



Winfield United



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MANAGING AND MAKING THE MOST OF DRIFT REDUCTION AGENTS

Bryan Young

Drift Reduction Technologies


- The use of drift reducing nozzles has increased along with the use of herbicide-resistant crops.

Ramsdale and Messersmith et al. 2001


Turbo TwinJet® (TTJ60)

|  | PSI | | | | | | | | | |
|---|-----|----|----|----|----|----|----|----|----|----|
| | 20 | 25 | 30 | 35 | 40 | 50 | 60 | 70 | 80 | 90 |
| TTJ60-11002 | C | C | C | C | C | M | M | M | M | M |
| TTJ60-110025 | VC | C | C | C | C | C | C | M | M | M |
| TTJ60-11003 | VC | C | C | C | C | C | C | C | M | M |
| TTJ60-11004 | VC | C | C | C | C | C | C | C | C | M |
| TTJ60-11005 | VC | C | C | C | C | C | C | C | C | C |
| TTJ60-11006 | XC | VC | VC | C | C | C | C | C | C | C |


Turbo TeeJet® (TT)

|  | PSI | | | | | | | | | | |
|--|-----|----|----|----|----|----|----|----|----|----|----|
| | 15 | 20 | 25 | 30 | 35 | 40 | 50 | 60 | 70 | 80 | 90 |
| TT11001 | C | M | M | M | M | M | F | F | F | F | F |
| TT110015 | C | C | M | M | M | M | M | M | F | F | F |
| TT11002 | C | C | C | M | M | M | M | M | M | M | F |
| TT110025 | VC | C | C | C | M | M | M | M | M | M | F |
| TT11003 | VC | VC | C | C | C | C | M | M | M | M | M |
| TT11004 | XC | VC | VC | C | C | C | C | C | M | M | M |
| TT11005 | XC | VC | VC | VC | VC | C | C | C | C | M | M |
| TT11006 | XC | XC | VC | VC | VC | C | C | C | C | C | M |
| TT11008 | XC | XC | VC | VC | VC | VC | C | C | C | C | M |


Air Induction Turbo TwinJet (AITTJ60)

|  | PSI | | | | | | | | | | | |
|--|-----|----|----|----|----|----|----|----|----|----|-----|--|
| | 20 | 25 | 30 | 35 | 40 | 50 | 60 | 70 | 80 | 90 | 100 | |
| AITTJ60-11002 | XC | XC | VC | VC | VC | C | C | C | C | C | M | |
| AITTJ60-110025 | XC | XC | VC | VC | VC | C | C | C | C | C | M | |
| AITTJ60-11003 | UC | XC | XC | XC | VC | VC | C | C | C | C | C | |
| AITTJ60-11004 | UC | XC | XC | XC | VC | VC | C | C | C | C | C | |
| AITTJ60-11005 | UC | XC | XC | XC | XC | VC | VC | C | C | C | C | |
| AITTJ60-11006 | UC | XC | XC | XC | XC | VC | VC | C | C | C | C | |


AIXR TeeJet® (AIXR)

|  | PSI | | | | | | | | |
|--|-----|----|----|----|----|----|----|----|---|
| | 15 | 20 | 25 | 30 | 35 | 40 | 50 | 60 | |
| AIXR110015 | XC | XC | VC | C | C | C | C | C | M |
| AIXR11002 | XC | XC | XC | VC | VC | C | C | C | |
| AIXR110025 | XC | XC | XC | XC | VC | VC | C | C | |
| AIXR11003 | XC | XC | XC | XC | VC | VC | C | C | |
| AIXR11004 | UC | XC | XC | XC | XC | XC | VC | VC | |
| AIXR11005 | UC | XC | XC | XC | XC | XC | VC | VC | |
| AIXR11006 | UC | XC | XC | XC | XC | XC | VC | VC | |













AI TeeJet (AI) and AIC TeeJet (AIC)



|  | PSI | | | | | | | | | |
|---|-----|----|----|----|----|----|----|----|--|--|
| | 30 | 35 | 40 | 45 | 50 | 55 | 60 | 70 | | |
| AI110015 | UC | XC | XC | XC | XC | XC | VC | VC | | |
| AI11002 | UC | UC | XC | XC | XC | XC | VC | VC | | |
| AI110025 | UC | UC | XC | XC | XC | XC | XC | VC | | |
| AI11003 | UC | UC | XC | XC | XC | XC | XC | VC | | |
| AI11004 | UC | UC | XC | XC | XC | XC | XC | VC | | |
| AI11005 | UC | UC | XC | XC | XC | XC | XC | VC | | |
| AI11006 | UC | UC | UC | XC | XC | XC | XC | XC | | |
| AI11008 | UC | UC | UC | UC | XC | XC | XC | XC | | |
| AI11010 | UC | UC | UC | UC | XC | XC | XC | XC | | |
| AI11015 | UC | UC | UC | UC | XC | XC | XC | XC | | |

Turbo TeeJet Induction (TTI)

|  | PSI | | | | | | | | | | | | | |
|---|-----|----|----|----|----|----|----|----|----|----|----|-----|----|--|
| | 15 | 20 | 25 | 30 | 35 | 40 | 50 | 60 | 70 | 80 | 90 | 100 | | |
| TTI110015 | UC | UC | UC | UC | UC | UC | UC | XC | XC | XC | XC | XC | XC | |
| TTI11002 | UC | UC | UC | UC | UC | UC | UC | UC | XC | XC | XC | XC | XC | |
| TTI110025 | UC | UC | UC | UC | UC | UC | UC | UC | XC | XC | XC | XC | XC | |
| TTI11003 | UC | UC | UC | UC | UC | UC | UC | UC | XC | XC | XC | XC | XC | |
| TTI11004 | UC | UC | UC | UC | UC | UC | UC | UC | XC | XC | XC | XC | XC | |
| TTI11005 | UC | UC | UC | UC | UC | UC | UC | UC | XC | XC | XC | XC | XC | |
| TTI11006 | UC | UC | UC | UC | UC | UC | UC | UC | XC | XC | XC | XC | XC | |

TeeJet® Broadcast Nozzle Selection Guide







|  | Reference page 7 | HERBICIDES | | |
|---|--|--------------|----------------|-----------|
| | | SOIL APPLIED | POST-EMERGENCE | |
| | | | CONTACT | SYSTEMIC |
|  | Turbo TeeJet® Reference page 7 | | VERY GOOD | VERY GOOD |
|  | Turbo TeeJet® at pressures below 30 PSI (2.0 bar) Reference page 7 | GOOD | GOOD | EXCELLENT |
|  | Turbo TwinJet® Reference page 16 | GOOD | EXCELLENT | EXCELLENT |
|  | Turbo TwinJet® at pressures below 30 PSI (2.0 bar) Reference page 16 | VERY GOOD | VERY GOOD | EXCELLENT |
|  | Turbo TeeJet Induction® Reference page 11 | EXCELLENT | | EXCELLENT |
|  | Air Induction Turbo TeeJet® Reference page 17 | VERY GOOD | GOOD | EXCELLENT |
|  | AI3070® Reference page 18 | | VERY GOOD | VERY GOOD |
|  | XR, XRC TeeJet® Reference pages 12-13 | | EXCELLENT | GOOD |
|  | XR, XRC TeeJet® at pressures below 30 PSI (2.0 bar) Reference pages 12-13 | GOOD | GOOD | VERY GOOD |
|  | AIXR TeeJet® Reference page 8 | VERY GOOD | GOOD | EXCELLENT |
|  | AI, AIC TeeJet® Reference pages 9-10 | VERY GOOD | GOOD | EXCELLENT |

| Spray Quality* | Size of Droplets | VMD Range (Microns**) | Color Code | Retention on Difficult to Wet Leaves | Used for | Drift Potential |
|------------------|---|-----------------------|------------|--------------------------------------|---------------------|---|
| Extremely Fine | Small | <60 | Purple | Excellent | Exceptions | High |
| Very Fine |  | 61-105 | Red | Excellent | Exceptions |  |
| Fine | | 106-235 | Orange | Very Good | Good Cover | |
| Medium | | 236-340 | Yellow | Good | Most Products | |
| Coarse | | 341-403 | Blue | Moderate | Systemic Herbicides | |
| Very Coarse | | 404-502 | Green | Poor | Soil Herbicides | |
| Extremely Coarse | Large | 503-665 | White | Very Poor | Liquid Fertilizer | Low |
| Ultra Coarse | | >665 | Black | Very Poor | Liquid Fertilizer | |

*Always read the pesticide label to determine which spray quality is required.
 **Estimated from sample reference graph in ASABE/ANSI/ASAE Standard S572.1

| Droplet Size VMD Range | ASABE S-572.1 Classification Category | Color Code | Contact Insecticide & Fungicide | Systemic Insecticide & Fungicide | Contact Foliar Herbicide | Systemic Foliar Herbicide | Soil-Applied Herbicide | Incorporated Soil-Applied Herbicide | Fertilizer |
|------------------------|---------------------------------------|------------|---------------------------------|----------------------------------|--------------------------|---------------------------|------------------------|-------------------------------------|------------|
| Under 60 | Extremely Fine (XF) | Purple | | | | | | | |
| 60-105 | Very Fine (VF) | Red | | | | | | | |
| 106-235 | Fine (F) | Orange | | | | | | | |
| 236-340 | Medium (M) | Yellow | | | | | | | |
| 341-403 | Coarse (C) | Blue | | | | | | | |
| 404-502 | Very Coarse (VC) | Green | | | | | | | |
| 503-665 | Extremely Coarse (XC) | White | | | | | | | |
| Over 665 | Ultra Coarse (UC) | Black | | | | | | | |

Wilger

| Droplet Size Classification | | | |
|---|------------------|---|--------------------------------------|
| | Droplet Size | Venturi Nozzle | Standard Nozzle |
|  | Extremely Coarse | Systemic (higher GPA rates) | Reduced Coverage |
|  | Very Coarse | Systemic | Reduced Coverage |
|  | Coarse | Systemic All Contact (higher GPA rates) | Systemic (higher GPA rates) |
|  | Medium | Systemic Contact | Systemic |
|  | Fine | DRIFT RISK! | Systemic, Contact DRIFT RISK! |
|  | Very Fine | NOT RECOMMENDED | NOT RECOMMENDED |

Recommended Uses for UC Droplets:

- Soil applied herbicides
- Fertilizer
- Riot suppression

Figure 5: These recommendations are based upon practical experience under field conditions. Do not replace individual chemical recommendations.

Greenleaf



<https://www.youtube.com/watch?v=>

| Spray Quality* | Size of Droplets | VMD Range (Microns**) | Color Code | Retention on Difficult to Wet Leaves | Used for | Drift Potential |
|------------------|------------------|-----------------------|------------|--------------------------------------|---------------------|-----------------|
| Extremely Fine | Small | <60 | Purple | Excellent | Exceptions | High |
| Very Fine | ↓ | 61-105 | Red | Excellent | Exceptions | ↓ |
| Fine | | 106-235 | Orange | Very Good | Good Cover | |
| Medium | | 236-340 | Yellow | Good | Most Products | |
| Coarse | | 341-403 | Blue | Moderate | Systemic Herbicides | |
| Very Coarse | | 404-502 | Green | Poor | Soil Herbicides | |
| Extremely Coarse | | 503-665 | White | Very Poor | Liquid Fertilizer | |
| Ultra Coarse | Large | >665 | Black | Very Poor | Liquid Fertilizer | Low |

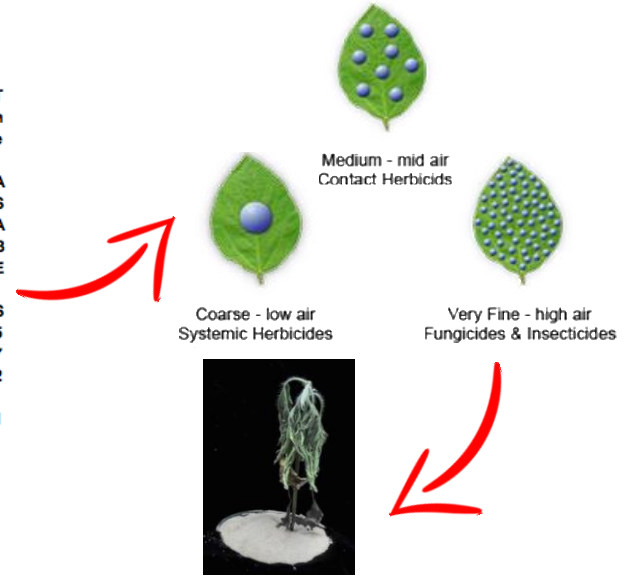
*Always read the pesticide label to determine which spray quality is required.
 **Estimated from sample reference graph in ASABE/ANSI/ASAE Standard S572.1

ASABE S572.1 standard uses eight droplet classification categories, six of which are common for agriculture and horticulture:

T
h
e

A
S
A
B
E

S
5
7
2
:
1

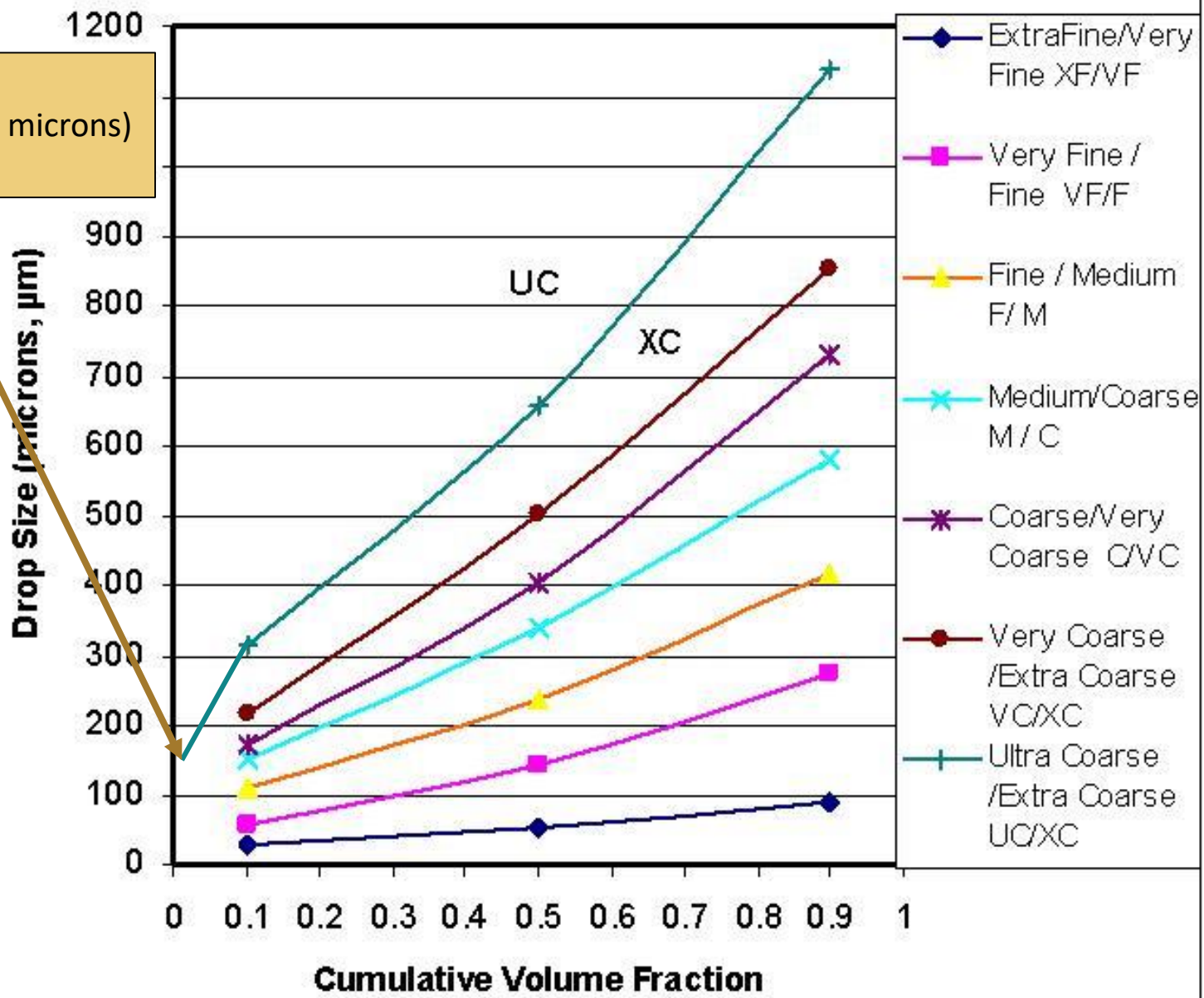


<http://cropwatch.unl.edu/2017/spraying-new-phenoxy-herbicide-formulations-xtend-and-enlist-soybeans>



Example Reference Graph

TTI 11104
Fines (<150 microns)
0.75%



Drift Reduction Technologies

- The use of drift reducing nozzles has increased along with the use of herbicide-resistant crops.

Ramsdale and Messersmith et al. 2001

- The number of adjuvants containing deposition and/or retention agents doubled between 2000 and 2010.

- ▣ 155 products listed in 2016 edition

Compendium of Herbicide Adjuvants 2000,2010

Drift Reduction Agents (DRAs)

****REQUIRED DRIFT REDUCING ADJUVANTS (DRAs)****

Certain products, as specified below, CANNOT be tank mixed with XtendiMax® With VaporGrip® Technology UNLESS those products are tank mixed with one of the following DRAs:

- AG16098®
- AP Span
- Brandt Adjulock
- Brandt OnSite
- Capsule™
- Chem-Trol
- Clasp®
- CORNBELT® Vaporgard™ + DRA
- Eight Ball
- Ensure Elite
- Impetro II
- FS Intention™
- Intact™
- Leeway II™
- Mist Control
- On-Point
- On Target
- PinPoint™
- Propel
- Reign®
- Serenity Cubed
- Serenity Plus
- STRIKEZONE® LC
- TRAPLINE™ PRO II
- TRAVERSE™ D
- Veracity™ Elite II

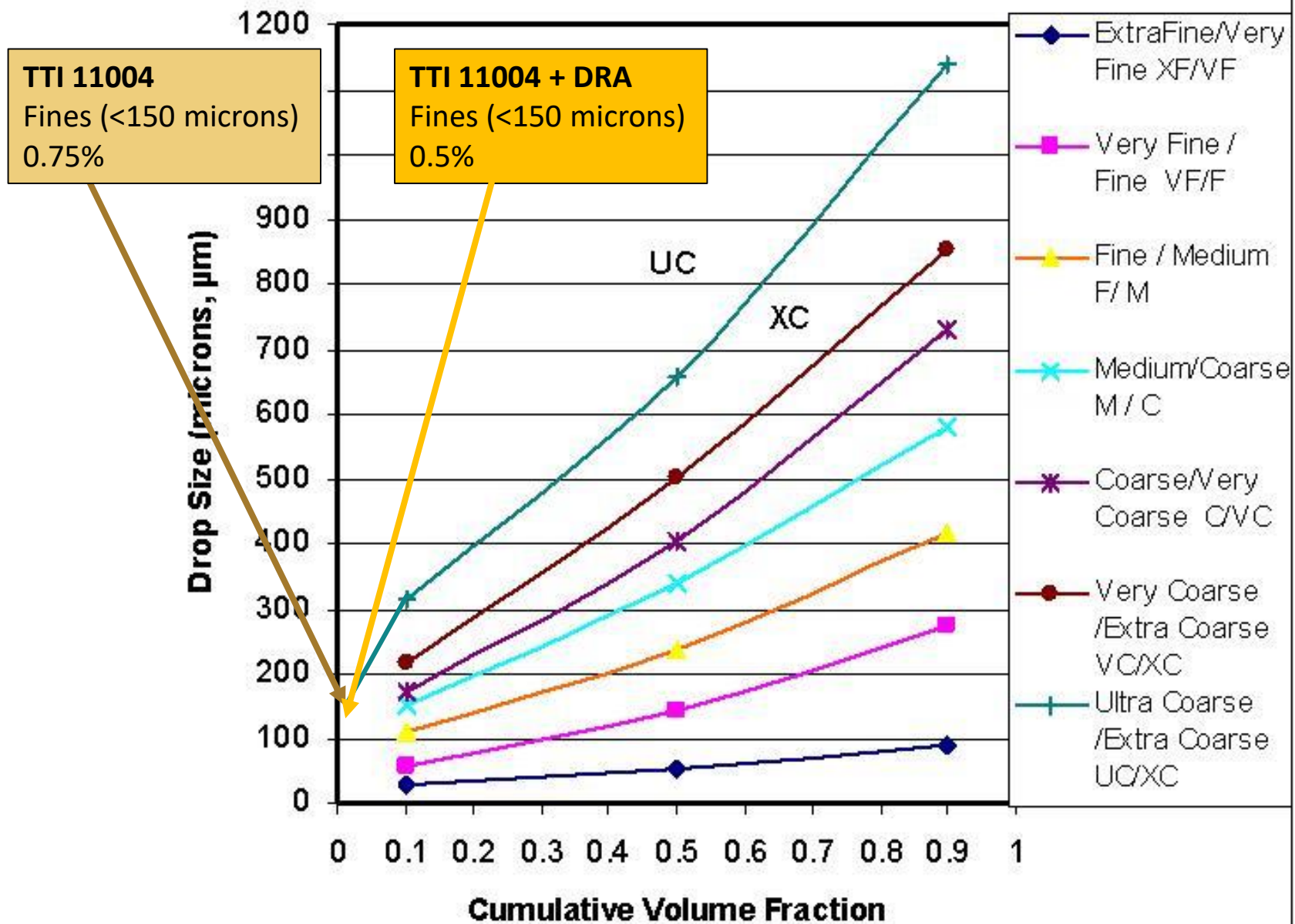
Nozzle selection is one of the most important parameters for drift control. Not all drift reduction additives are compatible with every nozzle type and pesticide/adjuvant combination. Check with the additive manufacture to ensure that the drift additive will work properly with the spray nozzle, spray pressure and specific spray solution. Read carefully and observe all precautions, limitations and all other information on the product label.

Polymer composition:

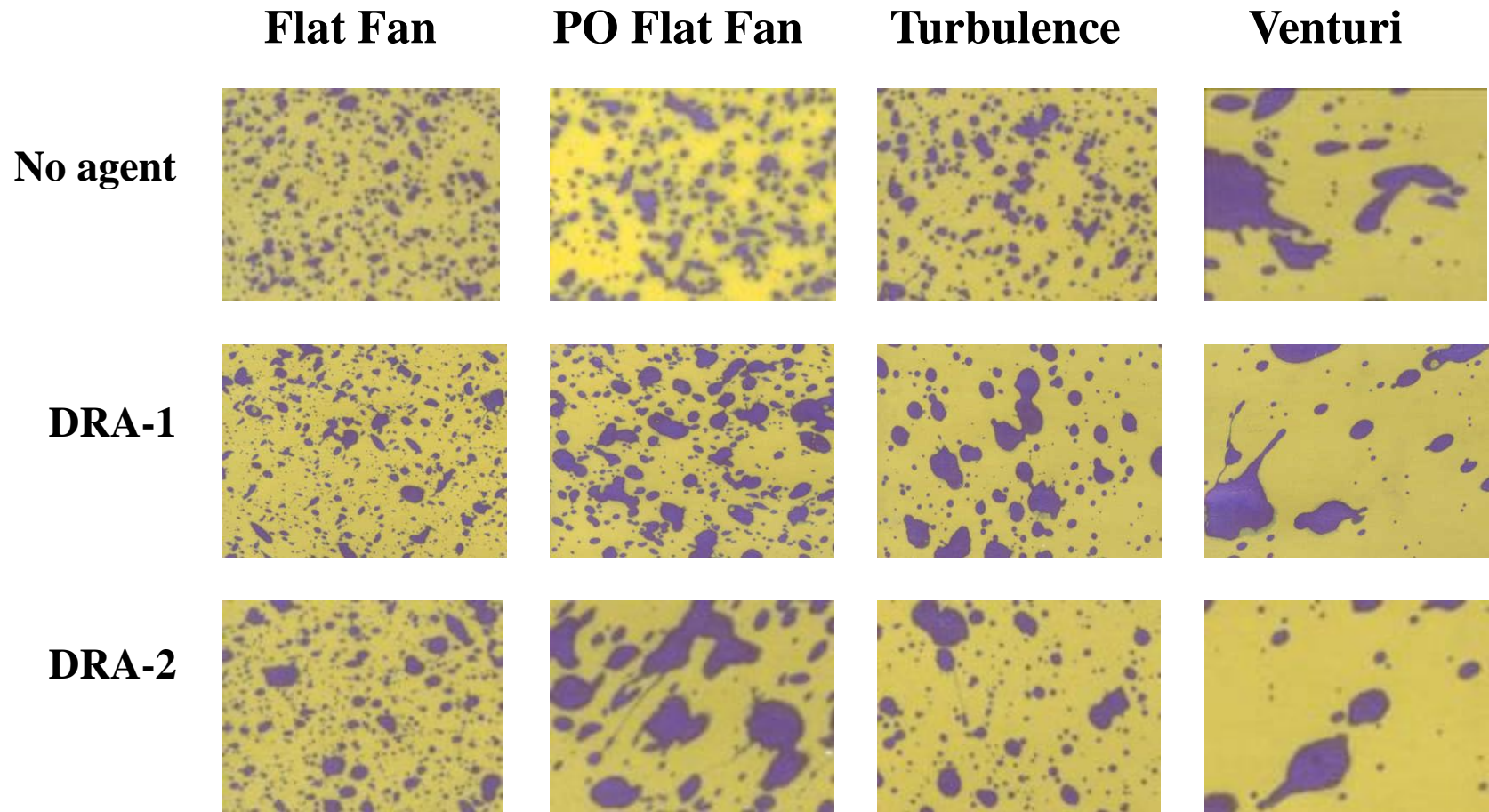
- Polyvinyl
- Polyacrylamide
- Hydroxypropyl guar

*****Increase the viscosity of the spray solution*****

Example Reference Graph

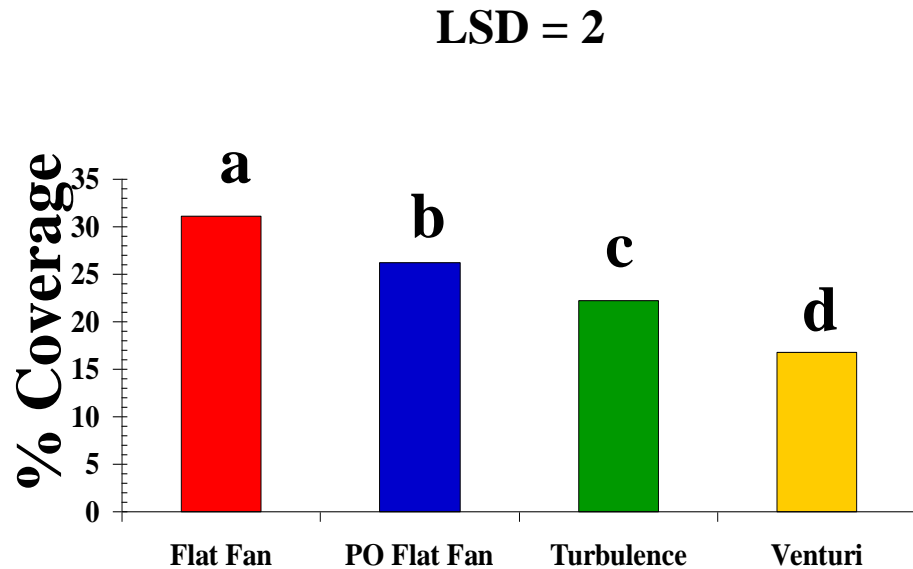


Spray Coverage

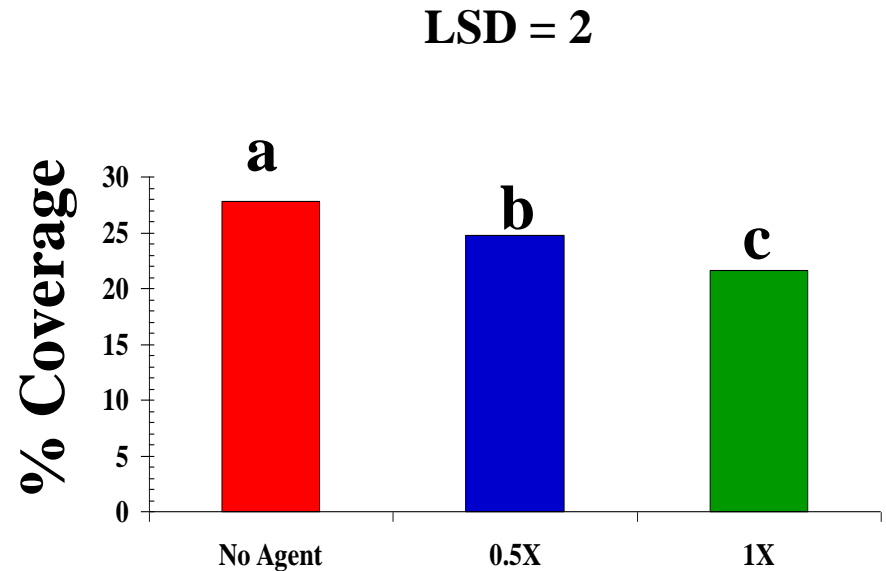


Coverage

Pooled Over Locations and Years



Nozzle Type

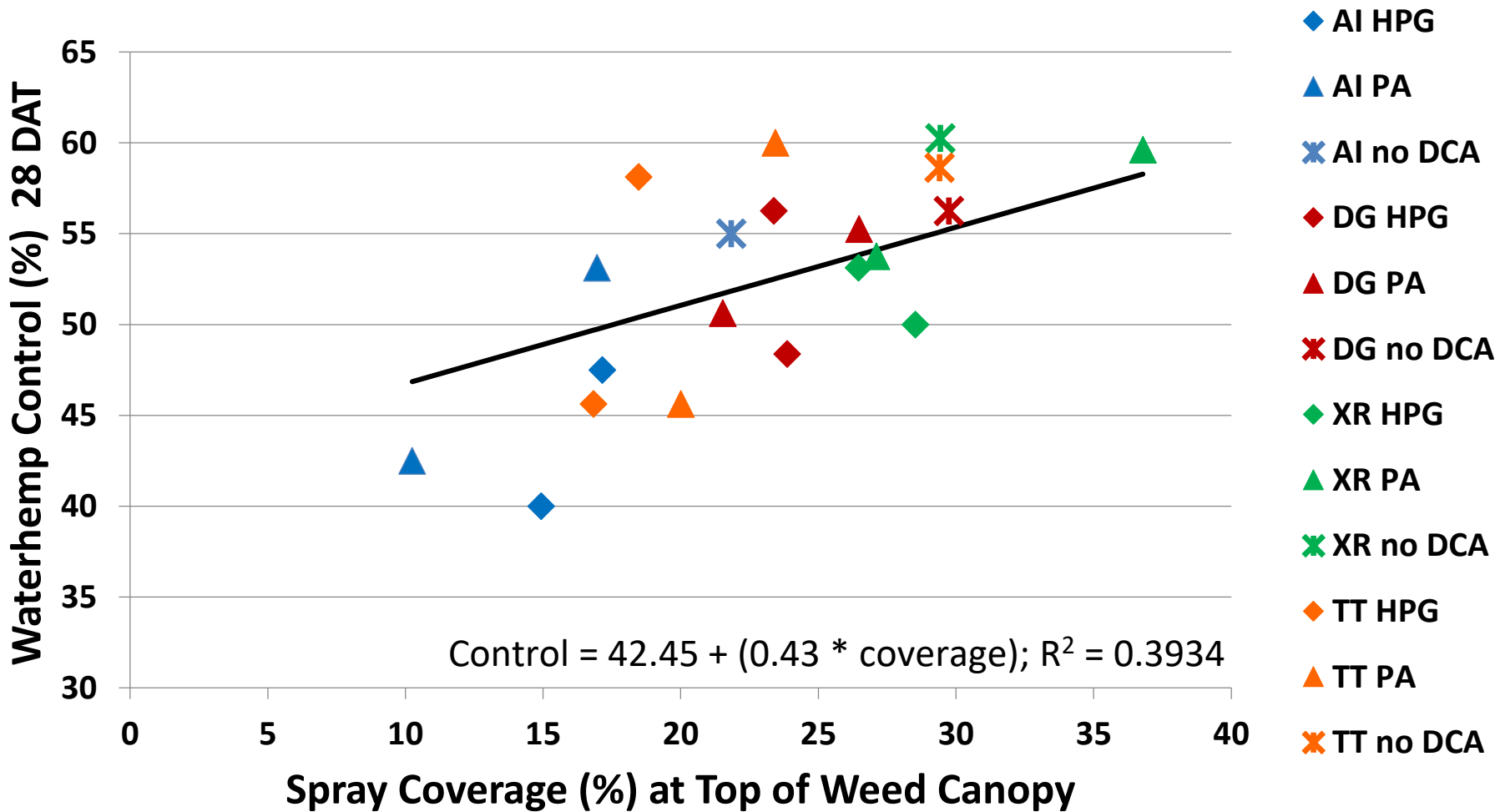


Agent Rate

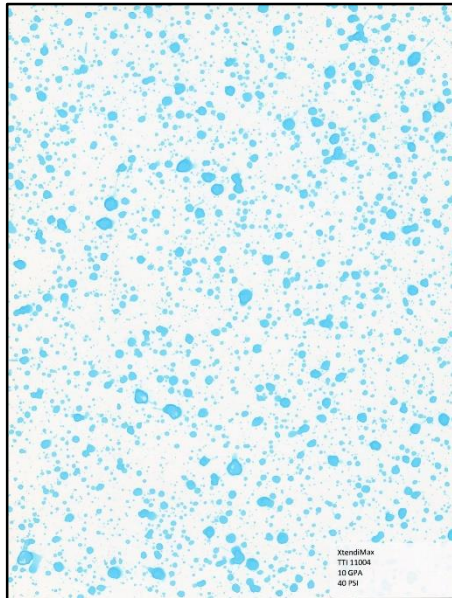
As coverage was reduced, so was control of common waterhemp.

$$r = 0.57$$

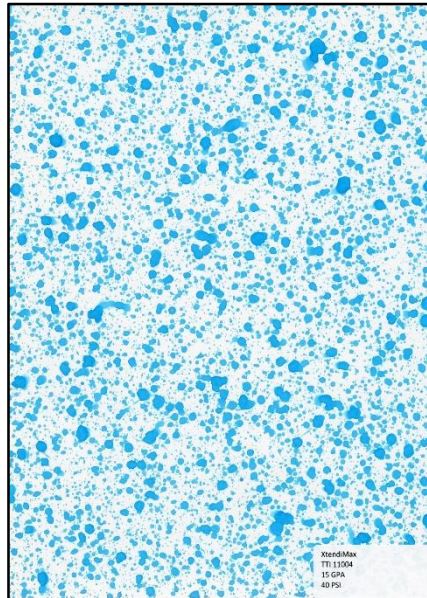
Waterhemp control and spray coverage for the four nozzle types with and without a polyacrylamide (PA) or a hydroxypropyl guar (HPG) drift control agent (DCA).



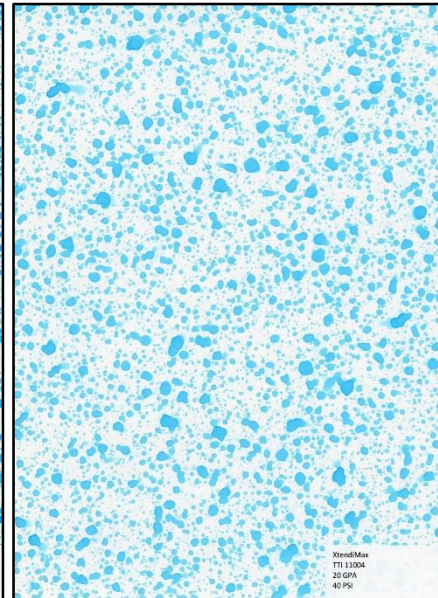
XTENDIMAX + ROUNDUP POWERMAX TTI11004 @ 40 PSI



10 GPA
12 MPH



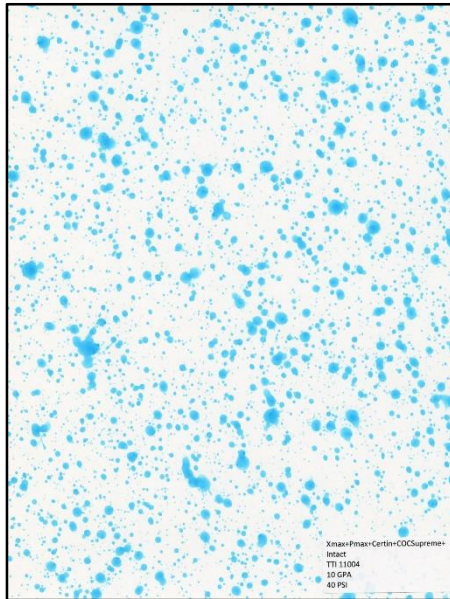
15 GPA
8 MPH



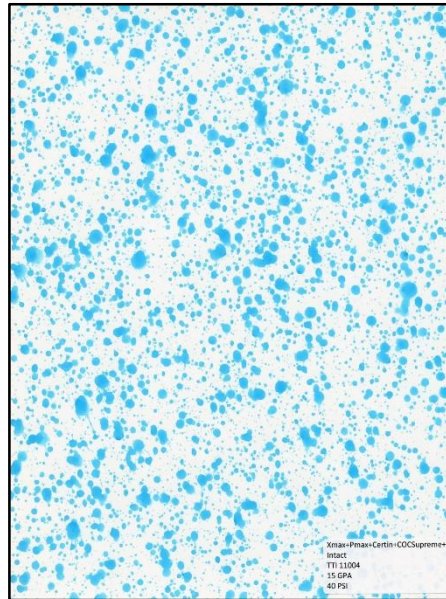
20 GPA
6 MPH



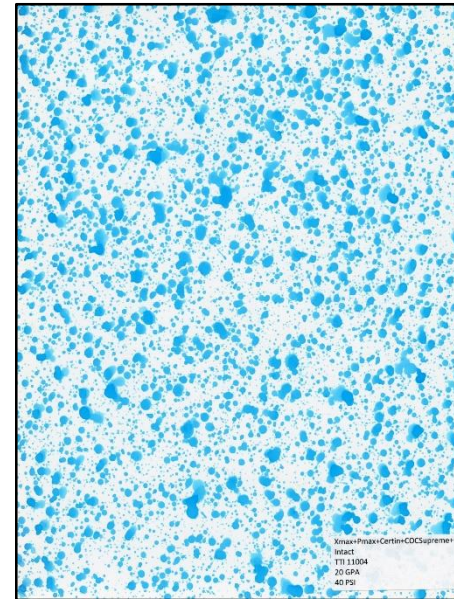
XMAX + PMAX + “water conditioner” + COC + INTACT
TTI11004 @ 40 PSI



10 GPA
12 MPH



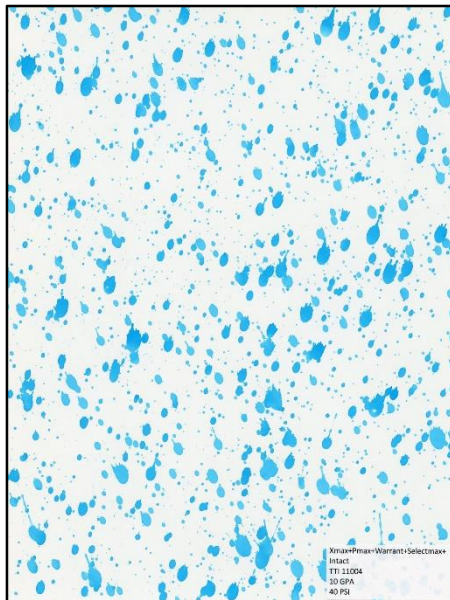
15 GPA
8 MPH



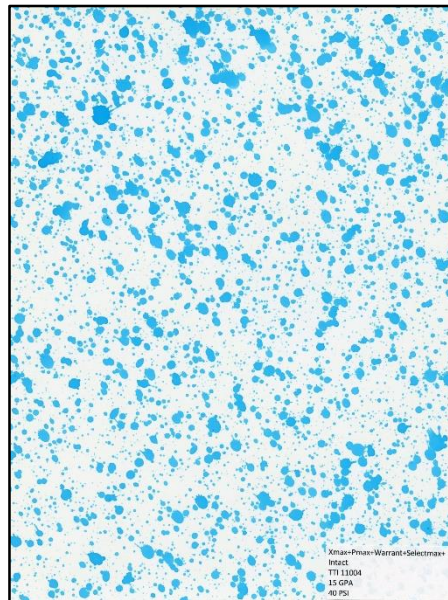
20 GPA
6 MPH



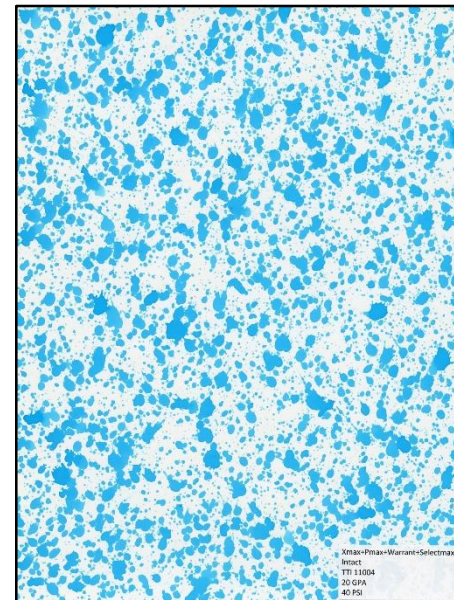
XMAX + PMAX + SELECTMAX + WARRANT + INTACT
TTI11004 @ 40 PSI



10 GPA
12 MPH



15 GPA
8 MPH

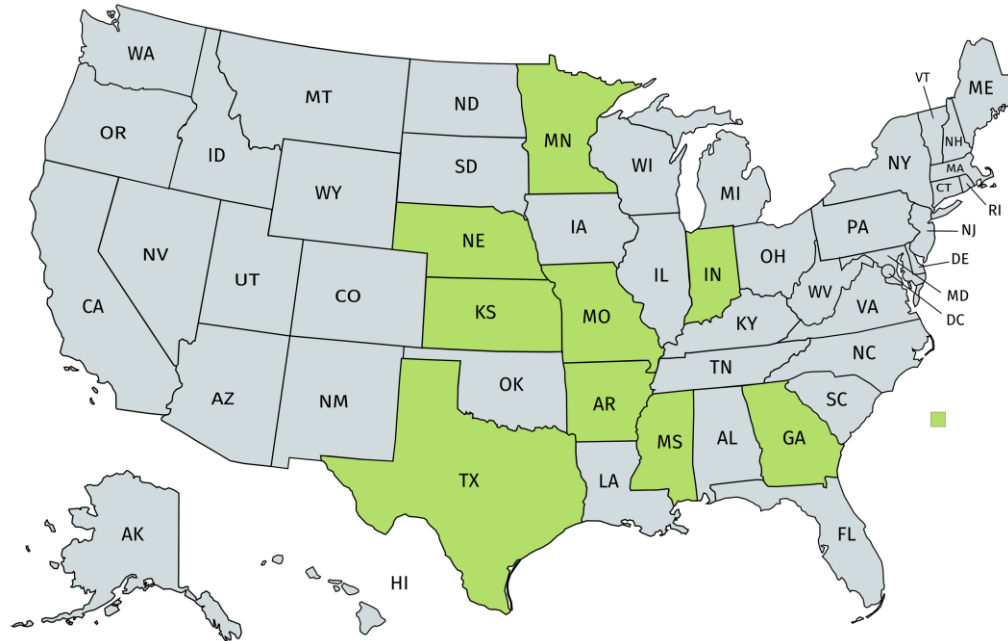


20 GPA
6 MPH



2017 Field Research Collaboration

What impact do the DRAs have on dicamba efficacy?



Created with mapchart.net ©

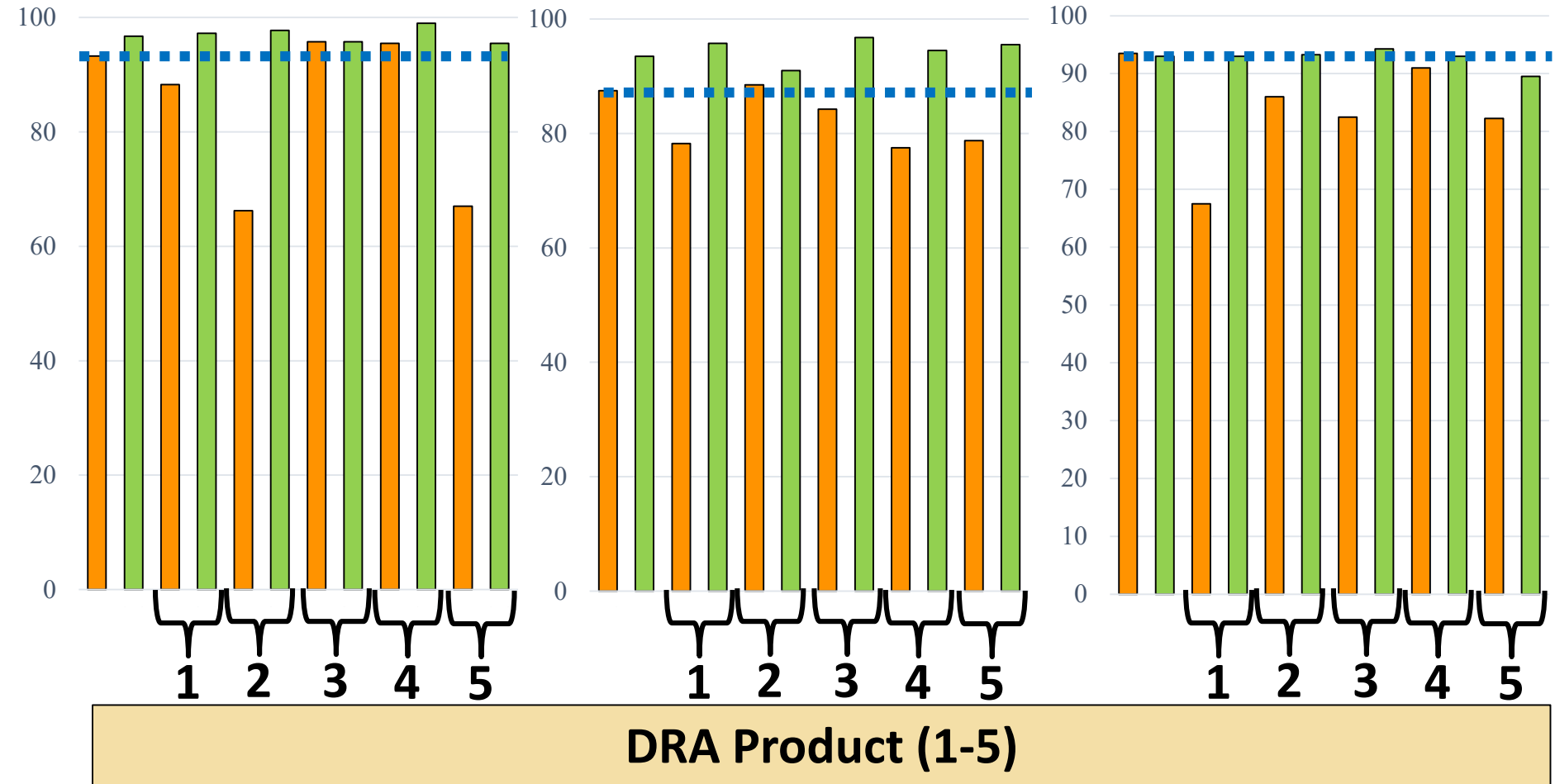


Waterhemp Control – 28 DAT

TTI 110015

TDXL-D 110015

ULD 120-015



 XtendiMax

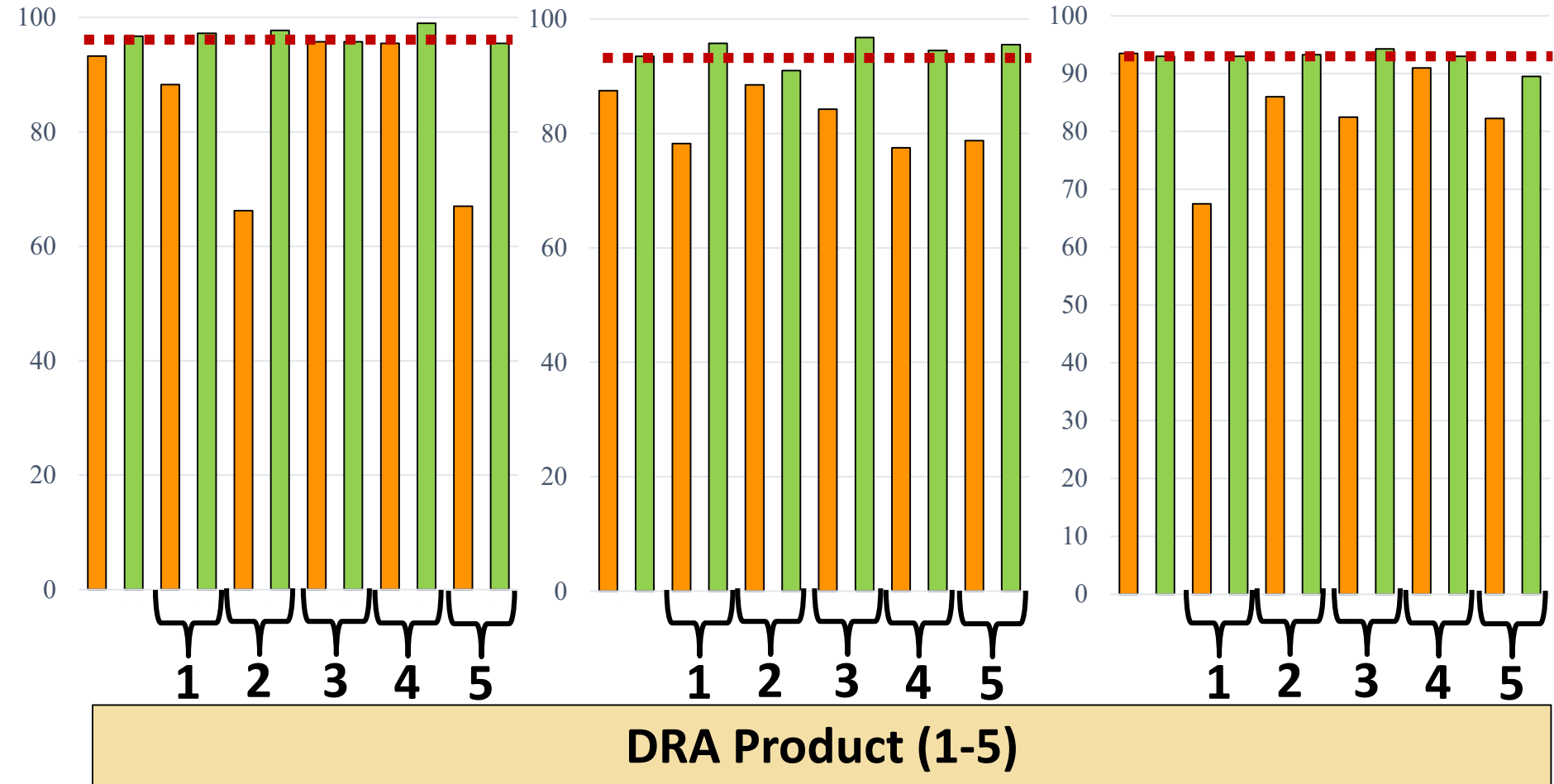
 XtendiMax + Roundup PowerMax

Waterhemp Control – 28 DAT

TTI 110015

TDXL-D 110015

ULD 120-015



 XtendiMax

 XtendiMax + Roundup PowerMax

Summary

- ❑ Large droplet size categories from ultra low drift nozzles are marginal for herbicide efficacy
- ❑ All required DRAs for Xtend system alter spray viscosity and will increase droplet size further
- ❑ Ultra low drift nozzles and DRAs both contribute to:
 - ❑ Insufficient spray coverage
 - ❑ Potential reductions in weed control
 - Small and big plants



Management

- ❑ More than one DRA or increasing the rate above label recommendations is NOT justified.
 - ▣ Minor impact on driftable fines
 - ▣ Potentially big impact on weed control

- ❑ Limit fluctuations in application travel speed to avoid major drops in spray pressure (PSI).

- ❑ Increasing the carrier volume to 15 or 20 GPA can regain spray coverage.
 - ▣ However, the total volume of driftable fines generated will increase per acre.

- ❑ These UC droplets from nozzles or DRAs will NEVER optimize herbicide efficacy.
 - ▣ Ultimately, the spray requirements for Xtend system are not ideal for herbicide activity which hastens the evolution of weed resistance to herbicides.

COMPENDIUM OF HERBICIDE ADJUVANTS

www.herbicide-adjuvants.com

2016 • 13th Edition

Bryan G. Young, Editor, Purdue University
Joseph L. Matthews, Southern Illinois University
Fred Whitford, Purdue Pesticide Programs

PURDUE
EXTENSION

SIU
Southern
Illinois
University
CARBONDALE

How to get the 2016 Compendium of Herbicide Adjuvants

- 1) Purdue Education Store
<https://edustore.purdue.edu>
Search for “PPP-115”
 - A. Order a booklet
 - B. Download a free pdf

- 2) Dedicated website:
www.herbicide-adjuvants.com
Sort product database

Please contact Bryan Young if you have any questions about the *Compendium*.
BryanYoung@purdue.edu



Questions?

