Top Questions Asked by Producers About Nozzles

1) Which low-drift nozzle should I put on my sprayer?

- That question is best answered with more questions:
  - What pressure is your sprayer capable of? (There are low- and high-pressure versions. Choose a nozzle that works well within that range).
  - What carrier volume do you use? (Use low-pressure air-induced or pre-orifice nozzles that produce "Coarse" sprays, VMD = 350 – 450 µm) for < 6 gpa).
  - What is your travel speed range? (Use nozzles capable of low pressures for greater range of speeds).
  - What is your tolerance to drift? (Certain air-induced ore pre-orifice nozzles give better drift control. These types of nozzles produce low-drift sprays even at elevated pressures).
  - Do you use Group 1 products, contact modes of action, or consider grassy weeds a serious problem? (use higher pressures and volumes with any nozzle, aiming for a Coarse spray quality or finer).

2) Why are your pressure recommendations different from those found in the manufacturers' literature?

- Manufacturers do not typically study the pesticide efficacy achieved with their nozzles. Instead, they limit themselves to measuring droplet size and pattern uniformity.
- At catalogue pressures, the manufacturer feels that fan angles and patterns are acceptable. However, research has shown that low-drift nozzles lose some of their efficacy at low pressures even if the pattern looks OK. The main reason is that the spray simply becomes too coarse, and the pattern more variable, at the low pressures. The minimum pressures in our chart are for acceptable pesticide performance, based on research.

3) If lower pressure reduces drift, why do I need to have high pressure with air-induced nozzles?

- Low pressures are a good way to reduce drift with conventional nozzles. Conventional nozzles require that the operator reduce the pressure to have an effect. Air-induced and pre-orifice nozzles reduce the internal pressure of a nozzle by design. The nozzle actually operates at a lower pressure than the gauge indicates.
- As a result, lowering pressure with "low-drift" nozzles can result in too low an internal pressure with air-induced nozzles. For such designs, high pressures are needed to fully develop their patterns. Higher pressures also provide flexibility in travel speed with rate controllers. Too low a pressure is the number one reason for poor performance with air-induced nozzles. Fortunately, drift reduction with air-induced nozzles at high pressures is still superior to conventional nozzles at low pressures.
- Use a pressure that is in the middle of a nozzle's recommended range. For example, if a nozzle is rated for 30 to 60 psi, aim for 45 psi. For an air-induced nozzle rated for 30 to 100 psi, aim for 60 to 70 psi. This approach gives you flexibility in travel speed when using a rate controller.

4) Do the air-vents on venturi nozzles ever get plugged, and if they do, what happens?

- They rarely plug. If they do, the spray pattern gets a bit narrower and the spray gets a bit finer. Neither change is dramatic and spraying can continue. Normal nozzle inspection and cleaning is sufficient.

5) **Many of the new nozzles are plastic and ceramic. How do these compare to steel for wear?**
   - There are many different types of plastic materials used in nozzles. They wear at least as well and usually significantly better than steel. Care should be taken when cleaning, as they can deform irreversibly. Ceramic is the most wear-resistant material available, and can last 10-times longer than steel.

6) **Do I need air-induction or can I just use low-pressure conventional sprays?**
   - Air-induction provides much more drift reduction than any comparable technology, even at high pressures. A low pressure conventional spray is not as coarse as an air-induced spray and many of the pre-orifice sprays. Nonetheless, lower pressures are still a good way to reduce drift. Air induction seems to improve spray retention on grassy weeds compared to same-sized droplets without air.
   - The Wilger Combojet low-drift nozzles (SR, MR, and DR) offer similar drift-reducing and coverage performance to air-induced nozzles, at a comparable spray quality.

7) **Should I get shrouds or low-drift nozzles to control drift?**
   - Nozzles are less expensive than shrouds per foot of boom (about half). With shrouds, finer conventional nozzles can be used if the user is nervous about the efficacy of pesticides with coarser sprays. Air-induced nozzles provide similar drift control, depending on the shroud and the nozzle. Both can be used together.

8) **Is more coverage better?**
   - You'd think this was a no-brainer. But it's not.
   - Coverage usually means how much target area is covered by the spray. Greater coverage can be achieved with higher water volumes or making the application with finer sprays that produce smaller (and therefore more abundant) droplets. More coverage does not mean more dose, just more area covered with the same dose.
   - It's important to achieve a certain minimum amount of coverage for most products, although that amount depends on the product and the pest in question. If we are below that minimum amount, there is a significant benefit to improving coverage. But if we are already above that amount, any additional increase in coverage has minimal returns. If more coverage were always better, we'd all be spraying high water volumes with Very Fine sprays. In reality, adequate coverage can be achieved with intermediate water volumes and Coarse spray qualities.
   - It is true that the goal is to get as much product on the target as possible. In the simplest terms, the more product on the target, the higher the dose, and the greater the effect. However, getting more dose on the target isn't as simple as using smaller droplets. The right droplet size depends on the target and the pesticide. Sometimes larger droplets are the most effective way to hit a target.
   - Guidelines:
     - When targeting grassy weeds or using contact products, best coverage is achieved with Medium to Coarse spray quality
     - With systemic products or broadleaf weeds, adequate coverage can be achieved with Coarse to Very Coarse sprays.
     - Water volume depends mostly on the crop canopy. More foliage requires more water, regardless of spray quality.

9) Don't coarser droplets reduce coverage?

- Yes, they can, but the loss of coverage is not important at reasonable water volumes. In most cases, coverage of coarse sprays is very similar to finer sprays, and efficacy is the same for broadleaf herbicides and fungicides at label volumes (5 to 10 gpa). Grassy herbicides require some caution – don't use a combination of very coarse sprays and low carrier volumes, and do maintain those higher pressures. Droplet number per square inch is more important than droplet size for determining efficacy. Pressure and volume should be adjusted to maintain at least 300 - 500 drops / square inch on water-sensitive paper, or 10-15% coverage.

10) Some low-drift nozzle manufacturers advertise that their nozzle gives larger and more uniform droplets, better coverage, and can be used at lower volumes than other nozzles. Is this true?

- No. Low-drift nozzles are designed to reduce drift, and without exception they do this by eliminating many of the finer droplets and replacing these with larger ones. Therefore, a low-drift spray reduces the number of droplets available for coverage. In practice, this has little noticeable impact on spray performance because we usually exceed the coverage necessary for good performance. So a small decrease in coverage not noticeable, and when it is, it's easily offset by maintaining a slightly higher carrier volume and optimizing pressure for the specific nozzle. If you want to reduce water volumes significantly, you need to use finer sprays to keep droplet numbers high enough. But you can compromise. Use a reasonable water volume (5 to 7 gpa) and an intermediate low-drift nozzle such as a low-pressure air-induced at 60 psi. You will have 70% less drift, but equivalent efficacy. That's what the majority of applicators are doing now.

11) Is air assistance any good?

- Yes, air assistance is great for increasing dense canopy penetration. This means it can be useful for fungicides and insecticides. Generally, air assistance is not necessary for herbicide application. Although some claim that air-assistance can reduce herbicide rates, most of this effect is attributable to lower carrier volumes and very fine sprays. Older air-assist technologies can increase spray drift significantly. Newer technologies can both reduce drift and improve coverage.

12) What nozzle is best for reducing herbicide rates?

- Success at reducing herbicide rates depends more on good agronomy than on a specific nozzle. Research, and experience, has shown that the following conditions favour the reduction of herbicide rates:
  - a competitive, vigorous, healthy crop (seeding practice, fertilizer placement, cultivar choice)
  - early crop emergence relative to weeds
  - small weed staging at spraying time
  - favourable growing conditions around spraying time
  - a strong, efficacious herbicide product for the weeds in question
- If these conditions are met, almost any application method will allow some rate reductions. If they are not, application method will not rescue a difficult weed problem.
- Think of nozzles not as tools for increasing efficacy, but as tools for doing the job in an efficient and timely manner. Low-drift sprays reduce your sensitivity to wind conditions, providing more opportunity to do the job on time. In pest control, timing is everything.

13) If aerial application can get away with 2 to 4 gpa for fungicides, why do I have to use 10 to 15 gpa with a ground sprayer?

- For fungicides, more water is usually better because more leaf area needs to be covered, and some of that is buried deeper down. Both aerial and ground sprays use as much water as economically and practically justifiable in each case. Aircraft can apply sprays in a more timely manner under some conditions, which can be more important than carrier volume.

14) How do I get rid of sprayer tracks?

- Sprayer tracks are hard to get rid of. Fast travel speeds, heavy sprayers, and dusty conditions appear to be the culprits. Some strategies involve placing higher flow-rate nozzles behind the wheels, moving the boom back away from the wheels, adding nozzles behind the wheels, or travelling slower.
- Reduce the proportional area of wheel tracks by using wider booms. With new auto-height and levelling controls, wider booms are easy to use.

15) How far can spray drift move?

- Fine spray droplets can move for many miles under the right conditions. They move farthest during temperature inversions (night or early morning) because high humidity keeps them from evaporating and calm, stable air keeps them from dispersing. Topography is also important, as drift will follow low-lying areas. Windy conditions actually help disperse the spray. When it's windy, a greater proportion of the spray will drift, but it also gets diluted rapidly and doesn't cause downwind damage for that reason.

16) How low can I go with water volumes and still get good results?

- The secret to using low water volumes is maintaining coverage. Since lower volumes result in less water available per square inch, applying this water in smaller droplets compensates. That is OK as long as drift can be managed. Low water volumes typically reduce the effect of hard water. Unfortunately, canopy penetration and overall consistency can be reduced when water volumes are reduced too low. I would not recommend that less than 5 gpa be used for any product other than glyphosate. Remember, water is a relatively cheap input and it offers significant returns in terms of a quality job.

17) Can I use low drift nozzles with all my chemicals?

- Yes, as long as all the other guidelines (appropriate water volume and spray pressure) are followed, and a Coarse to V. Coarse spray is maintained (VMD 350 – 450 µm). Among herbicides and weeds, broadleaf weeds and Group 2 and 4 herbicides can actually work better with coarser sprays. Grassy weeds and Group 1 herbicides prefer finer sprays. A Group 1 and Group 2 tank-mix can be applied with a Coarse to Very Coarse spray but water volume should be kept above 7 gpa.

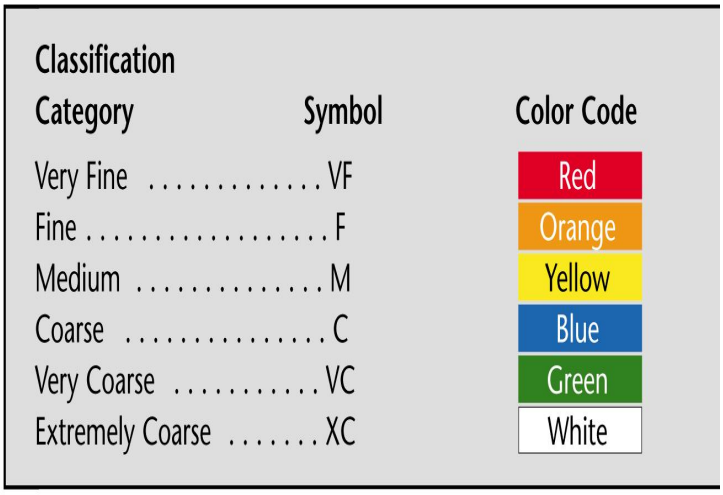
18) Should I point my nozzles forward or backward or both?

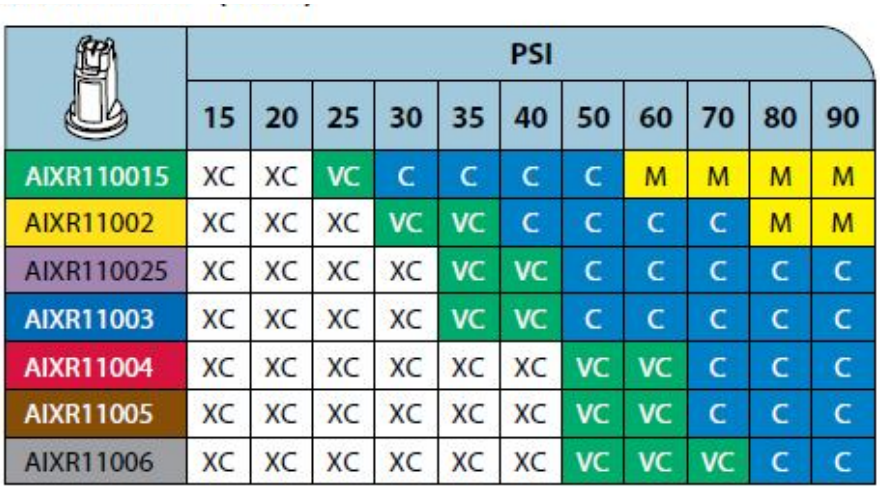
- Canopy penetration is best when nozzles are pointed backwards. Coverage of vertical targets such as wheat heads or grassy weeds is best when nozzles are pointed forwards. Using a double nozzle provides the best of both worlds, but they work best with a coarse spray. Using a double nozzle with a fine spray mostly increases drift potential with few other benefits. Double nozzles are available in conventional sprays (TeeJet TwinJet), as an air-induced spray (Albuz AVI Twin), or can be custom configured using the Lurmark TwinCap or swivel nozzles.

- Double nozzles do not double the number of droplets available. Making more droplets available is only a matter of droplet size – if you want more droplets, use a finer spray. It simply doesn't matter how you produce such a finer spray – increased spray pressure, finer nozzle type, using two smaller, finer nozzles instead of one large coarse one – these are all equivalent in their effect.
- In our research with fungicides and herbicides, we've seen benefits to double nozzles in specific situations when targeting the top third of a vertical canopy type. These benefits were usually less than 15% better efficacy, and they occurred only about 10 to 20% of the time. So while there's no serious downside, aside from the higher cost and greater plugging potential, the upside is also small.

19) How do I know what droplet size my nozzles are producing?

- All hydraulic and air-shear nozzles produce a wide range of droplet sizes, usually from 10 to 1000 µm. It's the proportion of the volume in each size fraction that differs.
- Nozzle manufacturers may quote a droplet size number. This is usually the VMD, or volume median diameter (the diameter below which contains 50% of the total volume of the spray).
- Nozzle manufacturers now publish spray quality charts that identify the ASAE spray quality. These charts are available in catalogues or on-line. For examples, see
  - www.teejet.com/techcent/catalog_english/techinfo.pdf
  - www.hypropumps.com/FileAttachments/Spray/en-us/400-Catalog-SprayTipGuide.pdf
  - www.turbodrop.com/chart_asae.html
  - www.hardi-international.com/huk_trade/sqc.html
  - www.wilger.net (enter site and select tip wizard)





	PSI										
	15	20	25	30	35	40	50	60	70	80	90
AIXR110015	XC	XC	VC	C	C	C	C	M	M	M	M
AIXR11002	XC	XC	XC	VC	VC	C	C	C	C	M	M
AIXR110025	XC	XC	XC	XC	VC	VC	C	C	C	C	C
AIXR11003	XC	XC	XC	XC	VC	VC	C	C	C	C	C
AIXR11004	XC	XC	XC	XC	XC	XC	VC	VC	C	C	C
AIXR11005	XC	XC	XC	XC	XC	XC	VC	VC	C	C	C
AIXR11006	XC	XC	XC	XC	XC	XC	VC	VC	VC	C	C