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Selecting drift-reducing NOZZLES

"What nozzle should I use?" That's as hard a question as "What tractor should I buy?" You wouldn't buy a 300 hp tractor to mow your ditches. The answer to either question depends upon your needs.

Some of the many nozzles on the market can reduce pesticide drift. Would these be right for you?

Jim Wilson,
Extension pesticide education coordinator,
South Dakota State University

John Nowatzki,
Agricultural Machine Specialist
North Dakota State University

Vern Hofman,
Professor Emeritus, Ag & Biosystems Engineering,
North Dakota State University

Whether a particular low-drift nozzle fits your program depends upon your spraying needs and operation. Larger droplets reduce drift potential, but may also reduce application effectiveness. One nozzle will seldom be the best choice for all situations.

Consider your priorities before making your nozzle choices. Nozzles are relatively inexpensive, but they can be the most important sprayer component you buy.

Should you be concerned about spray drift?

- Are you using more highly active or nonselective herbicides?
- Are you planting more herbicide-resistant crops? Soybeans, canola, or corn are examples.
- Are you able to make applications at the right crop growth stage? Or do you need a wider window in which to spray?
- Are there sensitive areas (shelterbelts, neighboring fields, rural homes) close by that you should protect from drift?
- Are you concerned about the effect of pesticide drift on the environment?
- Are you trying to avoid future drift problems?

These concerns have made drift management everybody's business. Adopting drift management strategies is a timely and appropriate move for all pesticide applicators.

Whatever nozzle you choose, the chemical label is still the law and must be followed. If a pesticide label prohibits application above a specific wind velocity you will be breaking the law if you go ahead. Be aware that drift-reducing nozzles only reduce drift, not elimitate it. Spraying when susceptible plants are downwind may still cause damage.

This publication summarizes some characteristics of low-drift nozzle technology and shows the nozzle with a picture of the spray deposit it produces. The deposits were made with water volumes of approximately 8 gal/acre for all nozzles at their

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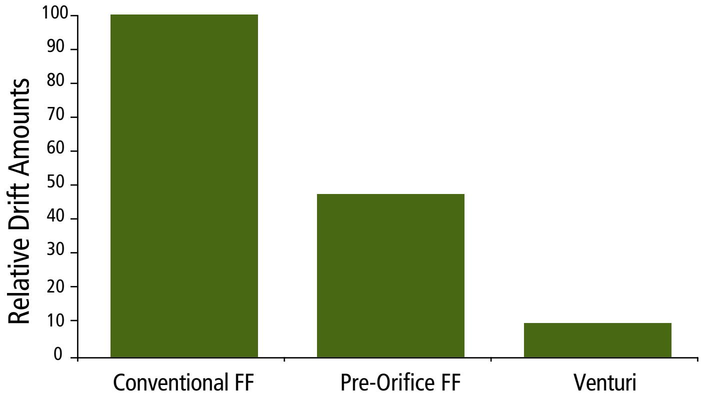


Figure 1. Drift comparison. (Wolf)

Figure 2. Conventional flat fan spray tips at 40 psi. (Wolf)

Figure 3. Air induction nozzles at 70 psi. (Wolf)

standard or optimum pressures where listed. Keep in mind that the spot cards were sprayed laying on a horizontal surface and will not indicate the coverage on an inclined or vertical surface.

Figure 1 shows a comparison of relative drift produced from the standard flat fan, the pre-orifice flat fan, and the venturi nozzle. The venturi nozzles show a 90% or more reduction in drift as compared to the flat fan at standard pressures. Figures 2 and 3 indicate the visual difference in drift between a commonly used flat fan nozzle and a drift-reducing venturi nozzle.

Some nozzle manufacturers list nozzle operating pressures down to 15 psi. Pressure loss may cause variation in the discharge over the length of the boom so check pressures at the nozzles and along the boom to ensure it is uniform and a minimum of 15 pounds.

Low-drift nozzles

Low-drift nozzles are designed to produce larger spray droplets with fewer driftable fines. The bigger droplets are produced in a pressure-reducing chamber inside the nozzle and, with several nozzles, by the incorporation of air into the spray droplets. These nozzles are excellent at reducing, but not eliminating all drift. Caution must still be used when susceptible crops are downwind.

When drift is reduced by increasing droplet size, spray coverage is usually less because fewer droplets will be deposited on the plant. There will be larger spaces between the spray droplets, even with the same application rate. Larger droplets combined with low carrier rates may not provide adequate coverage and could reduce the effectiveness of the application.

Systemic pesticides are generally recommended for use with low-drift nozzles. Pesticides that move within the plant usually do not need to cover the entire plant. Low-drift nozzles are usually not recommended for use with contact-type pesticides. Consult the pesticide label for specific restrictions.

Costs

Nozzle prices vary widely. Nozzle tips made from stainless steel or ceramic will usually cost more than plastic tips but generally last longer and may be worth the extra expense. Nozzle designs that incorporate air induction technology will usually cost more than standard flat fan nozzles, but again the extra cost may be worth the extra expense if they prevent drift injury. A drift problem can often cost thousands of dollars, so a few extra dollars for a set of drift-reducing nozzles may be a good investment.

After you decide on a nozzle, you may want to check with several suppliers—there may be considerable difference in price.

Table 1. Nozzle selection guidelines.

Conditions when coarser sprays could be considered:	Conditions when finer sprays could be considered:
(larger orifice / lower pressure conventional nozzles or drift reduction nozzle technology)	(smaller orifice / higher pressure conventional nozzles)
Non-selective herbicides	Insecticides/fungicides, contact herbicides
Easy-to-wet broadleaf weeds (pigweed, smartweed, thistles, etc.)	Difficult-to-wet broadleaf weeds / grassy weeds (lambsquarters, kochia / wild oat, foxtail etc.)
Cereal canopy penetration	Open broadleaf canopy penetration
Outside rounds and windy conditions	Favorable weather conditions
Adjacent sensitive crops or non-target areas	

Table 2. Nozzle droplet size classification.

Droplet size	Very fine	Fine	Medium	Coarse	Very coarse	Extremely coarse

* ASABE standard S572

Drift management strategies

The most important factor in reducing drift is the size of the droplets produced by the nozzle.

For conventional flat fan nozzles, the best approach to reducing fine droplets is to increase the nozzle orifice size and reduce the spray boom operating pressure.

Consider using a 110° nozzle. This will allow you to lower your boom height and give the wind less opportunity to catch the spray. Booms should be set as low as possible above the target, based on nozzle discharge angle and nozzle spacing, while maintaining uniform coverage. Check with your nozzle manufacturer to match proper boom height and overlap.

Droplet size classification

Droplet size classification is a helpful aid as manufacturers are beginning to list ASABE (American Society of Ag & Biological Engineers, formerly ASAE) categories that range from very fine to extremely coarse (table 2). This standard is based upon the average size droplet, known as the volume median diameter (VMD), measured in microns, that is produced at a particular operating pressure. One micron is 1/1000 millimeter, or approximately 1/25,000 inch. In comparison, a human hair is about 100 microns in diameter.

The volume median diameter (VMD) is a droplet dimension that indicates that half of the spray volume is in droplets smaller than this number and half of the spray volume is in droplets larger than this size. It is also often indicated by Dv0.5.

Two other important values are; the 10%-volume and 90%-volume droplet size indicated by Dv0.1 and Dv0.9, respectively. The Dv0.1 value indicates that 10% of the spray volume is in droplets smaller than this value and may be a major part of the driftable fines. For best drift control, this number should be near or above 200 microns, which will help minimize drift. The Dv0.9 value indicates that 90% of the spray volume is in droplets smaller than this value, or 10% of the spray volume is in droplets larger than this value. A large number indicates that some large spray drops are produced, which may result in poor coverage and wasted pesticide.

Since droplets are basically spheres, small changes in droplet diameters make a big difference in the potential for drift. A 200-micron droplet has one-half the volume and therefore one-half the weight of a 250-micron droplet. Moving to a 158-micron droplet will again cut the volume and weight in half as compared to a 200-micron drop. Droplets with diameters in this range and smaller can easily become suspended in air currents and moved off target.

The recommended droplet size category to use with a particular pesticide may be listed on the product label. Nozzle selection and pressure can then be based on the nozzle manufacturer's droplet-size category charts. Typically, low-drift nozzles will produce spray droplets that fall in the medium to very coarse range.

Conventional Nozzles

Extended range flat fan. The extended range flat fan is considered the standard nozzle for many pesticide applications in the Northern Plains. Variations of this design are available from several manufacturers. The design is available in a wide range of flow rates and fan angles to fit many application needs. A nozzle with an 80° discharge angle produces a larger spray droplet than a 110° angle nozzle at the same flow rate and pressure.

Spray quality is considered to be fine- to medium-size droplets for small nozzles. Larger nozzles (0.4 gpm and larger) operating at 20 psi are considered to be coarse to very coarse. These nozzles produce a uniform spray pattern when patterns are overlapped 30 to 50% and when operated at 15 to 60 psi. They should be mounted about 20 inches above the spray surface when mounted on a 20-in. nozzle spacing.

Lower pressures and higher flow rates produce coarser sprays that are resistant to drift, while higher pressures above 30 to 40 psi produce finer droplets that may be susceptible to drift.

Drift-Reduction Nozzles

Turbo TeeJet Nozzle. This is a flood-type nozzle with a pressure-reducing turbulence chamber. It produces a wide, uniform spray pattern of 110° with a 15° inclination, allowing spray to be directed slightly forward or backward. It should be mounted 20 inches above the target surface when using a 20-inch nozzle spacing. This will provide about 50% overlap over the adjoining nozzle spray pattern.

This nozzle produces a medium-to-coarse droplet at moderate operating pressures. It is capable of operating over a wide pressure range (15 to 90 psi), which makes it an excellent choice for use with automatic rate controllers that use pressure to adjust

Extended Range Flat Fan

Dv0.1 =171 Dv0.5 =365 Dv0.9 =532 40 psi 8 gpa

Turbo TeeJet

Dv0.1 =153 Dv0.5 =307 Dv0.9 =475 40 psi 8 gpa

* Note: Spot cards have been enlarged to show differences in drop sizes.

flow rate in response to a change in travel speed. The optimum pressure is 40 psi.

Operated at lower pressures with a medium to coarse spray, spray drift can be reduced by 50% compared to an extended range nozzle at equal flow rates. Turbo-TeeJet nozzles are an excellent choice for drift reduction and are situated between the extended range flat fan and the air-induction type. But, these nozzles may be difficult to clean in the field, so carry a few extra when spraying. You will often need compressed air to clean the nozzle due to its design.

Hypro Guardian: This nozzle is a flood-type nozzle with a pressure-reducing chamber that produces a uniform spray pattern over a pressure range of 15 to 115 psi. The wide pressure range makes it an excellent choice for equipment using rate controllers that vary pressure. It includes a one-piece design that includes the nozzle, cap, gasket, and removable strainer. Commonly used nozzle sizes and pressure ranges will produce medium through very coarse droplets. The nozzle produces a 120° discharge angle with a 20° inclined pattern built into the nozzle orifice to allow the spray to be directed forward or backward.

Venturi Air Induction Nozzles

Several different brands of venturi nozzles are currently on the market in North America and are known as “air induction” or “air inclusion” nozzles. All have the same basic design feature—two orifices, one to meter liquid flow and the other larger orifice to form the pattern. Between these two orifices is a venturi or jet, used to draw air into the nozzle body. In the body, liquid pressure decreases and air mixes with the liquid to form an air-entrained spray pattern. The coarse spray contains large, air-filled droplets and very few drift-susceptible droplets. Venturi nozzles differ from conventional low-pressure spray nozzles by producing coarse droplets with few fines.

Dramatic drift reductions have been observed with these tips, while good spray coverage has generally been maintained. The reason, the manufacturers say, is that the droplets are filled with air bubbles that cause the droplets to shatter on impact with the leaf, providing better coverage. Getting the maximum benefit from these nozzles, however, requires the careful selection of the right nozzle for your needs and proper operation. You need to be aware of differences in pressure operating ranges, ease of cleaning, and the ability to fit into existing nozzle caps.

Most venturi nozzles are designed to be disassembled for cleaning, but you may need a needle-nosed pliers, small screwdriver, or a piece of fine wire. It may be best to carry two or three extra nozzles along while spraying, in case some get plugged. Trying to clean venturi nozzles in the field will be difficult, as they usually contain some very small pieces that could be easily lost.

All brands of venturi nozzles can be installed on any standard spray boom. Some nozzles may require a different nozzle cap, so be sure to check this out when making a purchase.

Greenleaf TurboDrop. The first venturi nozzle that was available commercially in the US was the Greenleaf TurboDrop. The exit tip is separate from the nozzle body and can be exchanged with other tips to fit specific needs. For example, a Turbo TeeJet exit tip can be used to increase spray coarseness, widen the spray angle, and improve pressure operating range. Exit tips must conform to the manufacturer’s flow rate recommendations. The TurboDrop nozzle produces droplets of intermediate spray coarseness, which vary from medium to very coarse. Good patterns are achieved between 30 and 150 psi, while optimum pressures are 40 to 120 psi. Integrated nozzle caps fit Spraying Systems QuickJet nozzle bodies. The nozzle contains a long-lasting ceramic metering orifice that is easily detachable for cleaning.

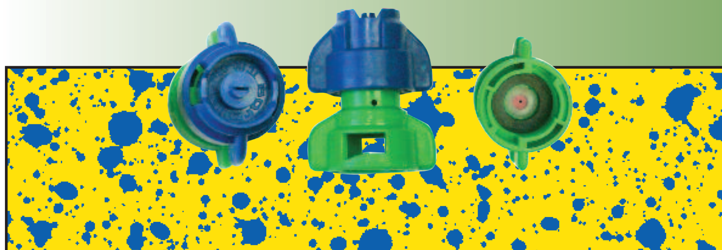
Greenleaf TurboDrop XL. The Turbo Drop XL is a lower-pressure, all-plastic version of the TurboDrop. Good patterns

Hypro Guardian

Dv0.1= 194 Dv0.5 =370 Dv0.9 =544 40 psi 8 gpa

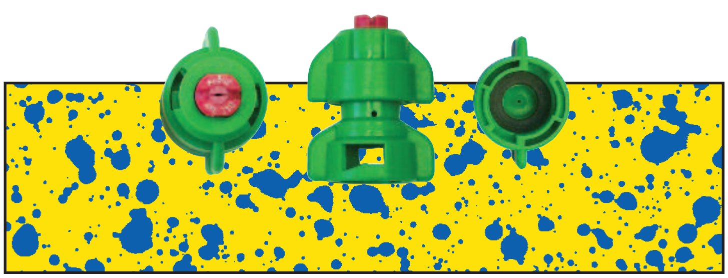
Greenleaf TurboDrop XL

Dv0.1=160 Dv0.5=323 Dv0.9=474 70 psi 8 gpa



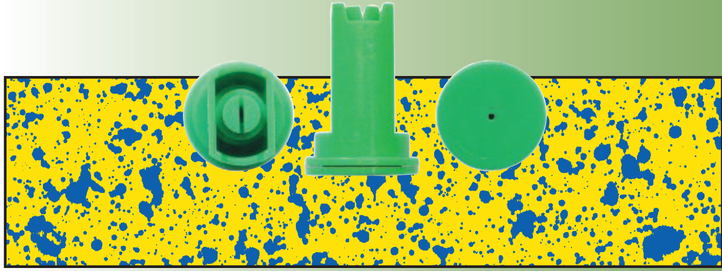
Greenleaf TurboDrop

Dv0.1=173 Dv0.5=339 Dv0.9=488 70 psi 8 gpa



Greenleaf - AirMix

Dv0.1=195 Dv0.5=384 Dv0.9=535 40 psi 8 gpa



* Note: Spot cards have been enlarged to show differences in drop sizes.

are produced between 20 and 120 psi. Pressures up to 75 psi provide a coarser spray than the original TurboDrop, while pressures over 75 psi create a finer spray. Optimum pressures are 30 to 90 psi. Optimum drop size classification varies from medium to a very coarse, depending on nozzle size and operating pressure.

These nozzles contain integrated nozzle caps that fit Spraying Systems QuickJet nozzle bodies. They are best suited for a lower, wider pressure range.

Greenleaf - AirMix. The Greenleaf AirMix nozzle is a two-piece, all-plastic design that separates easily for cleaning. It operates at a lower pressure than most venturi nozzles, with a suggested range of 15 to 90 psi. Optimal pressure ranges are from 20 to 60 psi. At these pressures, this nozzle produces moderate-sized droplets that are generally finer than those produced by most venturi nozzles. The optimum drop size classification varies from a fine to a very coarse droplet. The spray angle is rated at 110°. Pressures below 20 psi result in rapid pattern narrowing. The nozzle fits standard Spraying Systems QuickJet nozzle caps.

Air Bubble Jet. This nozzle is all-plastic, has a 100° spray angle, and contains a removable metering orifice for easy cleaning. Good patterns are produced between 20 and 90 psi, and the nozzle is suited for applications requiring a lower, wider pressure range. Unlike many other venturi nozzles, optimum pressures are 30 to 45 psi. This nozzle reportedly produces an intermediate drop size that offers good drift protection. The nozzle caps fit Spraying Systems QuickJet nozzle bodies.

Hardi Injet. This nozzle is all plastic with a removable venturi insert, produces a 110° spray discharge angle, and a 20-inch optimum boom height is recommended. A ceramic version is also available. Good spray patterns are produced between 40 and 120 psi. Most nozzle size and pressure combinations produce a very coarse-sized spray drop. Optimum operating pressures are 60 to 80 psi. It has a wider body than a standard nozzle and requires a special nozzle cap. Removal of the insert requires needle-nosed pliers.

TeeJet Air Induction (AI). This nozzle is similar in design to other venturi nozzles but has a stainless steel exit tip. Good patterns are produced between 40 and 100 psi, with optimum pressures of 60 to 80 psi. The nozzle produces a coarse to an extremely coarse spray droplet, depending on pressure and nozzle size. A special nozzle cap is required to accommodate its wider body. Removal of the venturi insert requires needle-nosed pliers or a short piece of fine wire.

Turbo Teejet Induction Nozzle. This is an all-polymer nozzle that produces a larger drop than the original turbo teejet nozzle. This is due to the internal pressure-reducing chamber and the induction of air into the spray drops. It produces a 110° spray pattern and an extremely coarse drop size with few fine drops. The pressure operating range is from 15 to 100 psi, with an optimum range of 40 to 60 psi.

Air Induction XR Flat Fan. This is an air-induction version of the original XR flat fan nozzle. It has a pressure operating range of 15 to 90 psi and produces a spray angle of 110°. It produces a much larger drift-reducing drop than the XR flat fan nozzle, which is due to the pressure-reducing design of the nozzle and the introduction of air into the spray drop. This nozzle produces droplets in the medium to extremely coarse size, depending upon nozzle size and pressure.

Hypro Ultra-Lo-Drift. This is the most compact of the venturi tips and closely resembles a conventional flat fan spray nozzle. It is an all-plastic nozzle with two pre-orifice holes to meter the liquid through the body of the nozzle.

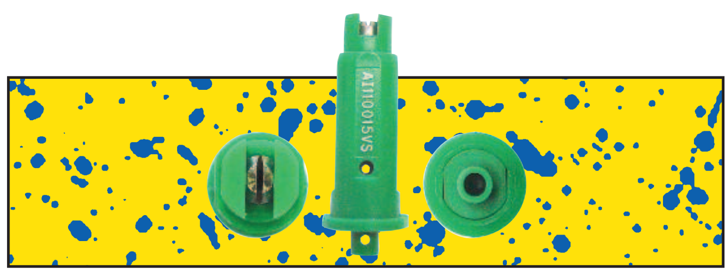
Good patterns are produced at pressures of 15 to 115 psi, with optimum pressures of 40 to 70 psi. Spray droplet size ranges from a medium to an extremely coarse in the droplet classifica-

Air Bubble Jet

Dv0.1=264 Dv0.5=581 Dv0.9=792 40 psi 8 gpa

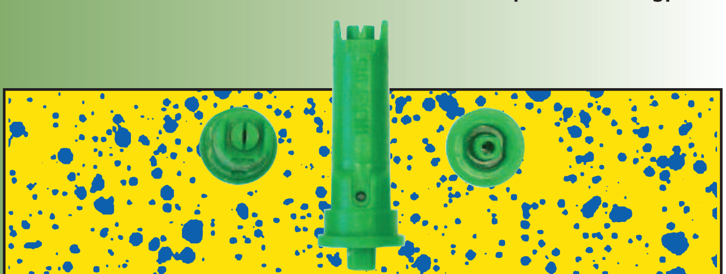
TeeJet Air Induction (AI)

Dv 0.1=210 Dv0.5=394 Dv0.9=563 70 psi 8 gpa



Hardi Injet

Dv0.1=195 Dv0.5=392 Dv0.9=548 70 psi 8 gpa



Turbo Teejet Induction

Dv0.1=267 Dv0.5=598 Dv0.9=865 40 psi 8 gpa

* Note: Spot cards have been enlarged to show differences in drop sizes.

tion system, depending on pressure and nozzle size. The nozzle produces a 120° degree angle spray pattern and operates at a slightly wider pressure range than some other venturi tips. It may have more problems with plugging due to the two small metering orifices. Good nozzle screens that are properly sized for the nozzles and are cleaned regularly should eliminate this problem.

Hypro AVI, Air-Inducing Venturi. This nozzle has a two-piece pressure-reducing design that contains a ceramic metering orifice along with a ceramic outer orifice that produces the spray pattern. Ceramic provides for long life and uniform flow rate.

Uniform spray patterns are produced over a wide pressure range of 30 to 100 psi, with droplets sizes in the coarse to extremely coarse range. This nozzle produces a 110° spray angle that should be mounted at an optimum height of 20 inches and with a 20-inch nozzle spacing.

Delavan Raindrop Ultra. This nozzle is available as an all-plastic type design with a stainless steel outer orifice. It produces a 110° spray pattern with a pressure operating range of 30 to 80 psi. This nozzle generates a coarse to extremely coarse spray drop. The venturi orifice is removable for cleaning and the nozzle body fits Spraying Systems nozzle caps.

Lechler IDK. This is an all-polymer or polymer-with-ceramic-orifice spray nozzle with a 110° spray angle. It produces a droplet that ranges from a medium to a very coarse, depending on operating pressure and nozzle size. The operating pressure range varies from 15 to 90 psi, with an optimum pressure range of 25 to 90 psi.

Hypro Guardian Air. This nozzle is a recent addition to the U.S. market and is based on the Amistar nozzle that is used in Europe. It is a 110°, all-plastic design that incorporates a 10 to 13° (depending upon nozzle size) rearward inclination to the pattern. It is reported to produce a slightly smaller droplet than other air inclusion nozzles. Pressures range from 15 to 90 psi, with expected droplet sizes of medium to extremely coarse.

Other Drift Reduction Technologies

VariTarget Nozzle. This is a new nozzle that is capable of controlling flow rate and maintaining the proper spray pattern and droplet size over an extended range of flow rates. The nozzle consists of a flexible spray orifice that is automatically controlled by a flexible metering assembly that changes in response to a change in operating pressure. Application rates from 5 to 40 gpa at spray speeds of 5 to 20 mph are possible with one nozzle. Flow rates can vary from 0.15 to 0.80 gpm as pressure varies from 15 to 50 psi.

Air Induction XR Flat Fan

Dv0.1=241 Dv0.5=557 Dv0.9=818 40 psi 8 gpa

Hypro Ultra-Lo-Drift

Dv0.1=192 Dv0.5=351 Dv0.9=519 50 psi 8 gpa

Lechler IDK

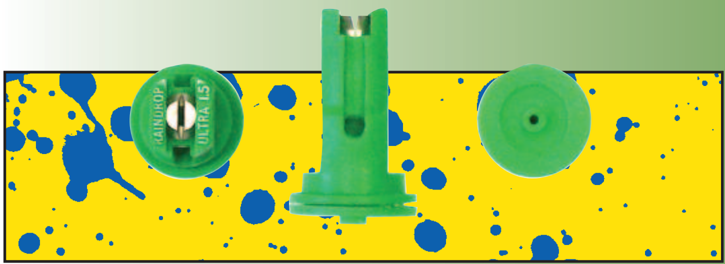
Dv0.1=260 Dv0.5=587 Dv0.9=746 40 psi 8 gpa

Hypro AVI, Air-Inducing Venturi

Dv0.1=179 Dv0.5=353 Dv0.9=493 70 psi 8 gpa

Delavan Raindrop Ultra

Dv0.1=256 Dv0.5=510 Dv0.9=678 80 psi 8 gpa



Hypro Guardian Air

Dv0.1=172 Dv0.5=403 Dv0.9=616 40 psi 8 gpa

* Note: Spot cards have been enlarged to show differences in drop sizes.

Three nozzle caps that can produce a range of drop sizes from medium to very coarse, are available. Examples of two of the caps are shown; the caps are operated at 20 and 40 psi. The caps produce a spray angle of 110° and will work with pressure regulators or automatic rate controllers.

Capstan Ag Syncro Blended Pulse Spraying System. The Syncro Blended Pulse Spraying System is designed to provide independent control over nozzle pressure and flow rate. This is accomplished by using a rapidly pulsing solenoid within each nozzle body to vary the amount of time spray is flowing to the nozzle. Operating pressure does not change with travel speed, so a low pressure, which will produce few driftable fine spray drops, can be used. Nozzles are paired so that when one nozzle is off the nozzles on either side are on, preventing skips.

Drift-reduction benefits come from using larger orifice nozzles to produce larger droplets at lower pressures, while allowing lower application rates by varying the duty cycle of the solenoid. Systems are available that may be manually operated or used in conjunction with a rate controller that allows a constant application rate and droplet size over varying travel speeds. Case IH offers this (AIM Command) as a factory-installed system on some models of spray equipment.

Issues to Consider

Venturi Tip Spray Pressure

Most of the drift-reducing nozzles provide excellent performance over a wide range of operating pressures; however, some air-induction nozzles require operation at pressures of 60 to 80 psi to provide optimum drift protection. Using lower pressures with these nozzles may cause the air induction system to not work properly. Check the operating pressure of your sprayer and the ability of your pump to operate at higher pressures. If your spray system has trouble exceeding 60 psi, either consider replacing the pump or use one of the nozzles that produces a desirable drop size at lower pressures.

When using an automatic flow regulator, monitor boom pressure and sprayer output closely when you change speeds. Poor spray patterns are often the No. 1 reason for performance complaints. But most of the newer nozzles will produce a good spray pattern even at low operating pressures. For best spraying results, check pressure at the nozzles to ensure minimum pressure and uniformity.

Nozzle Size Selection

Because some venturi nozzles should be operated at pressures of 60 psi or more, you may need to choose a nozzle with a smaller orifice (as compared to conventional nozzles) to maintain the correct spray volume without increasing travel speed.

For example, if you currently use a flat fan 0.2 gpm size nozzle at 40 psi, a venturi nozzle of 0.15 gpm operated at 70 psi will provide the same flow rate, produce much less drift, and give you some pressure flexibility if you need to slow down. If you use a flat fan 0.3 gpm tip at 40 psi, conversion to a 0.25 gpm nozzle at 60 psi, or a 0.2 gpm nozzle at 90 psi, all will give the same flow rate. Check the manufacturer guidelines for recommended pressures, and calibrate your sprayer at the start of every season.

Boom Height

Proper boom height allows uniform overlap and coverage of the spray pattern, and your spraying equipment should be easily adjustable to meet changing conditions. Check with the particular nozzle manufacturer to insure proper boom height. Although many venturi nozzles are sold as 110° fan angles, their spray pattern is sometimes closer to 80° and quickly becomes narrower at lower pressures. This is because the exit tip has a greater flow rate than the metering orifice, causing a significant pressure drop at the outer orifice which narrows patterns. Even at a gauge pressure of 80 psi, the exit tip pressure may only be 20 to 40 psi. Watch patterns carefully, and set your boom at the height needed to achieve proper overlap.

Nozzle Wear

Most venturi nozzles are plastic. Plastic has very good wear characteristics and sometimes can outlast stainless steel. Plastic is, however, prone to deformation if cleaned with hard objects such as fine wire or a knife tip. A soft bristled brush, such as a nozzle cleaning brush or a toothbrush, should be used.

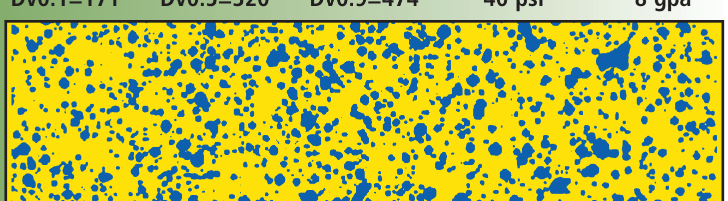
Nozzle Plugging

Even with clean water and screens, nozzles will occasionally plug. A venturi nozzle should present less plugging problems than conventional nozzles because the metering orifice is round, allowing larger particles to pass through.

VariTarget–Yellow Cap

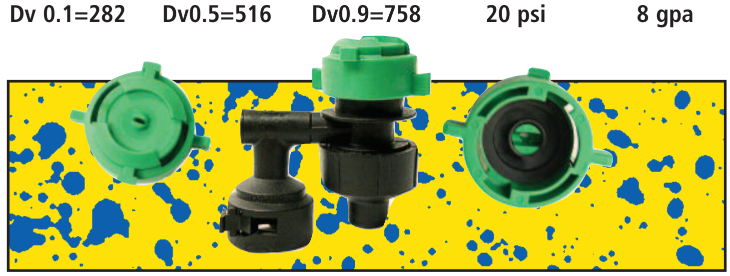
Dv0.1=163 Dv0.5=311 Dv0.9=453 20 psi 8 gpa

Dv0.1=171 Dv0.5=320 Dv0.9=474 40 psi 8 gpa

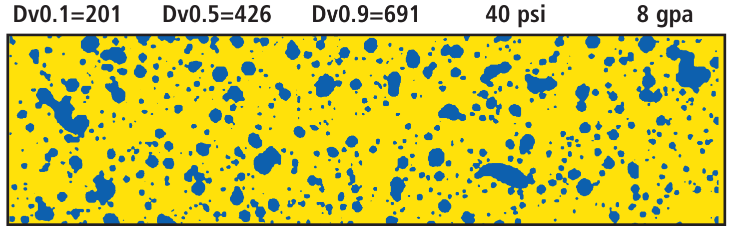


VariTarget–Green Cap

Dv 0.1=282 Dv0.5=516 Dv0.9=758 20 psi 8 gpa



Dv0.1=201 Dv0.5=426 Dv0.9=691 40 psi 8 gpa



* Note: Spot cards have been enlarged to show differences in drop sizes.

The exit orifice typically has about twice the flow rate of the metering orifice, reducing the likelihood of plugging. If this orifice plugs, the nozzle will have to be taken apart for cleaning. Venturi nozzles are sometimes difficult to disassemble, especially in the field, and nozzle parts can easily be lost. It may be best to carry extra nozzles and disassemble and clean the plugged ones at the shop where you have compressed air and water.

Adjuvants
Air inclusion in spray droplets is a function of pressure and formulation. Air bubbles may not form at lower presures or with various adjuvants.

Some viscosity modifying drift reducing adjuvants should not be used with verturi tips, as the spray may not atomize and form droplets properly. Always read th pesticide and adjuvant labels for restrictions before use and check your spray pattern after adding any adjuvant.

Efficacy
Venturi tips are best known for their dramatic ability to reduce drift. Many of these tips are new, and information on pesticide efficacy is becoming available. Initial data suggest that these tips perform well at conventional carrier volumes, travel speeds, and product rates when used with systemic herbicides. Situations such as low carrier rates, reduced pesticide rates, contact pesticides, and small weeds under heavy canopies may see reduced control with venturi nozzles. Manufacturers of spray nozzles have selection guides, available on the company website or in a nozzle catalog, that can be helpful in selecting a nozzle for a particular application.

Some weeds are more difficult targets than others, particularly the difficult-to-wet weeds, such as lambsquarters, wild oats, and green foxtail, or small weeds under a dense canopy. Sprays with finer droplet sizes may help maintain effective coverage, but finer drops do not penetrate thick plant canopies as well as larger drops. When using venturi nozzles on these weeds, make sure that you have adequate carrier rates to ensure there are enough droplets to provide good coverage deep into the canopy. Larger weeds and reduced product rates typically make chemical control more difficult, and these conditions may also reveal some performance differences between nozzles.

Most nozzle manufacturers rate their nozzles based on the droplet size classification chart discussed earlier in this publication. Some pesticide manufacturers list a recommended spray drop size on the label that performs best with their product. Follow these guidelines and you should obtain the best application job possible. Low-drift nozzles are classified by the manufacturers, and using the recommended drop size on the chemical label should produce excellent results with the product.

The Bottom Line

As with any technology, venturi nozzles should be used with caution. They have tremendous capability for reducing drift while maintaining good efficacy and have been used successfully by many applicators under a wide range of conditions. But they can be used improperly—make sure you pay attention to pressure and your herbicide/weed combination before you spray.

You may not want to or need to use venturi nozzles under all conditions. Think in terms of using the "right spray for the condition." This means that you may want to use conventional tips under good conditions but slow down and drop pressure or choose low-drift tips for the outside rounds or when winds come up. Always remember that the label is the law, and if the label states a maximum wind speed for spraying, it should be followed even when using drift-reducing nozzles.

Finer sprays are more appropriate for most insecticides and fungicides and for grassy weeds. Coarser sprays usually work well for many broadleaf weeds and when penetrating a small-grain canopy. You may also want to consider having two different flow rates available—for example, 5 gallons/acre may improve performance for glyphosate, and 10 gallons/acre or more may be required for other herbicides and most contact products.
Nozzles are the most important part of your sprayer. It makes sense to invest in the proper nozzle to make sure the job gets done right.

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Spot card deposition analysis was conducted using WRK Droplet Scan software.

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