

Is tank-mixing herbicides worth it?

By Scott McElroy, Ph.D. and Greg Breeden

New sulfonylurea (SU) herbicides for use in turfgrass systems have revolutionized weed management in turf. Because of these new herbicides, such as Revolver (foramsulfuron), Monument (trifloxysulfuron), and Certainty (sulfosulfuron), just to name a few, we now have options for some of our toughest weed control problems. Weeds normally difficult to control, annual bluegrass (*Poa annua*), clumpy perennial ryegrass (*Lolium perenne*), yellow nutsedge (*Cyperus esculentus*), and *Kyllinga* spp. can now be easily controlled in Bermudagrass and zoysiagrass turf with these herbicides.

But while these herbicides can control many weeds, they are not

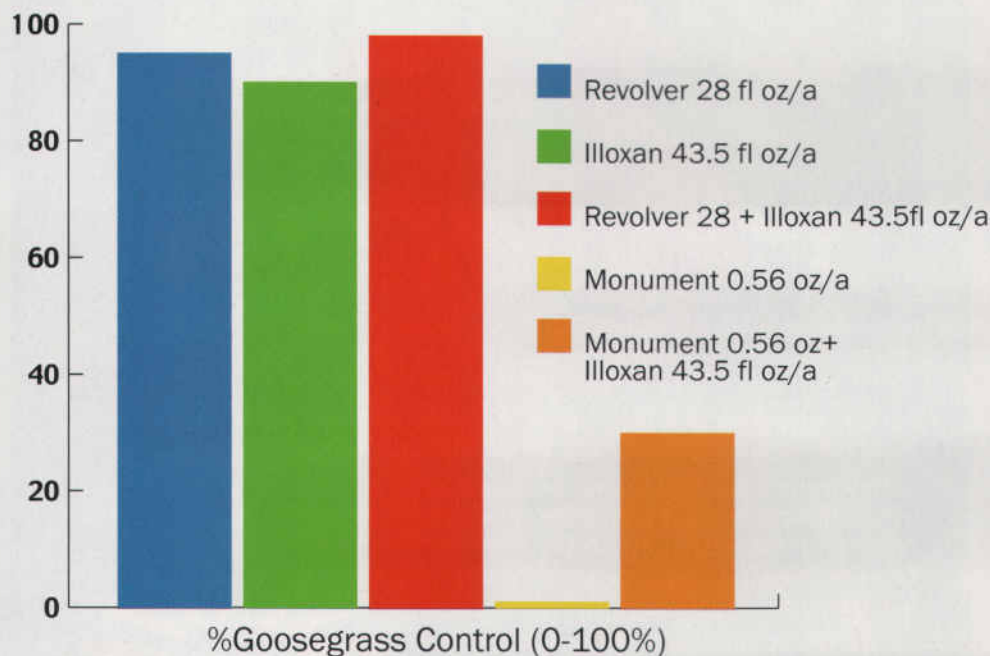
they panacea that one would hope. For example, many SU herbicides will control some broadleaf weeds, but no one SU herbicide will control all broadleaf weeds. So for complete control of a broad range of broadleaf weeds, you may want to tank-mix an SU herbicide with another herbicide to broaden your spectrum of weed control. But can you do this with out any antagonism occurring?

Well, with regard to tank-mixing SU herbicides with other herbicides to broaden the spectrum of weed control, we have some definite things we cannot do and there is much we simply do not know about tank-mixing these herbicides. Let's start with what we know we cannot do.

Definite "do not"

There is only one definite "Do not" with respect to tank-mixing SU herbicides. Do not tank-mix SU herbicides with the two herbicide families that only have herbicidal activity on grasses, cyclohexandiones and aryloxyphenoxy propionates, also know simply as graminicides. Herbicides in these families include Illoxan (diclofop), Fusilade II (fluazifop), Acclaim Extra (fenoxaprop), Vantage (sethoxydim), and Select (clethodim). (Cyclohexandiones and aryloxyphenoxy propionates are more easily remembered by their nicknames, the "dims" and the "fops," respectively. These pseudonyms are attributed to the suffix of the chemical names of members in these herbicide families. Fenoxaprop is the exception to the rule.)

Both of these herbicide families only control grasses and do not have herbicidal activity on broadleaf weeds. There is firm evidence that indicates that tank-mixing SU herbicides with graminicides will antagonize the activity of the graminicides (Burke et al. 2002). The activity of the SU herbicide will not be antagonized, however, so weeds targeted by the SU herbicide will still be controlled.



Goosegrass control with Revolver, Illoxan, and Monument alone and in tank-mixture. All treatments were applied twice with the second application applied 2 weeks after the first.



Goosegrass control with Revolver, Illoxan, and a tank-mixture of Illoxan + Monument. Note the high density of goosegrass in the treated plots. Photos taken one week after the second of two applications of each treatment.

One potential problem that could arise would be the potential tank-mixing Monument, for sedge control, and Illoxan for goosegrass control. Since Monument is an excellent herbicide for control of almost all sedges, including nutsedges (*Cyperus* spp.) and *Kyllinga* spp., you would observe excellent sedge control. Goosegrass control with Illoxan could be severely decreased however, due to Monument antagonizing the herbicidal activity of Illoxan.

Research conducted at the University of Tennessee in 2004 evaluated this potential problem. Treatments included Illoxan at 43.5 fl oz/a, Monument at 0.56 oz/a, and Revolver at 28 fl oz/a, with Monument and Revolver also being applied in tank-mixture with Illoxan. All treatments were applied twice with the second application being made 2 weeks after the first. The first applications were made on August 6, 2004. Goosegrass plants were producing seedheads at the time of application and contained from 8 to 12 tillers. Ratings were taken 3 weeks after the second application.

As was expected, Monument antagonized goosegrass control with Illoxan. In this scenario, however, if Monument controlled goosegrass, the antagonism would not be noticed simply because the SU herbicide activity is not disrupted (Burke et al. 2003). This is illustrated by treating goosegrass with a tank-mixture of Revolver and Illoxan. While this tank-mixture is equivalent to Revolver or Illoxan alone with respect to goosegrass control, the observed control is most likely attributed to the activity of Revolver on goosegrass as opposed to Illoxan.

This study illustrates the problem with tank-mixing SU herbicides with graminicides. Tank-mixing SU herbicides with other herbicide groups is not as clear-cut however.

Broadleaf herbicides

When determining if you can tank-mix SU herbicides with those other than graminicides, our knowledge of what you can and cannot tank-mix is a little murkier. Many SU herbicide labels allow for tank-mixtures with broadleaf herbicides, such as 2,4-D, dicamba, clopy-

ralid, and triclopyr, to broaden the spectrum of weed control. While there is currently no current research evidence available to suggest that one of these herbicides would be antagonized or would antagonize an SU herbicide, there is little evidence to suggest that antagonism does not occur. And while there have been isolated reports in 2005 of antagonism from turf managers who have used such tank-mixtures, there are countless others who have not had a problem or who have actually seen potential synergism of tank-mixtures.

Other herbicides that are commonly applied in tank-mixture with other herbicides are MSMA and Quicksilver (carfentrazone). Again, isolated complaints of MSMA or Quicksilver antagonizing an SU her-

bicide have surfaced, but there is little evidence to suggest that these herbicide cause SU herbicide antagonism. (Antagonism is potentially attributed to applicator error, but don't tell the applicator that.) To evaluate potential antagonism of one of these herbicides with an SU herbicide, a research trial was conducted at Tennessee. The trial evaluated Revolver, Monument, and an unlabeled SU herbicide, flazasulfuron, for control of clumpy tall fescue in bermudagrass turf. Each of these herbicides are known to provide excellent control of tall fescue, however, in our study we applied each alone or in tank-mixture with 2,4-D, MSMA, or Quicksilver to determine if any of these her-

bicides antagonize tall fescue control.

In this situation there was no antagonism of any of the SU herbicides. All of the herbicide treatments evaluated controlled tall fescue from 85 to 100%, regardless if it was applied with one of the tank-mix herbicides or not.

This research was also conducted on tall fescue a second time to confirm the results and also on clumpy perennial ryegrass. In both of these additional cases, no antagonism of the SU herbicides was observed. Does this mean that there is no problem with tank-mixing SU herbicides with these particular three herbicides? Not necessarily. There is still much research to be done to evaluate potential problems that may occur.

Can you mix any herbicides without any antagonism occurring?

SU herbicides with SU herbicides

This is one area where no one has spotted any definite problems concerning one SU herbicide antagonizing another SU herbicide. So spray on. In fact one of the best combination for total weed control in Bermudagrass or zoysiagrass turf is to tank-mix Manor and Monument both at 0.5 oz/a. With this combination you will say goodbye to cool-season grasses, sedges, wild garlic/onions, and almost all broadleaf weeds.

New herbicides and other pesticides in the turfgrass market often bring great benefit in solving pest problems that once had few, if any, solutions. With new chemistry usually can come with potential unforeseen problems. To avoid potential antagonism problems, remember to always consult the herbicide label on proper mixing instructions and tank-mix partners. ■

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Literature Cited

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Burke, I.C., J.W. Wilcut, and D. Porterfield. 2002. CGA-362622 antagonizes annual grass control with clethodim. *Weed Technol.* 16:749-754.

Vencill, W.K. 2002. *Herbicide Handbook*, 8th Edition. Weed Science Society of America: Lawrence, KS. pp. 493.

Definitions of herbicide tank-mixture effects (Vencill 2002)

Additive. An interaction of two herbicides would be considered additive when the observed weed control of the mixture is the combined effect of when the two herbicides are applied separately. Example: Product A and B each control crabgrass 50%, but when applied together they control crabgrass 100%.

Antagonism. An interaction of two herbicides such that the observed weed control when herbicides are combined is less than the weed control of the herbicides when they are applied separately. Example: Product A and B each control crabgrass 100% alone, but when applied together only 20% crabgrass control is achieved.

Synergism. An interaction of two herbicides such that the observed weed control when herbicides are combined is greater than the additive effect of the herbicides when they are applied separately. Example: Product A controls crabgrass 10% and Product B controls crabgrass 20%. When they are combined they control crabgrass 100%, instead of an additive effect of 30%.

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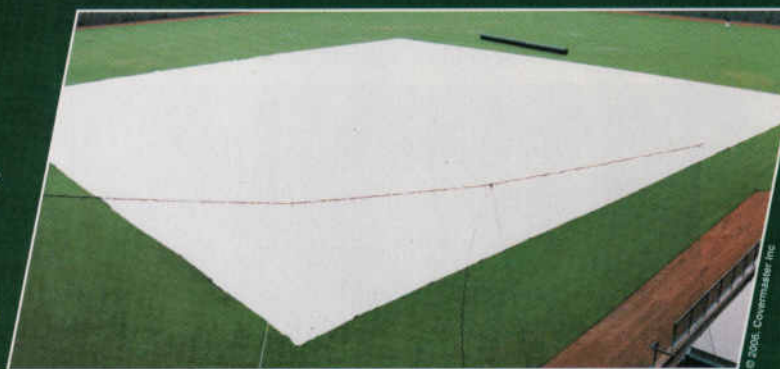
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