Controlling Tall Fescue, Common Bermuda, and Bahia

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Collectively, tall fescue (*Festuca arundinacea*), common Bermuda (*Cynodon dactylon*) and Bahiagrass (*Paspalum notatum*) have been seeded on more than 50 million acres throughout the southeast and midwestern United States. These exotic grasses have been seeded for hay, pasture, turfgrass, surface mine reclamation, conservation and roadside plantings, and for erosion control. As with many exotic organisms, these species are very aggressive and can quickly invade natural areas causing plant community degradation. Furthermore, these grasses do not provide quality wildlife habitat for grassland birds like the Northern Bobwhite quail or mammals such as the Eastern cottontail rabbit (Barnes *et al*. 1995, Randall 1996) . We (my graduate students and I) embarked upon an interesting journey eight years ago when we began our experiments with eradicating tall fescue using a variety of management techniques including fire, tillage, and herbicides (Madison *et al*. 2001). The results of our first studies indicated that a spring controlled burn followed by a single application of glyphosate at the maximum label rate was the most effective method of killing tall fescue at that time.

We monitored those initial plots for two years and by the end of study, tall fescue had reinvaded much of the herbicide treated plots. Because we were interested in developing wildlife habitat, we concluded that some other grass species should be seeded to keep the tall fescue from re-invading the plots. We determined that native warm season grasses were the best option for providing quality wildlife habitat. Our initial studies in killing fescue with glyphosate and establishing the

Photo 1 Typical no-till seeding of native warm season grasses six weeks after seeding. We used 12 oz imazapic + 1 qt surfactant + 1 qt 28-0-0 liquid fertilizer per acre four weeks prior to seeding. Note that the fescue has been completely eradicated and the native warm season grasses are flourishing.

Photo 2 This treatment of 1 quart imazapyr + 2 quarts glyphosate + 12 oz imazapic one month later was the most effective treatment for killing common Bermuda grass. However, neither the seeded native warm season grasses or anything else grew in these plots.

Photo 3 A spring burn followed by an application of 2 quarts glyphosate per acre + 12 oz imazapic per acre was the best treatment for reducing common Bermuda grass and establishing native warm season grasses. Notice the excellent stand of native warm season grasses in areas where the Bermuda grass was killed. In the upper right hand corner, notice the line of Bermuda grass. This is an area between spray units that did not receive a herbicide application.

Photo 4 The best treatment for killing bahiagrass and establishing native warm season grasses was to conduct a spring burn followed by an 8 oz application of clethodim followed by an 8 oz imazapic application at seeding. Note there is little bahiagrass in the plot and the strong establishment of Indiangrass at the end of the first growing season.

native grasses were met with disaster. As expected, severe weed competition from crabgrass (*Digitaria* spp.), johnsongrass, (*Sorghum halepense*), foxtail grasses (*Setaria* spp.), and ragweed (*Ambrosia* spp.) prevented the natives from becoming established and flourishing.

A chance meeting with scientists from American Cyanamid at a wildlife conference altered our research program forever. Drs. Joe and Jennifer Vollmer informed me that a new herbicide that contained the imazapic molecule would kill tall fescue and provide residual weed control for 45 to 60 days post-treatment. Like most scientists, I was skeptical of corporate marketing efforts, but I did agree that I would like to try some of their product for an upcoming research project. That first project consisted of two experiments: comparing the efficacy of imazapic to glyphosate for controlling tall fescue either singly or in combination. Because of limited space, readers are referred to our paper in *Weed Technology*, (Washburn and Barnes 2000) for specific information on methods and a complete discussion of the results.

In the first study we compared a single application during the spring and fall of glyphosate at label rates. Average pre-treatment tall fescue cover on the sites was 93%. Overall, tall fescue cover was reduced to less than 12% on average by a single postemergence spring or fall application. Tall fescue cover in the spring treatments averaged 1.3% remaining compared to 6% remaining in the fall treatments. These differences were not statistically different.

In the second study, we compared a single spring treatment using imazapic at maximum label rate (12 oz per acre) to a mixture of imazapic at label rate with either 1 quart or 2 quarts glyphosate per acre. We compared the efficacy of the treatments during the tall fescue spring vegetative growth stage, boot stage, summer dormancy stage, or fall vegetative stage. Average pre-treatment tall fescue cover was 91%. Imazapic alone and in combination with glyphosate reduced tall fescue cover to less than 3% regardless of application timing. The results of these two studies concluded that either glyphosate or imazapic kill tall fescue. The herbicides can be used alone or in combination and by using both herbicides, imazapic tolerant species would also be eliminated from the plant community.

Remember at the beginning of the article I mentioned the initial native warm season grass plantings were thought to be failures. Well, it turns out they were not. Even though we could not quantify their presence in the plots, the seedlings were being obstructed by the invasion of tall fescue and johnsongrass. At the beginning of the third growing season we applied the maximum label rate of imazapic without any fertilizer or surfactant in late April to the plots considered to be failures. In 7 of our 9 treatments, the imazapic reduced or eliminated the tall fescue and other exotic weeds including johnsongrass. Prior to applying the herbicide, native warm season grass cover ranged from 14 to 47%. That fall, native warm season grass covered had increased from 81 to 122% (Washburn *et al*. 1999).

With this information in hand, we designed an experiment to determine the efficacy of prescribed burning, postemergence imazapic applications, and combinations of prescribed burning and imazapic applications for eradicating tall fescue and increasing native warm season grasses in native prairie barrens. We implemented 16 different treatments that included different rates of imazapic with and without a non-ionic surfactant. The treatments also included burned and unburned plots. We observed that all 12 herbicide treatments had less tall fescue cover compared to the controls over a two year period. The best treatment for reducing tall fescue cover was spring burning followed by applying 8 and 10 oz of imazapic with a non-ionic surfactant. Prescribed burning alone did not decrease tall fescue cover. This has been documented in several other studies (Madison *et al*. 2001, Washburn *et al*. 1999). While we successfully reduced tall fescue cover in most treatment plots, another exotic cool-season grass, Kentucky bluegrass, that is tolerant to imazapic, became dominant in some plots.

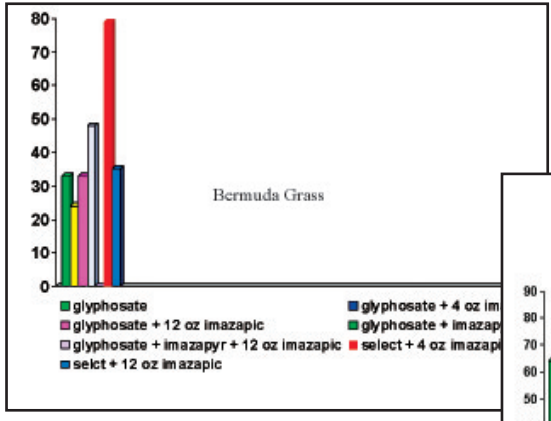
Our final fescue eradication experiment was implemented last spring. The goal of this project was to compare the efficacy of several herbicides including glyphosate, imazapic, clethodim, and sethoxydim for killing tall fescue. Our reasoning behind implementing this study was to determine if a grass-specific herbicide like clethodim or sethoxydim could be used to kill fescue and remove it from native grasslands. From our previous work we knew that both imazapic and glyphosate effectively kill tall fescue but both of these herbicides will kill many forbs.

This study was conducted at three locations throughout Central Kentucky in the outer bluegrass physiographic province. Specific treatments included maximum label rates of glyphosate and imazapic, 8 or 10 oz per acre clethodim, and 1 quart sethoxydim per acre. We also added 1 quart surfactant and 2.5 lbs Ammonium sulfate per acre in each herbicide tank mixture. The results of this experiment showed, to no ones surprise, that the glyphosate and imazapic effectively removed the tall fescue. Average tall fescue cover post-treatment for the glyphosate and imazapic treatments were less than 2% remaining and less than 5% remaining, respectively. Clethodim was also effective and at two locations reduced tall fescue cover to less than 20% fescue remaining. The sethoxydim treatments were largely unsuccessful and they left an average of 73% and 46% tall fescue at two sites and 6% at the third location.

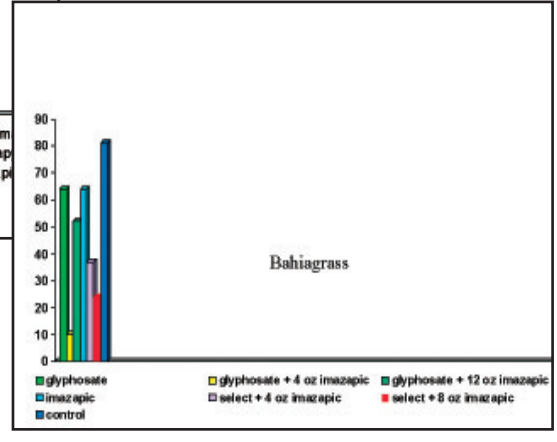
In summary, we feel very comfortable that either a single spring application of glyphosate or imazapic at maximum label rates can effectively kill tall fescue. We know that you get better results if you burn the fescue field prior to herbicide application. We also know that you get better control if you add a surfactant and small amount of nitrogen fertilizer to the tank mixture. If you are trying to remove tall fescue from a native prairie or oldfield dominated by broomsedge bluestem (*Andropogon virginicus*), you can use 10 or 12 oz of imazapic per acre and it will do the job. However, if you have a diverse field with forbs, the jury is still out on the most effective treatment. Our information suggests that clethodim may be an appropriate herbicide but

the others have not yet been tested for use in this situation. For example, if you apply glyphosate or imazapic in March prior to the warm season species breaking dormancy, more forb species may be tolerant to this treatment That is the subject for our next set of experiments that will begin this spring.

While most of our research has focused on tall fescue, we are now looking at controlling other exotic grasses and converting them to native warm season grasses. The first two exotic grasses we have worked on include common Bermuda and bahia. Our work on common Bermuda has been done in Alabama at Wheeler National Wildlife Refuge. The bahia work has been done along the South Carolina coastal plain.



Common Bermuda grass has proven to be a more difficult species to eliminate. The pre-treatment and control plots had an average of 80% Bermuda grass cover. All treatment plots in this study were burned in March and herbicides were applied the first week of April. We did find a treatment that did eliminate the Bermuda grass (1 quart imazapyr + 2 quarts glyphosate followed by 12 oz imazapic one month later) but there were few plants, of any species including the native warm season grasses, that survived the herbicide treatment. Total vegetative cover in these plots was less than 1% (see photo). Two treatments that showed tremendous promise were those treated with 2 quarts glyphosate per acre. These data are somewhat skewed because our spray unit did not overlap and in the small space between herbicide treatments the Bermuda grass escaped into the plots (see photo). Thus, where the herbicides reached the grass, we got almost complete control by burning and applying the maximum label rate of glyphosate per acre. When we added either 4 or 12 oz imazapic per acre



we were able to successfully establish the native warm season grasses (see photo).

Another species that has proven difficult to control has been bahia grass. The protocol for this experiment was similar to the Bermuda grass trials. Average bahia cover pre-treatment was 81%. All fields were burned prior to herbicide application. One quart surfactant and 2.5 lbs Ammonium sulfate were added to each herbicide tank mixture. The best treatment for killing the bahia and establishing the native warm season grasses was using 8 oz clethodim per acre as a burn down followed by an 8 oz imazapic application at seeding. This reduced the bahia cover to 24% (see photo). Another promising treatment for killing bahia was to use 2 quarts glyphosate per acre as a burn down followed by a 4 oz imazapic application approximately 1 month later. This reduced the bahia cover to about 10% but the native warm season grass establishment was not as good as the clethodim treatment. Others that reduced the amount of bahia included a 12 oz per acre imazapic treatment (37% cover) and an 8 oz clethodim + 4 oz imazapic treatment (37%).

The results of these studies show that herbicides are an effective management tool for killing tall fescue. The results of the Bermuda and bahia grass experiments show there is promise in using herbicides for killing these species and establishing native warm season grasses. We still need to do some more work to develop the best management recommendations for these two species. In addition to this work, we are also looking at converting Old World bluestems to native warm season grasses. The next few years may hold the key to generating more information on the most effective methods to kill these exotic grasses.

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