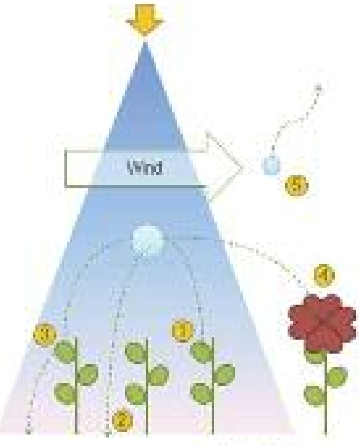
Maximizing pesticide performance

Editor's note: *The author is the product manager and technical specialist for WinField's Professional Products Group.*

Pesticides are one tool turfgrass managers use to create quality playing conditions. Using pesticides can increase the financial investment in a field and can raise concerns from stakeholders. Improving pesticide performance can reduce reapplications, thus optimizing financial investments and possibly reducing stakeholder exposure. Pesticide performance is influenced in three areas of the application process: in the spray tank, between the equipment and the target, and on the surface of the target. There are several adjuvant technologies on the market that can be used to improve pesticide performance in each of these areas.

In the environment

1. On-Target application: the goal is 100%!
2. Missing the target
3. Run or bounce off of leaf - > 600 µm
4. Drift: off-target deposition - 20-200 µm
5. Evaporation: very small droplets - < 50 µm



 WINFIELD

In the spray tank

Pesticides typically make up a fraction of the material in a spray tank. The quality of the carrier water is often overlooked, but the quality of the carrier water can have a significant impact on pesticide performance. The pH and presence of positively charged ions are the two main concerns with carrier water.

Mixing pesticides with too acidic or basic water can decrease pesticide performance. Under the wrong pH the rate of pesticide breakdown increases, which reduces the activity of the pesticide. With some pesticides, the activity can be reduced by half in a matter of minutes. Most pesticides prefer to be in slightly acidic water.

Buffering agents and acidifiers are two chemistries that can alter carrier water pH, thus limiting pesticide breakdown. Buffering agents lower the pH to around 6 and then maintain the pH in that range as other products are added. Acidifiers can lower the pH below 6. Unlike buffering agents, the addition of more carrier water or pesticides can raise the pH of a solution containing acidifiers, which could take the pH into a bad range for the pesticide being used. Both buffering agents and acidifiers must go in the spray tank before the pesticides to have the desired effect. Additionally, it is best to fill the spray tank almost completely before adding these products to limit pH fluctuations with additions to the tank.

Most everyone has witnessed an ineffective application of glyphosate, which is the active ingredient most effected by positive ions in carrier water. Positively charged ions in carrier water also decrease pesticide performance. Ions, such as calcium, iron, potassium, sodium and magnesium, can attach themselves to active ingredients. This attachment alters the chemistry of the active ingredient, therefore, rendering the individual molecule ineffective. Although positive ions cause problems with only a few pesticides, mainly weak acid herbicides, they can really limit pesticide performance.

Water conditioners can be used to remove free positive ions in the water. In one study at Kansas State University, the addition of the water conditioners, AirTech, Dispatch or Bronc Plus Dry EDT to a mix containing glyphosate and hard water (452 ppm) more than doubled the control of large crabgrass. Just like buffering agents and acidifiers, water conditioners must go in the tank before the active ingredient and it is ideal to have the spray tank mostly filled before using water conditioners.

As a spray droplet leaves the nozzle, the droplet can hit the target, miss the target, bounce off the target, drift away from the target, or evaporate. Numerous studies have concluded that pesticide performance is increased when more droplets reach the target. Too big and small droplets need to be minimized in order to get the most droplets on the target. The greatest concern should be over small droplets as they have the potential to drift away from the site and cause off target damage. Equipment modifications and adjuvants are the two main ways to alter droplet size.

Spray pressure, nozzle pattern, nozzle spray angle and nozzle age have the most impact on droplet size. As spray pressure increases, the average size of spray droplets decrease. Flat fan nozzles produce the finest spectrum of droplets, while air induction nozzles produce a coarser droplet spectrum. Wide angle nozzles, such as 110o, produce more small droplets. Brass and stainless steel nozzles wear the fastest and worn nozzles produce more small droplets. Spray pressure should be lowered and new nozzles with an 80o angle that produce a coarser droplet size, but still provide adequate coverage, should be selected to minimize the number of small droplets created.

Polymer and oil based drift adjuvants are two technologies that minimize small droplets. Polymer adjuvants increase surface tension by thickening the spray solution. This significantly increases the size of droplets, which makes them less prone to drift. Polymer products are known to create droplets that are too large and mix poorly in spray tanks. Oil-based drift adjuvants increase droplet size, but mix more easily and do not create substantially bigger droplets. This makes them the ideal adjuvant to optimize droplet size. Drift adjuvants should be considered for every spray, even when wind is not present, because the improved spray spectrum leads to significant improvements in pesticide performance.

On the target

Once a spray droplet reaches the target it must be absorbed to have the desired effect. Increasing droplet spread increases the contact area, thus increasing the potential for absorption. The longer a droplet remains in the liquid state the better chance there is of absorption. Droplet spread and droplet longevity can be improved with two different classes of adjuvants.

Droplet spread can be increased with the addition of non-ionic or organosillicone surfactants. Both of these technologies increase droplet spread by reducing surface tension. Organosillicones increase the droplet spread substantially, up to four times as much as a water droplet. The increased spread of organosillicones leads to faster drying time, which can limit overall uptake. Organosillicone surfactants are best used with contact insecticides and fungicides. Non-ionic surfactants are best used with systemic pesticides and herbicides.

Droplet longevity can be increased with the addition of crop oil concentrate and methylated seed oil adjuvants. Crop oil concentrate adjuvants do not increase the size of the droplet, while methylated seed oil adjuvants increase the size of the droplet. The difference in droplet size tends to lead to greater pesticide uptake with methylated seed oils. When using crop oil concentrates and methylated seed oils increased absorption occurs in both the target and the desirable species in the area. Thus, these oil adjuvants can lead to damage in non-target organisms. Both of these technologies are best used with herbicides.

Improving pesticide performance begins with recognizing the factors that limit pesticide performance. Pesticide performance can be increased by making sure the pesticide remains active in the spray tank, the spray droplets reach the intended target and the pesticide is absorbed by the target. Buffers, acidifiers, water conditioners, anti-drift, non-ionic surfactants, organosillicone surfactants, crop oil concentrates, and methylated seed oil adjuvants are useful products to manage factors impacting pesticide performance. The pesticide applicator is responsible for analyzing spray conditions and making the appropriate decisions that maximize pesticide performance. When pesticide performance is high, fewer reapplications are needed. ■

Aaron Johnsen is the product manager and technical specialist for WinField's Professional Products Group.