HERBICIDE APPLICATION ADJUSTMENTS FOR DROUGHT CONDITIONS

Cody Creech
Dryland Cropping Systems Specialist
Panhandle Research and Extension Center

“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

METHODS OF WEED CONTROL

• 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

PREVENTION

WEED SEED DISPERAL

• 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

**Mechanical**
- Tillage
- Mowing
- Pulling
- Hoeing
- Chaining
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

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

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
**Weed Emergence**

**SUMMER ANNUAL WEED EMERGENCE SEQUENCE**

- Kochia
- Giant ragweed
- Common lambsquarters
- Common ragweed
- Pentaena amaranth
- Burcucumber
- Common sunflower
- Common cocklebur
- Eastern black nightshade
- Vellosted
- Giant foxtail
- Woolly cupgrass
- Field saltbush
- Berry spurge
- Green foxtail
- Jianmucum
- Yellow foxtail
- Shartro casne
- Fall panicum
- Voicce mallow
- Redroot pigweed
- Common waterhemp
- Ipylead morning glory

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<th>APR</th>
<th>MAY</th>
<th>JUN</th>
<th>JUL</th>
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**PINKER AMARANTH**

**Emergence Pattern of Palmer amaranth McCook, NE - 2016**

- Kochia: Kochia has become a major weed problem in Western Nebraska

**CONTROL OF KOCHIA IN CHEMICAL FALLOW**

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Timing</th>
<th>Active Ingredient</th>
<th>Rate (lb/a)</th>
<th>Product</th>
<th>Rate (oz/ac)</th>
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**PRE-EMERGENT HERBICIDES FOR IMPROVED CONTROL OF KOCHIA IN CHEMICAL FALLOW WITH SINGLE ACTIVE INGREDIENT**

**Akron CO**

- Early spring: dicamba, isoxasulfuron
- Late fall: metribuzin, sulfentrazone
- Check - No PRE: na

**Avellmar, Werle et al. (Unpublished)**
CONTROL OF KOCHIA IN CHEMICAL FALLOW

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

ADJUVANTS

Spray drop behavior on impact

Bounce  Shatter  Run-off
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.

Leaf Angle
As tension decreases, drop will spread

- Giant Foxtail: Live herbicide
- Redroot Pigweed: Live herbicide

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.

- 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.

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

R-11®
NONIONIC SURFACTANT • SPREADER • ACTIVATOR

PRINCIPAL FUNCTIONING AGENTS:
- Polyethylene glycol mono(branched p-nonylphenyl) ether,
  Butyl alcohol, Dimethylpolysiloxane
CONSTITUENTS INEFFECTIVE AS SPRAY ADJUVANTS..................10%
TOTAL .............................................................................110%

Surfactant Content........80%
USE ADJUVANTS TO INCREASE CONTROL

2022 RESEARCH – CLEARFIELD AND COAXIUM CONTROL OF JOINTED GOATGRASS

<table>
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<tr>
<th>Treatment #</th>
<th>Herbicide/Rate</th>
<th>Adjuvant/UAN</th>
<th>GPA</th>
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</tr>
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Downy Brome Biomass (g)

Jointed Goatgrass Biomass (g)
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

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

FOLLOW ME ON TWITTER:
@NE_DrylandCrops

EMAIL ME:
ccreech2@unl.edu

THANK YOU!
QUESTIONS?