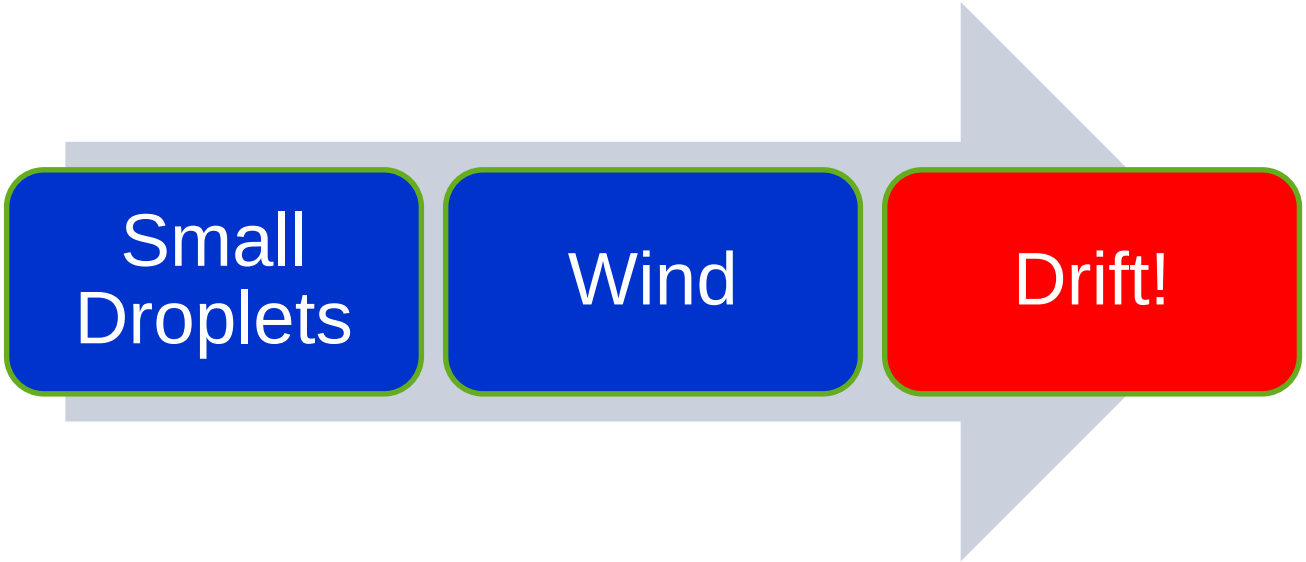
WHAT CAN WE DO TO RESEARCH AND TEACH LOW DRIFT PRACTICES?

Tom Wolf

Agrimetrix Research & Training, Saskatoon

Sprayers 101

Flexhaul

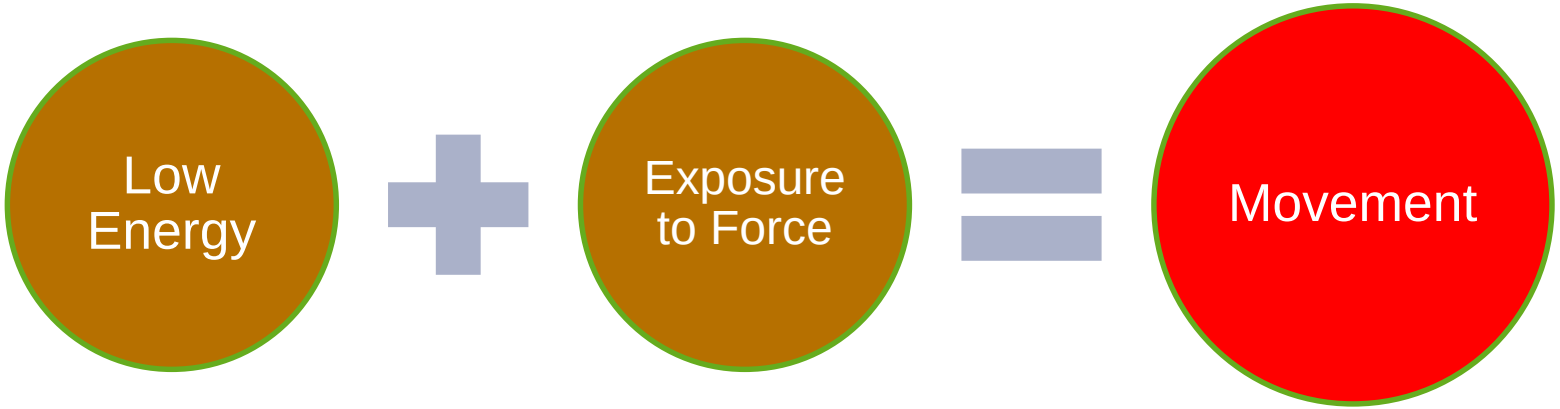

Small Droplets
Wind
Drift!

Factors Involved in Spray Drift

Droplet drift

- **Wind speed**
- **Atmospheric turbulence**
  - thermal
  - mechanical
- **Droplet size**
  - **Initial size**
    - sprayer type
    - nozzle type, size
    - pressure
    - formulation
  - **Rate of evaporation**
    - temperature
    - RH
  - **Transit time**
    - velocity
    - boom height
- **Droplet velocity**
  - sprayer type
  - pressure

What Causes Drift?



Forces Acting on Droplets

Gravity	• Droplets fall
Evaporation	• Droplets shrink
Wind	• Droplets move downwind
Drag	• Droplets slow down
Lift	• Droplets move with thermals

Strategy

Low Energy

- Increase size
- Increase velocity
- e.g. low drift nozzles, air assist

Exposure to Force

- Protect
- Decrease exposure time
- e.g. shrouds, low booms, slow travel

Greenleaf AirMix

- **Sizes:**
  - 01 to 06
- **Pressure:**
  - 15 – 90 psi (30-100)
- **Spray Quality:**
  - Medium to V. Coarse
- **Retail Cost:**
  - $4 - $6

Hypro Guardian Air (John Deere LDA)

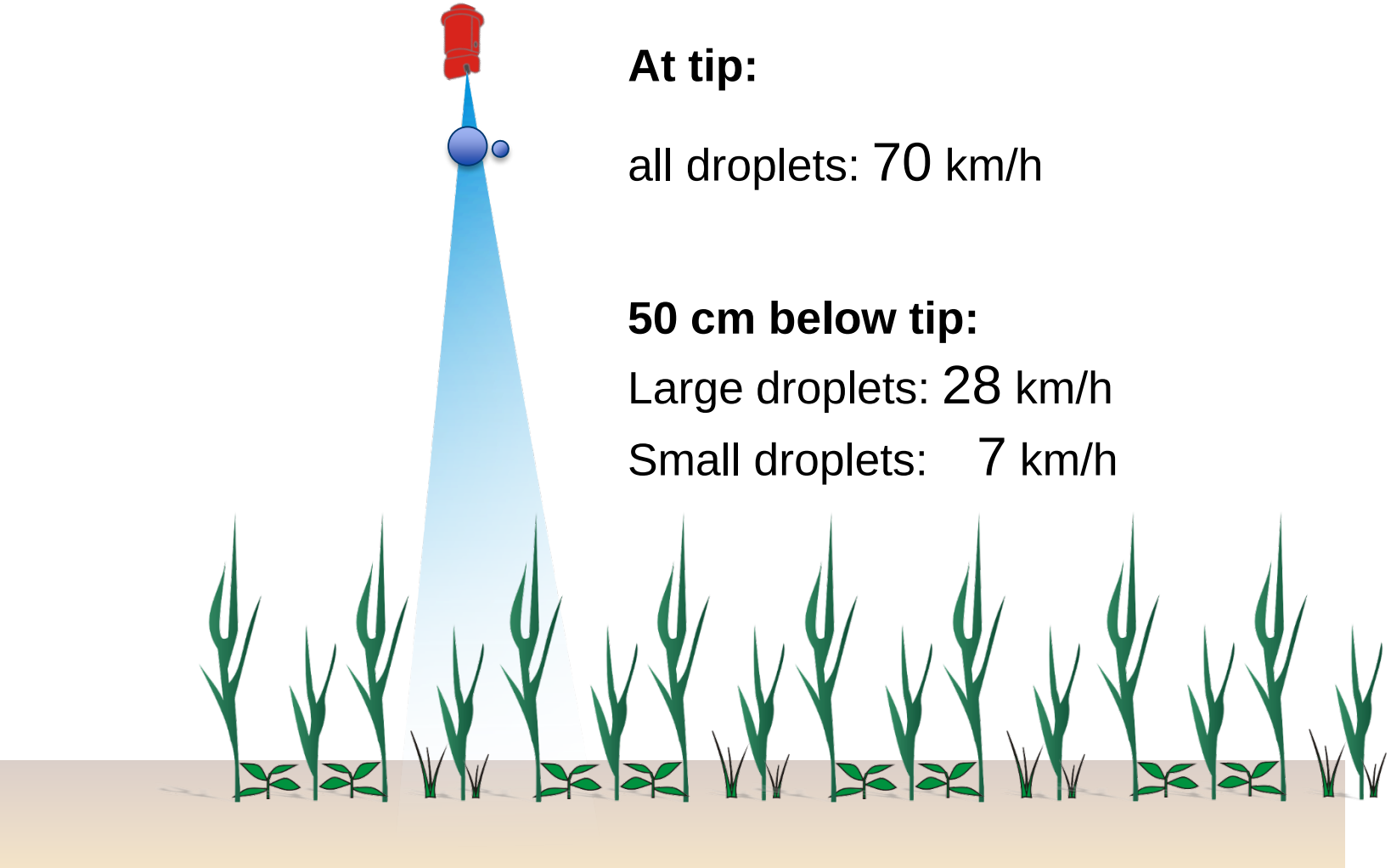
- **Sizes:**
  - 015 to 05 (035)
- **Pressure:**
  - 15 – 115 psi (30 – 100)
- **Spray Quality:**
  - Medium to V. Coarse
- **Retail Cost:**
  - $4 - $6

TeeJet AIXR

- **Sizes:**
  - 015 to 06
- **Pressure:**
  - 15 – 90 psi (30 – 100)
- **Spray Quality:**
  - Coarse – Extr. Coarse
- **Retail Cost:**
  - $4 - $6

Wilger SR, MR

- **Sizes:**
  - 01 to 20
- **Pressure:**
  - 20 – 80 psi
- **Spray Quality:**
  - Medium to Extr. Coarse
- **Retail Cost:**
  - $15



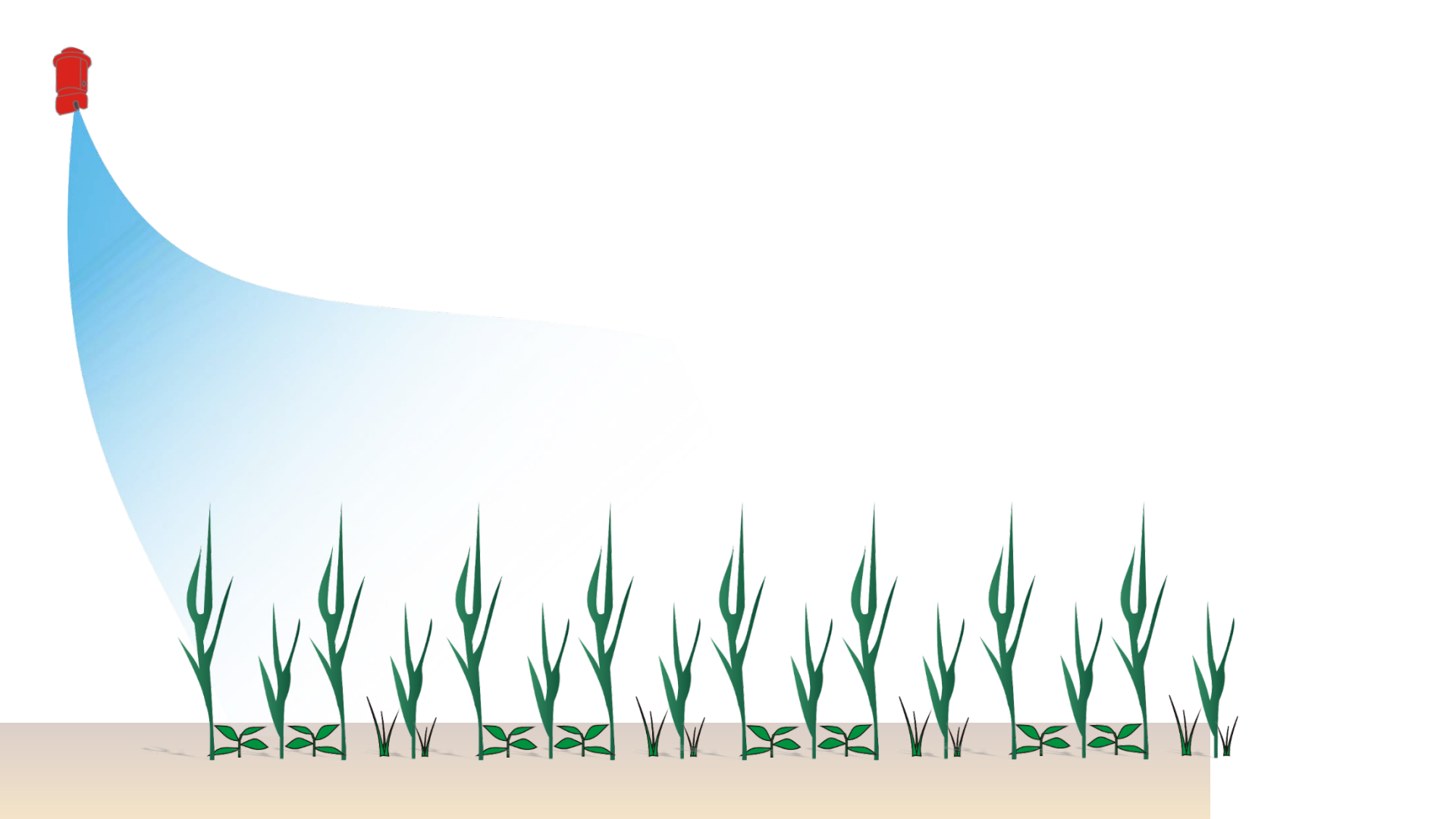
At tip:

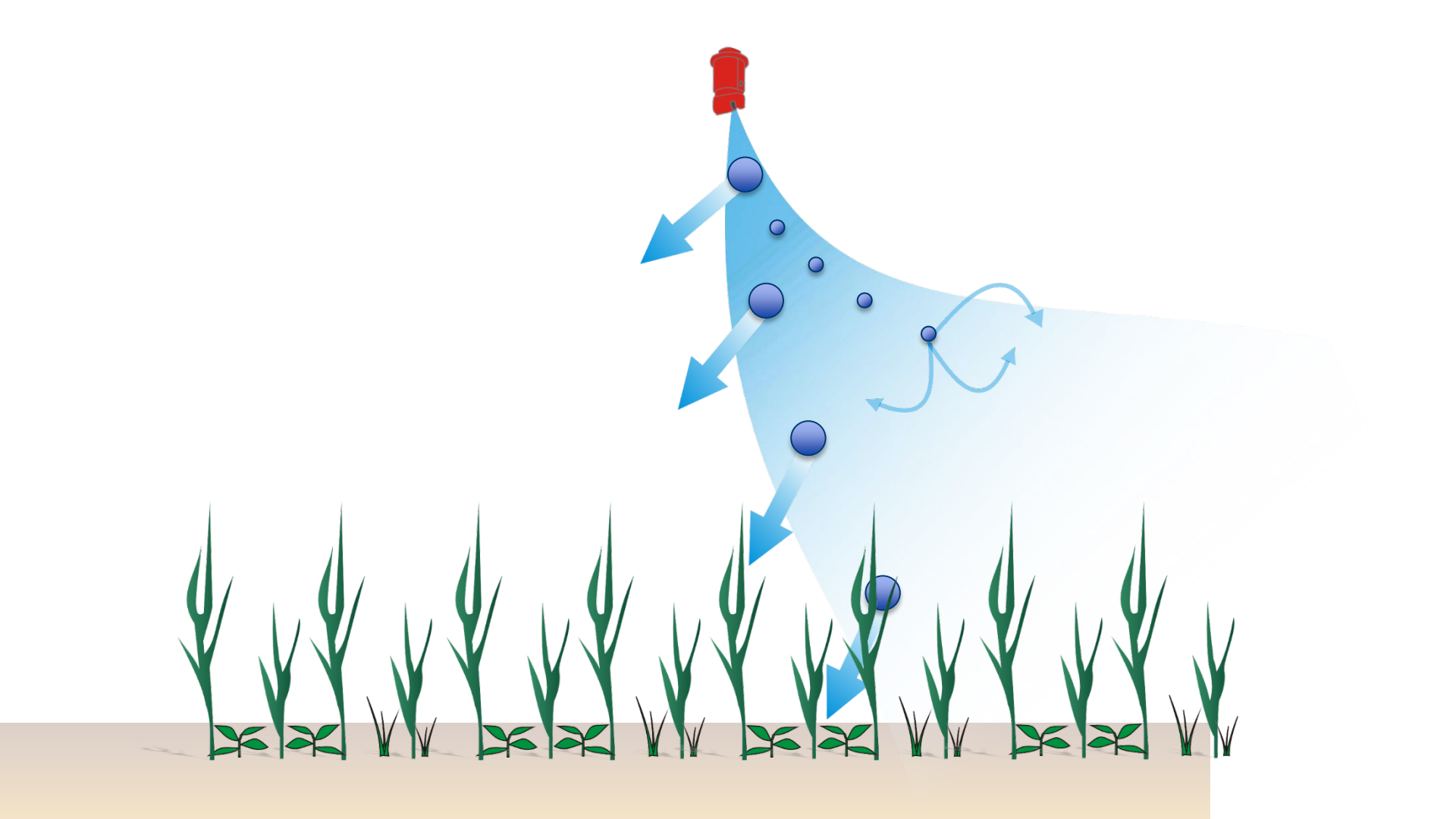
all droplets: 70 km/h

50 cm below tip:

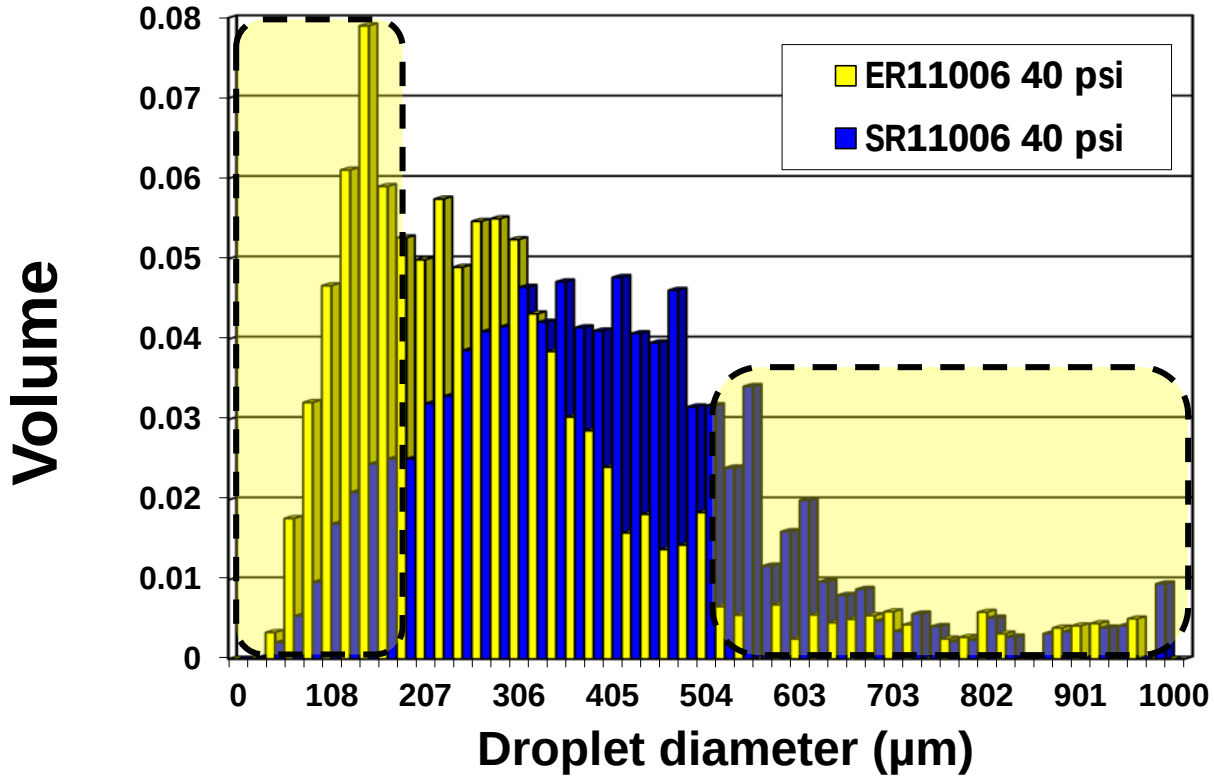
Large droplets: 28 km/h

Small droplets: 7 km/h

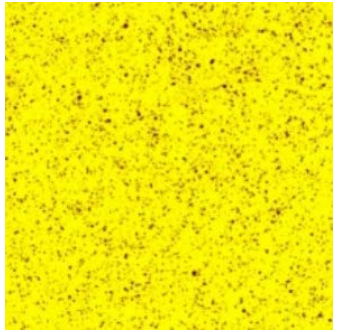


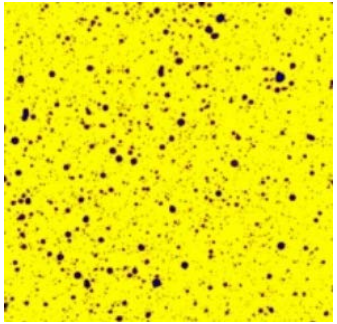


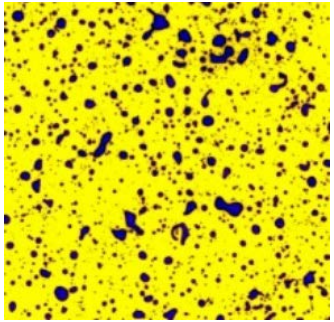
Droplet Size Distributions



Spray Quality







Drop Size	*~Fine*	*~Coarse*	*~X. Crse*
• <150 µm • >500 µm	• 51% • 2%	• 19% • 5%	• 3% • 52%

Identify Shared Values

(Make it Relevant)

R. Lussier, Agricore United

Namoi Valley Independent

Tuesday February 9, 2016

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Cotton spray drift causes damage into the millions

By Kate Ramien
Jan. 19, 2016, 2:16 p.m.

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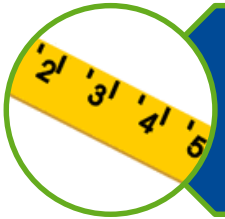
Cotton Australia chief executive officer Adam Kay.

Understand your Client

rb
2016

Teach Skills

Sizing Nozzles



Spacing

Volume

Speed

Nozzle Size	Pressure (psi)	Nozzle Flow (US gpm)	Travel Speed (columns, mph) at listed application volume (US gal/acre), 20" spacing											
			3	4	5	6	7	8	9	10	12	14	16	18
			US gpa											
015 Green	30	0.130	12.9	9.6	7.7	6.4	5.5	4.8	4.3	3.9	3.2	2.8	2.4	2.1
	40	0.150	14.9	11.1	8.9	7.4	6.4	5.6	5.0	4.5	3.7	3.2	2.8	2.5
	50	0.168	16.6	12.5	10.0	8.3	7.1	6.2	5.5	5.0	4.2	3.6	3.1	2.8
	60	0.184	18.2	13.6	10.9	9.1	7.8	6.8	6.1	5.5	4.5	3.9	3.4	3.0
	70	0.198	19.6	14.7	11.8	9.8	8.4	7.4	6.5	5.9	4.9	4.2	3.7	3.3
	80	0.212	21.0	15.8	12.6	10.5	9.0	7.9	7.0	6.3	5.3	4.5	3.9	3.5
	90	0.225	22.3	16.7	13.4	11.1	9.5	8.4	7.4	6.7	5.6	4.8	4.2	3.7
	100	0.237	23.5	17.6	14.1	11.7	10.1	8.8	7.8	7.0	5.9	5.0	4.4	3.9
02 Yellow	30	0.173	17.1	12.9	10.3	8.6	7.3	6.4	5.7	5.1	4.3	3.7	3.2	2.9
	40	0.200	19.8	14.9	11.9	9.9	8.5	7.4	6.6	5.9	5.0	4.2	3.7	3.3
	50	0.224	22.1	16.6	13.3	11.1	9.5	8.3	7.4	6.6	5.5	4.7	4.2	3.7
	60	0.245	24.2	18.2	14.5	12.1	10.4	9.1	8.1	7.3	6.1	5.2	4.5	4.0
	70	0.265	26.2	19.6	15.7	13.1	11.2	9.8	8.7	7.9	6.5	5.6	4.9	4.4
	80	0.283	28.0	21.0	16.8	14.0	12.0	10.5	9.3	8.4	7.0	6.0	5.3	4.7
	90	0.300	29.7	22.3	17.8	14.9	12.7	11.1	9.9	8.9	7.4	6.4	5.6	5.0
	100	0.316	31.3	23.5	18.8	15.7	13.4	11.7	10.4	9.4	7.8	6.7	5.9	5.2
025 Lilac	30	0.217	21.4	16.1	12.9	10.7	9.2	8.0	7.1	6.4	5.4	4.6	4.0	3.6
	40	0.250	24.8	18.6	14.9	12.4	10.6	9.3	8.3	7.4	6.2	5.3	4.6	4.1
	50	0.280	27.7	20.8	16.6	13.8	11.9	10.4	9.2	8.3	6.9	5.9	5.2	4.6
	60	0.306	30.3	22.7	18.2	15.2	13.0	11.4	10.1	9.1	7.6	6.5	5.7	5.1
	70	0.331	32.7	24.6	19.6	16.4	14.0	12.3	10.9	9.8	8.2	7.0	6.1	5.5
	80	0.354	35.0	26.3	21.0	17.5	15.0	13.1	11.7	10.5	8.8	7.5	6.6	5.8
	90	0.375	37.1	27.8	22.3	18.6	15.9	13.9	12.4	11.1	9.3	8.0	7.0	6.2
	100	0.395	39.1	29.3	23.5	19.6	16.8	14.7	13.0	11.7	9.8	8.4	7.3	6.5
03 Blue	30	0.260	25.7	19.3	15.4	12.9	11.0	9.6	8.6	7.7	6.4	5.5	4.8	4.3
	40	0.300	29.7	22.3	17.8	14.9	12.7	11.1	9.9	8.9	7.4	6.4	5.6	5.0
	50	0.335	33.2	24.9	19.9	16.6	14.2	12.5	11.1	10.0	8.3	7.1	6.2	5.5
	60	0.367	36.4	27.3	21.8	18.2	15.6	13.6	12.1	10.9	9.1	7.8	6.8	6.1
	70	0.397	39.3	29.5	23.6	19.6	16.8	14.7	13.1	11.8	9.8	8.4	7.4	6.5
	80	0.424	42.0	31.5	25.2	21.0	18.0	15.8	14.0	12.6	10.5	9.0	7.9	7.0
	90	0.450	44.6	33.4	26.7	22.3	19.1	16.7	14.9	13.4	11.1	9.5	8.4	7.4
	100	0.474	47.0	35.2	28.2	23.5	20.1	17.6	15.7	14.1	11.7	10.1	8.8	7.8

Nozzle Size	Pressure (psi)	Nozzle Flow (US gpm)	Travel Speed (columns, mph) at listed application volume (							
			3	4	5	6	7	8	9	10
			US gpa							
025 Lilac	30	0.217	21.4	16.1	12.9	10.7	9.2	8.0	7.1	6.4
	40	0.250	24.8	18.6	14.9	12.4	10.6	9.3	8.3	7.4
	50	0.280	27.7	20.8	16.6	13.8	11.9	10.4	9.2	8.3
	60	0.306	30.3	22.7	18.2	15.2	13.0	11.4	10.1	9.1
	70	0.331	32.7	24.6	19.6	16.4	14.0	12.3	10.9	9.8
	80	0.354	35.0	26.3	21.0	17.5	15.0	13.1	11.7	10.5
	90	0.375	37.1	27.8	22.3	18.6	15.9	13.9	12.4	11.1
	100	0.395	39.1	29.3	23.5	19.6	16.8	14.7	13.0	11.7
03 Blue	30	0.260	25.7	19.3	15.4	12.9	11.0	9.6	8.6	7.7
	40	0.300	29.7	22.3	17.8	14.9	12.7	11.1	9.9	8.9
	50	0.335	33.2	24.9	19.9	16.6	14.2	12.5	11.1	10.0
	60	0.367	36.4	27.3	21.8	18.2	15.6	13.6	12.1	10.9
	70	0.397	39.3	29.5	23.6	19.6	16.8	14.7	13.1	11.8
	80	0.424	42.0	31.5	25.2	21.0	18.0	15.8	14.0	12.6
	90	0.450	44.6	33.4	26.7	22.3	19.1	16.7	14.9	13.4
	100	0.474	47.0	35.2	28.2	23.5	20.1	17.6	15.7	14.1

Label says “Coarse”

Assume GA11003 to apply 10 gpa

What travel speeds are possible?

10 gpa, 110-03 Guardian AIR nozzle

PSI	MPH	Spray Quality
15	5.3	UC
20	6.2	UC
30	7.7	XC
40	8.9	VC
50	10.1	C
60	11.0	C
70	11.9	M
80	12.5	M
90	13.4	M
100	14.0	M
115	15.1	M

What's my Spray Quality, i
Tom
sprayers101.com/whats-my-spray-quality-in-3-simple-steps/
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What's my Spray Quality, in 3 Simple Steps

Nozzle_Guy Featured Article, Field Crop Sprayers, Field Sprayer Drift, Field Sprayer Nozzles, Field Sprayer Operation

The introduction of dicamba and 2,4-D tolerance traits in corn and soybeans will be accompanied by an unprecedented emphasis on spray drift management by the registrants. We've already seen promotion of low-drift nozzles at field days as well as websites dedicated to product stewardship. In addition, product label statements for 2,4-D choline and the new formulations of dicamba emphasize spray drift control to a greater degree than previous products.

In Canada, labels will make prominent reference to the appropriate "spray quality", a term referring to an internationally standardized droplet size classification (ASABE S572.1). In this standard, the droplet size spectrum produced by a nozzle is communicated using terms such as "Medium", "Coarse", "Very Coarse" etc., and used to describe the potential for spray coverage and spray drift. Spray qualities are colour coded for easy recognition.

Category	Symbol	Color Code
Extremely Fine	XF	Purple
Very Fine	VF	Red
Fine	F	Orange
Medium	M	Yellow
Coarse	C	Blue
Very Coarse	VC	Green
Extremely Coarse	XC	White
Ultra Coarse	UC	Black

An example of this label language is shown for Enlist Duo below:

*"**Droplet Size:** Apply as a **coarse to extremely coarse** spray (ASABE S572 Standard). Use drift reducing nozzle tips in accordance with manufacturer directions that produce a droplet classification of coarse to extremely coarse to significantly reduce the potential for drift."*

Although spray qualities are voluntarily measured and published by most nozzle manufacturers, their appearance on the label makes their use a legal requirement. This is because the Pest Management Regulatory Agency (PMRA) conducts a risk assessment which assumes, in this case, that a Coarse spray quality supports certain calculated buffer zones (15 m in this

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Other articles

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June 12, 2015

Pro Tips for Pre-Harvest and Desiccation Sprays
August 4, 2015

Do Labels Help us Apply Pesticides Properly?

Participate

Believe

Open Doors

Provide Solutions

Ron Krahn @RonKrahn 12 Jun

Spraying's version of a NASCAR pit. 5-7 minute fills. I like!
pic.twitter.com/b0Aunu3rcR

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Reply to @RonKrahn

Ron Krahn @RonKrahn 12 Jun

@nozzle_guy probably the most cost effective way to increase sprayer capacity is a good nurse truck set up

Expand Reply Retweet Favorite More

Tom Wolf @nozzle_guy 12 Jun

@RonKrahn Time saved at fill leaves more to do the spray job right! I like. #westcdnag

Hide conversation Reply Delete Favorite More

1:48 PM - 12 Jun 13 · Details

Reply to @RonKrahn

Ron Krahn @RonKrahn 12 Jun

@nozzle_guy probably the most cost effective way to increase sprayer capacity is a good nurse truck set up

Expand Reply Retweet Favorite More

M4
M3
M2
M1

Productivity Calculator | Sprayer Config

Units

US ✓

Metric

Sprayer Information

Tank Capacity: (US Gal)
800

Tank Remainder: (US Gal)
50

Boom Width: (ft)
90

Travel Speed: (mph)
14

Volume: (gpa)
10

Field Length: (mile)
0.5

Headlands:
2

Turn Speed: (mph)
8

Time To Load: (min)
15

Calculate!

Sprayer Config | Results

Calculations

Net Productivity:	**87 acres/h**
Driving Time Lost To Turns:	20 %
Spraying Time Lost To Loading:	29 %
Productivity Lost To Turns & Loading:	43 %

Calculation Details

Results | Results

Calculation Details

Gross Productivity:	153 acres/h
Productivity Counting Turns:	123 acres/h
Volume / h:	1,528 gph
Flow Rate:	25 US gpm
Spray & Turn Proportion:	0.80
Spray: Load Proportion:	0.71
Swath length:	695 m
Turn distance:	98 m
Time to empty:	29 min
Net time to empty:	37 min
Time for pass:	111 s
Time for turn:	27 s
Speed:	22,540 m/h

3
HIGH
DANGER
CAUTION

Be an Expert

MEASUREMENT AND CLASSIFICATION METHODS USING THE ASAE S572.1 REFERENCE NOZZLES

Bradley Keith Fritz[1], Wesley Clint Hoffmann[1], Zbigniew Czaczyk[1], William Bagley[2], Greg Kruger[3], Ryan Henry[3]*

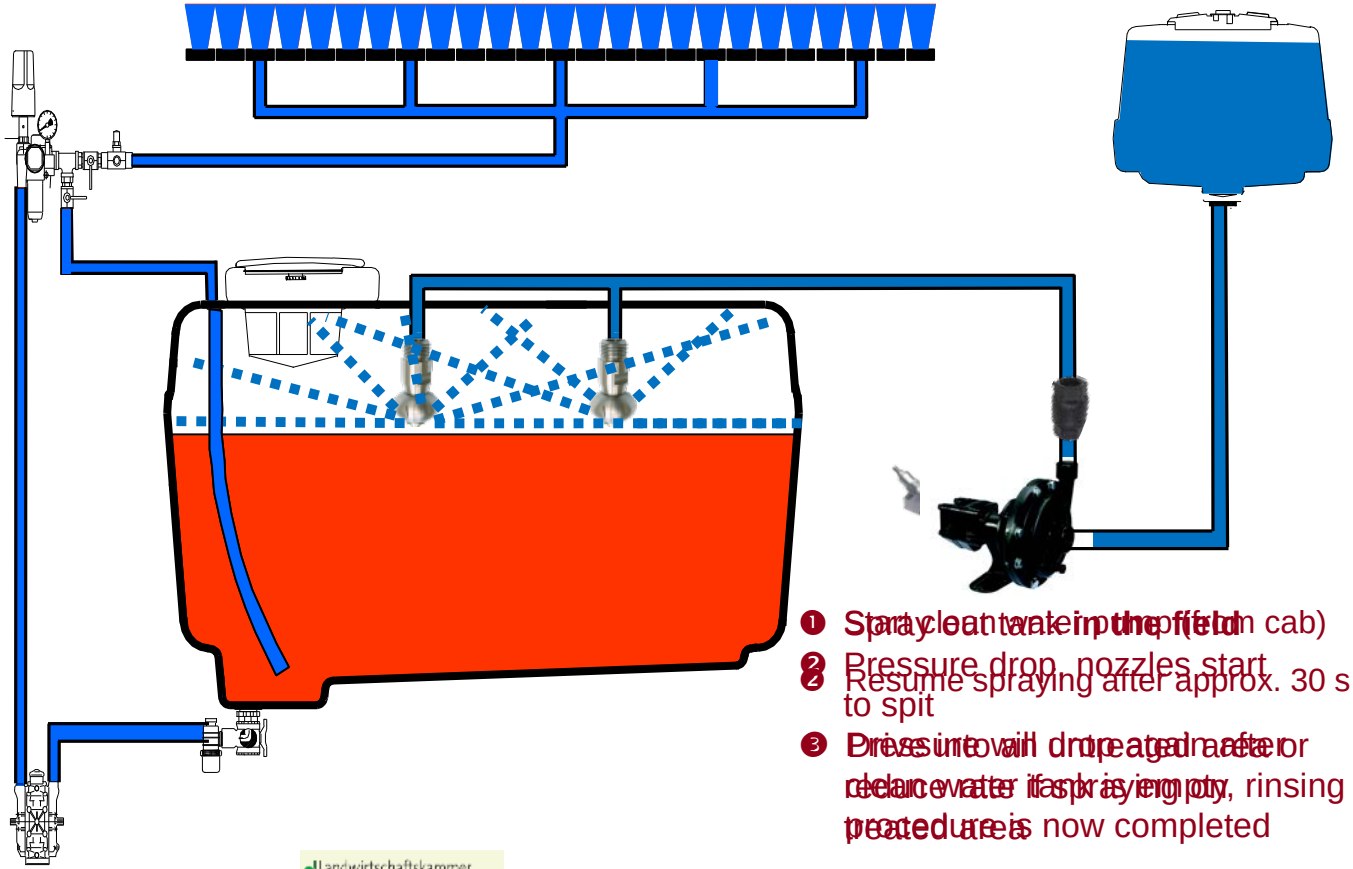
[1] United States Department of Agriculture Agricultural Research Service, 2771 F&B Road, College Station, Texas 77845, USA
[2] Wilbur-Ellis, 4396 East Evans Road, San Antonio, Texas 75289, USA
[3] University of Nebraska, 402 West State Farm Road, North Platte, Nebraska 69101, USA

Received: July 31, 2012
Accepted: September 17, 2012

Abstract: An increasing number of spray nozzle and agrochemical manufacturers are incorporating droplet size measurements into both research and development. Each laboratory invariably has their own sampling setup and procedures. This is particularly true about measurement distance from the nozzle and concurrent airflow velocities. Both have been shown to significantly impact results

Pulse Width Modulation

Continuous internal sprayer rinsing



1. Spray clean water in the field (from cab)
2. Pressure drop, nozzles start to spit
3. Pressure will drop and nozzles will no longer spray, rinsing procedure is now completed

Spray out tank in the field
Resume spraying after approx. 30 s
Drive into untreated area or clean water tank is empty
treated area

Modified according to Harald Kramer

Landwirtschaftskammer Nordrhein-Westfalen

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