Using the Information in the Guide (EC130) on Pesticide Application

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Nebraska Crop Management Conference

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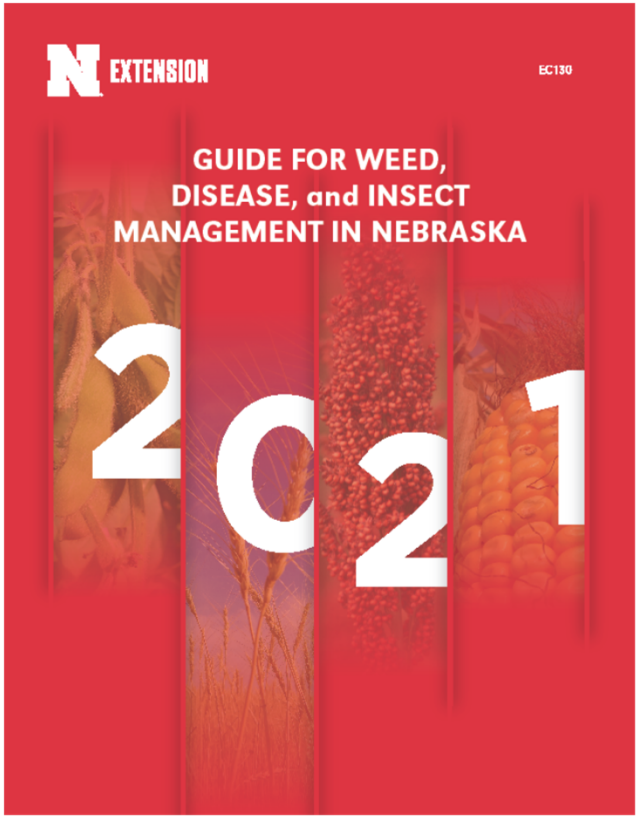


Reducing Drift Page 39

It is estimated that two-thirds of pesticide drift problems involve mistakes which could have been avoided. Drift is of concern because it takes the pesticide from the intended target, making it less effective, and deposits it where it is neither needed nor wanted. The pesticide then becomes an environmental pollutant in the off-target areas where it can injure susceptible vegetation, contaminate water, or damage wildlife. Drift cannot be eliminated but the use of proper equipment and application procedures will maintain the drift deposits within acceptable limits.

There are two kinds of drift:
Particle drift is off-target movement of the spray particles.

Vapor drift is the volatilization of the pesticide molecules and their movement off target.
A Mississippi State University study analyzed data from more than 100 studies involving drift from ground sprayers. Of the 16 variables considered, three were most important.

1. Wind speed. When the wind speed was doubled, there was almost a 700 percent increase in drift when the readings were taken 90 feet downwind from the sprayer. Hence the recommendation of spraying in 10 mph winds or less.

2. Boom height. When the boom height was increased from 18 to 36 inches, the amount of drift increased 350 percent at 90 feet downwind.

3. Distance downwind. If the distance downwind is doubled, the amount of drift decreases five-fold. Therefore, if the distance downwind goes from 100 to 200 feet, you have only 20 percent as much drift at 200 feet as at 100 feet and if the distance goes to 400 feet, you only have 4 percent of the drift you had at 100 feet. Check wind direction and speed when starting to spray a field. You may want to start spraying one side of the field when the wind is lower. Also, it may be necessary to only spray part of a field because of wind speed, wind direction, and distance to susceptible vegetation. The rest of the field can be sprayed when conditions change.

Pesticide drift also can be reduced by using one of the new types of tips and by adjusting spray pressure. Higher spray pressures produce smaller droplets which are more susceptible to drift. If using a rate controller, be careful of increased speed. Since most rate controllers increase the pressure to maintain the same gpa when the speed increases, try to maintain the speed within +10 percent. For example, if you're applying 20 gpa at 8 mph at 40 psi and you increase the speed to 11 mph, the pressure will now be 75.5 psi which will produce a lot of small particles prone to drift. Also, this pressure will be above the operating range of most tips. Drift reduction agents may be helpful.

New spraying technology such as the "blended pulse" can decrease the risk of drift by allowing flow rate to be controlled independently of spray pressure.

Wind Speed

When the wind speed doubles, there is almost a 700% increase in drift when readings are taken from 90 feet downwind from the sprayer. Hence the recommendation of spraying in 10 mph winds or less.

700% Increase → 90 ft.

Nozzle Selection Page 40-41

For maximum effectiveness of pesticides, they must be applied uniformly and at the correct rate. Six factors can affect application efficiency and success:

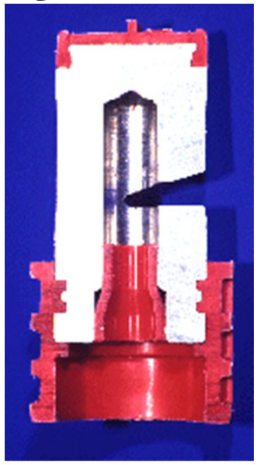
1. Sprayer design
2. Nozzle type
3. Boom height
4. Boom pressure
5. Agitation
6. Ground speed

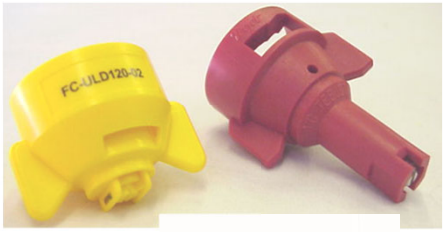
Pesticides applied uniformly at the proper rate will give maximum benefit while those applied incorrectly can result in wasted chemical, marginal weed, insect or disease control, excessive carryover, groundwater contamination, pesticide residues in plants and/or crop damage. New developments in application technology can help assure the proper application of pesticides. Along with these new developments, there has been a trend toward decreasing spray volumes. This is because some herbicides perform better with reduced spray volumes (especially with low in quality water). Many new row crop sprayers have limited tank capacity, and water is expensive to haul. In many areas of the state, it may be a great distance from the water source to the field and filling the sprayer takes time. Decreased spray volumes also may allow the use of less expensive, smaller sprayers. Larger sprayers increase soil compaction, especially if the soil is wet. More additives such as non-ionic surfactant and water conditioners may be needed with more carrier volume.

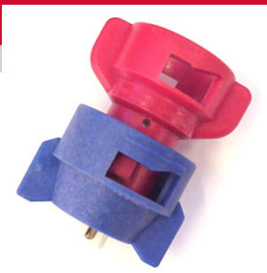
The nozzle is a major factor determining the amount of spray applied to an area, the uniformity of application, the coverage obtained on the target surface, and the potential amount of drift. Nozzles break the spray mix into droplets, form the spray pattern, and propel the droplets in the proper direction. Nozzles determine the amount of spray volume delivered at a given operating pressure, travel speed, and spacing. Drift can be minimized by selecting nozzles that produce the largest droplet size while providing adequate coverage at the intended application rate and pressure. Do not mix nozzles of different materials, types, spray angles, or spray volumes on the same spray boom. A mixture of nozzles produces uneven spray distribution

Nozzle Technology……

- **Nozzles designed to reduce drift**
- **Improved drop size control**
- **Emphasis on ‘Spray Quality’**







Spray Nozzles for Pulse Width Modulation (PWM) Systems Page 56-60

The PWM system has a set pulse frequency. Duty cycle (DC) is the amount of time a digital signal is *on* over a period of time, often given as a percentage. For example, a 70% DC means that every tenth of a second the nozzle is spraying for 70% of the tenth of a second. The sprayer can keep pressure constant over changes in speed or rate, because it modulates the duty cycle to spray the full volume as required by the application. In other words, operating a sprayer at 70% duty cycle means that the digital signal is on 70% of the time period; a nozzle will apply 70% of the amount the nozzle would apply with the same solution and pressure. Some nozzle spacings will better fit the desired volume median diameter (VMD), pressure, and speed parameters. A nozzle may not be available for the desired VMD, pressure, and speed parameters at a 30-inch spacing. Consider using 15-inch nozzle spacing instead.

Aim Command –
Automatic Droplet Control System

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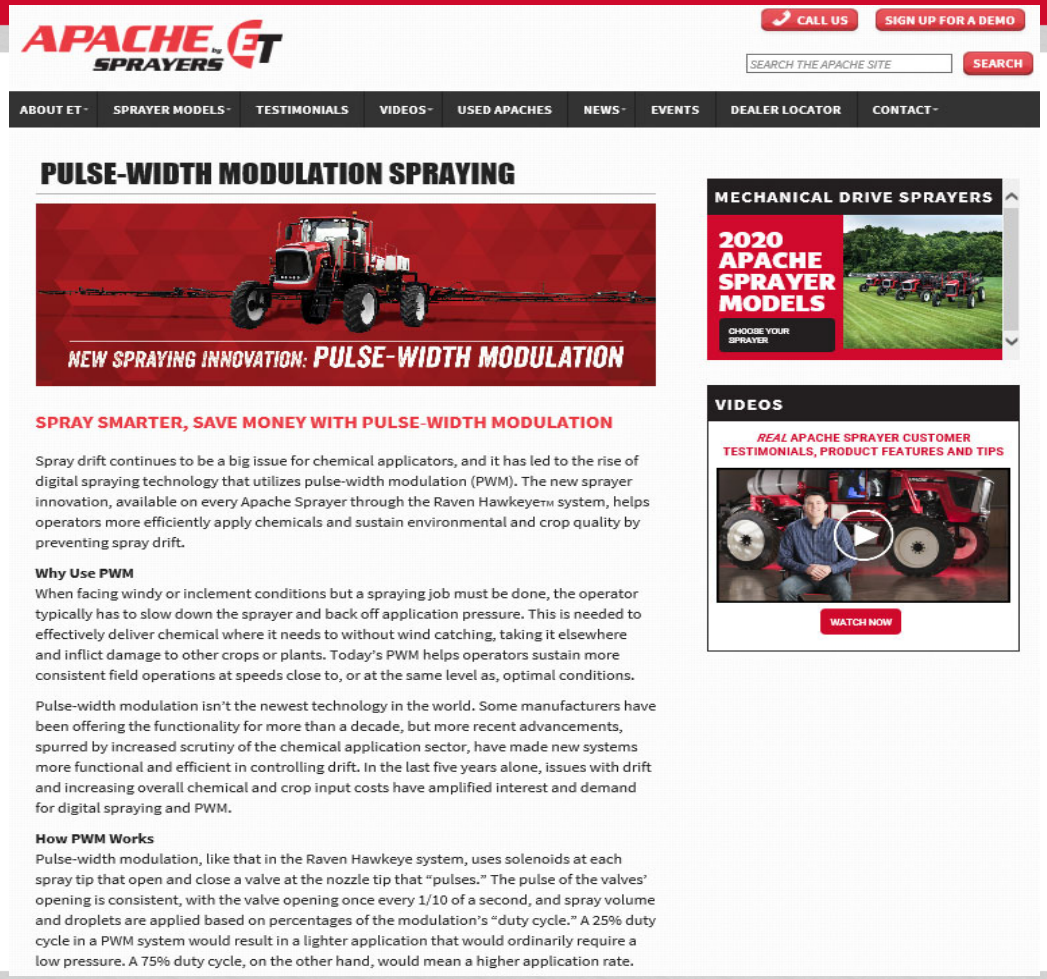

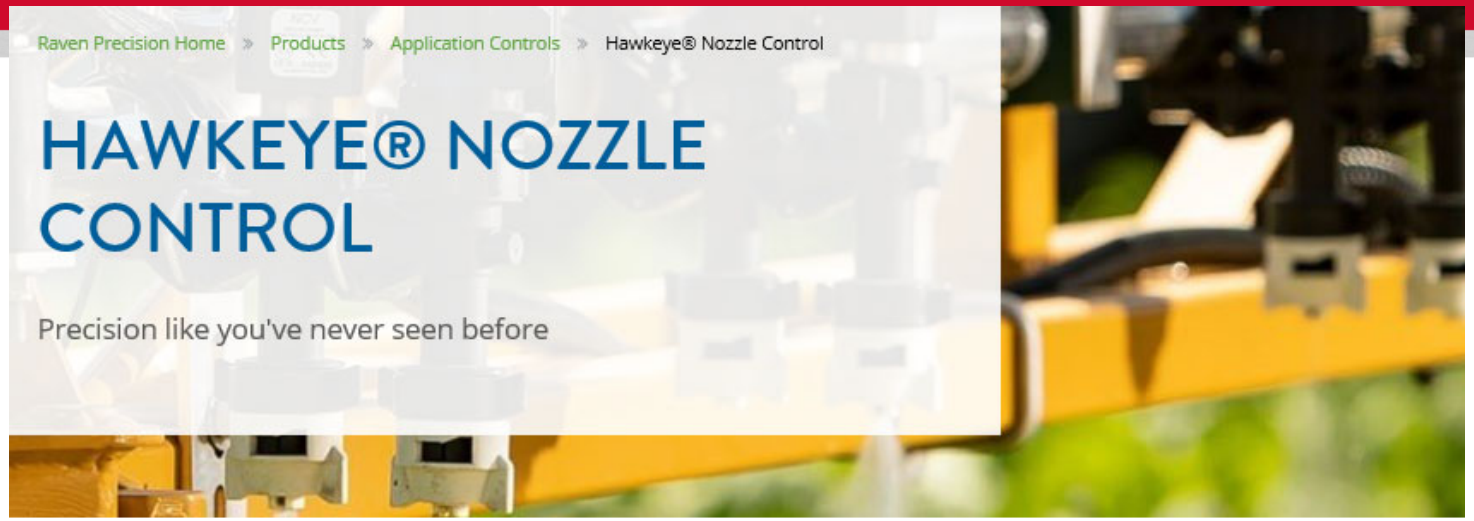

For over thirty years, Raven has dominated the application control market. Our blockbuster new product ensures this legacy will continue. The Hawkeye Nozzle Control System is the newest innovation in Raven technology – and the next application control system for your sprayer.

The Hawkeye Nozzle Control System is ultra-precise. This pressure based product control system allows for precise sprayer application in a variety of conditions, reducing spray drift and getting the most out of every nozzle. Each nozzle is controlled by its own individual pulsing valve giving you a consistent spray pattern as speed and conditions change.

The Hawkeye System is built on the ISOBUS communication platform which allows it to work with ISO Task Controllers, including the Viper® 4+. Hawkeye has also been tested for shock, vibration, impact, and weather resistance in rugged terrain and extreme temperatures. Its durability is unparalleled.

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MACHINEFINDER BLOG

FIND A MACHINE

4 PRIMARY BENEFITS OF SPRAYING WITH JOHN DEERE EXACTAPPLY

82

APRIL 5, 2017

Each year during the crop growing season, producers hit the fields with several goals in mind. One goal that typically lives near the top of producers' lists is improving spray resolution accuracy.

As the summer of 2016 came to a close, John Deere ExactApply was introduced in an effort to meet these demands and improve overall application efforts. The new system will be available on new 2018 model John Deere 4-Series sprayers.

Doug Felter, product marketing manager, crop protection and nutrient solutions, said at the time of the release, "The new ExactApply system was developed for producers and ag service providers who seek a higher level of control of product applications, especially improved application efficacy and accuracy in all field shapes and sizes."

Let's take a closer look at some of the benefits John Deere ExactApply offers users.

Individual Nozzle Control

With ExactApply, operators will have the opportunity to reduce sprayer drift. With individual nozzle control, vary rates can be controlled across the entire length of the boom so skips and overlaps can be minimized. This is an especially helpful tool when spraying crops near restricted border areas, sensitive crops, or waterways.

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New DynaJet® Flex 7140 Nozzle Control System Improves Spray Productivity by Maintaining A Constant Application Rate Over a Wide Range of Ground Speeds

Spraying crop protection products has traditionally been a compromise, requiring the operator to carefully balance ground speed and operating pressure. The DynaJet system controls the pressure and droplet size across a wide range of speeds allowing the operator to choose the optimum speed that conditions allow while maintaining a consistent droplet size. The compact touchscreen allows operators to easy select droplet size.

Herbicide and Fertilizer Compatibility Page 68

Most herbicide labels indicate specific fertilizer incompatibilities and restrictions. Be sure to read the herbicide label for specific mixing or impregnation instructions. Herbicide and fertilizer combinations can increase or decrease herbicide efficacy and increase crop response. Crop response can usually be decreased by adding water to the spray solution. Compatibility agents are required for many mixes. See *Tank-Mix Compatibility* for a method to test the compatibility of specific herbicide-fertilizer combinations.

Herbicide Compatibility with Fertilizers as Application Carriers

Herbicide	Fertilizer	
	Fluid	Dry
Burndown Herbicides		
2,4-D Amine	No	No
2,4-D Ester	Yes	No
Aim	Yes	No
Gramoxone SL	Yes	No
Harmony Extra	Yes	No
Roundup	No	No
Touchdown	No	No

Herbicide	Fertilizer	
	Fluid	Dry
Small Grain Postemergence Herbicides		
2,4-D Amine	No	No
2,4-D Ester	Yes	No
Achieve	No	No
Aim	Yes	No
Banvel	Yes	No
Buctril	Yes	No
Bronate	Yes	No
Harmony Extra	Yes	No
Hoelon	Yes	No
Peak	Yes	No
Sencor	Yes	No

Cleaning the Sprayer Pages 76-85

Herbicide residues in the sprayer can be dissolved by herbicides, solvents and/or adjuvants added to the tank later.

Pesticides may settle to the bottom of the tank if agitation is not adequate. The pesticides also may settle out in the tank, hoses, boom, etc. if the sprayer is shut down. Always end the workday, if possible, with an empty tank. A tank for fresh water mounted on the sprayer will provide water to flush the system in the field and the rinsate can be sprayed on the field of the product's labeled use.

Always keep the sprayer's inside and outside clean. Sprayers with stainless steel booms, which reduce the number of hoses and fittings on the sprayer, are easier to keep clean and have less area for pesticide to build up in the spray booms. Screens and strainers need to be cleaned or replaced. Sumps and pumps along with the inside of the sprayer tank, especially the top and around baffles and plumbing, should be checked.

Select a location to clean the sprayer where any spilled rinsate will not contaminate water supplies, streams, crops or other plants and where puddles will not be accessible to children, pets, livestock, or wildlife.

Preferably the area should be impervious to water and have a wash rack or cementapron with a sump to catch contaminated wash water and pesticides. If such a facility is not available, catch or contain the rinsate and spray the rinse water or the cleaning solution on a field in a manner consistent with the intended use of the agrichemical. Avoid discharging all the cleaning solution in a small area.

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Soybean Yield Loss from Ground Sprayer Wheel Tracks Page 86

University of Wisconsin-Madison and Iowa State University conducted research on wheel track damage from ground sprayers. Findings were that soybean plots with stands of more than 100,000 plants per acre and planted late April through Mid-May did not suffer any yield loss when sprayed with a self-propelled sprayer with narrow tires at the R1 growth stage (at least one flower on any node). Lower populations and later plantings may suffer yield loss during this period if sprayed. On average, it takes about 4 days to move from R1 to R2 (full flower).

After R1 through harvest, damage due to sprayer wheel tracks can reduce yields. Yield losses always occurred with 15-inch and narrower rows. With 30-inch rows, yield loss occurred in half of the research trials.

The following chart shows research and estimates for soybean yield loss using a self-propelled sprayer with narrow tires and sprayed after R1. Plant populations were at least 100,000 per acre and were planted late April to mid-May.

Sprayer Boom Width	% Yield Loss
60 ft	2.5 x 80 bu/ac = 2 bu
80 ft	2.1
90 ft	1.9
100 ft	1.7
120 ft	1.3

Application Equipment and Practices Page 1

Nozzle Selection for Droplet Size

Pages 44-50

- Many pesticide labels now list recommended or required spray droplet size(s) for application. Follow label guides to increase pesticide efficacy and help manage spray drift. Droplet size classes are based on BCPC specifications and in accordance with ASABE standard S572.1.

University of Nebraska EC130 2021 Guide for Weed, Disease, and Insect Management in Nebraska, pages 44-47

- Herbicides that list the recommended or required Spray Droplet Size and carrier rate on the label. Always check the label before application.

Herbicides	Drop Size Classification	Ground Application GPA
2,4-D amine	C	8 to 20+
2,4-D ester #4	C	10+
2,4-D ester #6	C	10+
AAtrex 4L	C	Minimum 10
AAtrex Nine-O	C	Minimum 10
Accent Q	M – C	Minimum 15
Acuron	M to C	Pre-Emergence 10-80 & Post-Emergence 10-30
Acuron Flexi	M to UC	Minimum 10
Affinity BroadSpec	Largest Droplet Size*	Minimum 5 to 20
Afforia	No Mention	Minimum 10
Aggressor	M, C, or larger	Min. 10, 15 for arid areas
Agility SG	Largest Droplet Size*	Minimum 5 to 20
Aim EC	Min Amt of Fine Spray Droplets*	Minimum 10
Ally Extra SGW/ TOTSOL	Largest Droplet Size*	Minimum 5 to 20

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University of Nebraska EC130
2021 Guide for Weed, Disease, and Insect Management in Nebraska, page 51

For Medium (M) Spray Quality 10 GPA				
	Nozzle Spacing			
Speed mph	Rate gpm	20-inch	Rate gpm	30-inch
6	0.202	TT11002@41psi	0.303	TT11003@41psi*
7	0.236	TT110025@36psi**	0.354	XRC11004-VK@31 or TT11003@56psi
8	0.269	TT110025@46psi	0.404	XRC11005-VK@26psi or TT11004@41psi*
10	0.337	XRC11004-VK@28psi or TT11003@50psi**	0.505	XRC11006-VK@28psi
12	0.404	XRC11005-VK@26psi	0.606	XRC11006-VK@41psi
14	0.471	XRC11006-VK@25psi	0.707	XRC11008-VK@31psi*

***Just into the next larger spray drop size with water – many pesticides and additives reduce the spray drop size**

****Just into spray drop size**

TT110025

TeeJet Technologies

XRC11004-VK

TeeJet Technologies

Sprayer Speeds

- I have limited the top Sprayer Speed in charts to 14 MPH
- At 2014 Crop Production Clinics, Bill Gordon (Emerging Issues for Australian Spraying) discussed Auto Height and said control may be limited in its effectiveness when traveling at speeds above 14-15 MPH

Problems

- The following problems will ask you the appropriate spray droplet sizes and ground application rates in gallons per acre. In the 2021 *Guide (EC130)*, use the charts that start on page 44.

- Then, you will be asked to select the appropriate nozzle. In the *2021 Guide (EC130)*, use the charts that start on page 51.

Problem 1:

- You will treat field corn with the herbicide Callisto XTRA. Using the chart on page 44 of the 2021 Guide (EC130),

– What spray droplet size should you use?
– What ground application rate in gallons per acre?

Herbicides	Drop Size Classification	Ground Application GPA
Broadaxe XC	Minimal Amts of Fine Spray	Minimum 10 Page 44
Brox2EC	L	Minimum 10
Butyrac 200	C-but nozzle types that will provide adequate coverage	Minimum 10
Cadet	M-C	Min 15; up to 40 for dense canopy or weeds
Callisto 4SC	M to C	PRE: 10 to 60 & POST: 10 to 30
Callisto GT	M-C	Minimum 10
Callisto XTRA	***M to C***	***10 to 30***
Callisto XTRA Enhanced	M-C	Minimum 10
Canopy Blend	M	Minimum 10
Canopy DF	C to VC	Minimum 10
Canopy EX	M,C	Minimum 20
Caparol	L	Minimum 10

Problem 1:

- You will treat field corn with the herbicide Callisto XTRA. Using the chart on page 44 of the 2021 Guide (EC130),
  - What spray droplet size? Medium to Coarse is listed
  - Use coarse to reduce drift
  - What ground application rate (GPA)? 10 to 30 GPA is listed
  - Use 20 GPA since we are using the larger particle size

Problem 1:

- You have a sprayer with
  - 15-inch nozzle spacing
  - Calibrated delivery rate of 20 GPA at 12 mph

- Using the chart on page 53 of the *2021 Guide (EC130)*, what nozzle would be a good choice?

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XRC11005-VK

TT11003

Page 53

For Medium (M) Spray Quality 20 GPA				
Nozzle Spacing				
Speed mph	Rate gpm	20-inch	Rate gpm	15-inch
6	0.404	XRC11005-VK@26psi	0.303	TT11003@41psi*
7	0.471	XRC11006-VK@25psi	0.354	XRC11004-VK@31psi or TT11003@56psi
8	0.539	XRC11006-VK@32psi	0.404	XRC11005-VK@26psi
10	0.673	XRC11008-VK@28psi*	0.505	XRC11006-VK@28psi*
12	0.808	XRC11008-VK@41psi	0.606	XRC11006-VK@41psi
14	0.943	XRC11008-VK@56psi	0.707	XRC11008-VK@31psi*

**Just into the next larger spray drop size with water – many pesticides and additives reduce the spray drop size

For Coarse (C) Spray Quality 20 GPA				
Nozzle Spacing				
Speed mph	**Rate gpm**	**20-inch**	**Rate gpm**	**15-inch**
6	0.404	TT11004@41psi**	0.303	AIXR110025@59psi
7	0.471	TT11005@36psi*	0.354	TT11004@31psi or AIXR11003@56psi
8	0.539	TT11005@46psi	0.404	TT11004@41psi**
10	0.673	XRC11010-VP@18psi* or TT11006@50psi**	0.505	TT11005@41psi

TT11004

XRC11010-VP

Speed mph	Rate gpm	15-inch
12	0.606	XRC11008-VK@23PSI or TT11006@41PSI*

Just into the next larger spray drop size with water – many pesticides and additives reduce the spray drop size
**Just into spray drop size

Problem 1:

- You have a sprayer with
  - 15-inch nozzle spacing
  - Calibrated delivery rate of 20 GPA at 12 mph

- Using the chart on page 53 of the *2021 Guide (EC130)*, what nozzle would be a good choice?

XRC11008-VK @ 23 psi or TT11006@ 41 psi*

**Just into spray drop size with water - many pesticides and additives reduce the spray drop size*

Problem 1:

- What speed do you use with your spray equipment?
  _____mph

- What is the nozzle spacing for your sprayer?
  _____inches

- Circle the nozzle for the speed and nozzle spacing that you could use with your sprayer in this situation

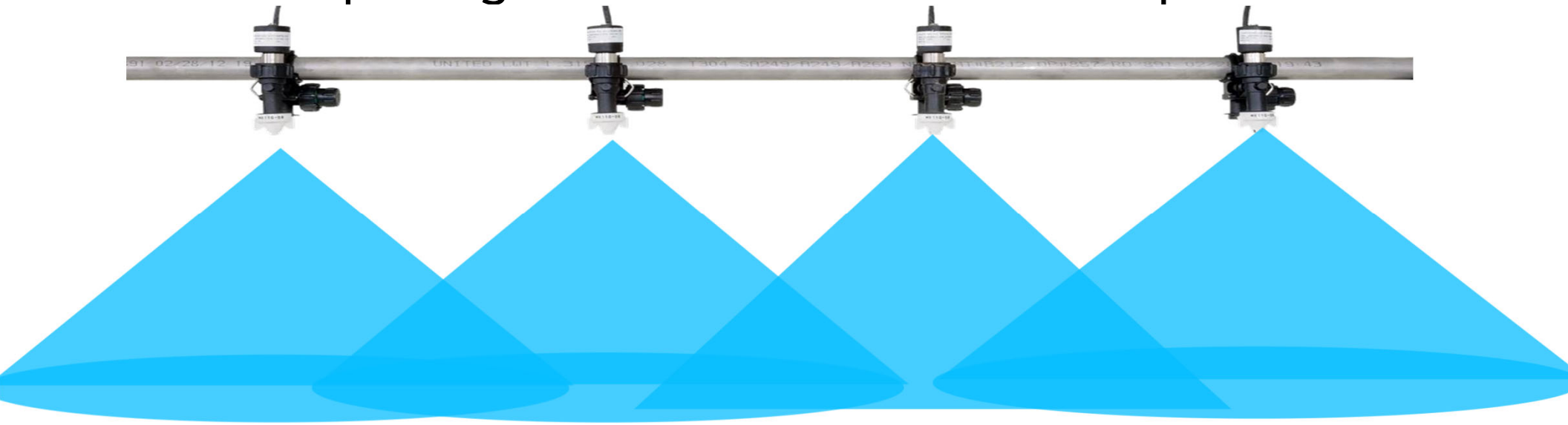
Pulse-Width Modulation (PWM)

- Variable rate control of flow by pulsing an electronically-actuated solenoid valve(1)
- Flow is changed by controlling the relative proportion of time each solenoid valve is open (duty cycle)

- Advantages:
  - Quick, real-time flow rate changes
  - Individual nozzle control
  - No pressure-based changes needed(2)

(1) Giles and Comino, 1989. J. of Commercial Vehicles, SAE Trans. 98:237-249
(2) (2) Giles, 1997. Atomization Spray. 7:161-181

With all this pulsing wouldn't the BPW leave skips in the field?



Through Alternating (Blended) Pulse We Maintain 100% Overlap

Courtesy of Brian Finstrom, Capstan Ag Systems, Inc.

For Medium Spray Quality (VMD approximately 236 to 340µ) at 20 GPA. If a dual-nozzle spray option is available, 20 GPA is a reasonable option, while still maintaining a droplet size at about 330µ.

Speed (mph)	VMD	Nozzle Spacing	Pressure (PSI)	DC (%)	Maximum Speed	Speed (mph) at 40% DC	Nozzle
6	320µ	20-inch	45	79%	7.6 mph	3.0	Combo-Jet®SR110-05
6	334µ	15-inch	40	63%	9.5 mph	3.8	Combo-Jet®SR110-05
6	332µ	30-inch	45	68%	8.8 mph	3.5	Combo-Jet®ER110-10
8	332µ	20-inch	45	61%	13.2 mph	5.3	Combo-Jet®ER110-10
8	320µ	15-inch	45	79%	10.1 mph	4.0	Combo-Jet®SR110-05
8	332µ	30-inch	45	68%	8.0 mph	3.5	Combo-Jet®ER110-10
10	332µ	20-inch	45	76%	13.2 mph	5.3	Combo-Jet®ER110-10
10	343µ	15-inch	40	60%	16.6 mph	6.6	Combo-Jet®ER110-010
10	µ	30-inch					Use 15-inch
12	332µ	20-inch	45	91%	13.2 mph	5.3	Combo-Jet®ER110-10
12	332µ	15-inch	45	68%	17.6 mph	7.0	Combo-Jet®ER110-10
12	µ	30-inch					Use 15-inch
14	313µ	20-inch	55	96%	14.6 mph	5.8	Combo-Jet®ER110-10
14	332µ	15-inch	45	80%	17.6 mph	7.0	Combo-Jet®ER110-10
14	µ	30-inch					Use 15-inch

Combo-Jet SR110-05

Combo-Jet ER110-10

Using a sprayer with a rate control at 10 mph at 20 GPA on 15-inch nozzle spacing we use a XRC11006-VK Nozzle@28PSI to obtain the medium droplet size. The slowest we can go with that nozzle is 7.3 mph and maintain 15 psi that results in a coarse droplet size. If we increase the speed to 14 mph the pressure increase to 55 PSI which gives us a fine-medium droplet size.

For Medium (M) Spray Quality 20 GPA				
		Nozzle Spacing		
Speed mph	Rate gpm	20-inch	Rate gpm	15-inch
6	0.404	XRC11005-VK@26psi	0.303	TT11003@41psi*
7	0.471	XRC11006-VK@25psi	0.354	XRC11004-VK@31psi or TT11003@56psi
8	0.539	XRC11006-VK@32psi	0.404	XRC11005-VK@26psi
10	0.673	XRC11008-VK@28psi*	0.505	XRC11006-VK@28psi*
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14	0.943	XRC11008-VK@56psi	0.707	XRC11008-VK@31psi*

Just into the next larger spray drop size with water – many pesticides and additives reduce the spray drop size.

**236 – 340 Microns

With PWM 6.6 to 16.6 MPH @ 40 PSI

7.3 MPH	15.0 PSI	Coarse = 341-403 Microns
14.0 MPH	55.0 PSI	Fine-Medium = about 235 Microns

WESTERN BEAN CUTWORM

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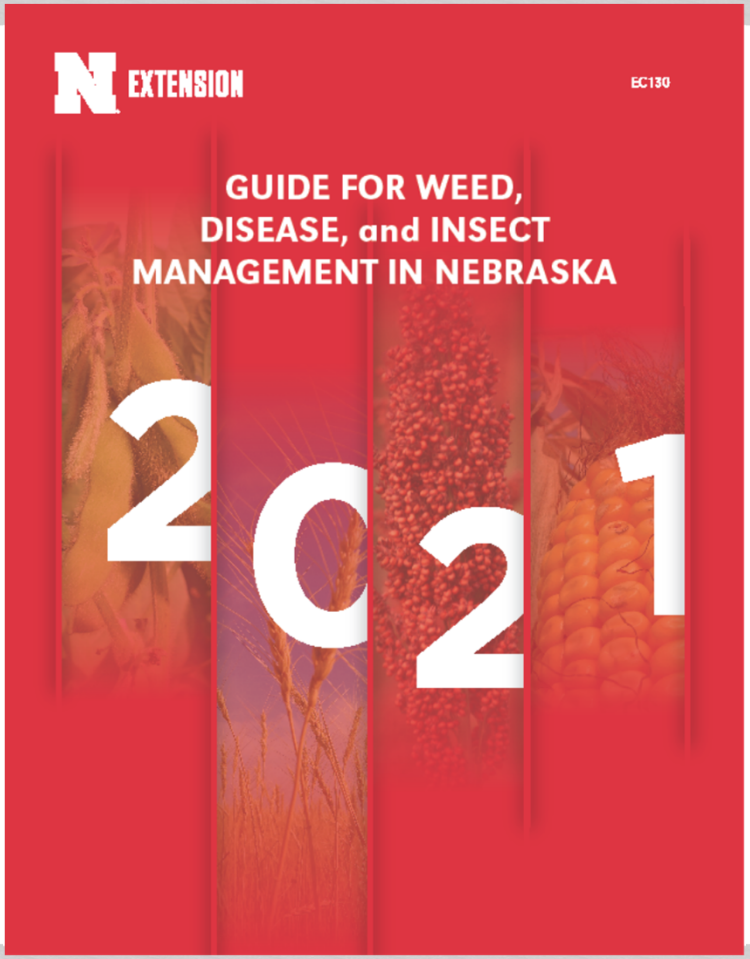

Field Corn

Seed, Soil, and Foliar Insecticides Page 328

Insecticide Active Ingredient	Mode of Action	Target Pest	Rate	Comments*
Ambush 2EC Permethrin	3A	1. Western bean cutworm 2. Armyworm, fall armyworm, cutworm, European corn borer, flea beetle, corn earworm, corn rootworm beetle, stalk borer	1. 3.2-6.4 fl oz/A 2. 6.4-12.8 fl oz/A	REI is 12 hours. Do not apply within 30 days of harvest of grain or fodder.
Arctic EC Permethrin	3A	1. Western bean cutworm 2. Armyworm, fall armyworm, European corn borer, corn earworm, corn rootworm beetle, cutworm, flea beetle, stalk borers	1. 2.0-4.0 fl oz/A 2. 4.0-6.0 fl oz/A	REI is 12 hours. Do not apply within 30 days of harvest of grain or fodder.
Asana XL Esfenvalerate	3A	1. Western bean cutworm 2. Armyworm, black cutworm, chinch bug, corn leaf aphid, corn rootworm (adult control), cutworm, flea beetle, grasshopper, stalk borer 3. European corn borer	1. 2.9-5.8 fl oz/A 2. 5.8-9.6 fl oz/A 3. 7.8-9.6 fl oz/A	PHI is 21 days. Do not apply more than 0.25 lb ai per acre per season. Do not enter or allow worker entry into treated areas during the REI of 12 hours.
Avicta Complete Corn Thiamethoxam	4A	Wireworm, white grub, seed corn beetle, chinch bug, southern corn leaf beetle, seed corn maggot, corn flea beetle, grape colaspis	0.5 mg ai/kernel	
Aztec HC Tebupirimiphos + Cyfluthrin	1B, 3A	Corn rootworm larvae, cutworm, wireworm, seedcorn maggot, seedcorn beetle, white grub	1.5 ounces/1000 row-ft	REI is 48 hours (72 hours where average rainfall is less than 25 inches per year). T-band or in-furrow application. Apply with SmartBox system.

Foliar-Applied Page 327

	Armyworm	Chinch Bug	Common Stalk Borer	Corn Flea Beetle	Corn Leaf Aphid	Corn Rootworm Lavae	Corn Rootworm Adult	European Corn Borer	Grasshopper	Soil Cutworm	Spider Mite	Western Bean Cutworm	White Grubs	Wireworm
Ambush 2EC	X		X	X			X	X		X		X		
Arctic EC	X		X	X			X	X		X		X		
Asana XL	X	X	X	X	X		X	X	X	X		X		
Baythroid XL		X	X	X			X	X	X	X		X		
Bifenture 2E, Brigade 2EC, Discipline 2E, Sniper 2E, Tundra 2EC	X	X	X	X	X		X	X	X		X	X		
Cobalt, Cobalt Advanced	X	X	X	X	X		X	X	X	X		X		X
Comite II											X			
Coragen								X				X		
Delta Gold	X	X	X	X			X	X	X			X		
Dimate 4E, Dimethoate					X		X		X		X			
DiPel ES	X													
Fastac EC/CS	X	X	X	X	X		X	X	X	X		X		
Govern 4E, Hatchet 4E, Lorsban 4E, Warhawk 4E, Yuma 4E	X	X	X	X	X	X	X	X	X	X	X	X		
Hero	X	X	X	X	X		X	X	X	X	X	X		
Intrepid 2F	X							X				X		
Lannate LV	X		X		X		X	X				X		
Lorsban 15G						X		X						X
Malathion 57EC	X				X		X		X					

2021 Approximate Retail Price ($) Per Unit of Selected Insecticides for Field Crops *(continued)*

Survey price estimates in September 2020

Product	2021 Price ($) per unit	Rate			Cost/acre ($)	
		Low	High	Unit	Low	High
Permethrin	$75/gal	2	8	Fl oz/acre	1.17	4.69
Prevathon	$170/gal	8	20	Fl oz/acre	10.63	26.56
Proaxis	$375/gal	1.92	3.84	Fl oz/acre	5.63	11.25
Radiant SC	$1000/gal	2	6	Fl oz/acre	15.63	16.88
Sevin 4F	$55/gal	1	2	qrt/acre	13.75	27.50
Sevin XLR Plus	$60/gal	1	3.4	qrt/acre	15.00	51.00

Cost at lowest rate for
Western Bean Cutworm Control.

Range: $1.25 to $23.44

Corn
Broadleaf Weed Response To Soil-Applied Herbicides

Plant response may be altered by growing conditions, genetic variation in crops and weeds, soil type, pH, organic matter, and application rates. Ratings may vary from season to season and area to area within the state. Ratings apply when herbicides are used as suggested in this publication and represent control that may be expected when using the higher rate when a rate range is presented (pages 94-99). See pages 179-186 for additional problem weeds and their control.

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Site of Action	Response Ratings: Ratings are for light to moderate weed densities, favorable conditions and weed growth stage as specified on product label. High weed densities, adverse conditions, or large weeds will reduce control. 10 = 96-100% 9 = 90-95% 8 = 85-90% 7 = 80-84% 6 = 70-79% 5 = 60-69% 4-2 = less than 60% 1 = 0 **Herbicide**	Cocklebur (5.5)§	E. Black Nightshade (3.5)	Kochia, ALS-Glyphosate Resistant (2.5)	Kochia, Triazine-Resistant (2.5)	Lambsquarters (1.5)	Morningglories (5.5)	Palmer amaranth (6)	Palmer Amaranth (ALS-Glyphosate resistant)	Redroot pigweed, Triazine Resistant (3)	Ragweed, Common and Giant (4.5)	Russian Thistle (2.3)	Smartweed (1.5)	Sunflower (10)	Velvetleaf (4.2)	Waterhemp, ALS-Resistant (2.5)	Waterhemp, Glyphosate-Resistant (2.5)	Waterhemp, Triazine-Resistant (2.5)
27+27+15+5	**Acuron/Acuron Flexi (27 + 27 + 15)**	8	9	10	9	9	8	9	9	10	9	9	9	9	9	9	9	9
14+15	**Anthem Maxx**	2	8	6	6	7	5	8	8	9	6	5	5	1	7	8	8	8
14+15+5	**Anthem ATZ**	7	9	9	6	9	7	8	8	9	8	9	7	5	9	10	10	9
27+5	**Balance Flexx + atrazine**	7	8	10	9	9	5	9	9	8	8	8	9	7	10	9	9	8
15+5	**Bicep II Magnum/Cinch ATZ/Parallel Plus**	7	8	9	2	9	6	6	6	8	8	8	8	6	6	9	9	8
27	**Callisto**	7	9	8	8	7	6	8	8	8	8	7	8	8	8	7	7	7
2+27+5	**Corvus + atrazine**	7	9	9	9	9	5	8	8	8	8	9	8	8	9	9	9	8
15	**Degree/Topnotch**	3	8	2	2	8	1	6	6	8	6	5	3	2	3	8	8	8
15+5	**Degree Xtra/Fultime NXT**	7	9	9	2	9	6	7	7	7	8	8	8	6	6	9	9	7
15	**Dual II Magnum/Cinch/Parallel**	2	7	2	2	7	1	6	6	7	5	3	2	2	2	8	8	8

Corn

Grass Weed Response To Soil-Applied Herbicides

Plant response may be altered by growing conditions, genetic variation in crops and weeds, soil type, pH, organic matter, and application rates. Ratings may vary from season to season and area to area within the state. Ratings apply when herbicides are used as suggested in this publication and represent control that may be expected when using the higher rate when a rate range is presented (pages 94-99). See pages 179-186 for additional problem weeds and their control.

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Response Ratings: Ratings are for light to moderate weed densities, favorable conditions and weed growth stage as specified on product label. High weed densities, adverse conditions, or large weeds will reduce control.

10 = 96-100% **6 = 70-79%**
9 = 90-95% **5 = 60-69%**
8 = 85-90% **4-2 = less than 60%**
7 = 80-84% **1 = 0**

§Weed Competitive Index — See page 11.

Site of Action‡	Herbicide	Grasses											Labeled for				
		Barnyardgrass (0.3)§	Crabgrass (0.5)	Fall Panicum (0.4)	Giant Foxtail (2)	Green Foxtail (1)	Yellow Foxtail (1)	Sandbur (1)	Shattercane/Sorghum (3.5)	Shattercane, ALS-Resistant (3.5)	Woolly Cupgrass (2.5)	Crop Safety©	Field Corn	Popcorn	Field Corn Grown for Seed	Field Corn Grown for Silage	Sweet Corn
27+27+15+5	Acuron/Acuron Flexi (27 + 27 + 15)	9	9	9	9	9	9	7	4	4	6	2	Y	Y	Y	Y	Y
14+15	Anthem Maxx	9	9	9	9	9	9	7	6	6	7	1	Y	Y	Y	Y	Y
14+15+5	Anthem ATZ	9	9	9	9	9	9	7	6	6	7	1	Y	Y	Y	Y	Y
27+5	Balance Flexx + atrazine	8	7	7	8	9	6	7	5	5	8	2	Y	N	Y	Y	N
15+5	Bicep II Magnum/Cinch ATZ/Parallel Plus	9	9	9	9	9	9	6	4	4	6	2	Y	Y	Y	Y	Y
27	Callisto	1	1	1	1	1	1	1	1	1	1	1	Y	Y	Y	Y	Y
2+27+5	Corvus + atrazine	9	9	7	9	9	9	7	7	7	8	2	Y	N	Y	Y	N
15	Degree/Topnotch	9	9	9	9	9	9	6	4	4	7	2	Y	Y	Y	Y	Y
15+5	Degree Xtra/Fultime NXT	9	9	9	9	9	9	6	4	4	7	2	Y	Y	Y	Y	Y
15	Dual II Magnum/Cinch/Parallel	9	9	9	9	9	9	5	4	4	6	2	Y	Y	Y	Y	Y

Corn Preemergence

Herbicide (See *Weed Response Charts* before selecting herbicides)	Commercial Product per Acre			Application Time, Remarks and Approximate Cost Per Acre Broadcast
	Sandy Loam <1% OM	Silt Loam 1-2% OM	Silty-Clay Loam >2% OM	
ACURON / ACURON FLEXI	**2.0 qt**	**2.5 qt**	**2.5 qt**	EPP, PPSA, PPI, PRE-EARLY POST UPJO V5 corn. Cost: $40.00-$45.00
ANTHEM MAXX	**4 oz**	**4-5 oz**	**4-5 oz**	EPP, PPI, Surface Mix, PRE, Early Post. Can be applied through V4 corn. Tank-mix with atrazine, Balance Flexx, Hornet, Sharpen, or Callisto to broaden weed spectrum. Cost: $20.00-$30.00.
ANTHEM ATZ	**2.0 pt**	**2.0-2.5 pt**	**2.25-3.0 pt**	EPP, PPI, Surface Mix, PRE, Early Post. Can be applied through V4 corn. Tank-mix with Balance Flexx, Hornet, Sharpen, or Callisto to broaden weed spectrum. Cost: $24.00-$36.00.
BALANCE FLEXX1	**1.0-3.0 oz**	**3-5 oz**	**3-6 oz**	30 DBP to V2 corn. EPP, PRE, SURFACE MIX or EARLY POST. Balance + atrazine improves cocklebur and sunflower control. Tank-mix Balance+ atrazine with a grass herbicide (Dual, Bicep, Harness, Surpass NXT, etc.) to improve grass control. Cost: Balance Flexx + atrazine $8.50- $37.50.
+ ATRAZINE DF	**1.0 lb**	**1.3 lb**	**1.5 lb**	
BICEP II MAGNUM/ CINCH ATZ	**1.8 qt**	**1.8-2.1 qt**	**2.1 qt**	EPP, PPSA, PPI, PRE, SURFACE MIX or EARLY POST — Bicep. Lite at 1.5 qt/A has 40% less atrazine than Bicep II Magnum at 2.1 qt/A. Both products at these rates contain 1.25 lb *S*-metalochlor. Cost: Bicep II Magnum $23.75-$27.75; Bicep Lite II Magnum $17.50-$28.00.
BICEP LITE II MAGNUM/ CINCH ATZ LITE	**1.0 qt**	**1.1-1.6 qt**	**1.6 qt**	
CALLISTO alone	**6.0 oz**	**6.0 oz**	**6.0 oz**	PRE. Callisto can be tank-mixed with other PRE herbicides to broaden weed control spectrum. For postemergence application, refer to post-emergence section. Cost: Callisto $36.00; Callisto + Dual $54.00-$59.25; Callisto + Bicep II Magnum $59.75-$63.75; Callisto + Bicep Lite $64.00- $74.50.
or with DUAL II MAGNUM/CINCH	**1.0 pt**	**1.3 pt**	**1.3 pt**	
or BICEP II MAGNUM/ CINCH ATZ	**1.8 qt**	**1.8-2.1 qt**	**2.1 qt**	
or BICEP LITE II MAGNUM/ CINCH ATZ LITE	**1.6 qt**	**1.6 qt**	**1.6-2.2 qt**	
CORVUS	**3.33 oz**	**3.33-5.6 oz**	**3.33-5.6 oz**	30 DBP to V2 corn. EPP, PPSA, PRE, SURFACE MIX or EARLY POST. Corvus includes a safener which reduces the risk of isoxaflutole injury to corn. Corvus may be tank-mixed with atrazine (0.5-1.0 lb/A) to increase the weed control and residual activity. Cost: $27.25-$43.50.
+ ATRAZINE	**1.0 qt**	**1.0 qt**	**1.0 qt**	

Questions?

Thank you!

Robert N. Klein

Western Nebraska

Crops Specialist