−pl	+pl	SE_d§	−pl	+pl	SE_d§
	– plants m^{-2} –			— Mg ha^{-1} —		
1 yr post-tillage						
No-till	32	1**	4.4	1.0	1.3**	0.06
Sub-till	4	1		0.9	1.1**	
Plow	0			1.2		
3 yr post-tillage						
No-till	68	38**	8.8	2.6	2.8*	0.08
Sub-till	20	10		2.5	2.9**	
Plow	1			3.0		
5 yr post-tillage						
No-till	113	67**	11.9	1.1	1.2†	0.07
Sub-till	38	16†		1.0	1.2**	
Plow	1			1.6		

†, *, ** Contrast of plowed and undisturbed treatment means within main tillage treatment are significant at the 0.10, 0.05, and 0.01 levels, respectively.
‡ Mean of experimental treatments at both Tillage A and B.
§ Standard error of the difference of the plowed and undisturbed treatment means within main tillage treatment.

EXTENSION

METHODS OF WEED CONTROL

Biological

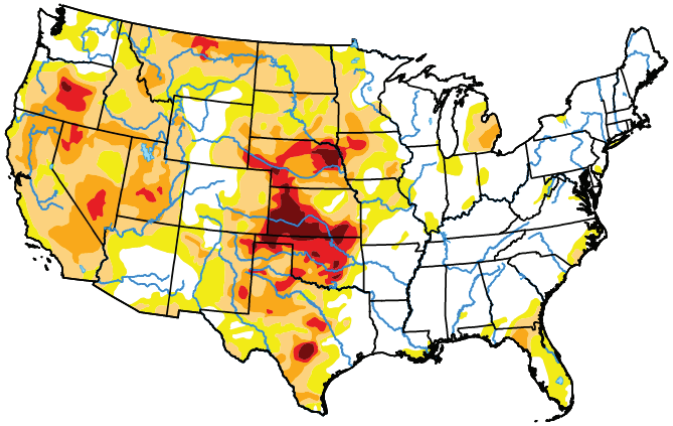
- Sheep to control tansy ragwort or leafy spurge
- Cinnabar moth and the tansy flea beetle to control tansy ragwort
- Chrysolira beetle to control St. John's Wort
- Goats to control brush on rangeland

METHODS OF WEED CONTROL

Chemical

- 2,4-D
- Bromoxynil
- Paraquat
- Glyphosate
- Dicamba
- Clethodim

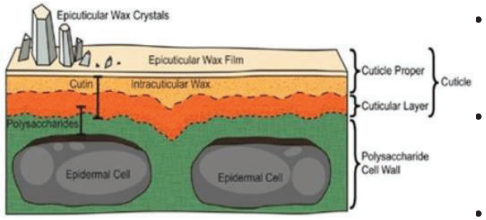
FEB 9 2023 – DROUGHT MONITOR



HERBICIDE APPLICATION CONSIDERATIONS IN DROUGHT

- Hot, dry conditions can influence weed control and crop injury from herbicides.
- Herbicides generally are most effective when applied to vigorously growing plants at 70 to 85 degrees Fahrenheit.
- Most herbicide labels caution against treatment of plants growing under extreme environmental conditions or stress
- Treatment of stressed plants can result in increased crop injury and/or decreased weed control.

WEEDS CHANGE UNDER STRESS



- Weeds growing under hot, dry conditions often become more tolerant to herbicides.
- Plants may develop a thicker wax layer on the leaf surface, which is a barrier to herbicide absorption into the plant.
- Herbicide movement within the plant will likely be reduced due to a slowed rate of translocation and metabolism.
- Consequently, application of herbicides under such conditions often results in reduced weed control.

SYSTEMIC HERBICIDE PERFORMANCE UNDER DROUGHT STRESS

- Reduced weed control during hot, dry weather probably is the biggest concern with the application of systemic herbicides
- Roundup or glyphosate-based products
- SU herbicides
- Phenoxy or growth regulator herbicides
- POST grass herbicides like Assure II, Puma (fenoxaprop), Fusilade DX, Fusion, and Poast

OPTIONS TO MITIGATE HERBICIDE PERFORMANCE ISSUES

- Application of POST herbicides early in the morning after the plants have recovered from the heat of the previous day should provide better weed control than afternoon or evening application
- Addition of adjuvants (spray additives), when recommended, also may improve weed control from these herbicides under adverse growing conditions
- Use higher recommended rates of herbicides and adjuvants when possible

CONTACT HERBICIDE PERFORMANCE UNDER DROUGHT STRESS

- Most contact herbicides become more active as temperatures increase
- Increased activity may provide improved weed control, but can also result in greater crop injury.
- Examples of contact herbicides: Aim, Basagran, Ultra Blazer, Bronate, Buctril, Cadet, Cobra, Flexstar/Reflex, Gramoxone, Liberty, Resource, Sencor, and Sharpen
- These all need to be used with caution when used in crop as temperatures increase to 85 degrees and above.

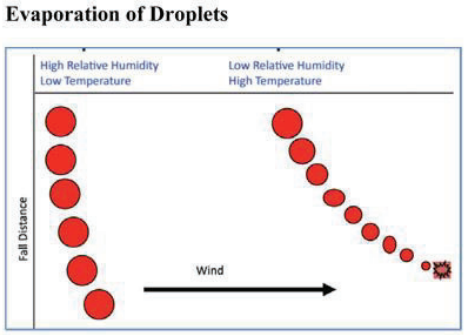
CONTACT HERBICIDE PERFORMANCE UNDER DROUGHT STRESS

- Postpone application of these herbicides if temperatures exceed 90 degrees to reduce risk of crop injury
- Good weed control with contact herbicides is dependent on timely application
- The best control generally is achieved with thorough spray coverage (high spray volume/**small droplets**) and application to small seedling weeds
- Waiting until temperatures subside will lessen the risk of crop injury - weeds may develop beyond the optimum treatment stage if application is delayed too long.
- In some cases, application of reduced herbicide rates may be better than delaying application, even when temperatures are over 90 degrees.

ADDITIONAL CONSIDERATIONS

- The most critical time for crop injury following application of a contact herbicide is the first few hours after treatment.
- Injury can be minimized by applying the herbicide in the evening after the temperature has decreased.
- Many contact herbicides are labeled for use with various additives. However, most additives also increase the chance for crop injury.

SPRAY DROPLET EVAPORATION



- Limit spray droplets less than 100 microns in size
- Example: 70-micron droplet will completely evaporate after traveling 13 feet in 86-degree temperatures
  - 150-micron droplet will lose only 3% of size in those same conditions
- Nozzle type and pressure are the major drivers of droplet size

NOZZLES

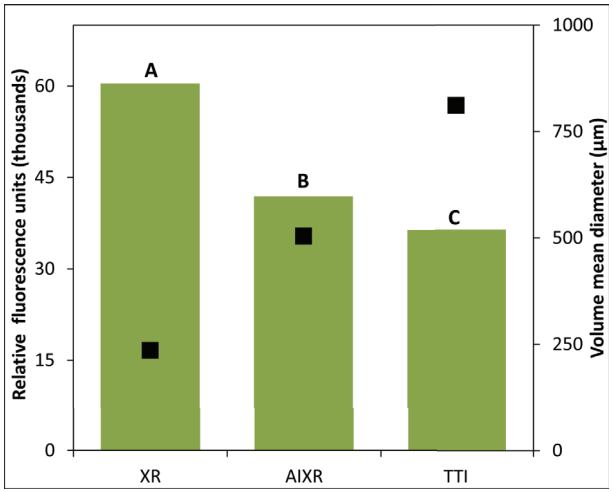
1) Primary factor in determining droplet size
2) Impact flow rates
3) Responsible for spray uniformity
4) Coverage
5) Cheap

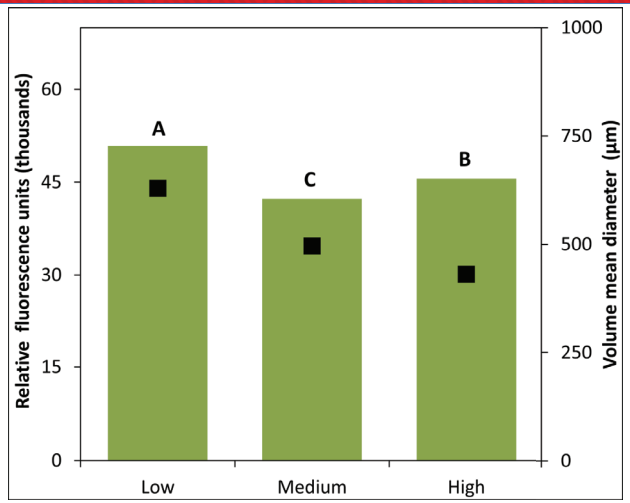
DROPLET RETENTION

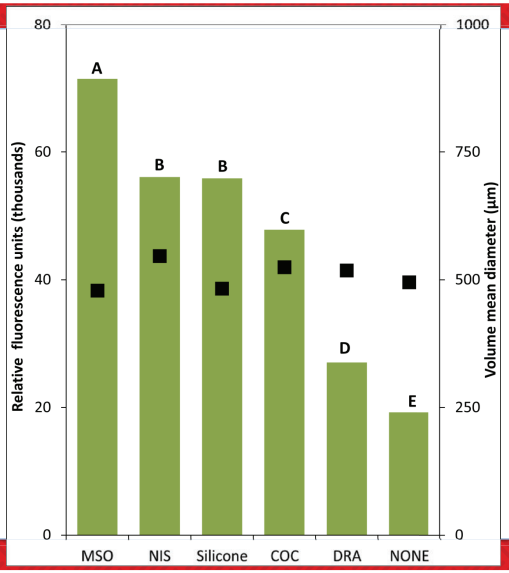
Common name	Trade name	Treatment rate
Crop oil concentrate	R.O.C.®	1.0% v/v
Dicamba	Clarity®	0.14 kg ae ha^{-1}
Drift agent	In-Place®	0.3 L ha^{-1}
Methylated seed oil	Super Spread MSO®	1.0% v/v
Non-ionic surfactant	R-11®	0.25% v/v
Silicone adjuvant	Syl-Coat®	0.95 L ha^{-1}

TREATMENTS

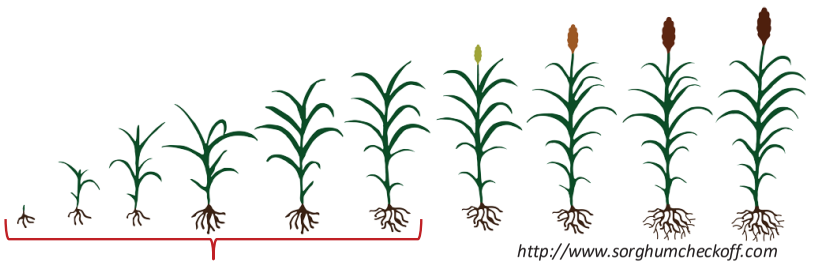
- Dicamba (Clarity®) applied at 0.14 kg ae ha^{-1}
- AIXR, TTI, and XR (110025)
- 138, 259, and 379 kPa
- PTSA dye added at 0.6 mg ml^{-1}







SORGHUM WEED CONTROL

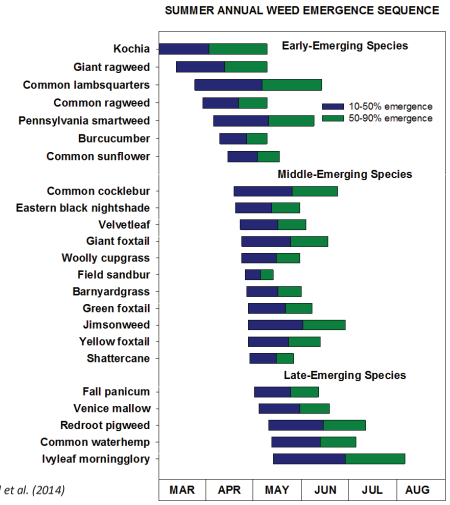


Kochia
Marestail

Redroot Pigweed
Palmer amaranth

Grasses

Marestail



Werle, Sandell et al. (2014)

Weed Emergence

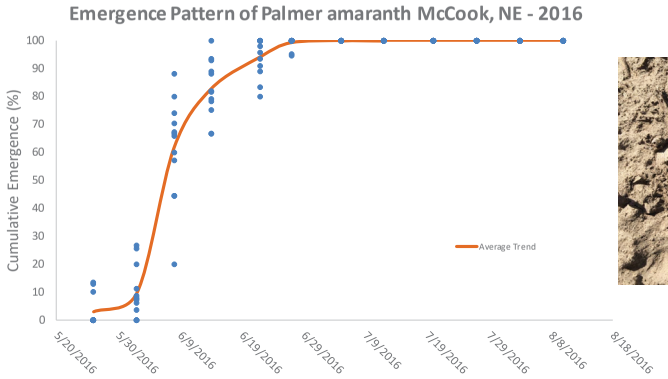
Kochia

Kochia has become a major weed problem in Western Nebraska

March 9, 2016 at North Platte

EXTENSION

PALMER AMARANTH



Avellar, Werle et al. (Unpublished)

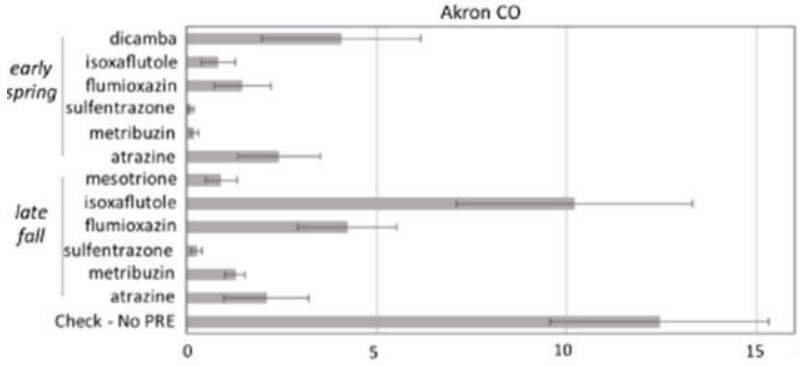
EXTENSION

CONTROL OF KOCHIA IN CHEMICAL FALLOW

Treatment	Timing	Active Ingredient	Rate (lb ai/ac)	Product	Rate (oz/ac)	MOA
1	*na*	*check, no PRE*	*na*	*na*	*na*	*na*
2		atrazine	0.5	Atrazine 4L	16	5
3		metribuzin	0.25	Dimetric 75DF	5.3	5
4	*fall*	sulfentrazone	0.14	Spartan Charge	5.5	14
5		flumioxazin	0.06	Valor SX	2	14
6		isoxaflutole	0.06	Scoparia	2	27
7		mesotrione	0.25	Callisto	8	27
8		atrazine	0.5	Atrazine 4L	16	5
9		metribuzin	0.25	Dimetric 75DF	5.3	5
10	*spring*	sulfentrazone	0.16	Spartan Charge	5.5	14
11		flumioxazin	0.06	Valor SX	2	14
12		isoxaflutole	0.08	Scoparia	2	27
13		dicamba	0.5	Banvel	16	4

EXTENSION

PRE-EMERGENT HERBICIDES FOR IMPROVED CONTROL OF KOCHIA IN CHEMICAL FALLOW WITH SINGLE ACTIVE INGREDIENT

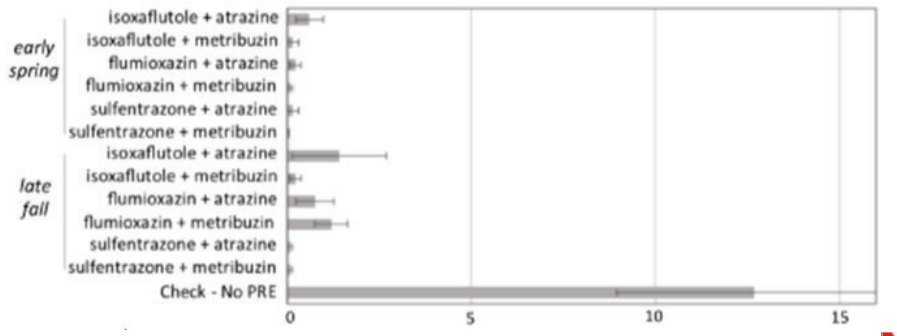


EXTENSION

CONTROL OF KOCHIA IN CHEMICAL FALLOW

Treatment	Timing	Active Ingredient	Rate (lb ai/ac)	Products	MOA
1	*na*	*check, no PRE*	*na*	*na*	*na*
2		sulfentrazone + metribuzin	0.14 + 0.25	Spartan Charge + Dimetric 75DF	14 + 5
3		sulfentrazone + atrazine	0.14 + 0.5	Spartan Charge + Atrazine 4L	14 + 5
4	*late fall*	flumioxazin + metribuzin	0.06 + 0.25	Valor SX + Dimetric 75DF	14 + 5
5		flumioxazin + atrazine	0.06 + 0.5	Valor SX + Atrazine 4L	14 + 5
6		isoxaflutole + metribuzin	0.06 + 0.25	Scoparia + Dimetric 75DF	27 + 5
7		isoxaflutole + atrazine	0.06 + 0.5	Scoparia + Atrazine 4L	27 + 5
8		sulfentrazone + metribuzin	0.14 + 0.25	Spartan Charge + Dimetric 75DF	14 + 5
9		sulfentrazone + atrazine	0.14+ 0.5	Spartan Charge + Atrazine 4L	14 + 5
10	*early spring*	flumioxazin + metribuzin	0.06 + 0.25	Valor SX + Dimetric 75DF	14 + 5
11		flumioxazin + atrazine	0.06 + 0.5	Valor SX + Atrazine 4L	14 + 5
12		isoxaflutole + metribuzin	0.06 + 0.25	Scoparia + Dimetric 75DF	27 + 5
13		isoxaflutole + atrazine	0.06 + 0.5	Scoparia + Atrazine 4L	27 + 5

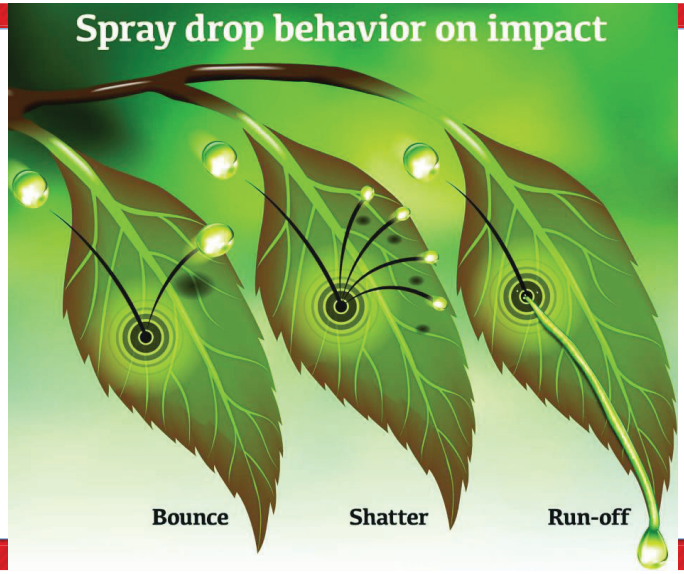
PRE-EMERGENT HERBICIDES FOR IMPROVED CONTROL OF KOCHIA IN CHEMICAL FALLOW WITH TWO ACTIVE INGREDIENTS



EXTENSION

ADJUVANTS

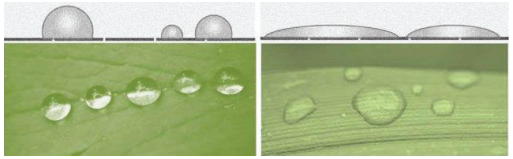
EXTENSION



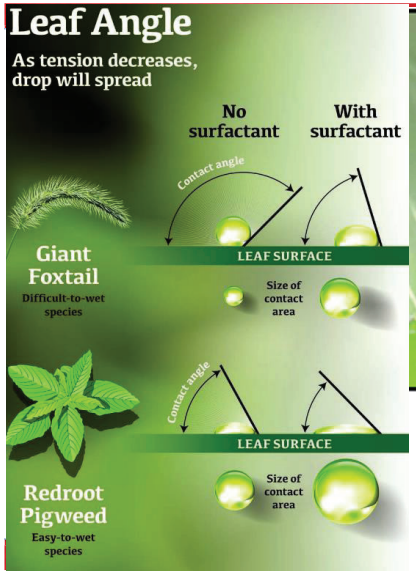
EXTENSION

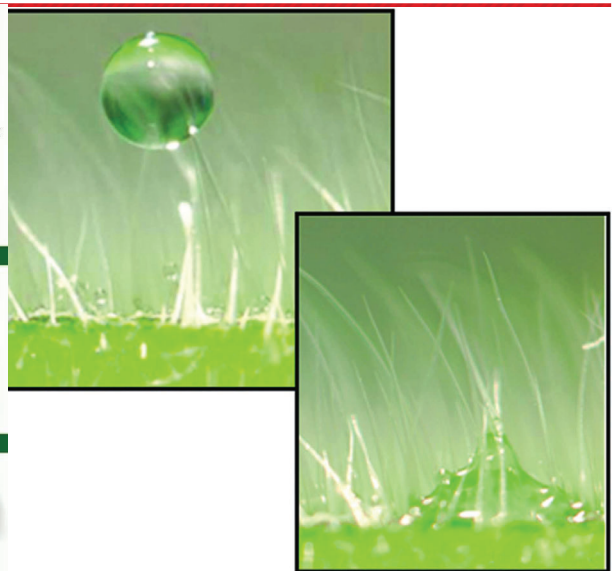
Non-ionic surfactant (NIS) – product retention
NIS and oils (Crop oil and methylated seed oil) – deposition
Oils and AMS (ammonium sulfate) – absorption

NIS breaks the surface tension of a droplet and helps it flatten it out on the leaf surface while oils help improve penetration into the leaf



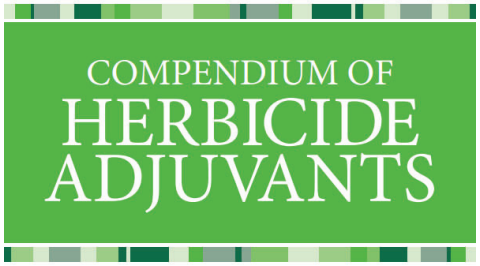
The spray droplet on the left does not contain a surfactant. The droplet on the right contains a surfactant, which improves its coverage.





WILD WEST WORLD OF ADJUVANTS

- Over 700 adjuvants from over 40 companies
- EPA does not require adjuvants to be registered
- Some states, California/Washington regulate them
- Not all adjuvants are created equal



American Society for Testing and Materials (ASTM) Section E35:22 developed a standard terminology with definitions for use with adjuvant products.

ASTM INTERNATIONAL

N EXTENSION

- Trade association —the Council of Producers & Distributors of Agrotechnology (CPDA)
- Offers a certification service that reviews adjuvant composition and classification claims
- The CPDA provides its seal of approval to an adjuvant product only after undergoing this thorough review process to assure it meets their guidelines and standards.

cpda Council of Producers and Distributors of Agrotechnology

N EXTENSION

HTTPS://CPDA.COM/CPDA-CERTIFIED-PRODUCT/

Show 220 entries Search:

PRODUCT REGISTRANT	PRODUCT NAME	SDS	CATEGORY 1	CATEGORY 2	Enlist One	Enlist Duo	Engenia	Tavium	XtendiMax
KALO, Inc	90% Nonionic Surfactant	SDS	Water Conditioner	Drift Reduction Agent		X			
WinField United	AccuDrop	SDS	Deposition Aid	Canopy Penetrating Aid	X		X	X	X
Titan Pro	Accero	SDS	High Surfactant Oil Conc	Nonionic Surfactant	X		X	X	
Innvictis	AD SORB RST	SDS	Nonionic Surfactant						
Helena Agri-Enterprises, LLC	Agri-Dex	SDS	Refer to Label		X		X	X	
Momentive Performance Materials	AgroSpred Flexx	SDS	Organosilicone spreader						
Delta Growers Association	All Oil	SDS	High Surfactant Modified Vegetable Oil	Nonionic Surfactant	X	X	X	X	X
Wilbur Ellis	Allowance-EA	SDS	Deposition Aid	Drift Reduction Agent					
WinField United	AMSol Plus	SDS	Water Conditioner	Deposition Aid					

N EXTENSION

cpda CERTIFIED

R-11®

NONIONIC SURFACTANT • SPREADER • ACTIVATOR

CPDA Certified

	% BY WT.
PRINCIPAL FUNCTIONING AGENTS:	90%
Polyethylene glycol mono(branched p-nonylphenyl) ether, Butyl alcohol, Dimethylpolysiloxane	
CONSTITUENTS INEFFECTIVE AS SPRAY ADJUVANTS	10%
TOTAL	100%

Surfactant Content.....80%

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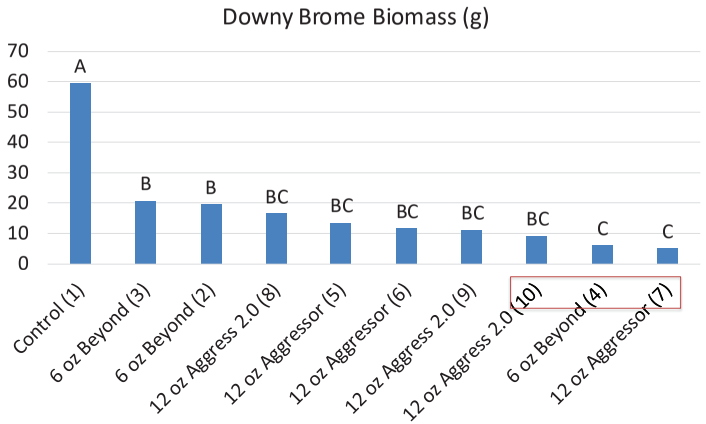
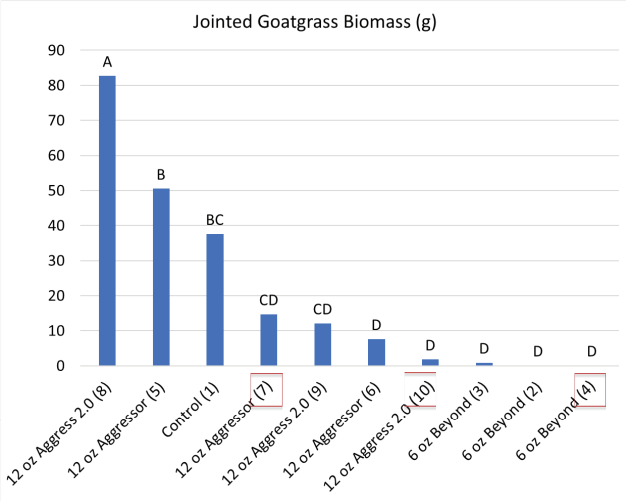
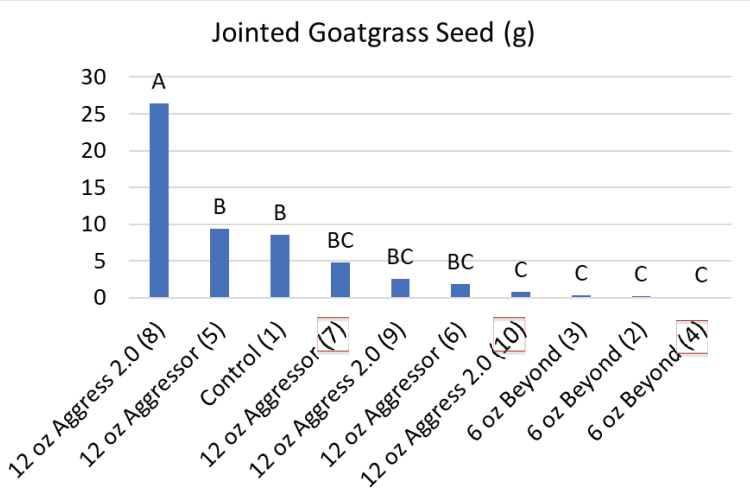
USE ADJUVANTS TO INCREASE CONTROL

2022 RESEARCH – CLEARFIELD AND COAXIUM CONTROL OF JOINTED GOATGRASS

Treatment #	Herbicide/Rate	Adjuvant/UAN	GPA
1	Control		
2	6 oz Beyond	1% MSO	10 gpa
3	6 oz Beyond	1% MSO	20 gpa
4	6 oz Beyond	1% MSO + 3 gpa 32-0-0	20 gpa
5	12 oz Aggressor	1% MSO	10 gpa
6	12 oz Aggressor	1% MSO	20 gpa
7	12 oz Aggressor	1% MSO + 3 gpa 32-0-0	20 gpa
8	12 oz Aggressor 2.0	1% MSO	10 gpa
9	12 oz Aggressor 2.0	1% MSO	20 gpa
10	12 oz Aggressor 2.0	1% MSO + 3 gpa 32-0-0	20 gpa







EXTENSION

TAKE HOME POINTS

- Increasing carrier volume did not increase control
- The addition of UAN to Beyond increased downy brome control
- Beyond consistently controlled jointed goatgrass better than Aggressor

EXTENSION

SHARPEN OUR TOOLS IN OUR TOOLBOX

- Know our enemy (weed)
  - What are their weaknesses?
- Know ourselves (what tools do you have)
  - Prevention
  - Cultural
  - Mechanical
  - Biological
  - Chemical

EXTENSION

FOLLOW ME ON TWITTER:
@NE_DrylandCrops

EMAIL ME:
ccreech2@unl.edu

THANK YOU!
QUESTIONS?

EXTENSION