Effect of Drift Control Adjuvants on Efficacy and Spray Patterns of Roundup D-pak™ and Roundup Weather Max™ Applied with Extended Range Spray Nozzles

E. J. Jones[1], J. E. Hanks[2], G. D. Wills[1], R. E. Mack[3], A. K. Underwood[3], and J. M. Thomas, III[3]
Delta Research and Extension Center[1] and USDA-ARS[2], Stoneville, MS
and Helena Chemcial Company[3], Memphis, TN

Abstract

Both laboratory and field studies were conducted in 2003 to determine the effect of the drift control adjuvants HM9752, HM2005B, and HM2006 on spray patterns and efficacy of glyphosate as applied without surfactant as Roundup D-pak and with surfactant as Roundup Weather Max. Earlier research has shown that herbicide application is influenced by pattern of spray delivery and by size of spray droplets wherein smaller droplets result in greater drift from the target area. Previous studies using an Insitec Measurement Systems® laser particle analyzer have shown that these drift control adjuvants will reduce droplet size of glyphosate formulations both with and without surfactants as applied with TeeJet® Extended Range 110015VS spray nozzles. The description of these drift reducing adjuvants and the rates applied are shown in Table 1.

In the field study, glyphosate was applied at 0.4 lb ai which is less than the recommended rate of 1 lb ai per acre in order to detect any increase or decrease in efficacy due to the addition of the drift control adjuvants. Mixtures of glyphosate both with and without surfactant were applied with each drift control adjuvant using a tractor-mounted sprayer at 40 psi with eight nozzles spaced 19 inches apart along the boom. Field applications were over-the-top to four rows each of three-trifoliolate-stage non-Roundup Ready® soybeans [*Glycine max* (L.) Merr] 'Pioneer 9594' spaced 38 inches apart, 40 feet long and interspaced with 4- to 6-inch-tall barnyardgrass [*Echinochloa crus-galli* (L.) Beauv.], 4- to 6-inch-tall pitted morningglory (*Ipomoea lacunose* Lag.), and 5- to 7-inch-tal velvetleaf (*Abutilon theophrasti* Medik.). Treatments were replicated four times in a randomized complete block design. Efficacy was determined by visual ratings 2 weeks after treatment (WAT) whereby 0 = no control and 100% = complete kill of shoots. Data were subject to analysis of variance. Means were separated suing Fisher's Protected Least Significant Difference (LSD) at P = 0.05.

Spray patterns were determined by using a single nozzle centered in a stationary position at 13 inches above a slanted sheet of corrugated metal. Spray mixtures were applied in 600-ml volumes at 45 psi to the sheet of corrugated metal with troughs spaced 2.5 inches apart and the discharge was collected in 100-ml graduated cylinders. The values for the average milliliter volumes of three replications as collected at each position from left to right were reversed right to left, added together and averaged again for each position to show a symmetrical spray pattern for each mixture. Glyphosate both with and without surfactant was applied at 2 rates, 0.4 lb ai/A which was the same rate as was used in the field efficacy test and 1 lb ai/A which is the recommended rate.

Percent control over all the plant species in the field study at 2 WAT with glyphosate applied with and without surfactant respectively was: with no drift control adjuvants, 93 to 100% and 79 to 94%; with HM9752 at 9 lb.100 gal, 95 to 100% and 96 to 100%; with HM2005B at 5 lb/100 gal, 93 to 99% and 93 to 97%; with HM2005B at 7 lb/100 gal, 93 to 100% and 89 to 98%; with HM2005B at 9 lb/100- gal, 95 to 100% and 91 to 98%; and with HM2006 at 9 lb/100 gal, 95 to 100% and 91 to 99% (Table 2).

The width of the spray patterns with glyphosate applied with or without surfactant at 0.4 and at f1 lb ai/A without the addition of drift control adjuvants was 45 inches and with the addition of each of the drift control adjuvants was 35 to 40 inches (Figure 1).

Results showed that the drift control adjuvants used in this study applied with glyphosate both with and without surfactant either increased or had no effect on the efficacy of this herbicide. The spray pattern for each glyphosate mixture was adequate to provide uniform applications with the spray nozzles positioned 19 inches apart along the boom.

Table 1. Drift control adjuvants and rates applied.

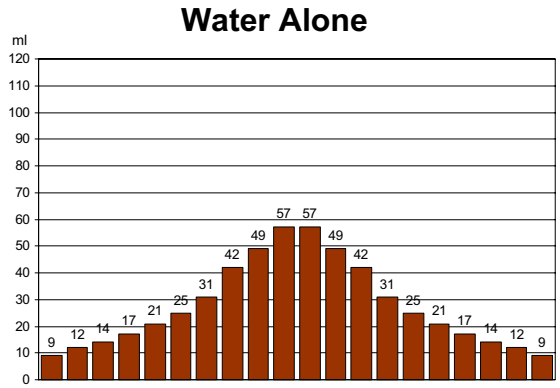
HM9752	Proprietary blend of polymeric viscosity modifiers and ammonium sulfate (9 lb/100 gal)
HM2005B	Proprietary blend of plant nutrients and water soluble organic polymers (5, 7, and 9 lb/100Gal)
HM2006	Proprietary blend of nonionic water soluble organic polymers and ammonium salts (9 lb/100 gal)

Table 2. Effect at two weeks after treatment with selected drift reducing adjuvants on the efficacy of Roundup D-pak (glyphosate without surfactant) and Roundup Weather Max (glyphosate with surfactant) applied over-the-top to 4- to 6-inch tall branyardgrass [*Echinochloa crus-galli* (L.) Beauv.] and pitted morningglory (*Ipomoea lacunose* Lag.), 5- to 7-inch tall velvetleaf (*Abutilon theophrasti* Medik.), and 3- to 4-inch tall soybean (*Glycine max* L.) with TeeJet Extended Range 110015VS nozzles. Average of four Replications.

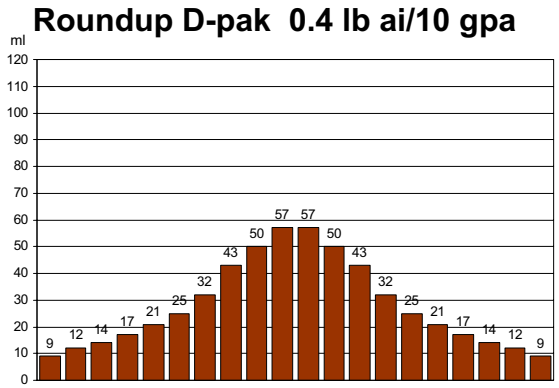
	Percent Control 2 Weeks After Treatment			
Treatment	Barnyardgrass	Pitted Morningglory	Velvetleaf	Soybean
	----------(%)----------			
Roundup D-pak 0.4 lb ai/10 gpa	84	90	79	94
D-pak + HM9752 9 lb/100 gal	97	96	97	100
D-pak + HM2005B 5 lb/100 gal	94	95	93	97
D-pak + HM2005B 7 lb/100 gal	89	91	95	98
D-pak + HM2005B 9 lb/100 gal	95	91	97	98
D-pak + HM2006 9 lb/100 gal	91	94	94	99
Untreated Control	0	0	0	0
Roundup Weather Max 0.4 lb ai/10 gpa	96	94	93	100
Weather Max + HM9752 9 lb/100 gal	98	95	97	100
Weather Max + HM20025B 5 lb/100 gal	94	96	93	99
Weather Max + HM20025B 7 lb/100 gal	93	95	94	100
Weather Max + HM20025B 9 lb/100 gal	97	96	95	100
Weather Max + HM20026 9 lb/100 gal	96	95	96	100
LSD (0.05)1/	4	2	3	2

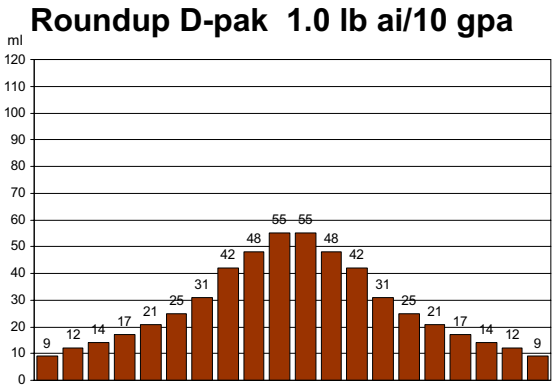
1/ Means within a column are not different a P<0.05 according to Fisher's Protected LSD test.

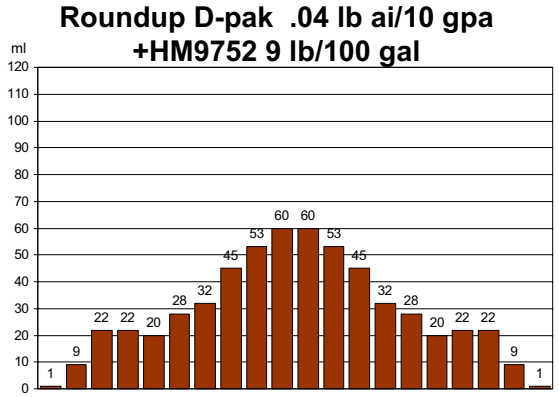
Figure 1. Spray patterns with a TeeJet Extended range 10015VS nozzle of 600 ml of solution collected at 2.5-inch intervals to a 50 inch-wide patternator at 45 psi.

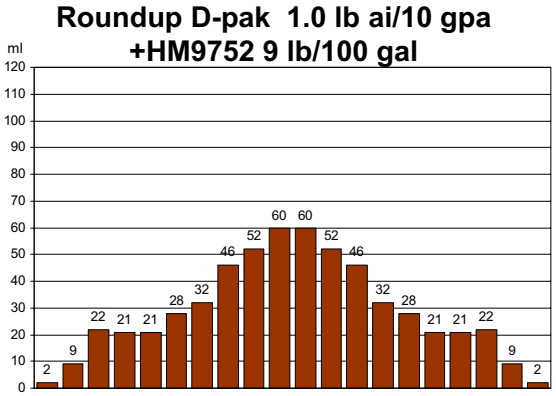


Roundup D-pak (glyphosate without surfactant)

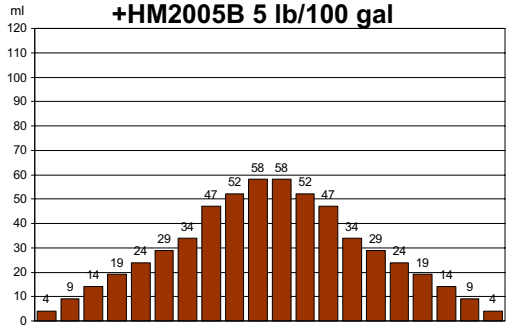




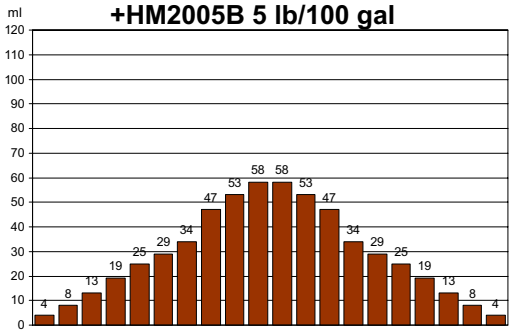




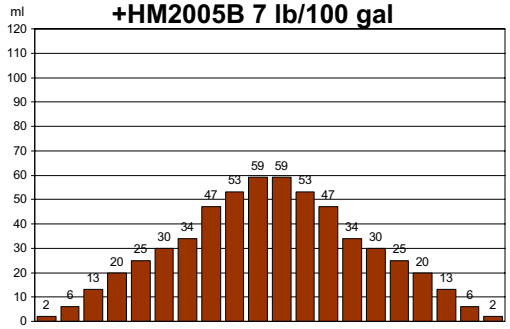
Roundup D-pak 0.4 lb ai/10 gpa +HM2005B 5 lb/100 gal



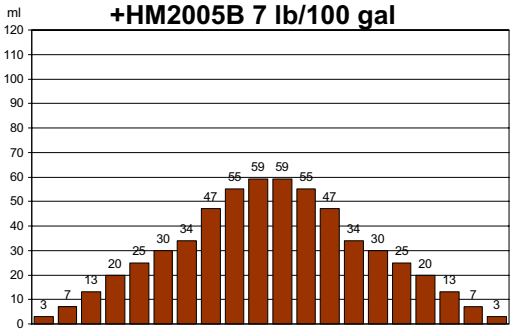
Roundup D-pak 1.0 lb ai/10 gpa +HM2005B 5 lb/100 gal



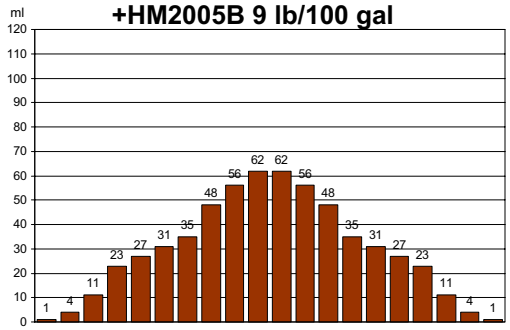
Roundup D-pak 0.4 lb ai/10 gpa +HM2005B 7 lb/100 gal



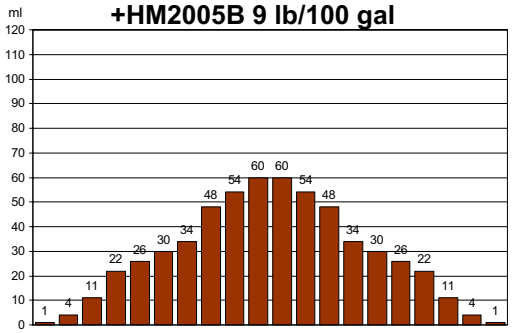
Roundup D-pak 1.0 lb ai/10 gpa +HM2005B 7 lb/100 gal



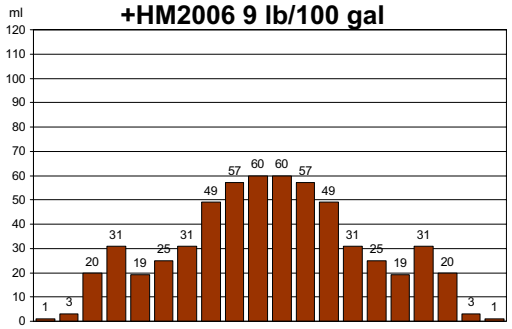
Roundup D-pak 0.4 lb ai/10 gpa +HM2005B 9 lb/100 gal



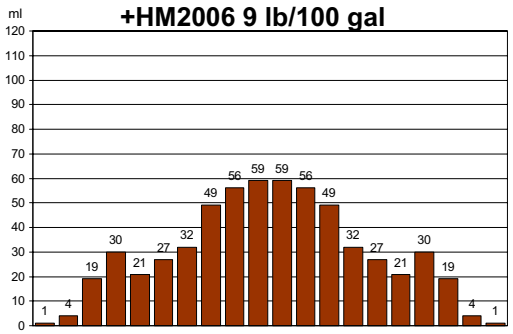
Roundup D-pak 1.0 lb ai/10 gpa +HM2005B 9 lb/100 gal



Roundup D-pak 0.4 lb ai/10 gpa +HM2006 9 lb/100 gal

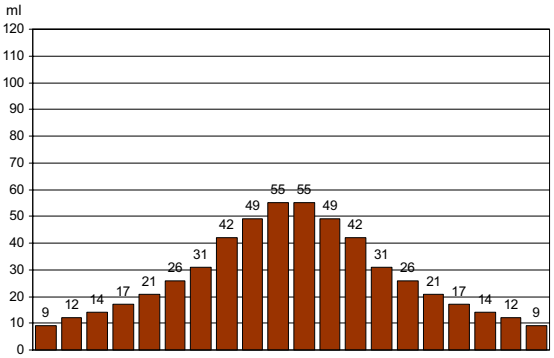


Roundup D-pak 1.0 lb ai/10 gpa +HM2006 9 lb/100 gal

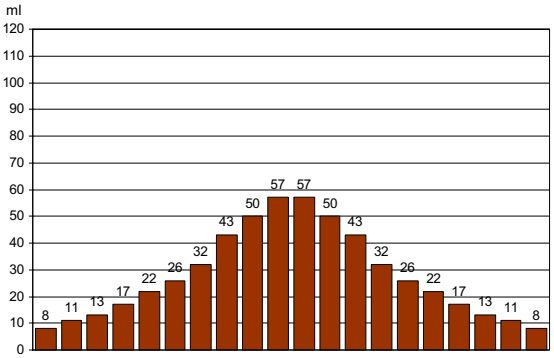


Roundup Weather Max (glyphosate with surfactant)

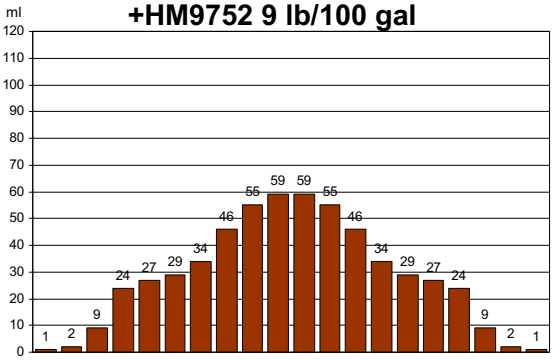
Roundup Weather Max 0.4 lb ai/10 gpa



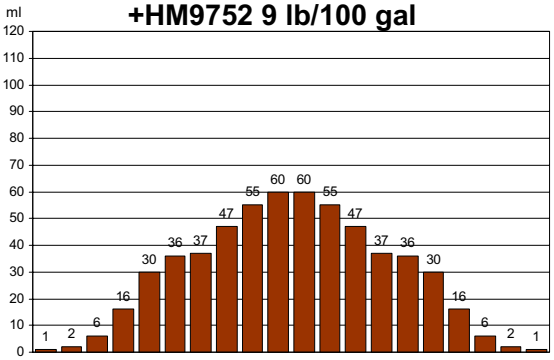
Roundup Weather Max 1.0 lb ai/10 gpa



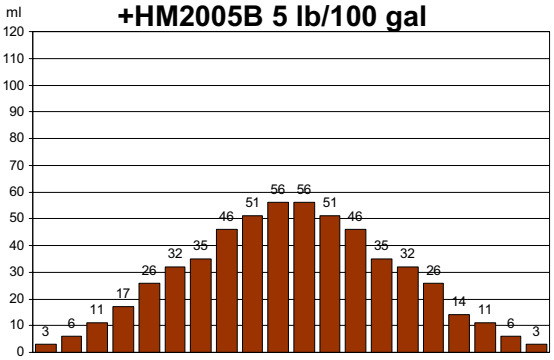
Roundup Weather Max 0.4 lb ai/10 gpa +HM9752 9 lb/100 gal



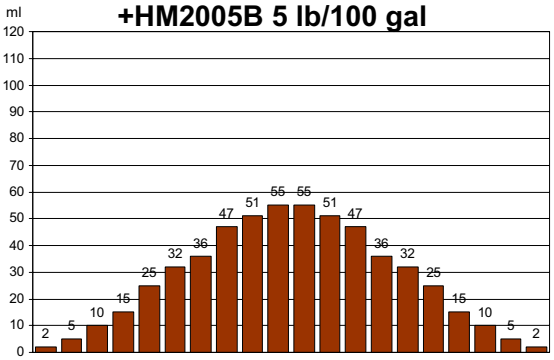
Roundup Weather Max 1.0 lb ai/10 gpa +HM9752 9 lb/100 gal



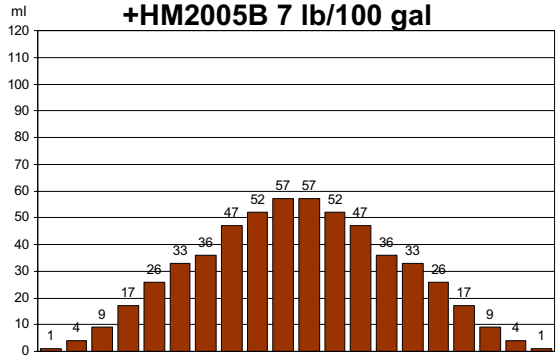
Roundup Weather Max 0.4 lb ai/10 gpa +HM2005B 5 lb/100 gal



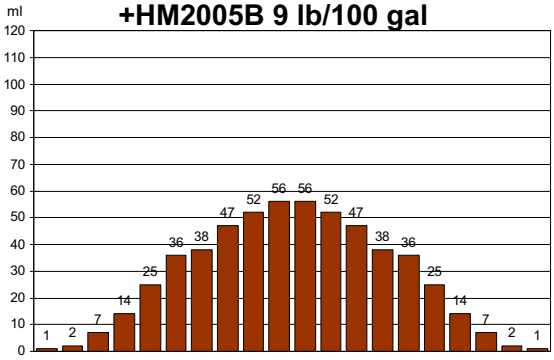
Roundup Weather Max 1.0 lb ai/10 gpa +HM2005B 5 lb/100 gal



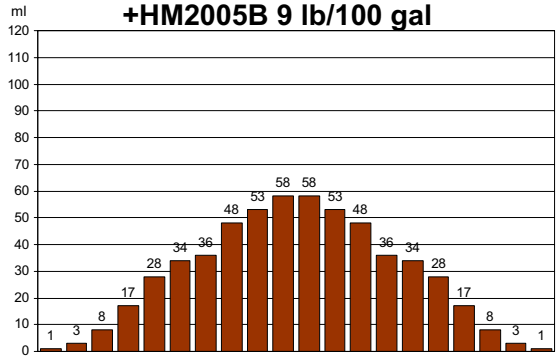
Roundup Weather Max 0.4 lb ai/10 gpa +HM2005B 7 lb/100 gal



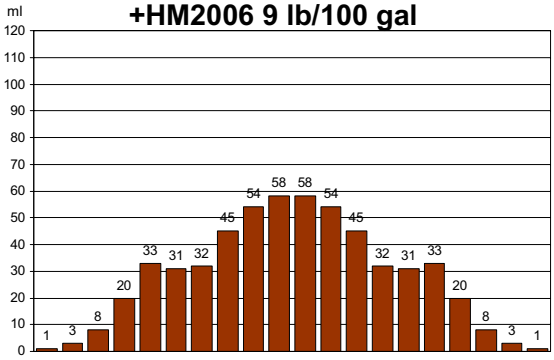
Roundup Weather Max 1.0 lb ai/10 gpa +HM2005B 9 lb/100 gal



Roundup Weather Max 0.4 lb ai/10 gpa +HM2005B 9 lb/100 gal



Roundup Weather Max 1.0 lb ai/10 gpa +HM2006 9 lb/100 gal



Roundup Weather Max 0.4 lb ai/10 gpa +HM2006 9 lb/100 gal