Crop Production Clinics

Importance of carrier volume and spray coverage during an herbicide application

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Session Goals

- Understand the impact of droplet size, spray volume and spray solution on coverage and control
  - Understand how different nozzles lead to different droplet size
  - Understand importance of carrier volume and how it affects a pesticide applications
  - Understand the impact of spray adjuvants on contact angle, coverage and control
  - How do I optimize my application?

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Choosing a nozzle to get a desirable droplet size

Droplet Size Category	Droplet Diameter Size (Approx.) µm
Extremely Fine	< 50
Very Fine	51 - 149
Fine	150 – 219
Medium	220 - 319
Coarse	320 - 419
Very Coarse	420 - 509
Extremely Coarse	510 - 650
Ultra Coarse	> 650

- As you can see here, we have the droplet size category and the droplet diameter size. This is very important because different herbicides require different size droplets for proper efficacy to be achieved.
- Different contact and systemic herbicides require different nozzle selevetion
- Also note that these colors on the chart are the same color for the nozzles that would fall in that droplet classification.

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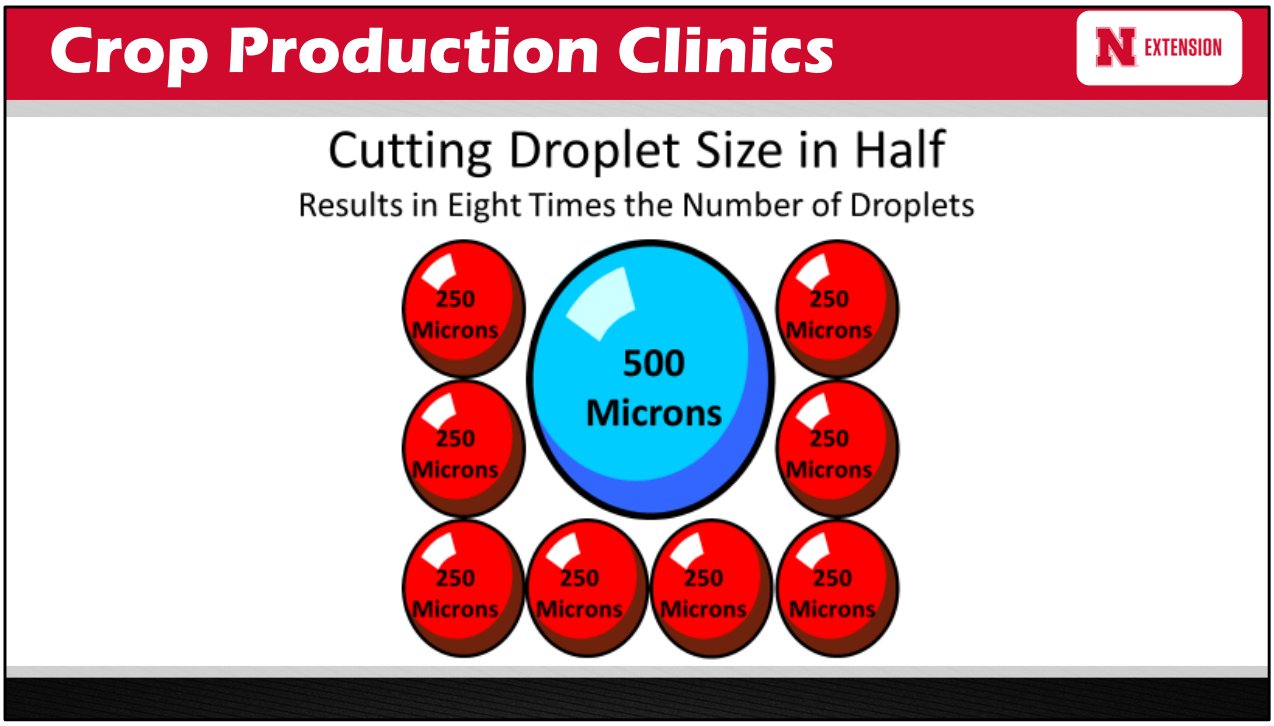

- When you cut the droplet size in half, you receive 8X the number of droplets. This is very important to understand when choosing a nozzle because different herbicides require different droplet sizing for the best efficacy possible.

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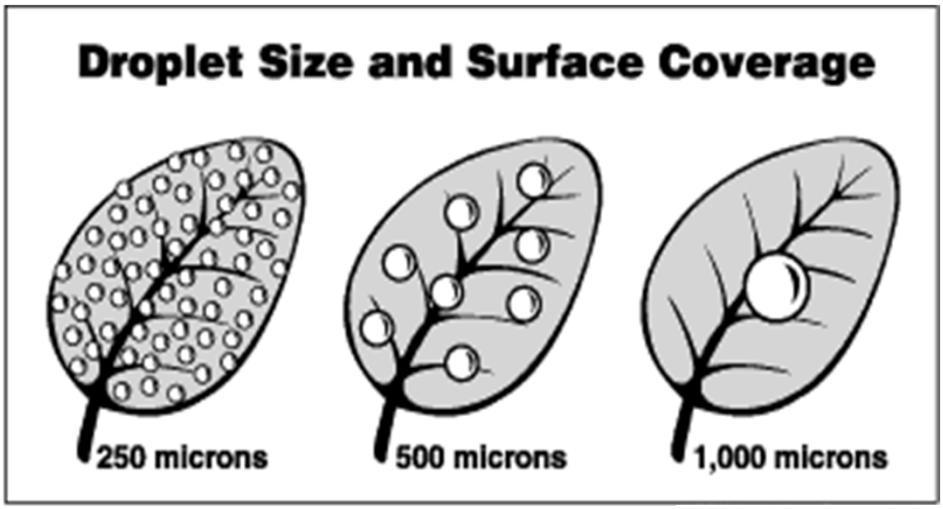

Photo courtesy of ND State University

250 microns = around the size of a toothbrush bristle
500 microns = around the size of a staple
1000 microns = around the size of a paperclip

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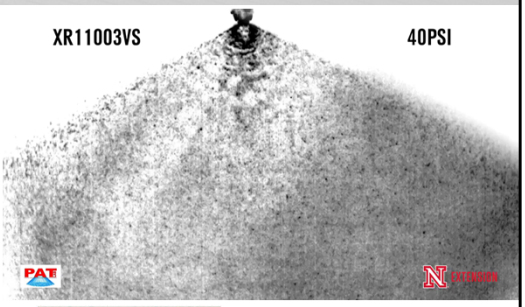
XR nozzles

- 250 µm droplets – fine
- Primarily fungicides and insecticides



XR11004 at 60 PSI 15 MPH 10 GPA
Also includes: paraquat

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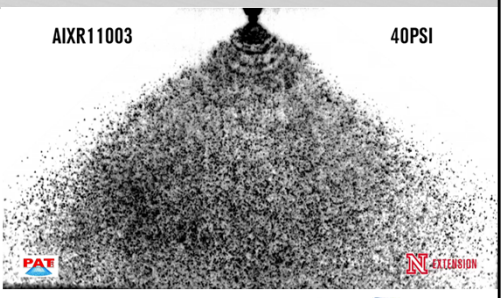
AIXR nozzles

- 450 µm droplets – very coarse
- Most contact herbicides



- 60 PSI, 10 MPH, 15 GPA
- Glyphosate and glufosinate

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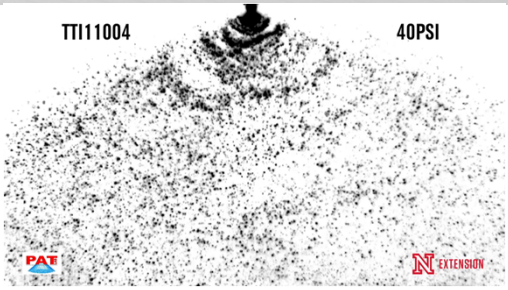
TTI nozzles

- >640 µm droplets – ultra coarse
- Many systemic herbicides



2,4-D, dicamba

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Carrier volume

- Carrier volumes impact coverage
  - Nozzle selection
  - Contact vs. systemic products
  - If carrier volume is held constant, and the droplet size is doubled, then less coverage will be the result

- Carrier volume can impact coverage by the amount of water that is applied per area.
- Typically, for contact products you will want higher carrier volumes, but for systemic products high coverage is not essential.
- Nozzle types produce different droplet sizes and therefore different levels of coverage. If you apply a product at 15 GPA, but use different nozzles that produce different droplet sizes, there will be less coverage which we saw in the previous slide. As droplet size increases then coverage decreases at the same carrier volume. Carrier volume can impact efficacy as well depending on the active applied. Carrier volume and droplet size also impact efficacy.

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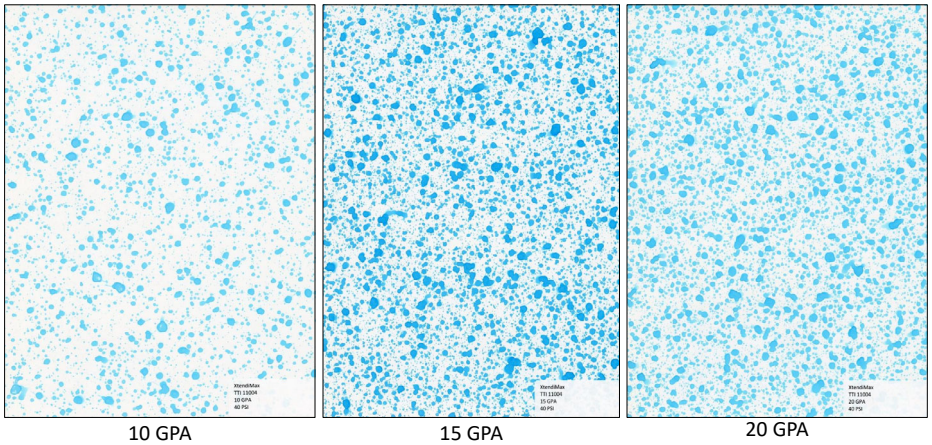
- Some products have a minimum required carrier volume
  - Coverage and Efficacy
  - Drift potential

TTI11004 @ 40 PSI



10 GPA
12 MPH

15 GPA
8 MPH

20 GPA
6 MPH

We can see here this is a TTI11004 nozzle at 40 PSI at different gallons/acre and different speeds.

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Systemic herbicides

- Herbicide enters the plant and moves throughout the plant
- Dicamba, 2,4-D, glyphosate, etc.

- Mesotrione example (waterhemp)
- Dicamba example

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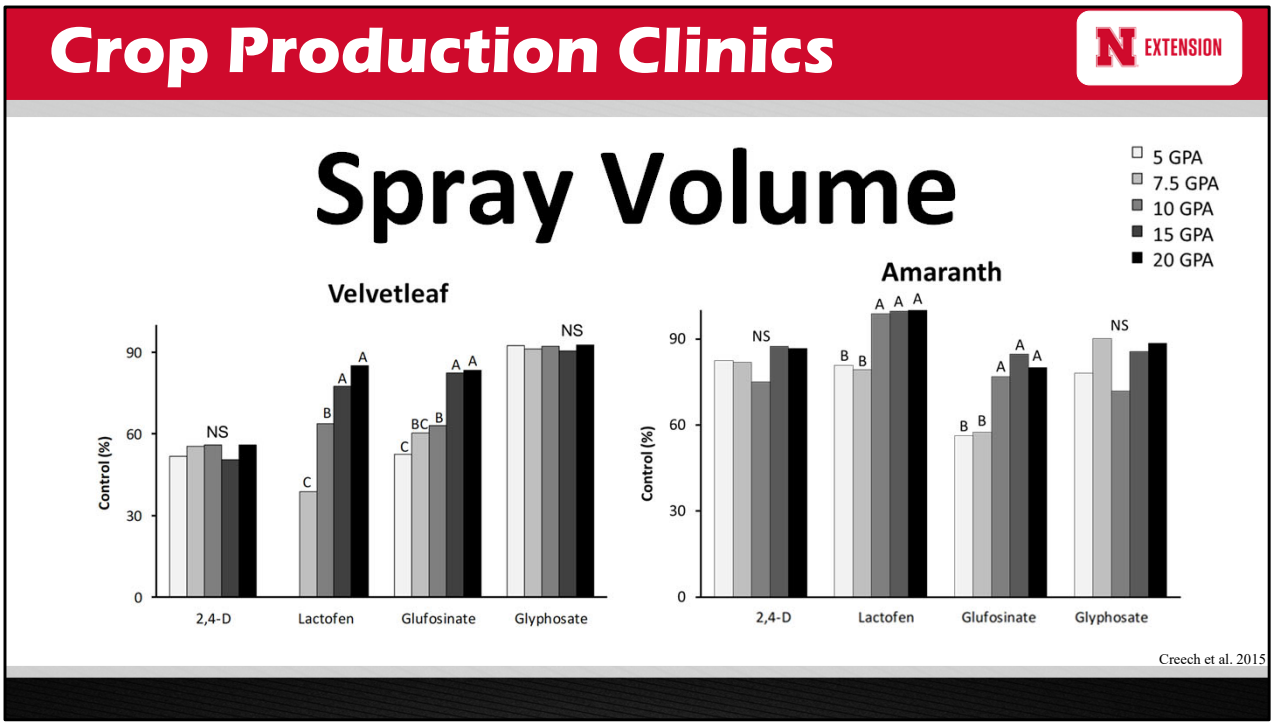
Contact herbicides

- Where the droplet lands is where you will see injury
- Glufosinate, paraquat, lactofen, etc.

- Contact herbicides are going to show damage where the droplet has landed on the plant. As we can see in the picture we have some necrosis occurring where the droplet landed on the plant and the herbicide began to work. Some examples would include glufosinate, paraquat, lactofen, etc. It is important to understand if you are working with a contact or systemic herbicide to be able to determine what kind of nozzle you should chose when making an application.



Here is some work we have done in our lab in the past looking at different GPAs and the control of two species with 4 herbicides.

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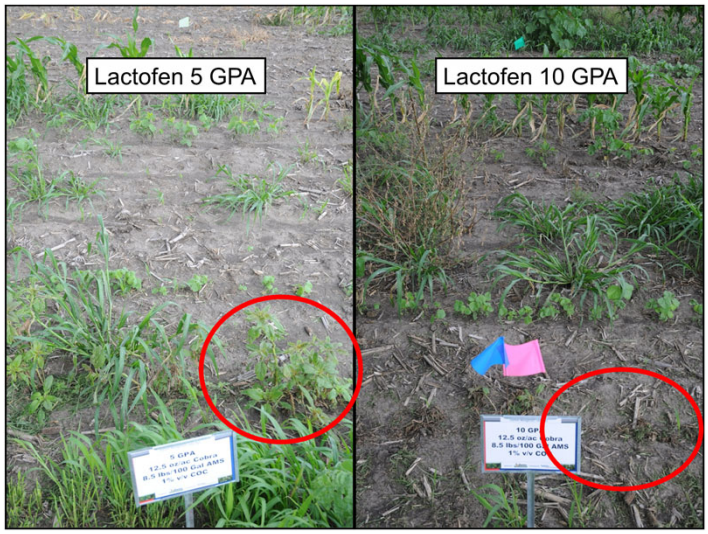

At 5 GPA no control occurred on this waterhemp plant, however, when 10 GPA was applied, 100% control was achieved.

Glufosinate at 5 GPA (14 DAA)

Butts et al. 2018

- As we can see, when using glufosinate at 5 GPA at 150 microns, the droplets are too small for this contact herbicide, causing little to no control. However, with 300 microns, we can see that these droplets are the correct size. Not too big and not too small and give us the appropriate control. From 450 to 900 microns, the droplets are too large, resulting in inadequate control.

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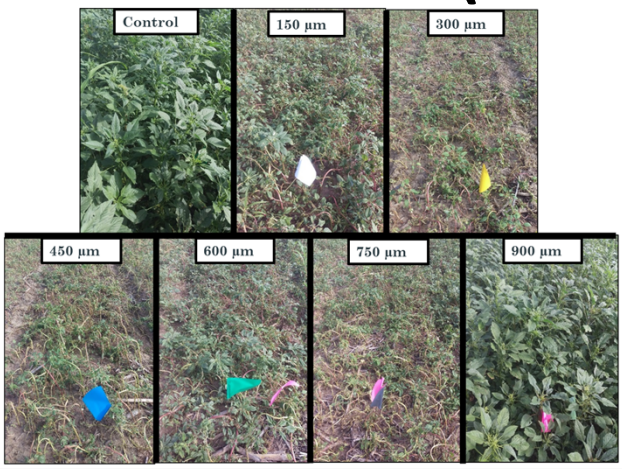
Dicamba at 5 GPA (14 DAA)



Butts et al. 2018

These pictures show a similar story to the last slide, however, this time we are looking at a systemic herbicide being dicamba. We can see that at 150 microns, the droplets are smaller and not achieving full efficacy. However, when moving up to 300 to 750 microns, adequate control is being achieved. 900 microns is too large of a droplet and is resulting in no control.

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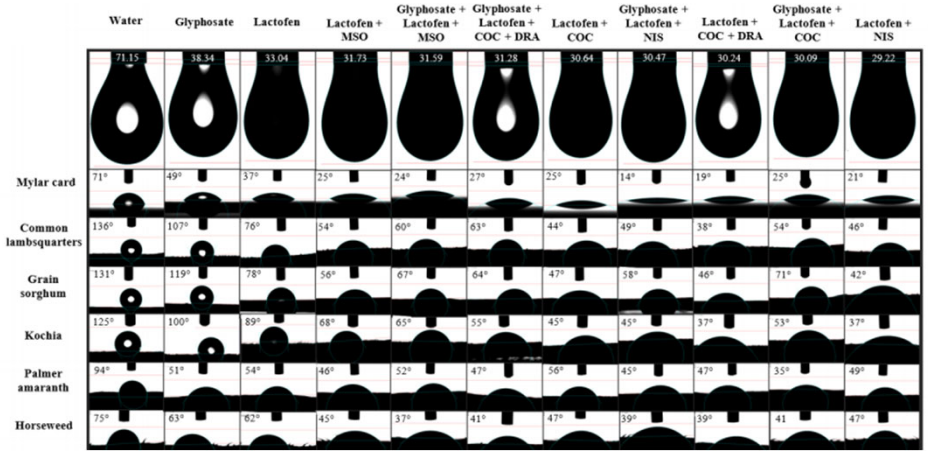
Adjuvants and spray deposition



Moraes 2018

This slide shows the effects that adjuvants can have on an herbicide tank solution. On the far left we have water alone and continuing to the right glyphosate, lactofen, and many different adjuvants. For example, on the surface of horseweed, we can see that adding a, adjuvant can lower the deposition of the droplet. This is very important with an herbicide such as lactofen because we want to get the proper coverage to achieve adequate weed control.

Its also important to note that water alone on lambsquarters, kochia, and palmer are worse than water on a mylar card. This would help inform us that different surfaces allow for different depositions to occur.

Take Home Points

- Contact herbicides rely on herbicide droplet-surface contact while systemic herbicides rely on translocation throughout the plant
- Nozzle selection greatly effects droplet size and coverage
- Carrier volume can impact herbicide coverage

Questions?