Surfactant Comparison for Johnsongrass Control

Introduction

Surface active agents, or surfactants, are one of the most common additives for pesticide mixtures and probably one of the least understood pesticide concepts. Terminology is often incorrectly interchanged as well as all surfactants and wetting agents are adjuvants but many adjuvants are neither surfactants nor wetting agent. By definition, spray adjuvants are substances that modify or enhance the performance of an herbicide. Surfactants facilitate and enhance the emulsifying, dispersing, wetting, spreading, sticking, penetrating, and/or other surface-modifying properties of liquids. There are several different types of surfactants and these include anionic, cationic, ampholytic, and, probably the most common, non-ionic.

Surfactant formulation and concentration are two commonly overlooked properties of a herbicide spray solution. Vegetation managers commonly use the same surfactant in all mixes due to simplicity and convenience. This practice is not necessarily wrong or inefficient. With several different surfactant types on the market, it is worthwhile to occasionally screen different types of surfactants to determine if one type of surfactant can increase herbicide efficacy at the standard rate or provide results at a lower herbicidal use rate.

A trial was established in 2008 to screen four surfactants at three rates combined with Outrider (a.i. sulfosulfuron) at three rates for johnsongrass control. More specifically, the trial was designed to determine if a certain surfactant at a certain rate could increase sulfosulfuron's efficacy on johnsongrass control.

Methods and Materials

Table 1 shows the surfactants tested. Surfactants were screened at 0.25 % v/v, 0.125 % v/v, and 0.0625 % v/v (0.25% v/v is the industry standard). Specific information on the active ingredients in each surfactant screened can be found on the manufacturer's websites. In total, 36 treatments were screened for johnsongrass efficacy.

Table 1: Surfactants screened in 2008 trial

Surfactant	Manufacturer	Surfactant Type	Concentration
Improve 90	GarrCo Products Inc.	Non-ionic	90 %
Activator 90	Loveland Industries	Non-ionic	90 %
Surf-Ac 820	Drexel	Non-ionic	80 %
Nu-Film IR	Miller Chemical	Non-ionic	96 %

Outrider was used as the herbicide standard as past research has shown Outrider at 1 oz / ac to be effective in suppressing johnsongrass in Kentucky. Outrider at 0.5 oz / ac is marginally effective and increasing rates of Outrider increases control. Using past research with Outrider as the baseline, three rates of Outrider, 0.25, 0.5, and 0.75 oz / ac were screened with the above

mentioned combinations of surfactants to determine if one of the four surfactants would increase efficacy of Outrider, especially at the lower rate.

Thirty-six treatments were installed in a randomized complete block design with 4 replications on 7/14/2008 in Lexington, KY. The study site was a johnsongrass dominated field whose past management included frequent mowing. Plots, measuring 10' X 30', were treated at 20 GPA using a CO2 powered sprayer mounted on an ATV. A 5' running check was installed between each plot to aid in efficacy ratings. Plots were rated 3, 9, 20, 30, and 50 DAT for visual percent necrosis. Data were analyzed using ARM software and treatment means were separated using Fisher's LSD at $p = 0.05$.

The drought in central Kentucky that began in 2007 continued into 2008. The trial was discontinued after 50 DAT due to the effects that the drought was causing on the untreated johnsongrass plants.

Results

Although statistical differences do exist between treatments at every interval, these differences are minor and do not contribute to the understanding of the effect surfactant types and rates have on herbicide efficacy (Table 2). More specifically, the data presented below in Table 2 provided little information as to the effect the four different surfactant types and rates have on Outrider efficacy at 3 different rates on johnsongrass control.

Figures 1 and 2 show control percentages for Outrider at 0.25 oz / ac (low rate) plus the 4 surfactants at 0.0625% v/v (low rate) and Outrider at 0.75 oz / ac (high rate) plus the 4 surfactants at 0.25% v/v (high rate), respectively. These figures are provided to show trends not obvious in Table 2. Control levels for the low rate of surfactant in combination with the low rate of Outrider (Figure 1) mirror those of the high rates of surfactant in combination with the high rate of Outrider (Figure 2). Control levels in each figure increase rapidly from 3 DAT to 30 DAT. Control levels begin to level out from 30 DAT to 50 DAT in both figures. Control levels appear to begin to decrease for the low rate of Outrider plus the low rates of surfactant (Figure 1).

Although all treatments appear to be operationally similar, it cannot be said whether or not the low rates of surfactant and low rate of Outrider would result in statistically similar control 1 YAT as the high rates of herbicide and surfactant due to the effects of the drought and the trial being terminated. It can be said that there were no statistical differences present 50 DAT for any surfactant at 0.25 % v/v (standard operational rate) combined with Outrider at 0.75 oz / ac.

Table 2: Results for 2008 surfactant trial

Outrider Rate (oz / ac)	Surfactant	Rate (% v/v)	Percent necrosis				
			3 DAT	9 DAT	20 DAT	30 DAT	50 DAT
0.25	Activator 90	0.25	20 a	19 a-d	38 a-d	63 a-d	65 a-d
0.25	Surf-AC 820	0.25	6 def	18 a-d	35 a-d	58 b-f	60 a-d
0.25	Nu-Film IR	0.25	11 b-e	23 a	36 a-d	60 a-f	55 cd
0.25	Improve 90	0.25	8 def	18 a-d	36 a-d	58 b-f	58 bcd
0.5	Activator 90	0.25	13 bcd	21 ab	38 a-d	60 a-f	64 a-d
0.5	Surf-AC 820	0.25	13 bcd	21 ab	39 bcd	65 abc	61 a-d
0.5	Nu-Film IR	0.25	9 c-f	16 a-d	34 bcd	53 ef	53 d
0.5	Improve 90	0.25	8 def	19 a-d	40 abc	70 a	73 a
0.75	Activator 90	0.25	11 b-e	19 a-d	38 a-d	61 a-f	65 a-d
0.75	Surf-AC 820	0.25	8 def	19 a-d	41 abc	59 b-f	60 a-d
0.75	Nu-Film IR	0.25	10 b-e	18 a-d	39 a-d	65 abc	63 a-d
0.75	Improve 90	0.25	11 b-e	21 ab	41 abc	65 abc	68 abc
0.25	Activator 90	0.125	10 b-e	19 a-d	36 a-d	61 a-f	60 a-d
0.25	Surf-AC 820	0.125	2.5 f	15 bcd	39 a-d	65 abc	70 ab
0.25	Nu-Film IR	0.125	8 def	18 a-d	33 cd	54 def	55 cd
0.25	Improve 90	0.125	9 c-f	20 abc	38 a-d	53 ef	55 cd
0.5	Activator 90	0.125	13 bcd	16 a-d	41 abc	66 abc	63 a-d
0.5	Surf-AC 820	0.125	16 ab	21 ab	34 bcd	61 a-f	65 a-d
0.5	Nu-Film IR	0.125	9 c-f	18 a-d	30 d	59 b-f	60 a-d
0.5	Improve 90	0.125	8 def	19 a-d	39 a-d	56 c-f	65 a-d
0.75	Activator 90	0.125	11 b-e	19 a-d	39 a-d	65 abc	68 abc
0.75	Surf-AC 820	0.125	8 def	16 a-d	39 a-d	68 ab	71 a
0.75	Nu-Film IR	0.125	13 bcd	21 ab	38 a-d	60 a-f	63 a-d
0.75	Improve 90	0.125	13 bcd	21 ab	44 a	68 ab	70 ab
0.25	Activator 90	0.0625	10 b-e	15 bcd	35 a-d	61 a-f	65 a-d
0.25	Surf-AC 820	0.0625	9 c-f	16 a-d	30 d	65 abc	63 a-d
0.25	Nu-Film IR	0.0625	6 def	14 cd	33 cd	63 a-e	58 bcd
0.25	Improve 90	0.0625	8 def	20 abc	34 bcd	51 f	60 a-d
0.5	Activator 90	0.0625	6 def	13 d	33 cd	63 a-e	55 cd
0.5	Surf-AC 820	0.0625	6 def	16 a-d	40 abc	59 b-f	63 a-d
0.5	Nu-Film IR	0.0625	7 def	21 ab	33 cd	59 b-f	60 a-d
0.5	Improve 90	0.0625	15 abc	19 a-d	40 abc	60 a-f	63 a-d
0.75	Activator 90	0.0625	5 ef	15 bcd	34 bcd	63a-e	60 a-d
0.75	Surf-AC 820	0.0625	6 def	18 a-d	33 cd	58 b-f	61 a-d
0.75	Nu-Film IR	0.0625	9 c-f	20 abc	39 a-d	66 abc	68 abc
0.75	Improve 90	0.0625	6def	19 a-d	43 ab	64 a-d	58 bcd
		Std Dev	5.24	4.53	6.46	7.32	9.60
		CV	56.15	24.83	17.63	11.98	15.44

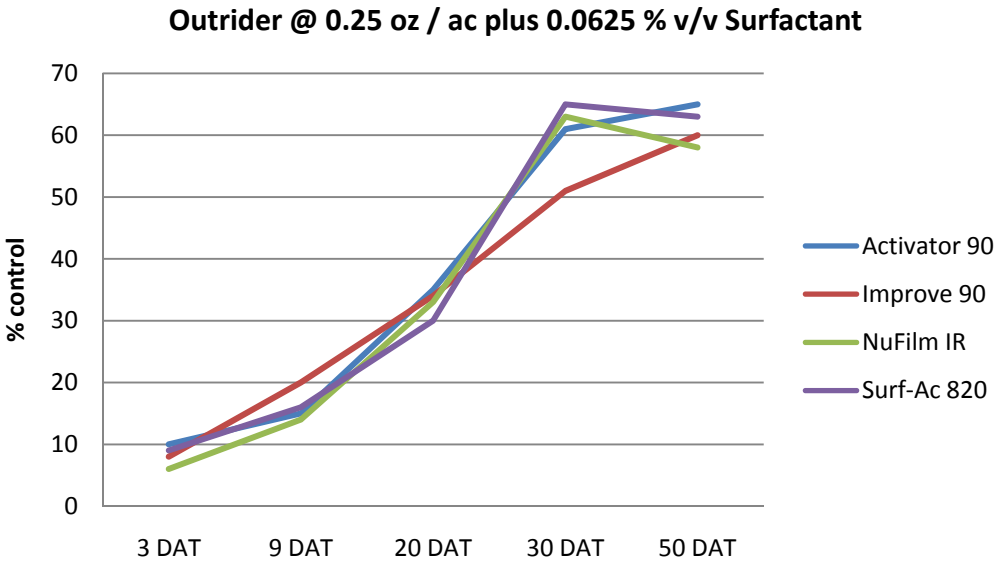

Figure 1: Control of johnsongrass with low rates of Outrider and surfactant

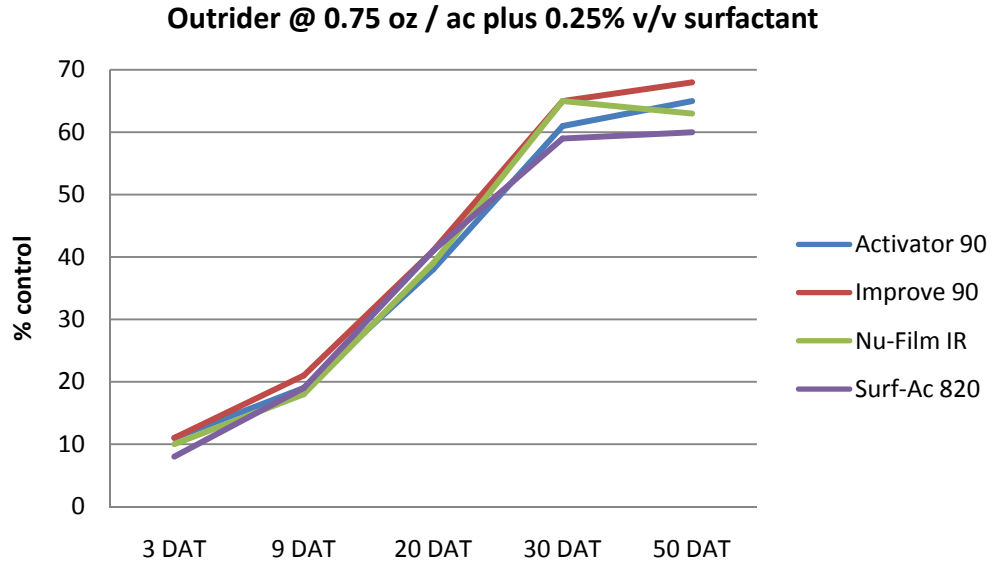

Figure 2: Control of johnsongrass with standard rates of Outrider and surfactant