CONTROL OF NATURAL PINES USING SITE PREPARATION MIXES WITH IMAZAPYR, GLYPHOSATE, SAFLUFENACIL, BAS #1, AND BAS #2

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ABSTRACT

Control of natural pine continues to be problematic in forestry site preparation efforts. Thirteen treatments were used in a study testing efficacy of two numbered BASF products (BAS #1 and BAS #2) for natural pine control in combinations with imazapyr and glyphosate. This study was established on a cutover forestry site in northeast Mississippi on August 31, 2018. Natural pine and hardwood stems were recorded prior to treatment applications and again at 14 days after treatment (DAT), 56DAT, 90DAT, and 1 year (YR). Results clearly indicate that addition of glyphosate is necessary for adequate control of natural pines and BAS #1 or BAS #2 serve to enhance glyphosate efficacy. In addition, neither product provided satisfactory levels of natural pine control in stand-alone treatments.

INTRODUCTION

Chemical site preparation is the largest end use of herbicides in forest management efforts. It is also one of the greatest expenses in plantation establishment. Consequently, cost efficacy is always a concern, and any new herbicide chemistry creates interest. The commonly applied mixture of imazapyr and glyphosate provides good woody and herbaceous control in chemical site preparation tank mixes, but natural pine control continues to be problematic when using these applications.

Interest in increasing efficacy of standard site preparation treatments has resulted in research using several compounds designed to increase efficacy of these treatments on natural pine germinants. Herbicides containing carfentrazone, aminocyclopyrachlor, saflufenacil, (Ezell and Yeiser 2010, Ezell and others 2012a, Ezell and others 2012b) and others have provided various results regarding pine control. However, the need for a cost-effective efficacy enhancing additive remains with product development and continued testing.

While saflufenacil (Detail®) has been recognized for enhancing "burn down" effects in agriculture and forestry for years, BASF continues to develop new herbicides to serve as glyphosate enhancers in vegetation management. Subsequently, two new proprietary compounds (henceforth called BAS #1 and BAS #2) have shown promise in this role. The objective of this study was to evaluate the efficacy of site preparation tank mixtures containing these two compounds in natural pine control efforts.

MATERIALS AND METHODS

Study Site

The study was installed on Mississippi State University property near Starkville, MS. Adequate numbers of pine germinants could not be found in a cutover setting in time for protocol installation, so a powerline right-of-way was utilized. The site had not been mown or chemically treated for 2 years prior to study installation. Soil series is Mathiston silt loam with an average pH of 5.3. Loblolly pine (*Pinus taeda*) was the dominant woody species onsite with densities ranging between 3,200 and 14,000 (averaging 6,500) seedlings per acre. These stems ranged between 6 inches and 4 feet tall but averaged 1 foot in height overall. Oaks (*Quercus* spp.), sweetgum (*Liquidambar styraciflua*), red maple (*Acer rubrum*), and green ash (*Fraxinus pennsylvanica*) comprised a minor vegetative component.

Treatments

A complete list of treatments is found in table 1. Plots were rectangular areas measuring 25 by 50 feet, marked at each end by vinyl pin flags with string stretched along the plot midline between pin flags. Treatments were applied using a CO2-powered backpack sprayer with pole extension and a KLC-9 spray tip to simulate aerial spraying. Total spray volume was 15 gallons per acre and all treatments were applied August 31, 2018.

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Table 1—List of treatments applied in 2018 BASF natural pine control study

Treatment number	Herbicide and rate per acre
1	Control
2	Chopper Gen2[a] (48 ounces) + Velocity[b] (2 ounces) + Elite Pinnacle[c] (19 ounces)
3	Chopper Gen2 (48 ounces) + BAS #1 (2.74 ounces) + Velocity (2 ounces) + Elite Pinnacle (19 ounces)
4	Chopper Gen2 (48 ounces) + Detail[d] (2 ounces) + Velocity (2 ounces) + Elite Pinnacle (19 ounces)
5	Chopper Gen2 (48 ounces) + BAS #2 (2.74 ounces) + Velocity (2 ounces) + Elite Pinnacle (19 ounces)
6	Chopper Gen2 (48 ounces) + BAS #2 (5.48 ounces) + Velocity (2 ounces) + Elite Pinnacle (19 ounces)
7	Chopper Gen2 (48 ounces) + Accord Concentrate[e] (4 quarts) + Velocity (2 ounces) + Elite Pinnacle (19 ounces)
8	Chopper Gen2 (48 ounces) + BAS #1 (2.74 ounces) + Accord Concentrate (4 quarts) + Velocity (2 ounces) + Elite Pinnacle (19 ounces)
9	Chopper Gen2 (48 ounces) + Detail (2 ounces) + Accord Concentrate (4 quarts) + Velocity (2 ounces) + Elite Pinnacle (19 ounces)
10	Chopper Gen2 (48 ounces) + BAS #2 (2.74 ounces) + Accord Concentrate (4 quarts) + Velocity (2 ounces) + Elite Pinnacle (19 ounces)
11	Chopper Gen2 (48 ounces) + BAS #2 (5.48 ounces) + Accord Concentrate (4 quarts) + Velocity (2 ounces) + Elite Pinnacle (19 ounces)
12	Chopper Gen2 (48 ounces) + Detail (2 ounces) + BAS #1 (1.37 ounces) + Accord Concentrate (4 quarts) + Velocity (2 ounces) + Elite Pinnacle (19 ounces)
13	Accord Concentrate (4 quarts) + Velocity (2 ounces) + Elite Pinnacle (19 ounces)

[a] Imazapyr.
[b] Bispyribac sodium.
[c] Surfactant.
[d] Saflufenacil.
[e] Glyphosate (5.4 pounds active ingredient per gallon or 4 pounds acid equivalent).

Evaluations

Vegetation assessments were completed on a sample area 10 by 50 feet centered in the treatment plot. Prior to treatment, pine seedlings were recorded by 1-foot height class. Pine control was evaluated at 14 DAT, 56DAT, 90DAT, and finally, at 1 year.

Experimental Design and Data Analysis

Treatments were replicated three times in a randomized complete block design. Cumulative heights were calculated by multiplying the number of stems by respective height classes. Percent brownout averages were calculated and are presented herein. Percent values were arcsine transformed, but for ease of interpretation, actual values are presented. Means separation was performed using Duncan's New Multiple Range Test at $\alpha = 0.05$.

RESULTS

Average brownout estimates are presented in table 2. As expected, 14 DAT brownout was appreciably less than brownout at 56 DAT. While statistical testing was not performed on brownout averages at 14 DAT, treatment differences were already separating from those lacking glyphosates as part of the application. By 56 DAT, treatments containing glyphosate (Treatments 7-13) all exhibited similar brownout rates ranging between 89.7 and 100 percent. This trend continued through both 90 DAT and 1 year after treatment (YAT) evaluations with a clear separation of treatment efficacy exhibited between plots with and without glyphosate as a part of their respective tank mixes.

Table 2—Percent brownout averages of pine seedlings in 2018 BASF natural pine control

	Percent brownout averages			
Treatment	14 DAT[a]	56 DAT	90 DAT	1 YAT[b]
1	0.0	0.0a[c]	0.7a	0.0a
2	3.7	3.7a	8.7a	0.0a
3	4.3	4.3a	2.3a	0.0a
4	6.7	7.3a	13.3ab	11.1b
5	6.7	8.3a	6.7a	0.0a
6	25.0	25.0b	21.7b	0.0a
7	86.7	98.3c	100.0c	100.0c
8	71.7	100.0c	100.0c	100.0c
9	81.7	100.0c	100.0c	100.0c
10	93.3	100.0c	100.0c	99.6c
11	76.7	99.7c	100.0c	99.7c
12	90.0	99.3c	100.0c	100.0c
13	10.0	89.7c	86.7c	99.6c

[a] Days after treatment.
[b] Year after treatment.
[c] Values within a column followed by the same letter do not differ at $\alpha = 0.05$.

Imazapyr is not expected to provide loblolly pine control, and throughout the duration of this study treatments not containing glyphosate (Treatments 1-6) all exhibited levels of control for pine seedlings that would be considered unsatisfactory in commercial operations. Only treatments containing glyphosate (Treatments 7-13, all approaching 100.0 percent at 1 YAT) provided control that would be acceptable.

Earlier work utilizing Detail® (saflufenacil) has shown that addition of this glyphosate enhancer can prove beneficial (Self and Ezell 2019). The addition of additives (Detail®, BAS #1, and BAS #2) did serve to increase early efficacy in some treatments not containing glyphosate (especially Treatment 6 with the higher rate of BAS #2) in this study. However, by the time 1 YAT evaluations were performed, brownout

percentages had dropped to 0 percent in all treatments except Treatment 4 (11.1 percent brownout).

Typically, high levels of pine control using glyphosate treatment alone is not expected and the degree of brownout observed in Treatment 13 (99.6 percent at 1 YAT) was somewhat unexpected. An explanation for this high level of control can be found when considering the nature of vegetation present on this site. This right-of-way has been well maintained over the last two decades and hardwood stems were limited. The shielding effect of hardwood stems, common on cutover sites, was not present and resulted in a higher-than-normal level of pine seedling exposure to applications.

SUMMARY

Chemical site preparation will continue to be utilized in a large percentage of pine plantation establishment efforts across the South. As we continue to develop genetically advanced planting stock, control of natural pine will continue to increase in importance. Currently prescribed site preparation mixtures vary in pine control efficacy and a desire to increase control will continue to drive additional research in the area. Both numbered compounds and Detail® increased glyphosate effectiveness; however, a need for two additives is not warranted by the results of this study. Finally, using currently tested products and product mixtures, if glyphosate is not used, pine control will not be satisfactory in site-preparation efforts.

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