Spray Technologies

And common practices to accomplish a successful spray application

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Goals For A Good Spray Application

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What is a good spray application?

- Getting the correct amount of the correct active ingredient to it's target
  - Mitigating over/under application
  - Uniform coverage across the entire area
  - Reduce potential for off target movement (drift)

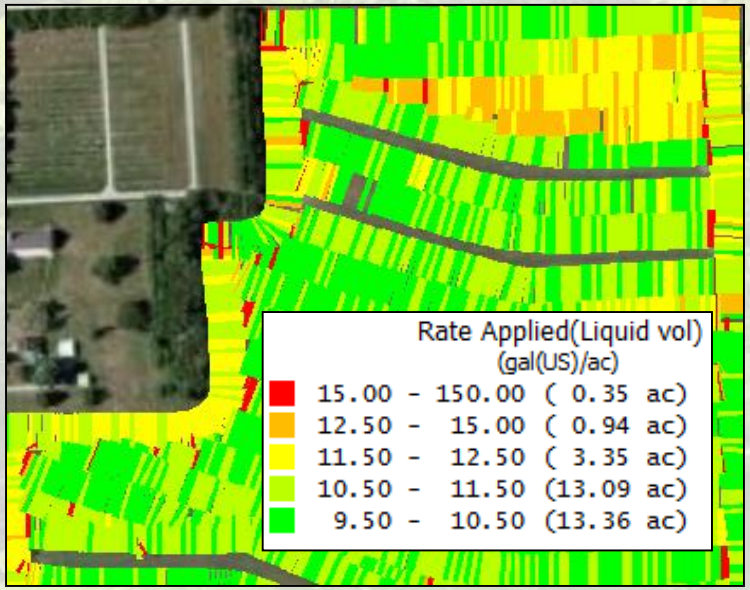
Image: Pentair

Goals for a good spray application

- On target and accurate:
  - Application Rate (Correct rate for the application)
  - Mixing (Pre-Mixing, Agitation, Direct Injection)
  - Flow (Clean Booms)
  - Pattern (Correct Nozzle Spray Angle/Nozzle Overlap)
  - Droplet Spectra (Correct Nozzle Size/Spray Pressure for mitigating drift while maintaining efficacy)

On Target and Accurate:

- Application Rate
  - Correct rate for the application
  - Can be affected by many factors including:
    - Proper mixing
    - Correct Nozzles
    - Properly setup rate controller



On Target and Accurate:

- Application rate
  - Rate Controller functionality/calibration

GPS

Field Computer

Spray Rate Controller

Flow

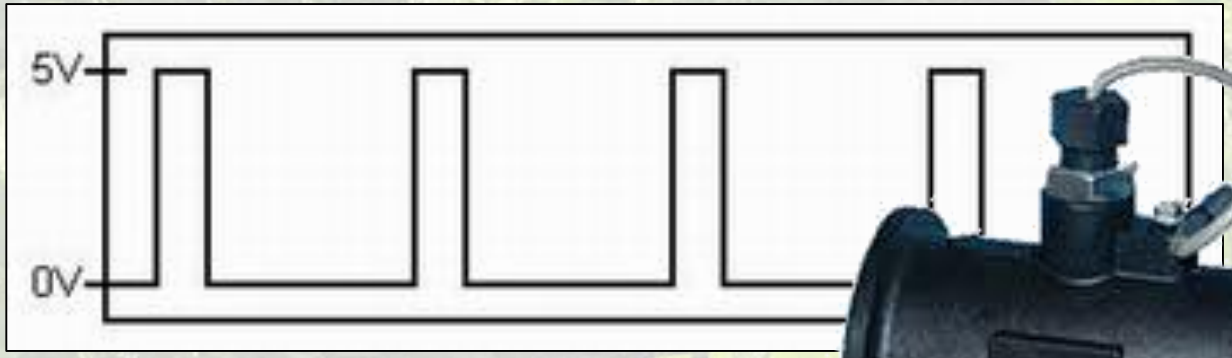
Control Valve

Flowmeter

Flow

On Target and Accurate:

- Flow
  - Properly calibrated flow meter
    - Cal Number (pulses/gal or pulses 10 gal)
  - Clean system
    - Strainer
    - Booms
    - Nozzles



On Target and Accurate:

- Mixing
  - Correct mixing of:
    - Adjuvants and the order they're mixed
    - Active ingredient to carrier ratio
      - Including premixed and direct injected
    - Agitation within the solution tank before and during the application

Image: The Western Producer

On Target and Accurate:

- Pattern
  - Correct nozzle spray angle for:
    - Nozzle spray angle
    - Nozzle spacing
    - Boom height

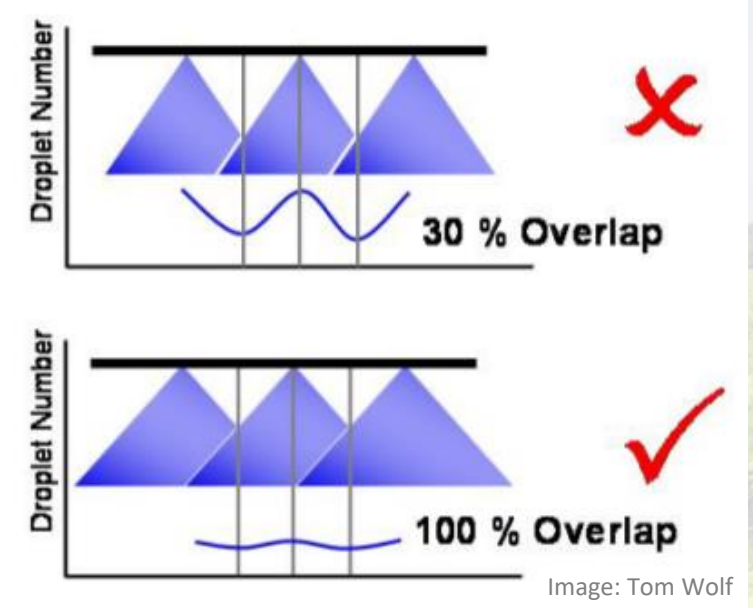


Image: Tom Wolf

Minimum Spray Tip Height

Tip Spacing	Minimum Spray Tip Height		
	ER, SR, MR & DR 80 Degree Tips	ER Series 110 Degree Tips	SR, MR & DR Series 110 Degree Tips
10	10”	9”	13”
20	17”	15”	19”
30	26”	20”	24”

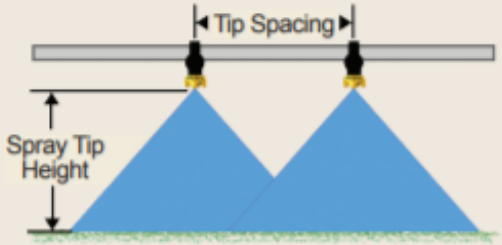


Image: Wilger

On Target and Accurate:

- Droplet Spectra
  - Designated by class for nozzles
  - Correct nozzle and pressure
    - Efficacy vs drift potential

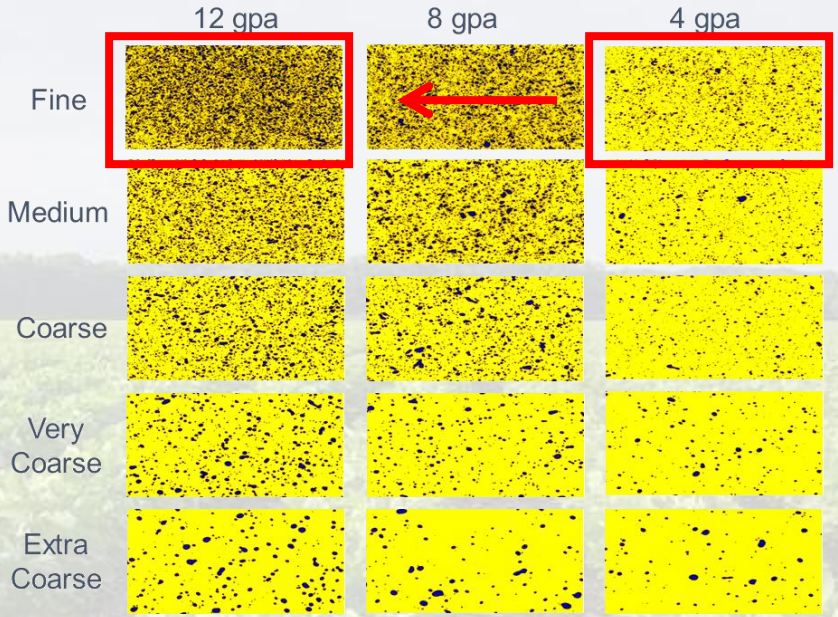


Image: Tom Wolf

Image: Wilger

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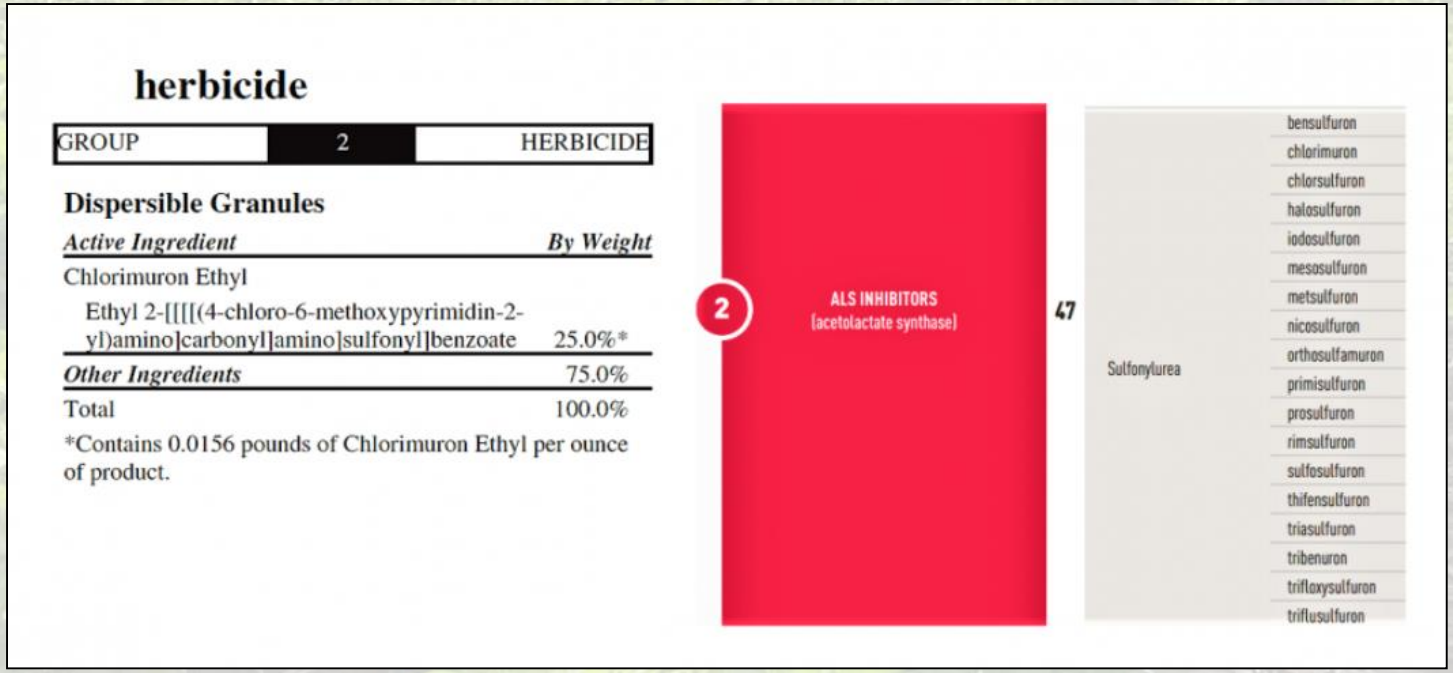
On Target and Accurate:

- Cleaning
  - More than cleaning the outside of the sprayer
  - https://cropwatch.unl.edu/2018/think-your-sprayers-clean-think-again
  - https://cropwatch.unl.edu/2018/removing-dicamba-residues-your-sprayer-tricky-task

Image: Ohio Field Leader

On Target and Accurate:

- Label Understanding
  - Know what's inside your tank
  - https://cropwatch.unl.edu/2018/what-should-you-look-herbicide-label



herbicide

GROUP	2	HERBICIDE

Dispersible Granules

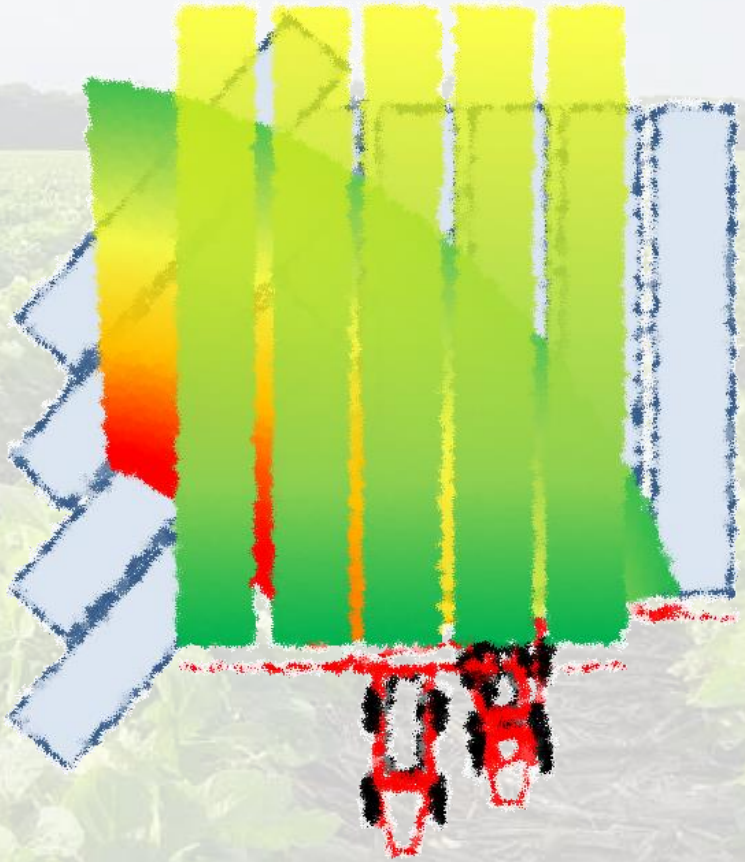
Active Ingredient	*By Weight*
Chlorimuron Ethyl	
Ethyl 2-[[[[(4-chloro-6-methoxypyrimidin-2-yl)amino]carbonyl]amino]sulfonyl]benzoate	25.0%*
Other Ingredients	75.0%
Total	100.0%

*Contains 0.0156 pounds of Chlorimuron Ethyl per ounce of product.

Current Issues That Can Prevent a Good Spray Application

Current Issues That Can Prevent a Good Spray Application

- Proper Batching
- Label Rates vs. Applied Rates
  - Improper mixing
  - Poor chemical Flow/Non-Uniform Boom Flow Velocities
  - Nozzle wear
  - Overlap
  - Turn
  - Drift



Proper Batching

- Are the correct adjuvants/adjuvant rates being used?

Some chemicals and adjuvants won't mix

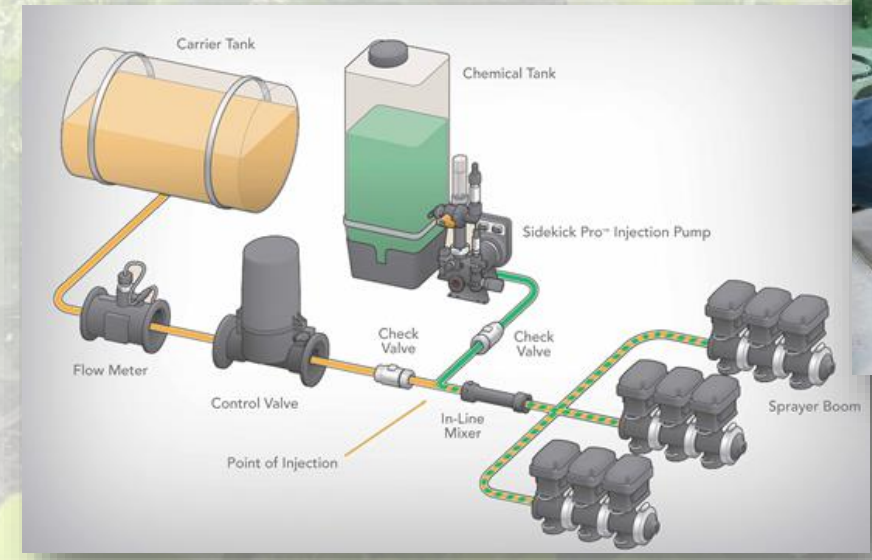
Water hardness can affect the chemical saturation

Proper Batching

- Chemical/Carrier Dilution
  - Is the correct amount of carrier being used?
    - If the dilution is incorrect, non-uniformity (streaking/spotting) is very possible
    - This may be critical with direct injection systems

Proper Batching

- Direct Injection Systems
  - DI systems allow for separate storage and metering of chemical into the carrier stream
  - Operator exposure and cleanout procedures are improved
  - Response (lag) times and mixing have been issues since they were initially developed



Label Rates vs. Applied Rates

- Improper mixing
  - Incorrect mixing of carrier, active and adjuvants

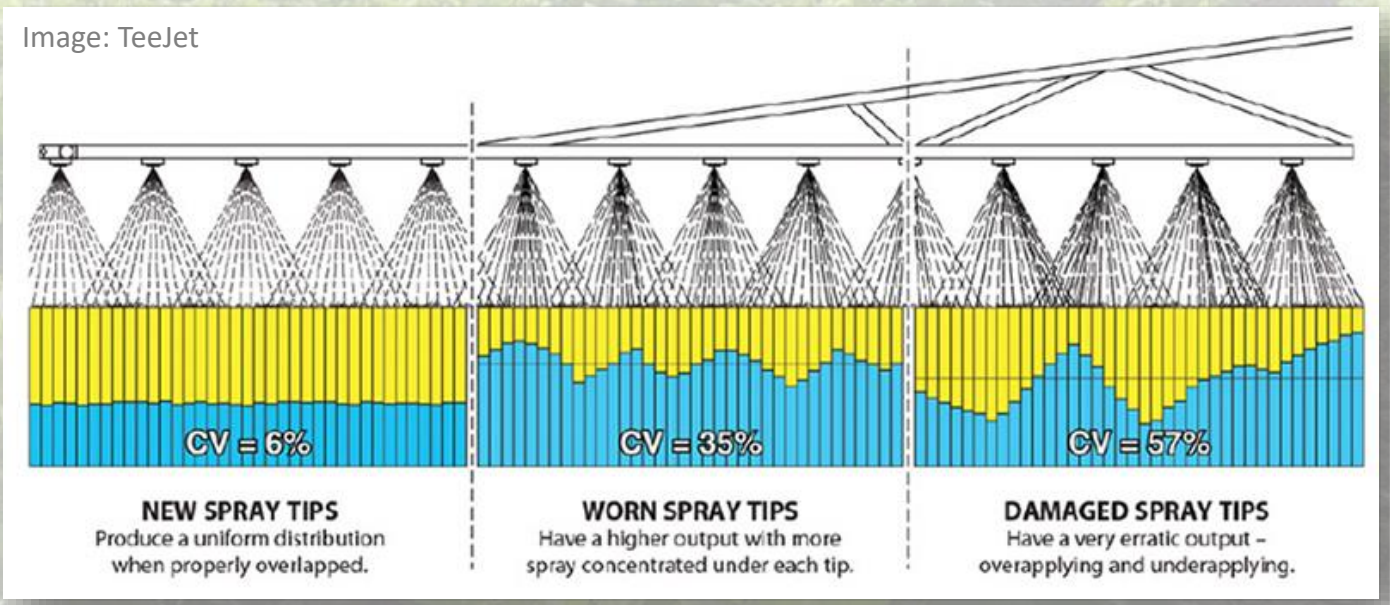
Label Rates vs. Applied Rates

- Poor chemical Flow/Non-Uniform Boom Flow Velocities
  - Plugged strainer
    - You should check your strainer more than once or twice per season
  - Sediment buildup in booms
    - Frequent boom flushing keeps boom flow rates/velocities at designed operating parameters
    - The use of a cleaner may be needed occasionally (i.e. CLR)

Label Rates vs. Applied Rates

- Nozzle wear
  - Worn nozzles, wrong strainer, improper flushing
    - Nozzles may look fine and even produce a good pattern, however the variability may be greatly increased with worn or damaged spray nozzles.

Image: TeeJet



Label Rates vs. Applied Rates

- Drift
  - Incorrect nozzle or spray pressure for the application
  - Weather Impacts on Drift
    - Wind
    - Temperature Inversions
  - https://cropwatch.unl.edu/2016/improving-pesticide-efficacy-and-managing-spray-drift

Image: Pesticide Action Network

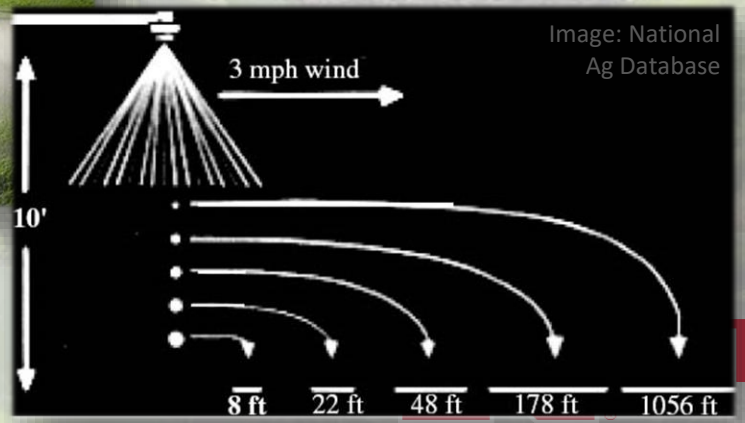
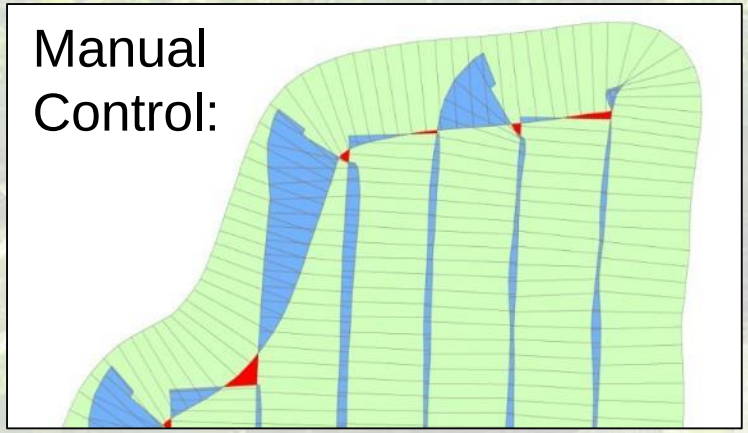
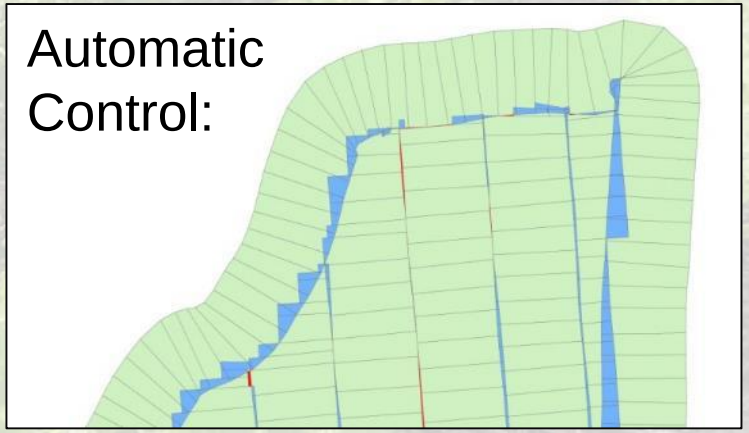


Image: National Ag Database

Label Rates vs. Applied Rates

- Overlap
  - No section control or non-uniform section control
  - Boom setup and field shape/size can have an impact on payback





Label Rates vs. Applied Rates

- Turning
  - Outside nozzles faster than inside nozzles during turns
    - The wider the boom, the greater the effect

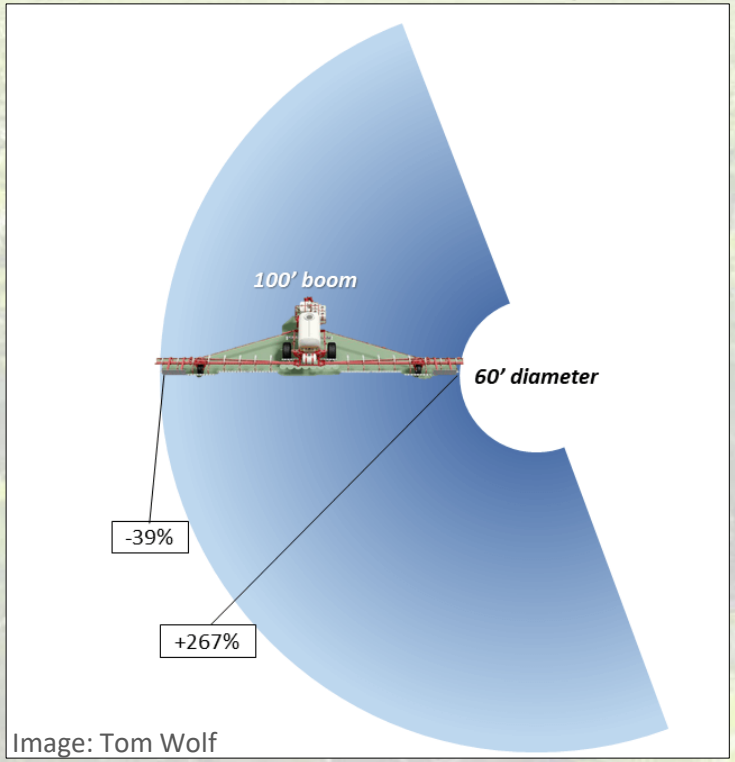
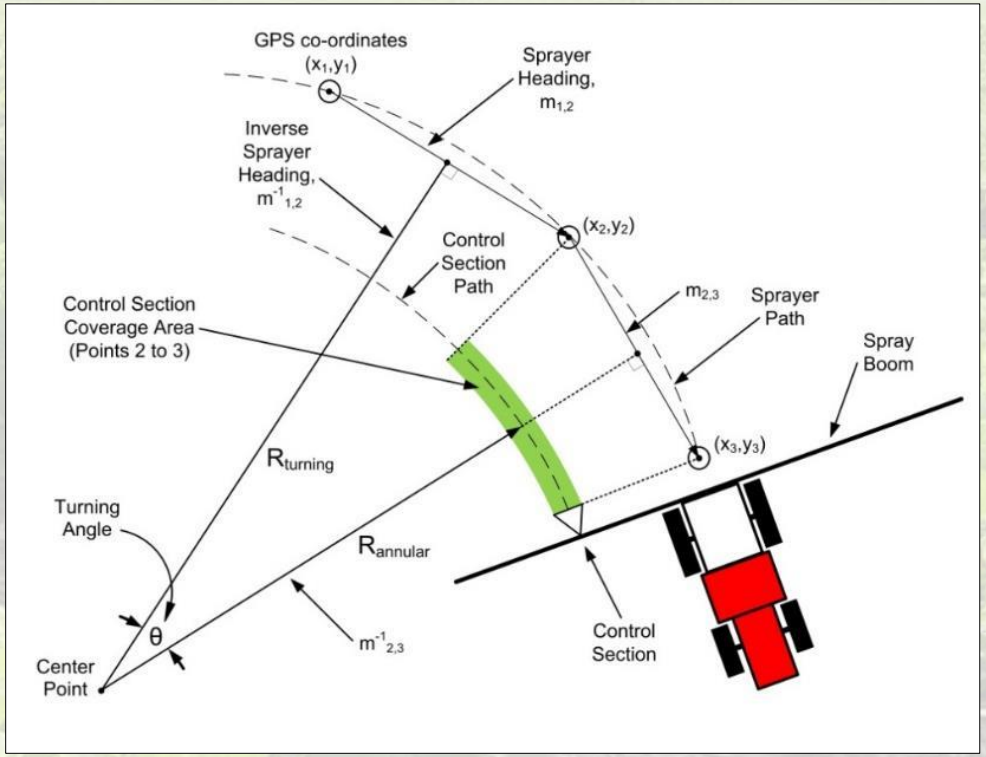
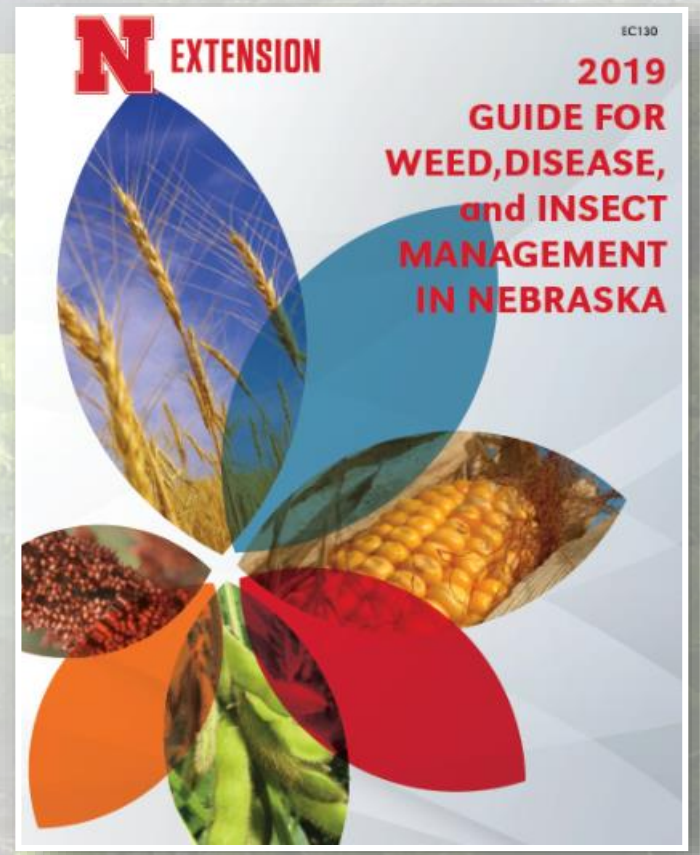


Image: Tom Wolf



A Valuable Resource

- https://marketplace.unl.edu/extension/extpubs/ec130.html



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Innovative Management Practices (IMP) and Technology Solutions

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Innovative Management Practices (IMP)/Technology Solutions

- Automated mixing
  - Meter and mix the right chemical for the job
  - Automated record keeping
  - Potentially helps reduce user errors
    - SureFire Ag: QuickDraw
    - PraxiDyne®: Mixmate
    - DuPont™: PrecisionPac®

Innovative Management Practices (IMP)/Technology Solutions

- Spray Nozzle Technology
  - Air Induction/Pre-Orifice Nozzles
    - Aid in reducing drift-able fines by entrapping air and/or slowing down the velocity of the spray exiting the final orifice
      - Wilger: Combo-Jet® MR, DR and UR Series
      - TeeJet®: TTI, Air Induction, XR,XRC, DG, AI3070
      - Hypro®: 3D Nozzle, Guardian, Guardian Air, Ultra Low-Drift
      - GreenLeaf: Softdrop, Low Drift Dual Fan for PWM, TurboDrop®

Innovative Management Practices (IMP)/Technology Solutions

- Spray Nozzle Technology
  - Variable Orifice Nozzles
    - Change flow/pressure rates while maintaining droplet spectra and pattern
      - GreenLeaf: Turbo [illegible]ariable Rate (TDVR)
      - Delevan: VariTa[illegible]

Innovative Management Practices (IMP)/Technology Solutions

- PWM Control
  - Maintains pressure (and droplet spectra) while accommodating flow changes through speed changes
  - Individual nozzle control allows for the duty cycle to vary across the boom to maintain target rate during turns
  - Some commercially available products offer individual nozzle overlap shutoff
    - CapstanAG ™ : SharpShooter RS®, EVO™, Pin Point® II
    - Raven: Hawkeye®
    - John Deere™: ExactApply™
    - TeeJet®: DynaJet® Flex
  - https://cropwatch.unl.edu/2018/precise-spray-droplet-sizes-optimizing-herbicide-applications

Innovative Management Practices (IMP)/Technology Solutions

- Boom height Control
- Maintaining proper boom-to-target height is critical and can affect:
  - Application uniformity (low clearance)
  - Off-target movement of spray particles (excessive clearance)
- Mechanical and non-contact sensors are available
- Sensors control boom hydraulics to maintain height
  - NORAC®: Boom Height Control™
  - Raven: AutoBoom®XRT
  - Bestway: AutoGlideXR™

Innovative Management Practices (IMP)/Technology Solutions

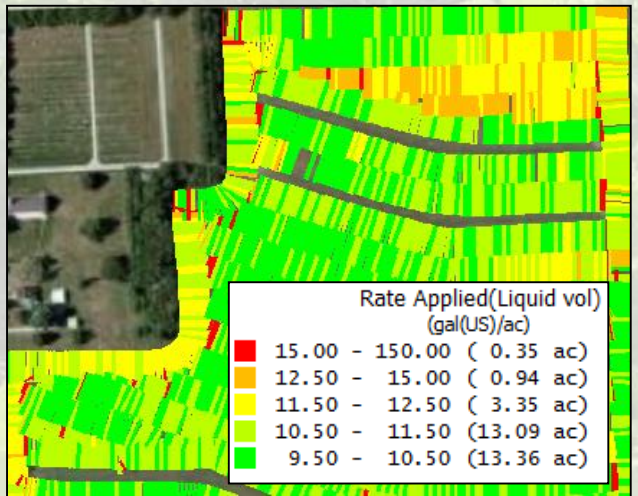
- Weed Sensing Technologies
- Reflectance-based systems work much like crop canopy sensors for detecting weeds
- Digital algorithms assess the presence of weeds and nozzle valves are actuated “on” or “off”
- Challenges to adoption continue to focus on Economics
- Payback depends on weed density in fields and acres in production
- Potential to greatly reduce chemical usage
  - Trimble®: WeedSeeker®
  - Blue River Technologies: See & Spray™

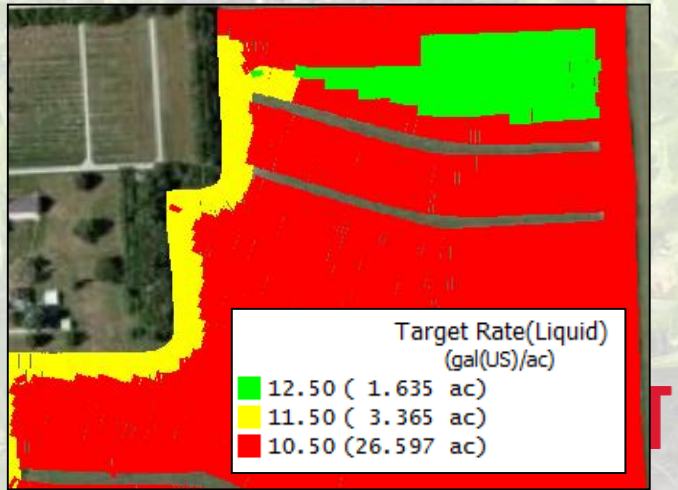
Weather Monitoring

- For in field weather monitoring and planning, there are tools available
  - Spoton®: Inversion Tester
  - John Deere™: Mobile Weather™
  - Kestral®: 5500AG
  - BASF: Engenia® Spray Tool (online resource)
    - https://www.engeniaspraytool.com

Innovative Management Practices (IMP)/Technology Solutions

- Digital Mapping
  - Digital record of application location and “As Applied” map
  - Can be used for record keeping
  - Can be used to verify target rate vs applied rate
    - For both single rate and prescription rates
  - Comparisons with as-applied data will allow us to determine where improvements can be made in our operations





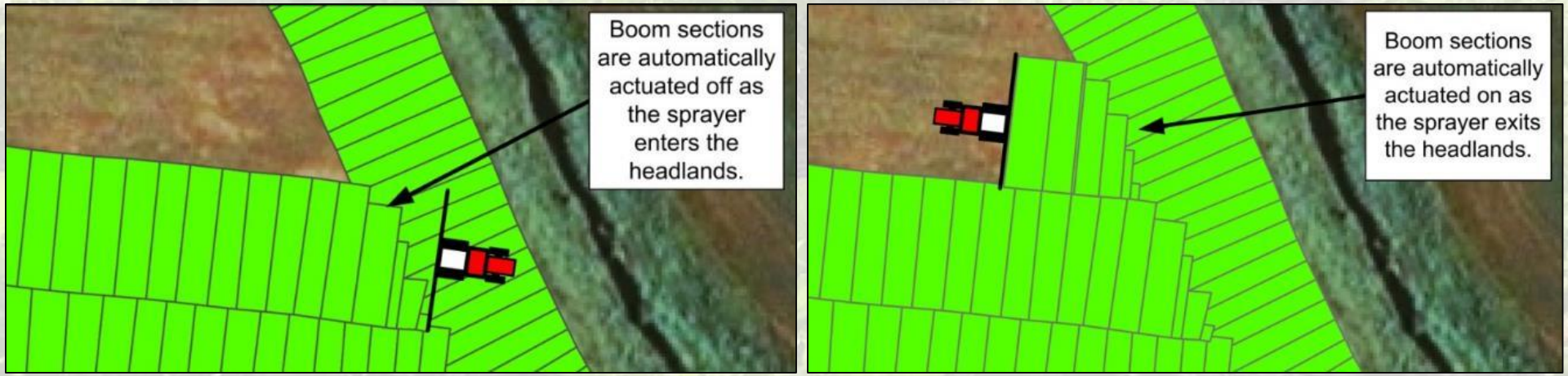
Innovative Management Practices (IMP)/Technology Solutions

- Automated Steering
  - Available on most self propelled sprayers
    - Integrated or steering wheel adapted
  - Reduces operator fatigue
  - Reduces potential for overlap/skips

Image: Crop Production Magazine

Innovative Management Practices (IMP)/Technology Solutions

- Map Based Section/Individual Nozzle Control
  - Automatic Section Control (ASC) is a technology that has reduced pesticide over-application
  - Reduces overlap by turning sections or individual nozzles off on previously covered area
  - ASC is an easy addition to most sprayers and takes little time to realize benefits



Questions