Variable rate nozzles could strike right balance

Low drift and adequate coverage at varying speeds.

Not too much drift. Not too little coverage. These variable rate nozzles might be just right.

VariTarget nozzles appear to offer better coverage at a greater variety of speeds than other nozzles on the market right now, says Brian Storozyrsky, a project manager at the AgTech Centre at Lethbridge, Alberta. He says their capacity for spray drift is comparable to many of the best drift-reducing nozzles available today. "In many ways, depending on what further studies reveal, it could turn out to be the only nozzle producers need, which could in turn mean less down time spent changing nozzles or for that matter the daunting experience of researching and finally selecting the so-called right nozzle," says Storozynsky.

Delavan Agspray Products produces the VariTarget nozzle. This nozzle uses a spring-loaded valve to control flow rate in response to pressure changes. In this system, doubling the pressure doubles the flow rate, whereas a conventional nozzle would only achieve a 40 percent increase in flow. There are four different nozzle caps of VariTarget system: green (very coarse droplets), blue (coarse droplets), yellow (medium droplets) and orange (fine droplets).

Two other manufacturers also make variable rate nozzles. The AIM Command Spray System, utilizing Capstan technology that was once available only on Case IH sprayers, is now available as an after market retrofit (Capstan Sharpshooter) for sprayers other than Case New-Holland. Each nozzle has an electronic pulsing solenoid that controls flow rate.

The third variable rate nozzle is from Greenleaf Technologies and is called the TurboDrop Variable Rate (TDVR) nozzle. It uses a similar spring loaded valve that adds flow volume in response to higher pressure, making the flow response directly proportional to pressure changes.

Storozynsky is most impressed with the VariTarget nozzles. They are built to work with auto rate controllers. The operator can enter his desired application rate, and the auto rate controller and variable rate nozzles work in conjunction to apply the correct rate at varying speeds, with only small changes in spray pattern and coverage. Spray quality also changes a little since spray fan angle remains constant in a typical spray application.

For example, in 2008, Storozynsky tested several nozzles and programmed the controller to apply 10 gallons per acre (gpa) at 7.5 mph in a rowed bean crop. The speed range was down to 4.5 mph in the low lying wet areas to 9 mph in the flat areas. Using VariTarget blue caps, nozzle pressure ranged from 30 to 38 psi between these speeds, with rather insignificant change to spray pattern or coverage. Spray patterns varied from 11 to 14 percent and coverage from 17 to 25 percent.

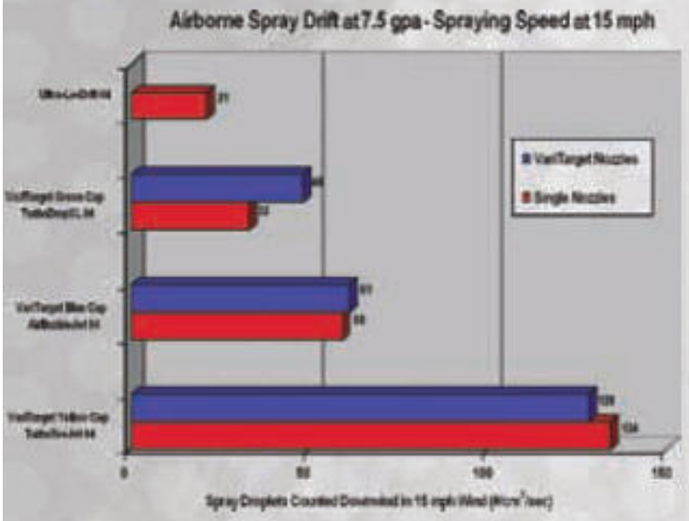
Brian Storozynsky of the AgTech Centre has seen positive results from variable rate nozzles. PHOTOS BY BRUCE BARKER.

In the same tests with air induction nozzles the pressure varied from 20 to 100 psi at that same speed range. Although the high pressures did not cause any difficulty with the air induction nozzles, the low pressure did, as coverage was severely reduced to 11 percent with spray pattern co-efficient of variables (CVs) as high as 60 percent. The following table shows spray droplet density, percent coverage and resultant spray pressure from the speed range used in that field trial.

Comparison of spray droplet density, percent coverage and spray pressure as influenced by application speed

VariTarget blue cap at 10 gpa				
Sprayer Speed (mph)	Nozzle Press (PSI)	Spray Pattern (CV - %)	Spray Avg (#/cm2)	Coverage Avg (%)
4.5	29	14	66	19
5.7	33	12	66	19
6.8	35	10	77	17
7.9	35	9	82	21
9.0	36	10	84	25
Avg	34	11	75	20
TurboDrop TwinFan at 10 gpa				
(mph)	(PSI)	(CV - %)	(#/cm2)	(%)
4.2	20	61	12	11
5.7	40	17	50	18
6.8	60	7	68	18
7.8	75	9	90	23
8.9	100	7	96	25
Avg	60	20	63	19

Source: AgTech Centre



This pressure range varies depending on application rate and VariTarget nozzle cap used. At 20 gpa, nozzle pressure ranged from 38 to 45 psi between 4.5 and 9 mph with the blue nozzle caps.

According to Storozynsky, application rates at or below 5 gpa are possible, but will require operating speeds faster than five or six mph to preserve spray quality. "Careful attention must be given when using low application rates and low speeds to obtain sufficient coverage," he says.

Storozynsky also has looked into droplet quality and the impact on drift. Based on the research numbers to date, an operator can reduce drift by about 50 percent by switching from a yellow VariTarget to a blue, and by about 20 percent by switching from a blue to a green.

Three of the four VariTarget nozzle caps were tested for drift at a water volume of 7.5 gpa and a spraying speed of 15 mph, which is comparable to using Turbo TeeJet single red nozzles. Not surprisingly, the green VariTargets, with their very coarse droplets, had the best results with about 50 droplets per square centimetre counted downwind in a 15 mph wind. This was comparable to some medium pressure venturi nozzles, which counted 45 droplets per square centimeter under the same conditions.

The blue VariTarget, at about 60 droplets per square centimetre, was more comparable to a single red 04 Air Bubble Jet, a low pressure venturi which also counted 60 droplets per square centimetre. VariTarget yellow caps, meanwhile, measured about 130 droplets. This makes them most comparable to the Turbo TeeJet single red 11004, one of the oldest pre-orifice low drift nozzles currently on the market, which resulted in about 135 droplets. For comparison, 135 droplets per square centimetre in wind tunnel drift tests translates to

about eight percent drift in field conditions.

"Spray droplet characteristics weren't perfect for the VariTarget nozzles, but they were close and remained similar across a range of speeds typically used in an application," explains Storozynsky. "We found that spray quality remains pretty consistent over a range of speeds, since the pressure range is so small. We did see that the volume median diameter (VMD) changes a bit, around 20 points, and to some people, that might be a change. But for all the work we have done on spray quality and efficacy, I would say that's not a big deal."

Airborne spray drift at 7.5 gal/ac – spraying speed at 15 mph Source: AgTech Centre.

The new variable rate nozzles are costly, at $42 to 49 range per nozzle for the VariTarget nozzles. At a nozzle spacing of 20 inches, that would cost $2650 for 54 nozzles on a 90-foot boom. ■

MANUFACTURER	GVM Incorporated	
MODEL	Predator 8275 with On Demand front wheel assist	Predator 6215 with on demand differential locks
	Our most rugged, all mechanical driven machine now featuring Front Wheel Assist ON DEMAND. The GVM 8275 Predator gives you the best return on investment with year round usability and combo capabilities with changeover in less than two hours. The Road Speeds up to 45 MPH to get you from field to field quicker.	Mechanically friendly, the GVM 6215 Predator is 2-wheel drive and has a drive train with an air shift differential and on demand front Wheel Assist. It comes standard with an Allison 5 speed transmission and torque converter lock-up. It's the most fuel efficient chassis in its class.
ENGINE		
Make	Cummins QSB	Cummins QSB
Peak rated power (hp)	275 HP / 750 lbs. torque	215 HP / 580 lbs. torque
Number of cylinders	6 Cylinder	6 Cylinder
Displacement, cu. in. (l)	6.7L	6.7L
Alternator	120 Amp	120 Amp
Fuel tank capacity, U.S. gallon	115 gallons	115 gallons
SOLUTION SYSTEM		
Capacity, U.S. gallon	1200 gallon	1000 gallon
Tank material	Stainless Steel	Stainless Steel / Poly
Rinse tank capacity, U.S. gallon	100 gallon Top Tank with interior rinse	100 gallon Top Tank with interior rinse (378 l)
Quick fill size	3 in.	3 in.
Rate control make	Raven / InSight	Raven / InSight
Model	Viper / Envizio Pro / 5000 / Ag Leader InSight	Viper / Envizio Pro / 5000 / Ag Leader InSight
Flow meter size	2 or 3 in.	2 or 3 in.
Suction strainer	None	None
Pressure strainer	2 in. T-strainer	2 in. T-strainer
Boom strainer	Optional	Optional
BOOM		
Boom width options, ft.	From 80 ft. to 120 ft. booms	From 80 ft. to 120 ft. booms
Plumbing material	Stainless Steel	Stainless Steel
Ground height adjustment, in.	53 in.	53 in.
Breakaway width, ft.	Depends on length of boom	Depends on length of boom
Boom sections	5	5
DRIVETRAIN		
Type	Mechanical drive rear axle / hydraulic front axle	Mechanical drive rear axle with diff. Lock
Drive	JCB rear Diff. / Fairfield Drop Boxes / Poclain FWA	JCB rear Diff. / Fairfield Drop Boxes
Shifting	3500 series Allison Automatic	2500 series Allison Automatic
Hydraulic reservoir capacity, gallons	75 gal.	75 gal.
GROUND SPEED W/STD. TIRES, MPH (KPH)		
1st range	6 mph	6 mph
2nd range	12 mph	12 mph
3rd range	18 mph	18 mph
4th range	27 mph	27 mph
5th range	36 mph	39 mph
6th range	45 mph	
CHASSIS		
Dry compatible	Quick Change GVM 8-ton Spreader body Optional	No
Suspension	Air	Air
Crop clearance w/std. tires, in.	50 in.	50 in.
Front tires	380/90R46	380/90R46
Rear tires	380/90R46	380/90R46
Flotation tires	650/75R32	650/75R32 Rear
Hydraulic tread adjust	Hydraulic	Optional Hydraulic
Wheel tread spacing, in.	120 in. - 152 in. (Optional 160 in.)	120 in. - 152 in. (Optional 160 in.)
Wheel base, in.	168 in.	168 in.
Steering lock-to-lock (turns)	3	3
Turning radius, ft.	22 ft.	22 ft.
Parking brake	Hydraulic	Hydraulic
Primary brakes	Power Hydraulic	Power Hydraulic
Ladder rabo/mver	Hydraulic	Hydraulic
Total weight w/60 ft. boom, lb.	N/A	N/A
Total weight w/84 ft. boom, lb.	25,720 lbs.	24,720 lbs.
Total weight w/90 ft. boom, lb.	26,260 lbs.	25,260 lbs.
Total weight w/108 ft. boom, lb.	26,890 lbs.	25,890 lbs.
Total weight w/120 ft. boom, lb.	27,680 lbs.	26,680 lbs.
OTHER OPTIONS		
Air compressor	Standard	Standard
Foam marker capacity, U.S. gallon	100 gal.	83 gal.