

Surfactant and ammonium sulfate effects on glyphosate efficacy in a hard water carrier.

Ramsdale, Brad K., Sam J. Lockhart, and Calvin G. Messersmith. The experiment was conducted to examine the effects of various commercial surfactants and ammonium sulfate on glyphosate efficacy using a hard water spray carrier. Bioassay species were planted as 6- to 10-ft-wide strips side-by-side. Plots 10 ft wide were laid out perpendicular to the strips so that each plot contained all three assay species. Treatments were applied with a CO₂-pressurized bicycle-wheel-type plot sprayer equipped with four 8001 flat-fan nozzles at 20-inch spacing. Experimental design was a randomized complete block with four replicates. Glyphosate was applied at a reduced rate of 0.06 lb ae/A to better detect treatment effects on glyphosate efficacy. Each adjuvant was applied alone and with ammonium sulfate (AMS) at 1% w/v, except for adjuvants that contain AMS in the formulation. The spray water used for herbicide treatments contained 1550 ppm CaCO₃. Weed control was evaluated visually where 0 equaled no visible injury and 100 equaled complete death of assay species.

Experiment location	Fargo	Prosper
Planting date	May 22	May 24
Treatment date	June 25	June 21
Sprayer		
gpa	8.5	8.5
psi	35	35
Air temperature (F)	85	65
Relative humidity (%)	45	60
Wind (mph)	5	8-10
Sky (% clouds)	50	100
Oat		
variety	'Jerry'	'Jerry'
growth stage	tillering	tillering
height (inch)	8-12	8-10
Barley		
variety	'Robust'	'Robust'
growth stage	tillering	tillering
height (inch)	8-12	8-10
Proso millet		
variety	'Sunrise'	'Sunrise'
growth stage	tillering	4- to 6-leaf
height (inch)	4-8	2-6

All treatments were applied with a hard water carrier. Glyphosate efficacy was best when applied with surfactants plus ammonium sulfate (AMS) or surfactant-AMS blends. Glyphosate efficacy, when applied without AMS, tended to be greater when applied with Liberate, Atplus GTM-10, Purity 100, and LI-700 than other surfactants. However, results varied across location, evaluation date, and species. (This material is based upon work supported by the Cooperative State Research, Education, and Extension Service, U.S. Department of Agriculture, under Agreement No. 00-34361-9038. Dept. of Plant Sciences, North Dakota State University, Fargo)

Table 1. Surfactant and ammonium sulfate effects on glyphosate efficacy in a hard water carrier, Fargo, ND. (Ramsdale, Lockhart, and Messersmith)

Treatment ^{ab}	Rate (lb/A)	July 9			July 18		
		Barley (%)	Proso millet (%)	Oat (%)	Barley (%)	Proso millet (%)	Oat (%)
Glyt + Activator 90	0.06 + 0.5%	65	64	84	78	70	90
Glyt + Activate-It	0.06 + 0.5%	59	59	81	65	64	85
Glyt + Premier 90	0.06 + 0.5%	63	65	89	68	70	89
Glyt + Induce	0.06 + 0.5%	64	65	85	70	73	90
Glyt + LI-700	0.06 + 0.5%	75	71	84	80	76	87
Glyt + Liberate	0.06 + 0.5%	88	75	89	91	81	92
Glyt + Preference	0.06 + 0.5%	66	65	83	76	75	91
Glyt + Purity 100	0.06 + 0.5%	73	81	93	80	85	93
Glyt + R-11	0.06 + 0.5%	70	66	84	76	73	86
Glyt + Atplus GTM-10	0.06 + 0.5%	80	84	88	85	88	91
Glyt + Activator 90 + AMS	0.06 + 0.5% + 1%	98	98	99	99	98	99
Glyt + Activate-It + AMS	0.06 + 0.5% + 1%	99	99	99	99	99	99
Glyt + Premier 90 + AMS	0.06 + 0.5% + 1%	99	99	99	99	99	99
Glyt + Induce + AMS	0.06 + 0.5% + 1%	99	99	99	99	99	99
Glyt + LI-700 + AMS	0.06 + 0.5% + 1%	99	99	99	99	99	99
Glyt + Liberate + AMS	0.06 + 0.5% + 1%	99	99	99	99	99	99
Glyt + Preference + AMS	0.06 + 0.5% + 1%	98	98	99	99	99	99
Glyt + Purity 100 + AMS	0.06 + 0.5% + 1%	99	99	99	99	99	99
Glyt + R-11 + AMS	0.06 + 0.5% + 1%	98	98	98	98	98	99
Glyt + Atplus GTM-10 + AMS	0.06 + 0.5% + 1%	98	98	99	99	99	99
Glyt + L-283	0.06 + 1%	98	97	98	99	96	99
Glyt + L-283	0.06 + 2%	99	99	99	99	99	99
Glyt + Class Act NG	0.06 + 2.5%	99	99	99	99	99	99
Glyt-UM	0.06	73	66	78	81	73	75
Glyt-UM + AMS	0.06 + 1%	98	99	98	98	99	99
LSD (5%)		8	8	7	6	7	5

^a The spray water used for herbicide treatments contained 1550 ppm CaCO₃.

^b Glyt = glyphosate as Roundup Custom; Glyt-UM = glyphosate as Roundup UltraMax; AMS = spray grade ammonium sulfate; Activator 90, Activate-It, Premier 90, Induce, LI-700, Liberate, Preference, Purity 100, R-11, and Atplus GTM-10 = surfactants; L-283 and Class Act NG (Next Generation) = surfactant-AMS blends.

Table 2. Surfactant and ammonium sulfate effects on glyphosate efficacy in a hard water carrier, Prosper, ND. (Ramsdale, Lockhart, and Messersmith)

Treatment ^{ab}	Rate (lb/A)	July 5			July 16		
		Barley (%)	Proso millet (%)	Oat (%)	Barley (%)	Proso millet (%)	Oat (%)
Glyt + Activator 90	0.06 + 0.5%	39	34	66	30	19	50
Glyt + Activate-It	0.06 + 0.5%	39	35	55	29	19	39
Glyt + Premier 90	0.06 + 0.5%	46	45	60	33	23	43
Glyt + Induce	0.06 + 0.5%	49	48	61	43	39	51
Glyt + LI-700	0.06 + 0.5%	63	56	74	65	38	61
Glyt + Liberate	0.06 + 0.5%	76	63	80	79	40	73
Glyt + Preference	0.06 + 0.5%	38	38	53	31	20	40
Glyt + Purity 100	0.06 + 0.5%	59	50	71	49	34	60
Glyt + R-11	0.06 + 0.5%	44	43	61	34	28	44
Glyt + Atplus GTM-10	0.06 + 0.5%	66	68	69	64	59	60
Glyt + Activator 90 + AMS	0.06 + 0.5% + 1%	93	78	93	94	63	91
Glyt + Activate-It + AMS	0.06 + 0.5% + 1%	92	83	89	94	65	87
Glyt + Premier 90 + AMS	0.06 + 0.5% + 1%	97	92	97	98	80	97
Glyt + Induce + AMS	0.06 + 0.5% + 1%	98	83	93	98	65	94
Glyt + LI-700 + AMS	0.06 + 0.5% + 1%	99	97	98	99	90	97
Glyt + Liberate + AMS	0.06 + 0.5% + 1%	99	94	98	99	85	97
Glyt + Preference + AMS	0.06 + 0.5% + 1%	96	90	95	96	79	95
Glyt + Purity 100 + AMS	0.06 + 0.5% + 1%	99	97	98	99	91	98
Glyt + R-11 + AMS	0.06 + 0.5% + 1%	95	91	93	96	82	93
Glyt + Atplus GTM-10 + AMS	0.06 + 0.5% + 1%	95	91	93	97	84	91
Glyt + L-283	0.06 + 1%	93	86	90	93	68	88
Glyt + L-283	0.06 + 2%	93	89	91	93	80	87
Glyt + Class Act NG	0.06 + 2.5%	96	89	93	97	78	93
Glyt-UM	0.06	71	41	61	69	19	46
Glyt-UM + AMS	0.06 + 1%	89	81	85	84	64	70
LSD (5%)		9	12	9	12	15	11

^a The spray water used for herbicide treatments contained 1550 ppm CaCO₃.

^b Glyt = glyphosate as Roundup Custom; Glyt-UM = glyphosate as Roundup UltraMax; AMS = spray grade ammonium sulfate; Activator 90, Activate-It, Premier 90, Induce, LI-700, Liberate, Preference, Purity 100, R-11, and Atplus GTM-10 = surfactants; L-283 and Class Act NG (Next Generation) = surfactant-AMS blends.