We’ve all heard that “familiarity breeds contempt.” Those things or persons with which we have frequent and intimate interaction are easy to take for granted; we lose conscious appreciation for their role in our lives. In our agriculturally related lives, one of the most easily overlooked items we see frequently are nozzles.

The extraordinary complexity of this seemingly simple device demands that we select nozzles in a conscious process. There is much more to nozzle selection than picking nozzles from our bins once a year as the season for herbicide or pesticide use arrives. Not only might our bin stock be outdated or damaged, but the reason we chose that bin stock may no longer be valid. Because our interactions with new labels, regulations, crops, herbicides, and pests change at least annually, we need to refresh our nozzle knowledge annually as well.

Fortunately, the basic ideas behind nozzle design are intuitively easy to grasp. This is because a nozzle is only, as the Merriam-Webster online dictionary tells us, “a short tube with a taper or constriction used (as on a hose) to speed up or direct a flow of fluid.”1 Most of us have been familiar with nozzles of some kind since our childhood when we “experimented” with a garden hose and brass nozzle and found these relationships:

- Opening the nozzle without increasing the flow to the nozzle creates larger drops that go a short distance away from us.
- Closing the nozzle without increasing the flow to the nozzle creates smaller drops that go a long distance from us. They can even fog and drift a very long way indeed.
- Whether our nozzle is open or closed, if we open up the supply line valve to allow more flow per unit time to the nozzle, we can make all large or small drops go a longer way from us than those emerging at a very low flow.

- Sometimes we want big drops. This might happen when we want to rinse off something such as the family car.
- Sometimes we want very fine drops. This might happen when we merely want to dampen something.

Our experiences are the basis of modern spray technology. Summarized in late January 2013, at the Southern Farm Show in Raleigh, NC, by Tom Reed, regional sales manager of TeeJet Technologies, these functions are: (1) control drift, (2) form droplets (which Reed sees as the most important nozzle function), and (3) make a pattern of the droplets. What Reed called the spray dilemma is that smaller droplets cover better but larger droplets result in less drift.

Not surprisingly, the earliest, first nozzle-based applications of agricultural chemicals were made by simple garden hose nozzles or by such nozzles slightly modified so that they wouldn’t “open up” a small amount with every bounce. Probably because basic fluid mechanics was a well-developed engineering science and because the potential market for nozzles was so large, nozzle science quickly advanced. Agricultural engineers were at the forefront of this advance.

Design fundamentals

Once engineers began designing nozzles, quantifiable relations between opening and pressure became the basis of nozzle design. The fundamental relations are that: (1) doubling output from a nozzle usually requires a fourfold increase in pressure and (2) reducing a nozzle opening diameter in half while keeping pressure constant creates an eightfold number of droplets compared with the number before diameter reduction. Finally, the speed at which one travels while discharging from nozzles is critical to applying a known discharge volume to an area per unit time. In other words, one can sit still and apply an entire tank to a few square feet or one can move forward in high gear and apply almost no volume to a square foot.

By Dennis J. Osborne, Ph.D., J.D., CPSC, and Licensed Professional Soil Scientist in North Carolina Raleigh, NC

Nozzles now advanced precision farming tools

Southern U.S.

Published March 28, 2013


1 See www.merriam-webster.com/dictionary/nozzle

[continued on p. 18]