

Evaluation of crop phytotoxicity and weed control in corn from preemergence and postemergence applied herbicides, Nashua, IA, 2002. Owen, Micheal D.K., James F. Lux, and Damian D. Franzenburg. The purpose of this study was to evaluate various preemergence and postemergence applied herbicides for crop phytotoxicity and weed control in corn. The soil was a Floyd, Kenyon, Ostrander, Clyde clay loam with a pH 6.85 and 3.5% organic matter. The experimental design was a randomized complete block with three replications and plots were 10 by 25 ft. The 2001 crop was soybean. Tillage included a spring field cultivation. Fertilization included 150 lb/A actual N applied as ammonia. Crop residue on the soil surface was 10% at planting. "DEKALB hybrid DKC 53-32" corn was planted 2 inches deep on May 14, at 33,674 seeds/A in 30-inch rows. Preemergence (PRE) treatments were applied shortly after planting. Conditions on May 14 were: air temperature 20 C, soil temperature at the 4-inch depth 13 C, 2 mph wind, 5% cloud cover, 53% relative humidity. Early postemergence (EPOST) and postemergence (POST) treatments were applied on June 11 and 22, respectively, at 20 gpa and 30 psi using flat fan nozzles. Conditions on June 11 were: air temperature 27 C, soil temperature at the 4-inch depth 22 C, 3 mph wind, 100% cloud cover, 85% relative humidity. Corn growth was V4 and 5 inches tall. Weed species, size and number per ft² in the untreated control included: giant foxtail one to four leaves, 0.5 to 4 inches tall, zero to five plants; velvetleaf cotyledon, 0.5 to 1 inch tall, zero to one plant; common lambsquarters two to four leaves, 0.5 to 2 inches tall, zero to one plant; Pennsylvania smartweed two to three leaves, 1 to 2 inches tall, zero to one plant. Conditions on June 22 were: air temperature 32 C, soil temperature at the 4-inch depth 24 C, 6 mph wind, 15% cloud cover, 71% relative humidity. Corn growth was V6 and 13 inches tall. Weed species, size and number per ft² in the untreated control included: giant foxtail two to four leaves, 1 to 4 inches tall, zero to ten plants; velvetleaf cotyledon to four leaves, 0.5 to 3 inches tall, zero to two plants; common waterhemp two to eight leaves, 2 to 5 inches tall, zero to one plant; common lambsquarters four to numerous leaves, 2 to 7 inches tall, zero to two plants; Pennsylvania smartweed four to eight leaves, 4 to 7 inches tall, zero to one plant. May rainfall included: 0.33, 0.2, 0.88, 0.01, 0.32, 0.5, 0.46, and 0.01 inches on May 1, 5, 11, 24, 25, 28, 29, and 31, respectively. Total rainfall for May was 2.71 inches. June rainfall included: 0.26, 0.41, 0.26, 0.19, 0.10, 0.18, 0.67, 0.09, and 0.48 inches on June 2, 3, 4, 5, 7, 11, 12, 14, and 18, respectively. Total rainfall for June was 2.64 inches. July rainfall included: 2 inches and 3.32 inches from July 1 through 15 and 16 through 31, respectively. Total rainfall for July was 5.32 inches. Rainfall total for August was 5.89 inches.

There were no significant differences in corn stand between herbicide treatments when observed on July 11. No crop injury was observed from soil applied (PRE) treatments prior to EPOST and POST application timings. Excellent giant foxtail and broadleaf weed control was noted on June 7 from PRE applied flufenacet & isoxaflutole and isoxaflutole. Other PRE treatments achieved excellent giant foxtail control. Broadleaf weed control with these PRE treatments was dependent upon the selectivity of the herbicide. Nearly all provided excellent control of the light infestation of Pennsylvania smartweed, poor to fair velvetleaf control, and fair to good common lambsquarters control. Significant corn injury resulting from EPOST and POST applied treatments was observed on June 24, thirteen and two days after application, respectively. On July 11, injury persisted with several EPOST and POST treatments. Excellent broad-spectrum weed control was observed on August 23 from EPOST and POST applied treatments following a PRE, and EPOST treatments not following a PRE. POST applied nicosulfuron & rimsulfuron plus atrazine that did not follow a PRE treatment provided fair giant foxtail control and poor velvetleaf control on August 23. All treatments resulted in significantly higher corn yields than the untreated control, except the POST applied nicosulfuron & rimsulfuron plus atrazine treatment. Yields ranged from 177 to 218 bu/A, with significant differences determined between several treatments. (Dept. of Agronomy, Iowa State University, Ames)

Table 1. Evaluation of crop phytotoxicity and weed control in corn from preemergence and postemergence applied herbicides, Nashua, IA, 2002 (Owen, Lux, and Franzenburg).

Treatment	Rate (lb/A)	Appl. time	Corn ^a stand	Corn inj. 6/7/02 --(%)--	SETFA 6/7/02	ABUTH 6/7/02	CHEAL 6/7/02	POLPY 6/7/02
----- (% weed control) -----								
Untreated	-	-	32	0	0	0	0	0
Flufenacet/ dicamba&atrazine+28% UAN ^b	0.788/ 0.34&0.66+2.0QT	PRE/ EPOST	33	0	98	53	75	98
Flufenacet&metribuzin/ dicamba&atrazine+28% UAN	0.782&0.196/ 0.34&0.66+2.0QT	PRE/ EPOST	33	0	99	78	98	99
Flufenacet&isoxaflutole ^c / dicamba&atrazine+28% UAN	0.536&0.045/ 0.34&0.66+2.0QT	PRE/ EPOST	33	0	99	93	99	99
Flufenacet&isoxaflutole ^d / dicamba&atrazine+28% UAN	0.36&0.075/ 0.34&0.66+2.0QT	PRE/ EPOST	32	3	99	99	99	99
Acetochlor&dichlormid/ flumetsulam&clopyralid+mesotrione+ atrazine+28% UAN+COC ^e	2.0/ 0.030&0.098+0.047+ 0.252+2.5%v/v+1.0	PRE/ POST	32	0	99	42	82	98
Acetochlor&dichlormid/ flumetsulam&clopyralid+ mesotrione+atrazine+ 28% UAN+COC	2.0/ 0.030&0.098+ 0.0312+0.252+ 2.5%v/v+1.0	PRE/ POST	31	0	99	43	80	98
S-metolachlor&CGA-154281/ carfentrazone+mesotrione+ COC+NIS ^f	1.6/ 0.0078+0.094+ 1.0+0.25	PRE/ POST	34	0	99	30	62	98
S-metolachlor&CGA-154281/ carfentrazone+ flumetsulam&clopyralid+NIS	1.6/ 0.0078+ 0.030&0.098+0.25	PRE/ POST	32	0	98	33	65	95
S-metolachlor&CGA-154281/ nicosulfuron&rimsulfuron+ dicamba&San 1269H+ COC+ammonium sulfate	0.66/ 0.023&0.012+ 0.062&0.025+ 1.0+2.0	PRE/ EPOST	31	0	98	20	50	96
S-metolachlor&CGA-154281/ nicosulfuron&rimsulfuron+mesotrione+ atrazine+ COC+ammonium sulfate	0.66/ 0.023&0.012+0.047+ 0.75+1.0+2.0	PRE/ EPOST	31	0	98	40	47	96
S-metolachlor&atrazine&CGA-154281/ nicosulfuron&rimsulfuron+ dicamba&San 1269H+ COC+ammonium sulfate	1.15/ 0.023&0.012+ 0.062&0.025+ 1.0+2.0	PRE/ EPOST	31	0	96	68	99	98
S-metolachlor&atrazine&CGA-154281/ nicosulfuron&rimsulfuron+mesotrione+ atrazine+ COC+ammonium sulfate	1.15/ 0.023&0.012+0.047+ 0.75+1.0+2.0	PRE/ EPOST	33	0	96	55	96	99
Nicosulfuron&rimsulfuron+mesotrione+ atrazine+COC+ammonium sulfate	0.023&0.012+0.047+ 0.75+1.0+2.0	EPOST	33	0	0	0	0	0
AE F 130360 01+atrazine+ MSO ^g +ammonium sulfate	0.0656+1.0+ 1.0+2.0	EPOST	33	0	0	0	0	0
Isoxaflutole/ AE F 130360 01+atrazine+ MSO+ammonium sulfate	0.047/ 0.0656+1.0+ 1.0+2.0	PRE/ EPOST	32	2	99	98	98	99
Nicosulfuron&rimsulfuron+ atrazine+COC+ammonium sulfate	0.023&0.012+ 0.75+1.0+2.0	POST	30	0	0	0	0	0
Nicosulfuron&rimsulfuron+ mesotrione+COC+ammonium sulfate	0.023&0.012+ 0.047+1.0+2.0	POST	33	0	0	0	0	0
Acetochlor&MON 4660/ halosulfuron&dicamba+ NIS+ammonium sulfate	2.19/ 0.031&0.138+ 0.25+2.0	PRE/ POST	32	0	99	45	73	98
Nicosulfuron+ halosulfuron&dicamba+NIS	0.0314+ 0.031&0.138+0.25	POST	32	0	0	0	0	0
LSD (P=.05)			3	2	2	17	15	2

^a Corn stand per 17.5 row feet on July 26.^b 28% UAN = mixtures of urea and ammonium nitrate.^c Flufenacet&isoxaflutole = USA 2001 from Bayer CropScience.^d Flufenacet&isoxaflutole = Epic from Bayer CropScience.^e COC = Riverside/Terra Prime oil, a petroleum base oil additive with a 17% emulsifier. Rate in % v/v.^f NIS = Activator 90, a non-ionic surfactant from Loveland Industries, Inc. Rate in % v/v.^g MSO = methylated seed oil from Loveland Industries, Inc. Rate in % v/v.

Table 2. Evaluation of crop phytotoxicity and weed control in corn from preemergence and postemergence applied herbicides, Nashua, IA, 2002 (Owen, Lux, and Franzenburg).

Treatment	Rate (lb/A)	Appl. time	Corn inj. 6/24/02 --(%)--	SETFA 6/24/02	ABUTH 6/24/02	AMATA 6/24/02	CHEAL 6/24/02	POLPY 6/24/02
----- (% weed control) -----								
Untreated	-	-	0	0	0	0	0	0
Flufenacet/ dicamba&atrazine+28% UAN ^a	0.788/ 0.34&0.66+2.0QT	PRE/ EPOST	5	99	99	99	99	99
Flufenacet&metribuzin/ dicamba&atrazine+28% UAN	0.782&0.196/ 0.34&0.66+2.0QT	PRE/ EPOST	5	99	99	99	99	99
Flufenacet&isoxaflutole ^b / dicamba&atrazine+28% UAN	0.536&0.045/ 0.34&0.66+2.0QT	PRE/ EPOST	5	99	99	99	99	99
Flufenacet&isoxaflutole ^c / dicamba&atrazine+28% UAN	0.36&0.075/ 0.34&0.66+2.0QT	PRE/ EPOST	7	99	99	99	99	99
Acetochlor&dichlormid/ flumetsulam&clopypirid+mesotrione+ atrazine+28% UAN+COC ^d	2.0/ 0.030&0.098+0.047+ 0.252+2.5%v/v+1.0	PRE/ POST	10	98	88	99	85	93
Acetochlor&dichlormid/ flumetsulam&clopypirid+ mesotrione+atrazine+ 28% UAN+COC	2.0/ 0.030&0.098+ 0.0312+0.252+ 2.5%v/v+1.0	PRE/ POST	13	99	87	99	85	91
S-metolachlor&CGA-154281/ carfentrazone+mesotrione+ COC+NIS ^e	1.6/ 0.0078+0.094+ 1.0+0.25	PRE/ POST	15	99	92	99	83	90
S-metolachlor&CGA-154281/ carfentrazone+ flumetsulam&clopypirid+NIS	1.6/ 0.0078+ 0.030&0.098+0.25	PRE/ POST	17	98	93	99	90	95
S-metolachlor&CGA-154281/ nicosulfuron&rimsulfuron+ dicamba&San 1269H+ COC+ammonium sulfate	0.66/ 0.023&0.012+ 0.062&0.025+ 1.0+2.0	PRE/ EPOST	7	99	98	99	93	98
S-metolachlor&CGA-154281/ nicosulfuron&rimsulfuron+mesotrione+ atrazine+ COC+ammonium sulfate	0.66/ 0.023&0.012+0.047+ 0.75+1.0+2.0	PRE/ EPOST	5	99	99	99	99	99
S-metolachlor&atrazine&CGA-154281/ nicosulfuron&rimsulfuron+ dicamba&San 1269H+ COC+ammonium sulfate	1.15/ 0.023&0.012+ 0.062&0.025+ 1.0+2.0	PRE/ EPOST	7	99	98	99	98	99
S-metolachlor&atrazine&CGA-154281/ nicosulfuron&rimsulfuron+mesotrione+ atrazine+ COC+ammonium sulfate	1.15/ 0.023&0.012+0.047+ 0.75+1.0+2.0	PRE/ EPOST	5	99	99	99	99	99
Nicosulfuron&rimsulfuron+mesotrione+ atrazine+COC+ammonium sulfate	0.023&0.012+0.047+ 0.75+1.0+2.0	EPOST	5	99	99	99	99	99
AE F 130360 01+atrazine+ MSO ^f +ammonium sulfate	0.0656+1.0+ 1.0+2.0	EPOST	7	98	99	99	99	99
Isoxaflutole/ AE F 130360 01+atrazine+ MSO+ammonium sulfate	0.047/ 0.0656+1.0+ 1.0+2.0	PRE/ EPOST	7	99	99	99	99	99
Nicosulfuron&rimsulfuron+ atrazine+COC+ammonium sulfate	0.023&0.012+ 0.75+1.0+2.0	POST	15	65	80	85	77	82
Nicosulfuron&rimsulfuron+ mesotrione+COC+ammonium sulfate	0.023&0.012+ 0.047+1.0+2.0	POST	13	63	62	63	57	58
Acetochlor&MON 4660/ halosulfuron&dicamba+ NIS+ammonium sulfate	2.19/ 0.031&0.138+ 0.25+2.0	PRE/ POST	5	98	62	99	70	92
Nicosulfuron+ halosulfuron&dicamba+NIS	0.0314+ 0.031&0.138+0.25	POST	12	52	57	57	58	58
LSD (P=.05)			5	6	7	6	8	8

^a 28% UAN = mixtures of urea and ammonium nitrate.^b Flufenacet&isoxaflutole = USA 2001 from Bayer CropScience.^c Flufenacet&isoxaflutole = Epic from Bayer CropScience.^d COC = Riverside/Terra Prime oil, a petroleum base oil additive with a 17% emulsifier. Rate in % v/v.^e NIS = Activator 90, a non-ionic surfactant from Loveland Industries, Inc. Rate in % v/v.^f MSO = methylated seed oil from Loveland Industries, Inc. Rate in % v/v.

Table 3. Evaluation of crop phytotoxicity and weed control in corn from preemergence and postemergence applied herbicides, Nashua, IA, 2002 (Owen, Lux, and Franzenburg).

Treatment	Rate (lb/A)	Appl. time	Corn inj. 7/11/02 --(%) --	SETFA 7/11/02	ABUTH 7/11/02	AMATA 7/11/02	CHEAL 7/11/02	POLPY 7/11/02
----- (% weed control) -----								
Untreated	-	-	0	0	0	0	0	0
Flufenacet/ dicamba&atrazine+28% UAN ^a	0.788/ 0.34&0.66+2.0QT	PRE/ EPOST	0	99	99	99	99	99
Flufenacet&metribuzin/ dicamba&atrazine+28% UAN	0.782&0.196/ 0.34&0.66+2.0QT	PRE/ EPOST	0	99	99	99	99	99
Flufenacet&isoxaflutole ^b / dicamba&atrazine+28% UAN	0.536&0.045/ 0.34&0.66+2.0QT	PRE/ EPOST	0	99	99	99	99	99
Flufenacet&isoxaflutole ^c / dicamba&atrazine+28% UAN	0.36&0.075/ 0.34&0.66+2.0QT	PRE/ EPOST	0	99	99	99	99	99
Acetochlor&dichlormid/ flumetsulam&clopyralid+mesotrione+ atrazine+28% UAN+COC ^d	2.0/ 0.030&0.098+0.047+ 0.252+2.5%v/v+1.0	PRE/ POST	0	98	99	99	99	99
Acetochlor&dichlormid/ flumetsulam&clopyralid+ mesotrione+atrazine+ 28% UAN+COC	2.0/ 0.030&0.098+ 0.0312+0.252+ 2.5%v/v+1.0	PRE/ POST	0	99	99	99	99	99
S-metolachlor&CGA-154281/ carfentrazone+mesotrione+ COC+NIS ^e	1.6/ 0.0078+0.094+ 1.0+0.25	PRE/ POST	10	98	99	99	96	98
S-metolachlor&CGA-154281/ carfentrazone+ flumetsulam&clopyralid+NIS	1.6/ 0.0078+ 0.030&0.098+0.25	PRE/ POST	8	96	95	99	90	95
S-metolachlor&CGA-154281/ nicosulfuron&rimsulfuron+ dicamba&San 1269H+ COC+ammonium sulfate	0.66/ 0.023&0.012+ 0.062&0.025+ 1.0+2.0	PRE/ EPOST	3	99	99	99	99	99
S-metolachlor&CGA-154281/ nicosulfuron&rimsulfuron+mesotrione+ atrazine+ COC+ammonium sulfate	0.66/ 0.023&0.012+0.047+ 0.75+1.0+2.0	PRE/ EPOST	0	99	99	99	99	99
S-metolachlor&atrazine&CGA-154281/ nicosulfuron&rimsulfuron+ dicamba&San 1269H+ COC+ammonium sulfate	1.15/ 0.023&0.012+ 0.062&0.025+ 1.0+2.0	PRE/ EPOST	0	99	98	99	99	99
S-metolachlor&atrazine&CGA-154281/ nicosulfuron&rimsulfuron+mesotrione+ atrazine+ COC+ammonium sulfate	1.15/ 0.023&0.012+0.047+ 0.75+1.0+2.0	PRE/ EPOST	0	99	99	99	99	99
Nicosulfuron&rimsulfuron+mesotrione+ atrazine+COC+ammonium sulfate	0.023&0.012+0.047+ 0.75+1.0+2.0	EPOST	0	99	99	99	99	99
AE F 130360 01+atrazine+ MSO ^f +ammonium sulfate	0.0656+1.0+ 1.0+2.0	EPOST	0	96	99	99	99	99
Isoxaflutole/ AE F 130360 01+atrazine+ MSO+ammonium sulfate	0.047/ 0.0656+1.0+ 1.0+2.0	PRE/ EPOST	0	99	99	99	99	99
Nicosulfuron&rimsulfuron+ atrazine+COC+ammonium sulfate	0.023&0.012+ 0.75+1.0+2.0	POST	7	82	63	90	92	94
Nicosulfuron&rimsulfuron+ mesotrione+COC+ammonium sulfate	0.023&0.012+ 0.047+1.0+2.0	POST	5	82	96	99	98	99
Acetochlor&MON 4660/ halosulfuron&dicamba+ NIS+ammonium sulfate	2.19/ 0.031&0.138+ 0.25+2.0	PRE/ POST	0	96	95	99	93	99
Nicosulfuron+ halosulfuron&dicamba+NIS	0.0314+ 0.031&0.138+0.25	POST	3	78	90	88	88	98
LSD (P=.05)			3	3	3	5	4	4

^a 28% UAN = mixtures of urea and ammonium nitrate.^b Flufenacet&isoxaflutole = USA 2001 from Bayer CropScience.^c Flufenacet&isoxaflutole = Epic from Bayer CropScience.^d COC = Riverside/Terra Prime oil, a petroleum base oil additive with a 17% emulsifier. Rate in % v/v.^e NIS = Activator 90, a non-ionic surfactant from Loveland Industries, Inc. Rate in % v/v.^f MSO = methylated seed oil from Loveland Industries, Inc. Rate in % v/v.

Table 4. Evaluation of crop phytotoxicity and weed control in corn from preemergence and postemergence applied herbicides, Nashua, IA, 2002 (Owen, Lux, and Franzenburg).

Treatment	Rate (lb/A)	Appl. time	SETFA 8/23/02	ABUTH 8/23/02	AMATA 8/23/02	CHEAL 8/23/02	POLPY 8/23/02	Corn yield (bu/A)
			----- (% weed control) -----					
Untreated	-	-	0	0	0	0	0	145
Flufenacet/ dicamba&atrazine+28% UAN ^a	0.788/ 0.34&0.66+2.0QT	PRE/ EPOST	96	99	99	99	99	189
Flufenacet&metribuzin/ dicamba&atrazine+28% UAN	0.782&0.196/ 0.34&0.66+2.0QT	PRE/ EPOST	99	98	99	99	99	218
Flufenacet&isoxaflutole ^b / dicamba&atrazine+28% UAN	0.536&0.045/ 0.34&0.66+2.0QT	PRE/ EPOST	99	99	99	99	99	210
Flufenacet&isoxaflutole ^c / dicamba&atrazine+28% UAN	0.36&0.075/ 0.34&0.66+2.0QT	PRE/ EPOST	98	99	99	99	99	206
Acetochlor&dichlormid/ flumetsulam&clopypirid+mesotrione+ atrazine+28% UAN+COC ^d	2.0/ 0.030&0.098+0.047+ 0.252+2.5%v/v+1.0	PRE/ POST	96	99	99	99	99	213
Acetochlor&dichlormid/ flumetsulam&clopypirid+ mesotrione+atrazine+ 28% UAN+COC	2.0/ 0.030&0.098+ 0.0312+0.252+ 2.5%v/v+1.0	PRE/ POST	95	99	99	99	99	198
S-metolachlor&CGA-154281/ carfentrazone+mesotrione+ COC+NIS ^e	1.6/ 0.0078+0.094+ 1.0+0.25	PRE/ POST	92	99	99	98	98	201
S-metolachlor&CGA-154281/ carfentrazone+ flumetsulam&clopypirid+NIS	1.6/ 0.0078+ 0.030&0.098+0.25	PRE/ POST	88	93	99	92	95	194
S-metolachlor&CGA-154281/ nicosulfuron&rimsulfuron+ dicamba&San 1269H+ COC+ammonium sulfate	0.66/ 0.023&0.012+ 0.062&0.025+ 1.0+2.0	PRE/ EPOST	98	98	99	99	99	214
S-metolachlor&CGA-154281/ nicosulfuron&rimsulfuron+mesotrione+ atrazine+ COC+ammonium sulfate	0.66/ 0.023&0.012+0.047+ 0.75+1.0+2.0	PRE/ EPOST	98	99	99	99	99	212
S-metolachlor&atrazine&CGA-154281/ nicosulfuron&rimsulfuron+ dicamba&San 1269H+ COC+ammonium sulfate	1.15/ 0.023&0.012+ 0.062&0.025+ 1.0+2.0	PRE/ EPOST	99	98	99	99	99	204
S-metolachlor&atrazine&CGA-154281/ nicosulfuron&rimsulfuron+mesotrione+ atrazine+ COC+ammonium sulfate	1.15/ 0.023&0.012+0.047+ 0.75+1.0+2.0	PRE/ EPOST	99	99	99	99	99	205
Nicosulfuron&rimsulfuron+mesotrione+ atrazine+COC+ammonium sulfate	0.023&0.012+0.047+ 0.75+1.0+2.0	EPOST	99	99	99	99	99	213
AE F 130360 01+atrazine+ MSO ^f +ammonium sulfate	0.0656+1.0+ 1.0+2.0	EPOST	96	99	99	99	99	222
Isoxaflutole/ AE F 130360 01+atrazine+ MSO+ammonium sulfate	0.047/ 0.0656+1.0+ 1.0+2.0	PRE/ EPOST	99	99	99	99	99	207
Nicosulfuron&rimsulfuron+ atrazine+COC+ammonium sulfate	0.023&0.012+ 0.75+1.0+2.0	POST	82	57	88	92	94	177
Nicosulfuron&rimsulfuron+ mesotrione+COC+ammonium sulfate	0.023&0.012+ 0.047+1.0+2.0	POST	83	96	99	99	99	181
Acetochlor&MON 4660/ halosulfuron&dicamba+ NIS+ammonium sulfate	2.19/ 0.031&0.138+ 0.25+2.0	PRE/ POST	93	96	99	98	99	211
Nicosulfuron+ halosulfuron&dicamba+NIS	0.0314+ 0.031&0.138+0.25	POST	88	96	92	99	99	193
LSD (P=.05)			5	4	5	3	4	34

^a 28% UAN = mixtures of urea and ammonium nitrate.^b Flufenacet&isoxaflutole = USA 2001 from Bayer CropScience.^c Flufenacet&isoxaflutole = Epic from Bayer CropScience.^d COC = Riverside/Terra Prime oil, a petroleum base oil additive with a 17% emulsifier. Rate in % v/v.^e NIS = Activator 90, a non-ionic surfactant from Loveland Industries, Inc. Rate in % v/v.^f MSO = methylated seed oil from Loveland Industries, Inc. Rate in % v/v.