Noncrop and Invasive Vegetation Management Weed Science

2008 Annual Research Report

UNIVERSITY
OF KENTUCKY

College of Agriculture
Department of Plant and Soil Sciences

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College of Agriculture
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INFORMATION NOTE 2009 NCVM-1

Forward

The information provided in this document represents a collaborative effort between the Roadside Environment Branch of the Kentucky Transportation Cabinet and the Department of Plant and Soil Sciences in the College of Agriculture at the University of Kentucky. The main priority of this project was to collect and disseminate information to the KTC REB to increase the efficiency of operations aimed at roadside environment management.

This report contains a summary of research conducted during 2007 and 2008. This document is primarily for the use of the Kentucky Transportation Cabinet. Other use is allowable if proper credit is given to the authors.

Weather data was obtained from weather recorders located on site of the Princeton Agricultural Research Station in Princeton, KY (located in western Kentucky), the Spindletop Agricultural Research Station in Lexington, KY (located in central Kentucky), and a University of Kentucky operated weather station located in Jackson, KY (located in eastern Kentucky)

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Appreciation is extended to Tom Hayes and Glenn McKinney at East Kentucky Power RECC for land area to perform brush trials.

The tobacco plant back trial discussed in this report would not have been possible without the assistance and donation of tobacco plants from Jack Zeleznik or Dr. Bob Pearce.

The research could not have been accomplished if not for the generous contributions of product. Contributors of product used include:

BASF Corporation
Dow AgroSciences
DuPont
Townsend Chemical

External funding for research projects was received from BASF Corporation, Dow AgroSciences LLC, and DuPont Inc. The financial support of these organizations is greatly appreciated.

We sincerely appreciate the effort and continued support of all our cooperators and look forward to future endeavors.

Species List

The following is a list of plant species discussed in the following document.

Scientific Name	Common Name
Acer rubrum L.	Red maple
Carduus nutans L.	Musk thistle
Carya glabra (Mill.) Sweet	Pignut hickory
Cirsium arvense (L.) Scop.	Canada thistle
Conyza canadensis (L.) Cronq.	Marestail
Dipsacus fullonum L.	Common teasel
Liriodendron tulipfera L.	Yellow-poplar
Lonicera maackii (Rupr.) Herder	Amur honeysuckle
Nictiana tabacum L.	Cultivated tobacco
Oxydendrum arboretum (L.) DC.	Sourwood
Pinus rigida Mill.	Pitch pine
Quercus rubra L.	Northern red oak
Rubus allegheniensis Porter	Allegheny blackberry
Sorghum halepense (L.) Pers.	Johnsongrass

Herbicide List

The following is a list of herbicides discussed in the following document.

Product	Active Ingredient(s)	Concentration	Manufacturer
Accord XRT	Glyphosate	5.4 lb a.i. per gallon	Dow AgroSciences
Arsenal	Imazapyr	2 lb a.i. per gallon	BASF
Arsenal Powerline	Imazapyr	2 lb a.i. per gallon	BASF
Banvel	Dicamba	4 lb a.i. per gallon	Micro Flo
Escort XP	Metsulfuron methyl	60 % w/w	DuPont
Formula 40	2,4-D amine	3.67 lb a.i. per gallon	NuFarm
Garlon 3A	Triclopyr amine	3 lb a.i. per gallon	Dow AgroSciences
Garlon 4	Triclopyr ester	4 lb a.i. per gallon	Dow AgroSciences
KJM-44	Aminocyclopyrchlor	80 % w/w	DuPont
Krenite	Fosamine	4 lb a.i. per gallon	DuPont
Krovar I DF	Bromacil + diuron	40 % + 40 % w/w	DuPont
Milestone VM	Aminopyralid	2 lb a.i. per gallon	Dow AgroSciences
Milestone VM Plus	Aminopyralid + triclopyr	0.1 lb a.i. + 1.0 lb a.i. per gallon	Dow AgroSciences
Oust XP	Sulfometuron	75 % w/w	DuPont
Outrider	Sulfosulfuron	75 % w/w	Monsanto
Plateau	Imazapic	2 lb a.i. per gallon	BASF
Roundup Pro	Glyphosate	4 lb a.i. per gallon	Monsanto
Stalker	Imazapyr	2 lb acid per gallon	BASF
Telar	Chlorsulfuron	75 % w/w	DuPont
Tordon RTU	Picloram + 2,4-D	5.4% v/v + 20.9% v/v	Dow AgroSciences

2008 Field Season Weather Data
Eastern Kentucky (Jackson Weather Station)

This weather data provided by the University of Kentucky
Agricultural Weather Center (Phone (859)257-3000 Ext245)
World Wide Web URL: http://wwwagwx.ca.uky.edu/

STATION	DATE	AIR TEMP MX	MN	AV	PRECIP	RH MX	MN	SOIL TEMP GRASS MX	MN	BARE MX	MN	EVAP
Jackson	03-01-2008	51	33	42	T	81	32	37	36			
Jackson	03-02-2008	64	36	50		54	24	37	36			
Jackson	03-03-2008	73	49	61		56	26	47	44			
Jackson	03-04-2008	71	49	60	0.80	94	39	45	44			
Jackson	03-05-2008	36	31	34	T	85	69	45	44			
Jackson	03-06-2008	56	29	42		89	38	41	40			
Jackson	03-07-2008	38	33	36	1.00	93	28	43	42			
Jackson	03-08-2008	25	22	24	0.52	92	18	41	39			
Jackson	03-09-2008	44	16	30	0.02	80	44	41	38			
Jackson	03-10-2008	55	32	44	0.06	93	36	42	38			
Jackson	03-11-2008	49	33	41		96	42	41	40			
Jackson	03-12-2008	61	34	48		59	28	40	39			
Jackson	03-13-2008	72	48	60		54	22	46	45			
Jackson	03-14-2008	56	49	52	0.24	100	31	49	48			
Jackson	03-15-2008	51	40	46	0.42	97	68	46	45			
Jackson	03-16-2008	49	38	44	0.03			49	46			
Jackson	03-17-2008	58	32	45	T	75	30	48	46			
Jackson	03-18-2008	70	48	59		54	39	44	43			
Jackson	03-19-2008	69	42	56	0.47	97	51	54	53			
Jackson	03-20-2008	53	32	42	0.06	96	33	45	44			
Jackson	03-21-2008	66	36	51		62	24	45	44			
Jackson	03-22-2008	53	38	46		88	34	49	48			
Jackson	03-23-2008	37	31	34	T	86	56	49	47			
Jackson	03-24-2008	44	27	36	0.06	100	27	48	46			
Jackson	03-25-2008	57	27	42		81	22	41	40			
Jackson	03-26-2008	69	51	60	T	53	28	47	46			
Jackson	03-27-2008	69	55	62	0.03	83	37	51	48			
Jackson	03-28-2008	64	40	52	0.17	97	44	51	48			
Jackson	03-29-2008	55	33	44	T	85	36	50	47			
Jackson	03-30-2008	66	42	54	0.07	86	54	49	48			
Jackson	03-31-2008	59	50	54	0.21	96	63	53	52			

Summary for Jackson for the period 3-1-2008 through 3-31-2008:

STATION	AIR TEMP MX	MN	AV	TOTAL PRECIP	RH MX	MN	SOIL TEMP GRASS MX	MN	BARE MX	MN	TOTAL EVAP
Jackson	56	37	47	4.16	82	37	46	44			
(Deviation from normal)	+2	+3	+3	-0.18							

This weather data provided by the University of Kentucky
Agricultural Weather Center (Phone (859)257-3000 Ext245)
World Wide Web URL: http://wwwagwx.ca.uky.edu/

STATION	DATE	AIR TEMP MX	MN	AV	PRECIP	RH MX	MN	SOIL TEMP GRASS MX	MN	BARE MX	MN	EVAP
Jackson	04-01-2008	71	55	63	0.04	89	43	53	52			
Jackson	04-02-2008	56	35	46		75	32	49	48			
Jackson	04-03-2008	52	41	46	0.87	100	40	53	50			
Jackson	04-04-2008	60	55	58	0.88	100	77	53	51			
Jackson	04-05-2008	49	43	46	0.10	100	76	53	51			
Jackson	04-06-2008	73	45	59		89	37	54	51			
Jackson	04-07-2008	76	52	64		83	33	58	53			
Jackson	04-08-2008	79	53	66		66	30	60	58			
Jackson	04-09-2008	68	59	64	T	81	50	52	48			
Jackson	04-10-2008	83	55	69		93	24	62	57			
Jackson	04-11-2008	71	58	64	0.87	100	43	63	60			
Jackson	04-12-2008	61	48	54	0.01	83	37	62	58			
Jackson	04-13-2008	43	36	40	0.10	96	64	57	54			
Jackson	04-14-2008	43	36	40	T	96	59	58	54			
Jackson	04-15-2008	59	34	46		70	18	58	46			
Jackson	04-16-2008	72	41	56		40	15	56	48			
Jackson	04-17-2008	77	51	64		39	24	60	52			
Jackson	04-18-2008	82	56	69		45	14	61	55			
Jackson	04-19-2008	65	53	59	0.26	97	25	63	58			
Jackson	04-20-2008	60	46	53	0.04	100	59	59	56			
Jackson	04-21-2008	69	44	56		93	46	61	58			
Jackson	04-22-2008	74	54	64		74	40	62	55			
Jackson	04-23-2008	80	56	68		74	33	64	60			
Jackson	04-24-2008	82	60	71		64	30	67	63			
Jackson	04-25-2008	82	65	74		60	33	66	62			
Jackson	04-26-2008	74	64	69	T	78	33	66	62			
Jackson	04-27-2008	69	52	60	0.02	97	32	65	61			
Jackson	04-28-2008	60	46	53	0.65	100	45	64	61			
Jackson	04-29-2008	46	35	40	0.16	100	55	62	58			
Jackson	04-30-2008	67	33	50		92	26	60	56			

Summary for Jackson for the period 4-1-2008 through 4-30-2008:

STATION	AIR TEMP MX	MN	AV	TOTAL PRECIP	RH MX	MN	SOIL TEMP GRASS MX	MN	BARE MX	MN	TOTAL EVAP
Jackson	67	49	58	4.00	82	39	59	55			
(Deviation from normal)	+1	+4	+3	-0.10							

This weather data provided by the University of Kentucky
Agricultural Weather Center (Phone (859)257-3000 Ext245)
World Wide Web URL: http://wwwagwx.ca.uky.edu/

STATION	DATE	AIR TEMP MX	MN	AV	PRECIP	RH MX	MN	SOIL TEMP GRASS MX	MN	BARE MX	MN	EVAP
Jackson	05-01-2008	78	54	66		59	21	63	60			
Jackson	05-02-2008	81	61	71	T	77	29	62	60			
Jackson	05-03-2008	71	62	66	0.04	78	50	62	60			
Jackson	05-04-2008	68	46	57		74	30	62	58			
Jackson	05-05-2008	72	46	59		74	27	66	61			
Jackson	05-06-2008	76	50	63		68	29	67	64			
Jackson	05-07-2008	80	58	69		94	28	66	64			
Jackson	05-08-2008	71	56	64	0.49	100	61	67	66			
Jackson	05-09-2008	70	57	64	0.13	100	72	67	64			
Jackson	05-10-2008	69	50	60		94	36	63	62			
Jackson	05-11-2008	66	48	57	0.65	97	52	66	62			
Jackson	05-12-2008	63	47	55	0.29	97	42	63	60			
Jackson	05-13-2008	70	45	58		93	41	63	60			
Jackson	05-14-2008	63	54	58	0.17	93	57	62	60			
Jackson	05-15-2008	64	60	62	0.43	100	72	60	59			
Jackson	05-16-2008	54	49	52	0.10	100	87	61	60			
Jackson	05-17-2008	72	45	58		100	45	64	62			
Jackson	05-18-2008	70	58	64	0.02	88	34	60	59			
Jackson	05-19-2008	70	45	58	T	82	30	67	63			
Jackson	05-20-2008	62	50	56	0.04	93	64	66	64			
Jackson	05-21-2008	67	46	56	T	93	35	68	64			
Jackson	05-22-2008	74	43	58		86	31	61	59			
Jackson	05-23-2008	73	55	64		93	42	61	59			
Jackson	05-24-2008	72	52	62	0.18	100	36	61	65			
Jackson	05-25-2008	78	48	63		80	27	69	65			
Jackson	05-26-2008	83	61	72	0.64	97	45	61	50			
Jackson	05-27-2008	78	63	70	T	100	66	70	68			
Jackson	05-28-2008	65	50	58	0.06	100	70	70	68			
Jackson	05-29-2008	78	52	65		97	46	71	68			
Jackson	05-30-2008	80	59	70		90	45	72	68			
Jackson	05-31-2008	82	71	76		84	55	73	70			

Summary for Jackson for the period 5-1-2008 through 5-31-2008:

STATION	AIR TEMP MX	MN	AV	TOTAL PRECIP	RH MX	MN	SOIL TEMP GRASS MX	MN	BARE MX	MN	TOTAL EVAP
Jackson	72	53	62	3.24	90	45	65	62			
(Deviation from normal)	-4	-2	-3	-1.24							

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World Wide Web URL: http://wwwagwx.ca.uky.edu/

STATION	DATE	AIR TEMP MX	MN	AV	PRECIP	RH MX	MN	SOIL TEMP GRASS MX	MN	BARE MX	MN	EVAP
Jackson	06-01-2008	79	64	72	0.55	100	63	74	71			
Jackson	06-02-2008	81	57	69		100	42	75	70			
Jackson	06-03-2008	73	61	67	0.61	97	61	77	74			
Jackson	06-04-2008	85	69	77		93	45	75	72			
Jackson	06-05-2008	90	70	80		75	44	76	73			
Jackson	06-06-2008	91	71	81		76	46	78	76			
Jackson	06-07-2008	88	70	79		84	54	77	74			
Jackson	06-08-2008	90	73	82		85	47	79	75			
Jackson	06-09-2008	90	73	82		78	51	79	76			
Jackson	06-10-2008	83	65	74	0.16	90	57	79	77			
Jackson	06-11-2008	85	63	74		72	34	80	76			
Jackson	06-12-2008	90	67	78		81	44	80	76			
Jackson	06-13-2008	88	71	80		81	43	80	77			
Jackson	06-14-2008	77	67	72	0.04	100	73	79	76			
Jackson	06-15-2008	85	62	74		100	45	78	74			
Jackson	06-16-2008	85	62	74	0.13	97	56	80	78			
Jackson	06-17-2008	74	57	66	T	93	39	79	76			
Jackson	06-18-2008	78	53	66		86	32	79	76			
Jackson	06-19-2008	79	55	67	0.02	93	30	78	73			
Jackson	06-20-2008	72	58	65	0.37	93	50	78	75			
Jackson	06-21-2008	80	61	70	T	90	53	78	76			
Jackson	06-22-2008	79	61	70	0.25	97	50	78	76			
Jackson	06-23-2008	80	57	68		86	45	76	74			
Jackson	06-24-2008	82	58	70		86	36	76	75			
Jackson	06-25-2008	87	61	74		77	39	78	74			
Jackson	06-26-2008	89	68	78	T	70	46	78	74			
Jackson	06-27-2008	87	67	77	0.04	90	51	76	75			
Jackson	06-28-2008	87	67	77	0.71	97	52	78	74			
Jackson	06-29-2008	81	66	74	0.67	97	55	77	75			
Jackson	06-30-2008	70	61	66	0.39	94	65	78	75			

Summary for Jackson for the period 6-1-2008 through 6-30-2008:

STATION	AIR TEMP MX	MN	AV	TOTAL PRECIP	RH MX	MN	SOIL TEMP GRASS MX	MN	BARE MX	MN	TOTAL EVAP
Jackson	83	64	73	3.94	89	48	78	75			
(Deviation from normal)	-0	+2	+1	+0.12							

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STATION	DATE	AIR TEMP MX	MN	AV	PRECIP	RH MX	MN	SOIL TEMP GRASS MX	MN	BARE MX	MN	EVAP
Jackson	07-01-2008	78	54	66		93	24	76	73			
Jackson	07-02-2008	83	55	69		80	32	68	67			
Jackson	07-03-2008	84	65	74		75	45	79	76			
Jackson	07-04-2008	74	66	70	0.09	94	73	70	69			
Jackson	07-05-2008	82	66	74	0.92	100	69	71	70			
Jackson	07-06-2008	83	61	72		100	54	72	70			
Jackson	07-07-2008	84	64	74		97	44	72	70			
Jackson	07-08-2008	84	68	76	0.98	90	64	72	71			
Jackson	07-09-2008	81	68	74	1.38	96	73	75	74			
Jackson	07-10-2008	80	65	72	0.33	97	45	74	73			
Jackson	07-11-2008	85	59	72		93	40	73	70			
Jackson	07-12-2008	87	65	76	0.01	87	56	73	71			
Jackson	07-13-2008	77	69	73	0.17	94	56	74	73			
Jackson	07-14-2008	80	59	70		92	44	78	77			
Jackson	07-15-2008	82	59	70		89	37	71	69			
Jackson	07-16-2008	84	64	74		65	33	71	69			
Jackson	07-17-2008	89	66	78		73	35	72	70			
Jackson	07-18-2008	89	67	78		75	31	73	71			
Jackson	07-19-2008	89	66	78		81	41	73	71			
Jackson	07-20-2008	91	69	80		84	46	74	73			
Jackson	07-21-2008	91	66	78	0.05	97	47	75	73			
Jackson	07-22-2008	86	65	76	0.57	96	53	75	74			
Jackson	07-23-2008	79	65	72	0.13	100	51	72	71			
Jackson	07-24-2008	80	56	68		97	41	70	69			
Jackson	07-25-2008	83	65	74		87	47	72	70			
Jackson	07-26-2008	85	68	76		84	58	79	77			
Jackson	07-27-2008	85	69	77		93	39	79	81			
Jackson	07-28-2008	86	65	76	0.39	94	49	73	72			
Jackson	07-29-2008	88	66	77	0.03	96	44	74	73			
Jackson	07-30-2008	83	69	76	0.45	94	71	75	74			
Jackson	07-31-2008	78	69	74	0.63	100	78	75	74			

Summary for Jackson for the period 7-1-2008 through 7-31-2008:

STATION	AIR TEMP MX	MN	AV	TOTAL PRECIP	RH MX	MN	SOIL TEMP GRASS MX	MN	BARE MX	MN	TOTAL EVAP
Jackson	84	64	74	6.13	90	49	74	72			
(Deviation from normal)	-2	-0	-1	+0.88							

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World Wide Web URL: http://wwwagwx.ca.uky.edu/

STATION	DATE	AIR TEMP MX	MN	AV	PRECIP	RH MX	MN	SOIL TEMP GRASS MX	MN	BARE MX	MN	EVAP
Jackson	08-01-2008	86	68	77		100	60	75	74			
Jackson	08-02-2008	87	71	79		90	45	83	81			
Jackson	08-03-2008	83	64	74		81	43	81	77			
Jackson	08-04-2008	85	62	74		80	42	74	72			
Jackson	08-05-2008	84	67	76	T	93	62	75	74			
Jackson	08-06-2008	82	69	76	0.02	96	69	75	74			
Jackson	08-07-2008	83	68	76	0.01	100	40	74	70			
Jackson	08-08-2008	79	61	70		86	41	73	72			
Jackson	08-09-2008	78	57	68		90	41	81	76			
Jackson	08-10-2008	80	58	69	0.06	90	51	71	69			
Jackson	08-11-2008	78	55	66		83	41	71	69			
Jackson	08-12-2008	79	53	66		93	41	70	67			
Jackson	08-13-2008	83	60	72		80	37	70	68			
Jackson	08-14-2008	84	58	71		93	35	70	68			
Jackson	08-15-2008	82	60	71		93	45	70	68			
Jackson	08-16-2008	81	60	70		75	33	76	76			
Jackson	08-17-2008	82	60	71		75	30	69	67			
Jackson	08-18-2008	87	57	72		80	30	79	76			
Jackson	08-19-2008	88	61	74		72	27	78	76			
Jackson	08-20-2008	91	65	78		75	34	72	70			
Jackson	08-21-2008	93	69	81		65	33	79	77			
Jackson	08-22-2008	91	69	80		73	24	74	72			
Jackson	08-23-2008	90	67	78		68	33	80	76			
Jackson	08-24-2008	88	68	78		65	39	79	75			
Jackson	08-25-2008	85	68	76		84	50	75	74			
Jackson	08-26-2008	72	66	69	0.52	100	75	74	73			
Jackson	08-27-2008	71	65	68	0.52	100	90	78	76			
Jackson	08-28-2008	78	65	72	0.03	100	61	74	72			
Jackson	08-29-2008	86	63	74		100	49	74	72			
Jackson	08-30-2008	87	68	78	T	96	56	80	74			
Jackson	08-31-2008	87	69	78		96	51	76	74			

Summary for Jackson for the period 8-1-2008 through 8-31-2008:

STATION	AIR TEMP MX	MN	AV	TOTAL PRECIP	RH MX	MN	SOIL TEMP GRASS MX	MN	BARE MX	MN	TOTAL EVAP
Jackson	84	64	74	1.16	86	45	75	73			
(Deviation from normal)	-0	+1	+0	-2.85							

This weather data provided by the University of Kentucky
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World Wide Web URL: http://wwwagwx.ca.uky.edu/

STATION	DATE	AIR TEMP MX	MN	AV	PRECIP	RH MX	MN	SOIL TEMP GRASS MX	MN	BARE MX	MN	EVAP
Jackson	09-01-2008	92	68	80		84	46	82	79			
Jackson	09-02-2008	89	69	79		90	41	76	74			
Jackson	09-03-2008	90	66	78		90	38	76	75			
Jackson	09-04-2008	91	65	78		90	26	76	75			
Jackson	09-05-2008	91	69	80		73	40	75	74			
Jackson	09-06-2008	79	68	74	0.04	96	55	75	73			
Jackson	09-07-2008	85	59	72		100	39	73	72			
Jackson	09-08-2008	87	61	74		90	37	73	72			
Jackson	09-09-2008	77	65	71	0.27	100	61	72	71			
Jackson	09-10-2008	74	60	67		90	68	73	71			
Jackson	09-11-2008	86	61	74	T	93	51	73	72			
Jackson	09-12-2008	86	71	78	0.22	82	58	79	78			
Jackson	09-13-2008	89	70	80		90	46	81	79			
Jackson	09-14-2008	87	70	78	0.03	94	47	78	77			
Jackson	09-15-2008	70	61	66	0.01	93	52	75	74			
Jackson	09-16-2008	77	56	66		90	44	71	69			
Jackson	09-17-2008	79	57	68		80	35	69	68			
Jackson	09-18-2008	83	55	69		83	33	77	72			
Jackson	09-19-2008	83	58	70		83	33	70	68			
Jackson	09-20-2008	80	58	69		80	36	74	72			
Jackson	09-21-2008	83	55	69		90	29	70	70			
Jackson	09-22-2008	85	58	72		66	21	71	70			
Jackson	09-23-2008	83	58	70		78	29	70	69			
Jackson	09-24-2008	81	57	69		78	21	69	68			
Jackson	09-25-2008	79	57	68		66	22	69	67			
Jackson	09-26-2008	76	57	66		80	39	66	65			
Jackson	09-27-2008	76	59	68	T	96	57	74	69			
Jackson	09-28-2008	73	62	68		93	61	69	68			
Jackson	09-29-2008	81	52	66		100	30	67	66			
Jackson	09-30-2008	73	57	65	0.10	96	40	68	66			

Summary for Jackson for the period 9-1-2008 through 9-30-2008:

STATION	AIR TEMP MX	MN	AV	TOTAL PRECIP	RH MX	MN	SOIL TEMP GRASS MX	MN	BARE MX	MN	TOTAL EVAP
Jackson	82	61	72	0.67	87	41	73	71			
(Deviation from normal)	+5	+6	+5	-2.85							

2008 Field Season Weather Data
Central Kentucky (Spindletop Weather Station)

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			AIR TEMP				RH		SOIL TEMP GRASS		SOIL TEMP BARE		
STATION	DATE		MX	MN	AV	PRECIP	MX	MN	MX	MN	MX	MN	EVAP
Spindletop	03-01-2008		50	30	40		95	50	39	35	41	36	
Spindletop	03-02-2008		64	35	50	T	94	55	42	37	44	38	
Spindletop	03-03-2008		71	51	61		93	40	47	42	49	44	
Spindletop	03-04-2008		53	40	46	1.48	100	81	47	45	49	47	
Spindletop	03-05-2008		36	31	34	T	100	30	44	41	46	42	
Spindletop	03-06-2008		53	28	40		92	52	44	39	47	40	
Spindletop	03-07-2008		34	25	30	0.30	100	100	43	39	45	40	
Spindletop	03-08-2008		27	21	24	0.28	100	55	39	37	40	38	
Spindletop	03-09-2008		40	13	26		84	59	38	37	38	37	
Spindletop	03-10-2008		46	35	40	0.03	100	56	37	36	38	38	
Spindletop	03-11-2008		46	25	36		100	45	38	36	40	36	
Spindletop	03-12-2008		60	33	46		79	39	42	37	45	38	
Spindletop	03-13-2008		67	48	58		68	41	46	41	49	43	
Spindletop	03-14-2008		52	42	47	0.49	100	100	45	43	47	45	
Spindletop	03-15-2008		46	31	38	0.31	100	100	44	42	45	43	
Spindletop	03-16-2008		48	38	43	T	97	56	44	42	47	43	
Spindletop	03-17-2008	E	55	34	44	T	73	41	43	41	45	42	
Spindletop	03-18-2008		66	48	57	0.06	96	48	46	42	48	44	
Spindletop	03-19-2008		58	37	48	1.70	100	62	49	45	51	47	
Spindletop	03-20-2008		53	30	42	T	100	30	46	43	49	44	
Spindletop	03-21-2008		65	32	48		100	50	47	42	50	43	
Spindletop	03-22-2008		43	37	40		83	45	46	43	49	45	
Spindletop	03-23-2008		44	26	35		100	100	44	41	47	42	
Spindletop	03-24-2008		45	29	37	0.02	96	30	43	41	46	43	
Spindletop	03-25-2008		58	26	42		82	31	43	39	45	41	
Spindletop	03-26-2008		66	49	58		89	35	48	43	51	45	
Spindletop	03-27-2008		65	47	56	0.81	100	77	49	47	52	49	
Spindletop	03-28-2008		66	56	61	0.71	94	74	50	47	52	48	
Spindletop	03-29-2008		51	31	41		88	46	47	44	49	45	
Spindletop	03-30-2008		66	64	65		84	63	49	45	51	47	
Spindletop	03-31-2008		66	55	60	0.09	94	73	51	49	54	51	

Summary for Spindletop for the period 3-1-2008 through 3-31-2008:

	AIR TEMP			TOTAL	RH		SOIL TEMP GRASS		SOIL TEMP BARE		TOTAL
STATION	MX	MN	AV	PRECIP	MX	MN	MX	MN	MX	MN	EVAP
Spindletop	54	36	45	6.28	93	57	45	41	47	43	
(Deviation from normal)	-1	+2	+1	+1.88							

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STATION	DATE	AIR TEMP MX	MN	AV	PRECIP	RH MX	MN	SOIL TEMP GRASS MX	MN	BARE MX	MN	EVAP
Spindletop	04-01-2008	59	48	54	0.09	93	62	52	50	55	52	
Spindletop	04-02-2008	52	42	47		70	47	51	47	54	49	
Spindletop	04-03-2008	64	45	54	0.55	100	63	51	47	53	49	
Spindletop	04-04-2008	61	50	56	3.50	100	100	54	51	56	54	
Spindletop	04-05-2008	53	43	48	0.20	100	88	53	51	55	53	
Spindletop	04-06-2008	65	35	50		100	83	51	49	53	50	
Spindletop	04-07-2008	71	46	58		100	87	57	52	61	54	
Spindletop	04-08-2008	73	52	62		86	53	57	53	61	55	
Spindletop	04-09-2008 E	63	60	62		97	72	57	55	60	58	
Spindletop	04-10-2008 E	77	54	66		100	59	59	55	61	57	
Spindletop	04-11-2008	73	45	59	0.38	100	60	60	57	62	60	
Spindletop	04-12-2008	52	42	47		100	39	58	53	61	55	
Spindletop	04-13-2008 E	42	36	39	0.50	100	73	53	51	55	53	
Spindletop	04-14-2008	48	37	42		100	65	51	50	53	52	
Spindletop	04-15-2008	57	32	44		100	15	52	47	56	49	
Spindletop	04-16-2008	67	37	52		90	36	53	47	56	49	
Spindletop	04-17-2008 E	72	45	58		69	38	53	48	57	50	
Spindletop	04-18-2008	71	48	60		82	41	55	50	59	52	
Spindletop	04-19-2008	70	59	64	0.08	94	68	56	54	59	57	
Spindletop	04-20-2008	59	46	52	0.09	93	62	55	53	58	56	
Spindletop	04-21-2008	64	46	55		95	45	57	52	61	55	
Spindletop	04-22-2008 E	72	50	61		90	43	59	53	62	56	
Spindletop	04-23-2008 E	80	54	67		97	82	60	56	64	58	
Spindletop	04-24-2008 E	80	56	68		67	46	61	57	65	60	
Spindletop	04-25-2008	84	62	73		90	45	62	59	66	62	
Spindletop	04-26-2008	67	55	61	0.03	90	50	61	59	65	62	
Spindletop	04-27-2008 E	70	46	58	T	86	42	59	57	63	59	
Spindletop	04-28-2008 E	59	44	52	0.30	100	43	58	56	62	59	
Spindletop	04-29-2008 E	45	32	38	T	92	70	55	52	59	55	
Spindletop	04-30-2008 E	65	34	50		89	40	55	50	58	53	

Summary for Spindletop for the period 4-1-2008 through 4-30-2008:

STATION	AIR TEMP MX	MN	AV	TOTAL PRECIP	RH MX	MN	SOIL TEMP GRASS MX	MN	BARE MX	MN	TOTAL EVAP
Spindletop	64	46	55	5.72	92	57	56	52	59	55	
(Deviation from normal)	-1	+1	+0	+1.84							

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STATION	DATE	AIR TEMP MX	MN	AV	PRECIP	RH MX	MN	SOIL TEMP GRASS MX	MN	BARE MX	MN	EVAP
Spindletop	05-01-2008 E	78	53	66		69	20	57	54	61	56	
Spindletop	05-02-2008	79	57	68	0.26	95	55	59	57	62	59	
Spindletop	05-03-2008	73	58	66	0.80	100	65	60	58	63	61	
Spindletop	05-04-2008 E	64	39	52		93	40	59	55	61	57	
Spindletop	05-05-2008 E	71	41	56		92	32	60	55	63	57	
Spindletop	05-06-2008 E	76	46	61		80	32	60	56	65	58	
Spindletop	05-07-2008 E	77	58	68	0.04	92	43	62	59	65	61	
Spindletop	05-08-2008 E	68	59	64	1.04	100	65	62	61	64	63	
Spindletop	05-09-2008	66	59	62	0.57	100	65	62	61	64	63	
Spindletop	05-10-2008	68	48	58	T	90	59	64	59	68	61	
Spindletop	05-11-2008 E	64	51	58	0.66	91	45	63	59	66	61	
Spindletop	05-12-2008 E	64	47	56	0.02	91	58	61	57	65	59	
Spindletop	05-13-2008 E	69	46	58		99	65	60	57	62	59	
Spindletop	05-14-2008 E	63	54	58	0.25	100	60	0		0		
Spindletop	05-15-2008 E	64	59	62	0.57	100	93	0		0		
Spindletop	05-16-2008 E	62	48	55		100	61	63	62	68	63	
Spindletop	05-17-2008 E	74	45	60		93	45	64	62	69	65	
Spindletop	05-18-2008 E	70	59	64	0.15	89	33	60	59	71	69	
Spindletop	05-19-2008	67	51	59	0.15	92	40	73	58	65	60	
Spindletop	05-20-2008	65	50	58	0.09	99	60	60	58	63	60	
Spindletop	05-21-2008	68	45	56		97	33	60	57	62	59	
Spindletop	05-22-2008	73	43	58		92	32	62	56	64	58	
Spindletop	05-23-2008	70	55	62	0.15	97	51	62	60	64	62	
Spindletop	05-24-2008	72	53	62	0.01	98	46	65	60	67	61	
Spindletop	05-25-2008	79	47	63		87	32	66	60	69	61	
Spindletop	05-26-2008	80	62	71		89	56	66	63	69	65	
Spindletop	05-27-2008	81	56	68	0.09	97	61	69	65	72	67	
Spindletop	05-28-2008	70	50	60	0.03	96	45	69	64	70	65	
Spindletop	05-29-2008	77	48	62		81	28	69	62	70	63	
Spindletop	05-30-2008	81	55	68		82	61	68	63	71	65	
Spindletop	05-31-2008	83	71	77		83	46	70	67	73	69	

Summary for Spindletop for the period 5-1-2008 through 5-31-2008:

STATION	AIR TEMP MX	MN	AV	TOTAL PRECIP	RH MX	MN	SOIL TEMP GRASS MX	MN	BARE MX	MN	TOTAL EVAP
Spindletop	71	52	62	4.88	92	49	59	59	62	62	
(Deviation from normal)	-4	-3	-4	+0.41							

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STATION	DATE	AIR TEMP MX	MN	AV	PRECIP	RH MX	MN	SOIL TEMP GRASS MX	MN	BARE MX	MN	EVAP
Spindletop	05-01-2008 E	78	53	66		69	20	57	54	61	56	
Spindletop	05-02-2008	79	57	68	0.26	95	55	59	57	62	59	
Spindletop	05-03-2008	73	58	66	0.80	100	65	60	58	63	61	
Spindletop	05-04-2008 E	64	39	52		93	40	59	55	61	57	
Spindletop	05-05-2008 E	71	41	56		92	32	60	55	63	57	
Spindletop	05-06-2008 E	76	46	61		80	32	60	56	65	58	
Spindletop	05-07-2008 E	77	58	68	0.04	92	43	62	59	65	61	
Spindletop	05-08-2008 E	68	59	64	1.04	100	65	62	61	64	63	
Spindletop	05-09-2008	66	59	62	0.57	100	65	62	61	64	63	
Spindletop	05-10-2008	68	48	58	T	90	59	64	59	68	61	
Spindletop	05-11-2008 E	64	51	58	0.66	91	45	63	59	66	61	
Spindletop	05-12-2008 E	64	47	56	0.02	91	58	61	57	65	59	
Spindletop	05-13-2008 E	69	46	58		99	65	60	57	62	59	
Spindletop	05-14-2008 E	63	54	58	0.25	100	60	0		0		
Spindletop	05-15-2008 E	64	59	62	0.57	100	93	0		0		
Spindletop	05-16-2008 E	62	48	55		100	61	63	62	68	63	
Spindletop	05-17-2008 E	74	45	60		93	45	64	62	69	65	
Spindletop	05-18-2008 E	70	59	64	0.15	89	33	60	59	71	69	
Spindletop	05-19-2008	67	51	59	0.15	92	40	73	58	65	60	
Spindletop	05-20-2008	65	50	58	0.09	99	60	60	58	63	60	
Spindletop	05-21-2008	68	45	56		97	33	60	57	62	59	
Spindletop	05-22-2008	73	43	58		92	32	62	56	64	58	
Spindletop	05-23-2008	70	55	62	0.15	97	51	62	60	64	62	
Spindletop	05-24-2008	72	53	62	0.01	98	46	65	60	67	61	
Spindletop	05-25-2008	79	47	63		87	32	66	60	69	61	
Spindletop	05-26-2008	80	62	71		89	56	66	63	69	65	
Spindletop	05-27-2008	81	56	68	0.09	97	61	69	65	72	67	
Spindletop	05-28-2008	70	50	60	0.03	96	45	69	64	70	65	
Spindletop	05-29-2008	77	48	62		81	28	69	62	70	63	
Spindletop	05-30-2008	81	55	68		82	61	68	63	71	65	
Spindletop	05-31-2008	83	71	77		83	46	70	67	73	69	

Summary for Spindletop for the period 5-1-2008 through 5-31-2008:

STATION	AIR TEMP MX	MN	AV	TOTAL PRECIP	RH MX	MN	SOIL TEMP GRASS MX	MN	BARE MX	MN	TOTAL EVAP
Spindletop	71	52	62	4.88	92	49	59	59	62	62	
(Deviation from normal)	-4	-3	-4	+0.41							

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STATION	DATE	AIR TEMP MX	MN	AV	PRECIP	RH MX	MN	SOIL TEMP GRASS MX	MN	BARE MX	MN	EVAP
Spindletop	07-01-2008	80	53	66		95	27	74	67	76	68	
Spindletop	07-02-2008	85	60	72		65	30	74	68	76	69	
Spindletop	07-03-2008	81	68	74	0.09	95	46	73	70	75	71	
Spindletop	07-04-2008	78	67	72	0.21	97	74	73	71	75	72	
Spindletop	07-05-2008	83	67	75		99	59	76	71	78	73	
Spindletop	07-06-2008	85	62	74		100	44	78	71	79	72	
Spindletop	07-07-2008	86	62	74		91	50	76	71	78	72	
Spindletop	07-08-2008	90	70	80	0.24	93	47	77	73	79	74	
Spindletop	07-09-2008	80	71	76	0.09	93	72	75	73	77	75	
Spindletop	07-10-2008	82	63	72		95	39	78	72	79	73	
Spindletop	07-11-2008	91	61	76		93	32	79	71	80	72	
Spindletop	07-12-2008	87	68	78	0.05	87	59	76	73	77	74	
Spindletop	07-13-2008	82	64	73	0.04	97	38	77	73	79	75	
Spindletop	07-14-2008	84	58	71		95	34	77	70	79	72	
Spindletop	07-15-2008	87	58	72		95	36	78	70	79	72	
Spindletop	07-16-2008	88	61	74		91	37	79	71	80	73	
Spindletop	07-17-2008	93	63	78		92	24	80	72	81	73	
Spindletop	07-18-2008	93	64	78		92	26	80	73	81	74	
Spindletop	07-19-2008	93	70	82		84	34	81	74	82	75	
Spindletop	07-20-2008	93	69	81	0.02	90	43	81	75	82	77	
Spindletop	07-21-2008	93	72	82		81	44	80	76	82	77	
Spindletop	07-22-2008	89	65	77	0.17	95	39	81	75	82	76	
Spindletop	07-23-2008	81	64	72	0.48	98	44	78	73	80	75	
Spindletop	07-24-2008	85	58	72		99	31	78	71	78	73	
Spindletop	07-25-2008	87	68	78		89	34	78	74	78	75	
Spindletop	07-26-2008	90	68	79		96	46	80	74	80	75	
Spindletop	07-27-2008	90	67	78		93	28	81	75	81	76	
Spindletop	07-28-2008	84	67	76	0.30	94	63	79	75	79	75	
Spindletop	07-29-2008	92	68	80		100	36	82	75	81	76	
Spindletop	07-30-2008	88	71	80	0.10	90	49	80	76	80	77	
Spindletop	07-31-2008	85	69	77	0.75	99	60	79	76	80	77	

Summary for Spindletop for the period 7-1-2008 through 7-31-2008:

STATION	AIR TEMP MX	MN	AV	TOTAL PRECIP	RH MX	MN	SOIL TEMP GRASS MX	MN	BARE MX	MN	TOTAL EVAP
Spindletop	87	65	76	2.54	93	43	78	73	79	74	
(Deviation from normal)	+1	+0	+1	-2.46							

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STATION	DATE	AIR TEMP MX	MN	AV	PRECIP	RH MX	MN	SOIL TEMP GRASS MX	MN	BARE MX	MN	EVAP
Spindletop	08-01-2008	89	70	80		95	49	81	75	81	76	
Spindletop	08-02-2008	89	71	80		91	47	82	77	83	78	
Spindletop	08-03-2008	86	62	74		92	40	81	75	81	76	
Spindletop	08-04-2008	90	62	76		90	40	81	74	80	75	
Spindletop	08-05-2008	88	71	80	0.35	95	57	79	76	79	76	
Spindletop	08-06-2008	83	71	77	0.04	98	66	79	76	80	77	
Spindletop	08-07-2008	86	68	77		97	39	81	75	81	77	
Spindletop	08-08-2008	82	58	70		93	39	78	73	79	74	
Spindletop	08-09-2008	81	56	68		98	37	77	71	77	72	
Spindletop	08-10-2008	83	59	71		95	40	77	71	78	72	
Spindletop	08-11-2008	80	51	66		98	37	77	69	77	71	
Spindletop	08-12-2008	82	54	68		94	34	77	70	76	71	
Spindletop	08-13-2008	86	57	72		93	30	78	70	78	72	
Spindletop	08-14-2008	85	58	72	0.41	98	33	77	71	77	72	
Spindletop	08-15-2008	83	58	70	0.01	100	41	77	70	78	72	
Spindletop	08-16-2008	82	56	69		91	33	76	70	77	71	
Spindletop	08-17-2008	86	56	71		90	28	77	69	77	71	
Spindletop	08-18-2008	89	56	72		97	27	77	69	78	71	
Spindletop	08-19-2008	89	57	73		93	27	79	70	79	72	
Spindletop	08-20-2008	92	63	78		93	28	80	72	79	73	
Spindletop	08-21-2008	92	67	80		84	26	79	74	80	75	
Spindletop	08-22-2008	93	71	82		68	29	81	74	81	75	
Spindletop	08-23-2008	93	67	80		70	29	81	74	82	75	
Spindletop	08-24-2008	93	69	81		74	30	80	75	81	76	
Spindletop	08-25-2008	86	68	77		95	56	79	75	80	76	
Spindletop	08-26-2008	82	64	73	0.03	95	52	77	73	78	75	
Spindletop	08-27-2008	72	67	70	0.24	99	88	75	73	76	75	
Spindletop	08-28-2008	88	66	77		99	40	78	72	80	74	
Spindletop	08-29-2008	92	69	80		96	37	79	73	81	75	
Spindletop	08-30-2008	89	65	77		100	48	79	74	80	75	
Spindletop	08-31-2008	92	65	78		90	32	81	73	81	75	

Summary for Spindletop for the period 8-1-2008 through 8-31-2008:

STATION	AIR TEMP MX	MN	AV	TOTAL PRECIP	RH MX	MN	SOIL TEMP GRASS MX	MN	BARE MX	MN	TOTAL EVAP
Spindletop	87	63	75	1.08	92	40	79	73	79	74	
(Deviation from normal)	+3	+1	+2	-2.85							

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STATION	DATE	AIR TEMP MX	MN	AV	PRECIP	RH MX	MN	SOIL TEMP GRASS MX	MN	BARE MX	MN	EVAP
Spindletop	09-01-2008	96	63	80		77	34	80	73	81	74	
Spindletop	09-02-2008	96	70	83		93	33	82	75	83	77	
Spindletop	09-03-2008	92	71	82		89	30	80	76	82	78	
Spindletop	09-04-2008	90	67	78		86	24	79	75	80	76	
Spindletop	09-05-2008	80	69	74	0.36	99	47	77	75	78	77	
Spindletop	09-06-2008	82	63	72	0.08	98	47	77	73	78	75	
Spindletop	09-07-2008	83	59	71		98	40	76	70	78	73	
Spindletop	09-08-2008	89	58	74		98	32	77	70	79	72	
Spindletop	09-09-2008	75	63	69	0.08	94	70	75	72	77	74	
Spindletop	09-10-2008	81	57	69		95	44	76	69	76	71	
Spindletop	09-11-2008	86	56	71	0.35	97	52	74	69	76	71	
Spindletop	09-12-2008	89	72	80		96	52	76	72	78	74	
Spindletop	09-13-2008	93	70	82		92	40	78	73	79	75	
Spindletop	09-14-2008	87	67	77		85	45	76	73	78	75	
Spindletop	09-15-2008	73	60	66		94	51	73	70	75	72	
Spindletop	09-16-2008	81	51	66		100	35	73	67	74	69	
Spindletop	09-17-2008	81	52	66		100	32	74	67	75	69	
Spindletop	09-18-2008	85	51	68		97	33	74	67	75	69	
Spindletop	09-19-2008	85	54	70		86	30	74	68	75	70	
Spindletop	09-20-2008	83	61	72		86	38	73	69	75	71	
Spindletop	09-21-2008	86	55	70		95	25	75	68	76	70	
Spindletop	09-22-2008	87	56	72		82	20	75	68	76	70	
Spindletop	09-23-2008	88	54	71		96	23	76	68	76	70	
Spindletop	09-24-2008	84	57	70		82	19	75	68	76	70	
Spindletop	09-25-2008	83	52	68		83	15	74	67	74	68	
Spindletop	09-26-2008	76	56	66		81	45	72	67	73	68	
Spindletop	09-27-2008	81	58	70		95	48	73	68	74	69	
Spindletop	09-28-2008	79	57	68		100	48	72	68	73	70	
Spindletop	09-29-2008	85	52	68		100	29	73	66	74	67	
Spindletop	09-30-2008	73	57	65	0.34	99	43	71	68	73	70	

Summary for Spindletop for the period 9-1-2008 through 9-30-2008:

STATION	AIR TEMP MX	MN	AV	TOTAL PRECIP	RH MX	MN	SOIL TEMP GRASS MX	MN	BARE MX	MN	TOTAL EVAP
Spindletop	84	60	72	1.21	92	37	75	70	77	72	
(Deviation from normal)	+7	+4	+5	-1.99							

2008 Field Season Weather Data
Western Kentucky (Princeton Weather Station)

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STATION	DATE	AIR TEMP MX	MN	AV	PRECIP	RH MX	MN	SOIL TEMP GRASS MX	MN	BARE MX	MN	EVAP
Princeton	03-01-2008	62	27	44		95	20	39	34			
Princeton	03-02-2008 E	75	44	60	0.02	70	45	40	35			
Princeton	03-03-2008	74	55	64	0.23	100	45	46	43			
Princeton	03-04-2008	56	34	45	2.91	100	100	46	40			
Princeton	03-05-2008	51	29	40	T	95	50	43	36			
Princeton	03-06-2008	51	29	40		100	100	42	35			
Princeton	03-07-2008	34	29	32	0.17	95	58	46	45			
Princeton	03-08-2008	37	22	30	0.30	100	35	34	30			
Princeton	03-09-2008	50	20	35		90	50	36	31			
Princeton	03-10-2008	53	31	42	0.01	90	45	36	30			
Princeton	03-11-2008	53	25	39		90	40	40	31			
Princeton	03-12-2008	70	39	54		95	20	45	34			
Princeton	03-13-2008	72	38	55		80	30	48	38			
Princeton	03-14-2008	71	48	60	0.25	100	95	50	42			
Princeton	03-15-2008	56	39	48	0.06	100	100	49	41			
Princeton	03-16-2008	52	38	45		100	70	49	42			
Princeton	03-17-2008	62	42	52		95	50	47	42			
Princeton	03-18-2008	66	55	60	0.15	95	60	48	41			
Princeton	03-19-2008	69	39	54	2.71	100	100	48	39			
Princeton	03-20-2008	59	33	46		95	30	46	40			
Princeton	03-21-2008	69	29	49		92	20	50	40			
Princeton	03-22-2008	69	40	54		80	20	48	43			
Princeton	03-23-2008	40	26	33	0.04	100	80	47	43			
Princeton	03-24-2008	48	27	38	0.04	95	40	45	38			
Princeton	03-25-2008	64	32	48		95	20	43	38			
Princeton	03-26-2008	68	38	53		95	70	50	40			
Princeton	03-27-2008	68	57	62	0.04	90	20	45	39			
Princeton	03-28-2008	68	40	54	0.32	95	75	49	39			
Princeton	03-29-2008	50	39	44		90	60	49	42			
Princeton	03-30-2008	61	38	50	0.28	100	95	49	43			
Princeton	03-31-2008	68	53	60	0.02	95	60	50	44			

Summary for Princeton for the period 3-1-2008 through 3-31-2008:

STATION	AIR TEMP MX	MN	AV	TOTAL PRECIP	RH MX	MN	SOIL TEMP GRASS MX	MN	BARE MX	MN	TOTAL EVAP
Princeton	60	37	48	7.55	94	55	45	39			
(Deviation from normal)	-1	+1	+0	+2.61							

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STATION	DATE	AIR TEMP MX	MN	AV	PRECIP	RH MX	MN	SOIL TEMP GRASS MX	MN	BARE MX	MN	EVAP
Princeton	04-01-2008	70	52	61	0.81	100	50	53	44			
Princeton	04-02-2008	59	34	46		75	25	54	45			
Princeton	04-03-2008	60	43	52	1.30	95	40	53	43			
Princeton	04-04-2008	64	41	52	2.57	100	100	51	51			
Princeton	04-05-2008	64	36	50	0.07	95	45	53	46			
Princeton	04-06-2008	66	34	50		90	40	53	45			
Princeton	04-07-2008	75	44	60		95	30	59	46			
Princeton	04-08-2008	77	58	68		95	30	61	54			
Princeton	04-09-2008	71	49	60	0.23	100	60	56	54			
Princeton	04-10-2008	79	50	64		95	50	57	54			
Princeton	04-11-2008	79	58	68	0.85	100	30	56	46			
Princeton	04-12-2008	71	43	57		70	50	54	46			
Princeton	04-13-2008	46	34	40	0.05	95	70	53	43			
Princeton	04-14-2008	48	34	41		95	45	58	45			
Princeton	04-15-2008	60	28	44		95	20	52	42			
Princeton	04-16-2008	69	40	54		60	25	55	41			
Princeton	04-17-2008	76	49	62		70	40	56	41			
Princeton	04-18-2008	76	51	64		65	40	58	49			
Princeton	04-19-2008	69	46	58	0.05	100	50	57	48			
Princeton	04-20-2008	74	52	63		95	25	58	48			
Princeton	04-21-2008	76	45	60		90	30	61	55			
Princeton	04-22-2008	81	50	66		90	40	64	55			
Princeton	04-23-2008	86	51	68		90	20	67	61			
Princeton	04-24-2008	81	51	66		95	25	70	62			
Princeton	04-25-2008	83	62	72		90	35	65	59			
Princeton	04-26-2008	82	50	66	0.25	90	20	64	57			
Princeton	04-27-2008	82	50	66	0.25	90	20	64	57			
Princeton	04-28-2008	61	41	51	0.06	100	30	65	59			
Princeton	04-29-2008	60	32	46	0.07	95	30	63	58			
Princeton	04-30-2008	78	37	58		95	25	61	55			

Summary for Princeton for the period 4-1-2008 through 4-30-2008:

STATION	AIR TEMP MX	MN	AV	TOTAL PRECIP	RH MX	MN	SOIL TEMP GRASS MX	MN	BARE MX	MN	TOTAL EVAP
Princeton	71	45	58	6.56	90	38	58	50			
(Deviation from normal)	-0	-2	-1	+1.76							

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STATION	DATE	AIR TEMP MX	MN	AV	PRECIP	RH MX	MN	SOIL TEMP GRASS MX	MN	BARE MX	MN	EVAP
Princeton	05-01-2008	78	51	64		70	20	62	57			
Princeton	05-02-2008	75	51	63	0.20	100	60	61	55			
Princeton	05-03-2008	65	39	52	3.10	95	40	62	60			
Princeton	05-04-2008	70	40	55		95	30	60	55			
Princeton	05-05-2008	76	42	59		95	30	63	55			
Princeton	05-06-2008	80	48	64		95	25	67	64			
Princeton	05-07-2008	77	58	68	0.08	98	41	65	63			
Princeton	05-08-2008	77	64	70	0.12	100	50	67	66			
Princeton	05-09-2008	76	56	66	T	90	70	67	64			
Princeton	05-10-2008	73	59	66		95	60	65	64			
Princeton	05-11-2008	60	50	55	0.37	95	70	66	62			
Princeton	05-12-2008	69	41	55	T	100	25	61	53			
Princeton	05-13-2008	72	42	57		95	30	61	56			
Princeton	05-14-2008	70	56	63	0.45	100	90	60	57			
Princeton	05-15-2008	69	61	65	0.41	100	95	59	55			
Princeton	05-16-2008	68	50	59	0.27	95	40	61	59			
Princeton	05-17-2008	79	49	64		50	20	60	57			
Princeton	05-18-2008	77	61	69		60	20	62	58			
Princeton	05-19-2008	80	44	62		95	25	65	60			
Princeton	05-20-2008	81	53	67		95	40	65	61			
Princeton	05-21-2008	76	46	61		95	15	66	60			
Princeton	05-22-2008	78	47	62	0.03	100	25	68	64			
Princeton	05-23-2008	86	58	72		95	50	68	64			
Princeton	05-24-2008	86	60	73		90	60	69	61			
Princeton	05-25-2008	85	57	71		95	50	68	61			
Princeton	05-26-2008	85	65	75	1.16	100	75	70	65			
Princeton	05-27-2008	84	62	73		100	70	66	62			
Princeton	05-28-2008	79	59	69		80	60	65	61			
Princeton	05-29-2008	83	51	67		95	30	69	63			
Princeton	05-30-2008	86	59	72		95	55	72	65			
Princeton	05-31-2008	81	75	78		95	50	70	66			

Summary for Princeton for the period 5-1-2008 through 5-31-2008:

STATION	AIR TEMP MX	MN	AV	TOTAL PRECIP	RH MX	MN	SOIL TEMP GRASS MX	MN	BARE MX	MN	TOTAL EVAP
Princeton	77	53	65	6.19	92	46	65	60			
(Deviation from normal)	-4	-3	-3	+1.23							

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STATION	DATE	AIR TEMP MX	MN	AV	PRECIP	RH MX	MN	SOIL TEMP GRASS MX	MN	BARE MX	MN	EVAP
Princeton	06-01-2008	88	65	76	T	95	45	71	66			
Princeton	06-02-2008	86	62	74		95	35	73	65			
Princeton	06-03-2008	89	69	79		95	45	75	71			
Princeton	06-04-2008	90	75	82		80	45	72	66			
Princeton	06-05-2008	89	74	82		90	45	75	69			
Princeton	06-06-2008	91	73	82		90	45	77	70			
Princeton	06-07-2008	92	73	82		90	45	77	70			
Princeton	06-08-2008	94	71	82		90	30	77	71			
Princeton	06-09-2008	94	71	82		90	30	77	71			
Princeton	06-10-2008	92	68	80		95	40	76	70			
Princeton	06-11-2008	89	58	74		95	35	77	70			
Princeton	06-12-2008	92	69	80		85	40	77	71			
Princeton	06-13-2008	94	71	82		95	55	77	71			
Princeton	06-14-2008	89	66	78	0.44	95	55	78	72			
Princeton	06-15-2008	89	64	76		95	50	79	71			
Princeton	06-16-2008	89	66	78		95	40	80	75			
Princeton	06-17-2008	88	67	78		85	30	77	70			
Princeton	06-18-2008	82	51	66		95	20	79	72			
Princeton	06-19-2008	86	55	70		95	25	78	69			
Princeton	06-20-2008	87	57	72	0.45	60	25	78	75			
Princeton	06-21-2008	87	60	74		60	30	74	66			
Princeton	06-22-2008	88	61	74	0.35	50	20	78	67			
Princeton	06-23-2008	86	63	74		95	20	78	69			
Princeton	06-24-2008	88	58	73		95	25	80	69			
Princeton	06-25-2008	92	74	83		90	40	79	70			
Princeton	06-26-2008	91	71	81		95	45	80	75			
Princeton	06-27-2008	91	66	78		95	50	80	74			
Princeton	06-28-2008	90	76	83	T	95	60	77	71			
Princeton	06-29-2008	82	69	76		95	40	78	72			
Princeton	06-30-2008	81	63	72		95	40	76	71			

Summary for Princeton for the period 6-1-2008 through 6-30-2008:

STATION	AIR TEMP MX	MN	AV	TOTAL PRECIP	RH MX	MN	SOIL TEMP GRASS MX	MN	BARE MX	MN	TOTAL EVAP
Princeton	89	66	78	1.24	89	38	77	70			
(Deviation from normal)	+2	+3	+2	-2.61							

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STATION	DATE	AIR TEMP MX	MN	AV	PRECIP	RH MX	MN	SOIL TEMP GRASS MX	MN	BARE MX	MN	EVAP
Princeton	07-01-2008	87	56	72		95	20	76	70			
Princeton	07-02-2008	89	59	74		90	20	77	69			
Princeton	07-03-2008	90	67	78		50	20	77	68			
Princeton	07-04-2008	86	69	78	0.83	100	80	74	67			
Princeton	07-05-2008	82	63	72	0.56	95	50	71	66			
Princeton	07-06-2008	86	65	76		95	40	73	67			
Princeton	07-07-2008	89	73	81		90	70	77	73			
Princeton	07-08-2008	93	71	82		95	50	76	72			
Princeton	07-09-2008	93	69	81	0.55	100	75	76	70			
Princeton	07-10-2008	91	69	80		95	50	75	71			
Princeton	07-11-2008	93	71	82		95	45	76	71			
Princeton	07-12-2008	94	70	82		95	50	77	71			
Princeton	07-13-2008	89	69	79	1.30	95	40	77	76			
Princeton	07-14-2008	84	58	71		95	30	78	72			
Princeton	07-15-2008	88	60	74		85	25	80	68			
Princeton	07-16-2008	89	63	76		95	30	79	74			
Princeton	07-17-2008	92	65	78		95	30	80	75			
Princeton	07-18-2008	93	67	80		95	30	79	69			
Princeton	07-19-2008	94	66	80		95	45	79	70			
Princeton	07-20-2008	97	69	83		95	40	81	70			
Princeton	07-21-2008	97	73	85		95	40	80	72			
Princeton	07-22-2008	98	70	84	0.02	100	55	82	74			
Princeton	07-23-2008	86	67	76		95	35	81	74			
Princeton	07-24-2008	85	57	71		95	30	78	73			
Princeton	07-25-2008	86	64	75	0.66	100	65	78	74			
Princeton	07-26-2008	91	68	80		95	60	79	73			
Princeton	07-27-2008	93	70	82		95	40	80	74			
Princeton	07-28-2008	94	72	83		75	50	81	74			
Princeton	07-29-2008	93	69	81		95	60	80	73			
Princeton	07-30-2008	95	67	81	0.05	100	50	80	70			
Princeton	07-31-2008	88	71	80	1.15	100	95	79	74			

Summary for Princeton for the period 7-1-2008 through 7-31-2008:

STATION	AIR TEMP MX	MN	AV	TOTAL PRECIP	RH MX	MN	SOIL TEMP GRASS MX	MN	BARE MX	MN	TOTAL EVAP
Princeton	90	67	79	5.12	93	46	78	71			
(Deviation from normal)	+1	+0	+1	+0.83							

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STATION	DATE	AIR TEMP MX	MN	AV	PRECIP	RH MX	MN	SOIL TEMP GRASS MX	MN	BARE MX	MN	EVAP
Princeton	08-01-2008	91	67	79		95	60	79	70			
Princeton	08-02-2008	91	68	80		95	50	89	69			
Princeton	08-03-2008	92	65	78		95	40	81	71			
Princeton	08-04-2008	94	68	81		100	40	81	72			
Princeton	08-05-2008	95	68	82		95	40	81	74			
Princeton	08-06-2008	90	66	78		95	50	81	74			
Princeton	08-07-2008	90	69	80	T	95	35	79	71			
Princeton	08-08-2008	85	62	74		95	30	74	67			
Princeton	08-09-2008	85	56	70		95	30	76	68			
Princeton	08-10-2008	86	59	72		95	35	77	68			
Princeton	08-11-2008	81	57	69		95	30	75	70			
Princeton	08-12-2008	83	58	70		95	30	75	68			
Princeton	08-13-2008	84	58	71		95	40	76	67			
Princeton	08-14-2008	88	60	74		90	45	76	68			
Princeton	08-15-2008	87	59	73		95	40	75	67			
Princeton	08-16-2008	85	62	74		95	30	74	67			
Princeton	08-17-2008	88	61	74		95	45	75	68			
Princeton	08-18-2008	87	57	72		95	25	76	69			
Princeton	08-19-2008	88	67	78		90	25	75	60			
Princeton	08-20-2008	94	70	82		65	25	76	69			
Princeton	08-21-2008	95	72	84	0.53	100	95	76	70			
Princeton	08-22-2008	90	71	80		95	45	76	70			
Princeton	08-23-2008	93	71	82		95	40	76	69			
Princeton	08-24-2008	87	72	80		95	50	75	68			
Princeton	08-25-2008	83	69	76	0.04	95	70	76	72			
Princeton	08-26-2008	84	69	76		95	50	75	71			
Princeton	08-27-2008	86	63	74		95	50	76	70			
Princeton	08-28-2008	91	64	78		95	40	76	72			
Princeton	08-29-2008	91	68	80	0.12	95	70	75	71			
Princeton	08-30-2008	88	62	75		85	55	76	70			
Princeton	08-31-2008	94	67	80		95	35	78	70			

Summary for Princeton for the period 8-1-2008 through 8-31-2008:

STATION	AIR TEMP MX	MN	AV	TOTAL PRECIP	RH MX	MN	SOIL TEMP GRASS MX	MN	BARE MX	MN	TOTAL EVAP
Princeton	89	65	77	0.69	94	43	77	69			
(Deviation from normal)	+1	+0	+1	-3.32							

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STATION	DATE	AIR TEMP MX	MN	AV	PRECIP	RH MX	MN	SOIL TEMP GRASS MX	MN	BARE MX	MN	EVAP
Princeton	08-01-2008	91	67	79		95	60	79	70			
Princeton	08-02-2008	91	68	80		95	50	89	69			
Princeton	08-03-2008	92	65	78		95	40	81	71			
Princeton	08-04-2008	94	68	81		100	40	81	72			
Princeton	08-05-2008	95	68	82		95	40	81	74			
Princeton	08-06-2008	90	66	78		95	50	81	74			
Princeton	08-07-2008	90	69	80	T	95	35	79	71			
Princeton	08-08-2008	85	62	74		95	30	74	67			
Princeton	08-09-2008	85	56	70		95	30	76	68			
Princeton	08-10-2008	86	59	72		95	35	77	68			
Princeton	08-11-2008	81	57	69		95	30	75	70			
Princeton	08-12-2008	83	58	70		95	30	75	68			
Princeton	08-13-2008	84	58	71		95	40	76	67			
Princeton	08-14-2008	88	60	74		90	45	76	68			
Princeton	08-15-2008	87	59	73		95	40	75	67			
Princeton	08-16-2008	85	62	74		95	30	74	67			
Princeton	08-17-2008	88	61	74		95	45	75	68			
Princeton	08-18-2008	87	57	72		95	25	76	69			
Princeton	08-19-2008	88	67	78		90	25	75	60			
Princeton	08-20-2008	94	70	82		65	25	76	69			
Princeton	08-21-2008	95	72	84	0.53	100	95	76	70			
Princeton	08-22-2008	90	71	80		95	45	76	70			
Princeton	08-23-2008	93	71	82		95	40	76	69			
Princeton	08-24-2008	87	72	80		95	50	75	68			
Princeton	08-25-2008	83	69	76	0.04	95	70	76	72			
Princeton	08-26-2008	84	69	76		95	50	75	71			
Princeton	08-27-2008	86	63	74		95	50	76	70			
Princeton	08-28-2008	91	64	78		95	40	76	72			
Princeton	08-29-2008	91	68	80	0.12	95	70	75	71			
Princeton	08-30-2008	88	62	75		85	55	76	70			
Princeton	08-31-2008	94	67	80		95	35	78	70			

Summary for Princeton for the period 8-1-2008 through 8-31-2008:

STATION	AIR TEMP MX	MN	AV	TOTAL PRECIP	RH MX	MN	SOIL TEMP GRASS MX	MN	BARE MX	MN	TOTAL EVAP
Princeton	89	65	77	0.69	94	43	77	69			
(Deviation from normal)	+1	+0	+1	-3.32							

This weather data provided by the University of Kentucky
Agricultural Weather Center (Phone (859)257-3000 Ext245)
World Wide Web URL: http://wwwagwx.ca.uky.edu/

STATION	DATE	AIR TEMP MX	MN	AV	PRECIP	RH MX	MN	SOIL TEMP GRASS MX	MN	BARE MX	MN	EVAP
Princeton	09-01-2008	97	68	82		95	30	77	69			
Princeton	09-02-2008	94	76	85		80	35	78	69			
Princeton	09-03-2008	93	68	80		95	35	78	71			
Princeton	09-04-2008	91	76	84	0.02	90	50	77	70			
Princeton	09-05-2008	79	64	72	0.21	99	75	76	69			
Princeton	09-06-2008	82	62	72		95	60	77	70			
Princeton	09-07-2008	86	58	72		95	45	75	69			
Princeton	09-08-2008	90	61	76		95	30	78	73			
Princeton	09-09-2008	91	61	76		90	60	77	72			
Princeton	09-10-2008	88	55	72		95	30	77	69			
Princeton	09-11-2008	88	67	78	T	95	55	76	71			
Princeton	09-12-2008	91	73	82		95	40	76	71			
Princeton	09-13-2008	95	71	83		95	60	75	70			
Princeton	09-14-2008	89	62	76		95	60	74	69			
Princeton	09-15-2008	70	53	62		95	45	75	68			
Princeton	09-16-2008	76	55	66		95	30	71	66			
Princeton	09-17-2008	82	52	67		95	28	73	65			
Princeton	09-18-2008	88	59	74		95	15	72	63			
Princeton	09-19-2008	88	60	74		90	30	73	65			
Princeton	09-20-2008	86	60	73		90	60	72	65			
Princeton	09-21-2008	87	61	74	0.06	90	30	72	64			
Princeton	09-22-2008	88	58	73		95	20	72	66			
Princeton	09-23-2008	92	57	74		95	10	73	65			
Princeton	09-24-2008	92	53	72		92	20	74	65			
Princeton	09-25-2008	91	54	72		94	12	74	65			
Princeton	09-26-2008	87	54	70		82	20	74	66			
Princeton	09-27-2008	85	55	70		80	40	75	65			
Princeton	09-28-2008	86	52	69		90	20	75	64			
Princeton	09-29-2008 E	83	53	68		90	35	72	69			
Princeton	09-30-2008	89	60	74	0.32	90	20	76	63			

Summary for Princeton for the period 9-1-2008 through 9-30-2008:

STATION	AIR TEMP MX	MN	AV	TOTAL PRECIP	RH MX	MN	SOIL TEMP GRASS MX	MN	BARE MX	MN	TOTAL EVAP
Princeton	87	61	74	0.61	92	37	75	68			
(Deviation from normal)	+6	+3	+4	-2.72							

Aminocyclopyrachlor (KJM44) Combinations for Total Vegetation and Marestail (Conyza canadensis) Control

Introduction

Aminocyclopyrachlor (DPX-MAT28 / KJM44) is a synthetic auxin active ingredient currently in development for the noncrop and invasive plant market by DuPont. Noncrop vegetation management occasionally requires total vegetation management and problematic plant species, such as marestail, thrive in the microconditions created by total vegetation management. The potential for glyphosate and ALS resistant marestail plants to exist in these areas is increasing due to the repeated use of glyphosate and ALS inhibiting herbicides in total vegetation management. KJM44, both alone and in combination with standard bareground treatments, was evaluated in late spring of 2008 for total vegetation and marestail control.

Methods and Materials

Eleven treatments were installed in late spring 2008 in a completely randomized block design with 4 replications under the guardrails at the Newtown Pike and New Circle Road interchange in Lexington, KY. Marestail plants were evenly distributed across the study site that included vegetation common to roadside guardrails. All treatments included methylated seed oil at 1 % v/v and glyphosate at 64 fl oz per acre. Plots, measuring 5' X 30', were treated at 25 GPA on May 28, 2008 using a CO_2 powered sprayer. Data collected included visual percent bareground and visual percent cover by plant species at application, 30 DAT, 60 DAT, 90 DAT, and 120 DAT.

Data analysis examined treatment effects on percent area bareground and marestail control. Analysis of covariance, with percent area bareground at application as the covariate, was used to analyze the bareground data set with Tukey-Kramer's HSD for treatment mean separation. Marestail data were analyzed using analysis of variance and Fisher's LSD for treatment mean separation. The untreated check was removed from analysis of the marestail control dataset to reduce variance.

Results

There were no statistical differences between any herbicide treatment tested for percent bareground at any evaluation interval (Table 1). All chemical treatments, except Krovar I, resulted in greater than 90% area bareground 30 DAT. KJM44 alone treatments reached maximum bareground area 30 DAT then began to decrease throughout the trial. The three-way mixes of KJM44 plus Oust plus either Escort or Telar resulted in the highest and only operationally acceptable (i.e. > 80%) treatments for percent bareground at 120 DAT.

All herbicide treatments resulted in excellent control of marestail (Table 2). Treatments containing KJM44, at any rate tested, resulted in statistically higher control of marestail 120 DAT than Roundup alone or the Oust plus Telar treatment.
KJM44 is not recommended as a stand alone total vegetation control product. It does proved an excellent tank mix partner to provide effective post emergent and some pre emergent weed control while minimizing the potential of herbicide resistant species. KJM44 is an excellent marestail control product.

Table 1: Percent area bareground by treatment for KJM44 Trial

Treatment	Rate per acre	Percent Bareground				
		0 DAT	30 DAT	60 DAT	90 DAT	120 DAT
KJM44	3.75 oz	50	97 a	82 a	74 a	72 ab
KJM44	5 oz	65	96 a	95 a	85 a	67 ab
KJM44	6.25 oz	46	98 a	92 a	75 a	55 ab
Oust + Telar	3 oz + 1.5 oz	75	95 a	84 a	83 a	70 ab
Roundup Pro	64 fl oz	57	91 a	73 a	77 a	54 ab
KJM44 + Oust + Escort	5 oz + 3 oz + 1 oz	64	99 a	97 a	94 a	88 a
KJM44 + Oust + Telar	3.75 oz + 3 oz + 1.12 oz	71	96 a	95 a	93 a	88 a
KJM44 + Oust + Telar	5 oz + 3 oz + 1.5 oz	54	100 a	100 a	98 a	81 a
KJM44 + Oust + Telar	6.25 oz + 3.73 oz + 1.88 oz	79	98 a	93 a	91 a	88 a
Krovar I	8 lb	39	82 a	93 a	78 a	78 a
Untreated		25	37 b	26 b	11 b	30 b

Note: Treatment means in the same column followed by the same letter are not statistically different using Tukey-Kramer's HSD at p = 0.05. All treatments included a MSO at 1% v/v.

Table 2: Percent control marestail by treatment

Treatment	Rate per acre	Percent Control Marestail		
		30 DAT	60 DAT	90 DAT
KJM44	3.75 oz	100 a	100 a	100 a
KJM44	5 oz	99 a	100 a	100 a
KJM44	6.25 oz	100 a	98 a	100 a
Oust + Telar	3 oz + 1.5 oz	98 a	98 a	95 b
Roundup Pro	64 fl oz	89 b	93 b	95 b
KJM44 + Oust + Escort	5 oz + 3 oz + 1 oz	100 a	100 a	100 a
KJM44 + Oust + Telar	3.75 oz + 3 oz + 1.12 oz	100 a	97 a	100 a
KJM44 + Oust + Telar	5 oz + 3 oz + 1.5 oz	100 a	100 a	100 a
KJM44 + Oust + Telar	6.25 oz + 3.73 oz + 1.88 oz	100 a	100 a	100 a
Krovar I	8 lb	98 a	100 a	100 a
Untreated		0	0	0

Note: Treatment means in the same column followed by the same letter are not statistically different using Fisher's LSD at p = 0.05. All treatments included a MSO at 1% v/v.

Canada Thistle Control with Aminocyclopyrachlor (KJM44)

Introduction

Aminocyclopyrachlor (KJM44) is a pyrimidine carboxylic acid active ingredient currently under development by DuPont. KJM44 is in the same mode of action family (i.e. auxin-type herbicides) as 2,4-D, triclopyr, dicamba, and aminopyralid. Aminopyralid has been shown to be effective in controlling stands of Canada thistle. A trial was established in late spring 2007 to compare KJM44 (80% a.i. w/w) to aminopyralid for Canada thistle control.

Methods and Materials

Eleven treatments with 4 replications were installed in a randomized complete block design on May 25, 2007. The study was located at the Spindletop Research Facility in Lexington, KY in a tall fescue dominated field. Plots measuring 10' by 30' were distributed across an even Canada thistle population. Treatments, all of which included methylated seed oil at 1% v/v, were applied at 20 GPA using a CO2 powered sprayer mounted on an ATV. Visual percent control of Canada thistle was evaluated 17, 42, 83, and 374 DAT. Data were analyzed using ARM® software and Fisher's LSD at $p = 0.05$ for treatment means separation.

Results

Milestone VM at 7 fl oz / ac resulted in significantly higher control than Telar, KJM44 + Telar, or KJM44 at 0.625 oz / ac 17 DAT (Table 1). KJM44 at 0.625 oz / ac and Telar alone resulted in significantly lower control of Canada thistle 42 DAT than all chemical treatments except KJM44 at 3.75 oz / ac. Telar alone at 1 oz / ac resulted in significantly lower control than all other treatments 83 DAT and this trend continued into the following growing season. The KJM44 at 2.5 oz / ac treatment as well as the KJM44 plus Telar treatment maintained excellent control (> 90%) from 42 DAT through the following year.

Figure 1 shows the amount of variance in control levels by treatment 1YAT. Percent control of Canada thistle increased as the KJM44 rate increased from 0.625 oz / ac to 2.5 oz / ac. KJM44 at 2.5 oz / ac showed consistent control across replications (i.e. low variability) 1 YAT. This pattern was also visible in the Milestone VM at 7 fl oz / ac treatment and the KJM44 plus Telar treatment.

KJM44 at 2.5 oz / ac and KJM44 at 1.25 oz / ac plus Telar at 0.67 oz / ac resulted in excellent control of Canada thistle 1 YAT (91%). These two treatments' results were consistent with that of the current industry standard, aminopyralid at 7 fl oz / ac.

Table 1: 2007 Canada thistle control

Treatment	Rate per acre	Percent control			
		17 DAT	42 DAT	83 DAT	374 DAT
KJM44	0.625 oz	53 d	87 b	75 a	58 a
KJM44	1.25 oz	68 a-d	98 a	88 a	79 a
KJM44	2.5 oz	68 a-d	98 a	95 a	91 a
KJM44	3.13 oz	71 a-d	98 a	93 a	73 a
KJM44	3.75 oz	79 abc	93 ab	76 a	86 a
KJM44	5 oz	85 ab	99 a	94 a	86 a
Milestone VM	5 fl oz	78 abc	97 a	78 a	61 a
Milestone VM	7 fl oz	86 a	99 a	93 a	86 a
Telar	1 oz	63 cd	89 b	40 b	18 b
KJM44 + Telar	1.25 oz + 0.67 oz	66 bcd	98 a	93 a	91 a
Untreated		0	0	0	7.5

Note: Treatment means in the same column followed by the same letter are not statistically different using Fisher's LSD at p = 0.05. All treatments included MSO at 1 % v/v.

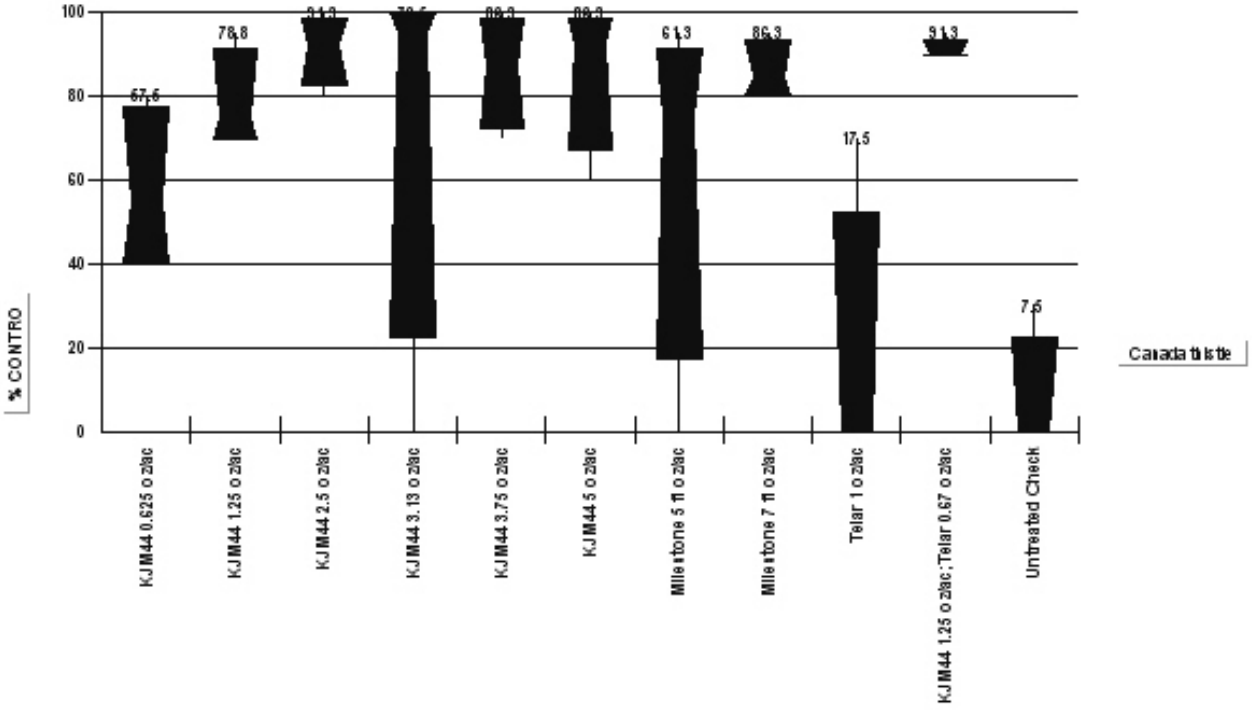

Figure 1: Box-whisker plot of treatment variance for Canada thistle control 1 YAT

Aminocyclopyrachlor (KJM44) Combinations for Selective Weed Control in Cool Season Grasses

Introduction

Aminocyclopyrachlor (KJM44) is a synthetic auxin active ingredient currently in development for the non crop and invasive vegetation management market by DuPont. KJM44 has shown potential, both alone and in tank mixes, to provide a selective weed control option for problematic plant species common to the roadside environment. Problematic species include musk thistle, common teasel, poison hemlock, and others. A trial was installed in the summer of 2008 to examine the potential of KJM44 in controlling some of the problematic species that occur along Kentucky's roadsides. Specifically, KJM44 was evaluated for musk thistle, common teasel, and overall herbaceous weed control.

Methods and Materials

Fourteen treatments were installed in a randomized complete block design with 4 replications at the intersection of the Gene Snyder Expressway (I- 265) and Billtown Road (exit 19) in Jefferson County, KY. Plots, measuring 10' X 30', were treated at 20 GPA using a CO_2 powered sprayer mounted on an ATV on July 1, 2008. Treatments included KJM44 alone, KJM44 plus Telar, KJM44 plus Escort, and Milestone VM plus Plateau as the standard and all treatments included a methylated seed oil at 1% v/v. A severe drought, which started in 2007, continued into the growing season of 2008. Data were collected 16, 31, and 44 DAT and included visual percent control by species. Data were analyzed using ARM® software and treatment means were separated using Fisher's LSD at $p = 0.05$.

Results

Musk Thistle Control
KJM44 plus Escort plus Roundup Pro, KJM44 plus Telar plus Roundup Pro, KJM44 at 1.25 oz / ac plus Telar at 0.5 oz / ac, and KJM44 at 1.25 oz / ac plus Escort at 0.5 oz / ac resulted in statistically significant more control of musk thistle 16 DAT than the Milestone plus Plateau treatment (Table 1). This difference was short-lived, however, as all chemical treatments resulted in excellent control of musk thistle (99%) 44 DAT.

Common Teasel Control
Control levels for common teasel 16 DAT ranged from 40 % (KJM44 at 1.87 oz / ac plus Telar at 0.75 oz / ac) to 20 % (KJM44 at 1.25 oz / ac plus Telar at 0.5 oz / ac and KJM44 at 1.25 oz / ac) (Table 1). Although not as consistent as musk thistle control, all treatments resulted in control levels greater or equal to 85 % 44 DAT.

Overall Broadleaf Weed Control
All treatments resulted in greater than 90% broadleaf weed control 44 DAT (Table 1). There were no statistical differences in control levels for any treatment 31 or 44DAT.

Drought Effects

The trial was terminated 44 DAT due to the effects of the 2007-2008 drought. Cool season grass species were under extreme stress 44 DAT and were not evaluated for damage. Broadleaf weeds were also under extreme stress during the trial and undoubtedly influenced control levels, especially for common teasel.

Summary

KJM44 appears to be effective in controlling two common problematic weeds, musk thistle and common teasel. The two treatments that included Roundup Pro were extremely damaging to cool season grasses, even at the low 16 fl oz / ac rate tested. The trial will be re-installed in 2009 in an attempt to truly determine rate titrations for effective weed control and cool season grass response to KJM44 applications.

Table 1: Results of 2008 KJM44 Selective Weed Control Trial

Treatment	Rate per acre	Musk Thistle Control			Common Teasel Control			Broadleaf Weed Control		
		16 DAT	31 DAT	44 DAT	16 DAT	31 DAT	44 DAT	16 DAT	31 DAT	44 DAT
KJM44	0.625 oz	57 abc	97 ab	99 a	35 ab	85 ab	97 ab	43 abc	85 a	97 a
KJM44	1.25 oz	48 bc	99 a	99 a	20 c	55 c	90 abc	34 bc	85 a	96 a
KJM44	1.87 oz	65 abc	99 a	99 a	28 bc	75 ab	93 abc	40 abc	90 a	96 a
KJM44	2.5 oz	73 abc	99 a	99 a	23 c	68 bc	85 c	46 abc	86 a	94 a
KJM44 + Telar	0.625 oz + 0.25 oz	47 bc	93 b	99 a	25 bc	88 a	95 abc	34 bc	88 a	95 a
KJM 44 + Telar	1.25 oz + 0.5 oz	83 ab	98 a	99 a	20 c	55 c	88 abc	43 abc	87 a	95 a
KJM44 + Escort	1.25 oz + 0.5 oz	90 a	99 a	99 a	23 c	87 ab	95 abc	55 ab	94 a	96 a
KJM44 + Escort	1.88 oz + 0.75 oz	68 abc	98 a	99 a	25 bc	83 ab	92 abc	50 abc	92 a	97 a
Milestone VM + Plateau	4 fl oz + 2.84 fl oz	38 c	98 a	99 a	25 bc	93 a	99 a	30 c	91 a	98 a
KJM44 + Telar	1.87 oz + 0.75 oz	64 abc	99 a	99 a	40 a	90 a	99 a	58 a	97 a	99 a
KJM44 + Telar	2.5 oz + 1 oz	65 abc	99 a	99 a	27 bc	85 ab	93 abc	48 abc	91 a	97 a
KJM44 + Escort + Roundup Pro	2.5 oz + 0.75 oz + 16 fl oz	90 a	99 a	99 a	28 bc	93 a	99 a	58 a	96 a	99 a
KJM44 + Telar + Roundup Pro	2.5 oz + 1 oz + 16 fl oz	93 a	99 a	99 a	25 bc	80 ab	97 bc	63 a	94 a	94 a
Untreated		0	0	0	0	0	0	0	0	0

Note: Treatment means in the same column followed by the same letter are not statistically different using Fisher's LSD at p = 0.05. All treatments included MSO at 1 % v/v.

Milestone® VM Plus Fall Applications for Musk Thistle (Carduus nutans L.) Control

Introduction

Musk thistle is a biennial noxious herbaceous plant common in Kentucky. Musk thistle typically occurs in pastures, hayfields, roadsides, and other low maintenance areas. In recent history, researchers at the University of Kentucky have examined the efficacy of Milestone VM (a.i. aminopyralid) on several thistle species, including musk and Canada. Results have shown aminopyralid to be successful in controlling thistle species. Research at the University of Kentucky has also shown that the most effective timing application to control biennial species is either in the spring or fall when these plants are in the rosette stage of their life cycle.

Although effective on several species, Milestone VM was shown to be only somewhat effective of several species such as poison hemlock and buckhorn plantain. Milestone VM Plus was introduced into the marketplace in the summer of 2007. The product is a combination of aminopyralid at 0.1 lb a.i. / gl and triclopyr (the a.i. in Garlon 3A) at 1 lb / gl. This combination was done in order to broaden the spectrum of control without having to tank mix 2 separate products. A trial was installed in late October of 2007 to evaluate Milestone VM Plus for late season applications on musk thistle rosettes. This was done to ensure there were no adverse effects (i.e. antagonism) on control levels for musk thistle when aminopyralid and triclopyr were applied together.

Methods and Materials

The trial was located in a cloverleaf at the intersection of I – 265 (Gene Snyder Expressway) and Billtown Rd (exit 19) in Jefferson County, KY. Six herbicide treatments and an untreated check were evaluated in a randomized complete block design with 4 replications (Table 1). Plots, measuring 10’ X 30’ with a 5’ running check in between, were treated at 20 GPA on October 22, 2007 using a CO_2 powered sprayer mounted on an ATV. A 3 day rain event began approximately 30 minutes after application. Plots were evaluated 39 DAT (11/30/2007) and 197 DAT (5/6/2008) to visually estimate percent control of musk thistle. Data were analyzed using ARM software and treatment means were compared using Fisher’s LSD at $p = 0.05$.

Results

Two treatments, Milestone VM Plus at 8 pt / ac and Milestone VM at 5 fl oz, resulted in greater than 90 % control at 39 DAT (Table 1). These 2 treatments were significantly higher than Milestone VM Plus at the low rate or 4 pt / ac, Garlon 3A at 32 fl oz, and the 2,4-D and Telar tank mix. The 6 pt and 8 pt rates of Milestone VM Plus along with the Milestone at 5 fl oz performed exceptionally well considering the severity and duration of the rain event that occurred immediately after application. The Milestone VM Plus at 6 pt / ac treatment, which is equivalent to Milestone VM at 5 fl oz / ac plus Garlon 3A at 32 fl oz / ac, performed equally as well as the Milestone VM at 5 fl oz / ac treatment.

The low rate of Milestone VM Plus resulted in a higher degree of variance in control levels 39 DAT than the highest rate of Milestone VM Plus tested (Figure 1). Control levels for this treatment ranged from 50 % to 90 % by replication. This shows that more consistent control of musk thistle rosettes early after application (i.e. 39 DAT) is seen with Milestone VM Plus if the rate is kept at 6 pt / ac or above.

The 8 pt rate of Milestone VM Plus and the Milestone VM alone treatment maintained excellent control levels (Table 1) and low degree of treatment variance (Figure 2) through 197 DAT. All Milestone VM Plus and Milestone VM treatments resulted in significantly higher levels of control of musk thistle than Garlon 3A alone or 2,4-D amine plus Telar the following growing season after application.

Overall results of this trial indicate that higher rates of Milestone VM Plus (8 pt / ac) and Milestone VM at 5 fl oz / ac, when applied in the fall, can result in excellent musk thistle control the following growing season.

Table 1: Treatments and results for the Milestone VM Plus / Musk Thistle trial

Treatment	Rate per acre	Tank mix equivalent	Tank mix equivalent rate per acre	Percent Control 39 DAT	Percent Control 197 DAT
Milestone VM Plus	4 pt	Milestone VM + Garlon 3A	3 fl oz + 21 fl oz	74 b	84 a
Milestone VM Plus	6 pt	Milestone VM + Garlon 3A	5 fl oz + 32 fl oz	89 ab	82 a
Milestone VM Plus	8 pt	Milestone VM + Garlon 3A	6.4 fl oz + 42 fl oz	93 a	98 a
Milestone VM	5 fl oz	n/a	n/a	90 a	96 a
Garlon 3A	32 fl oz	n/a	n/a	35 c	18 b
2,4-D amine + Telar	32 fl oz + 0.25 oz	n/a	n/a	31 c	8 b
Untreated	n/a	n/a	n/a	0	0

Note: Treatment means followed by the same letter are not significantly different using Fisher's LSD at p = 0.05. All treatments included a non-ionic surfactant at 0.25 % v/v.

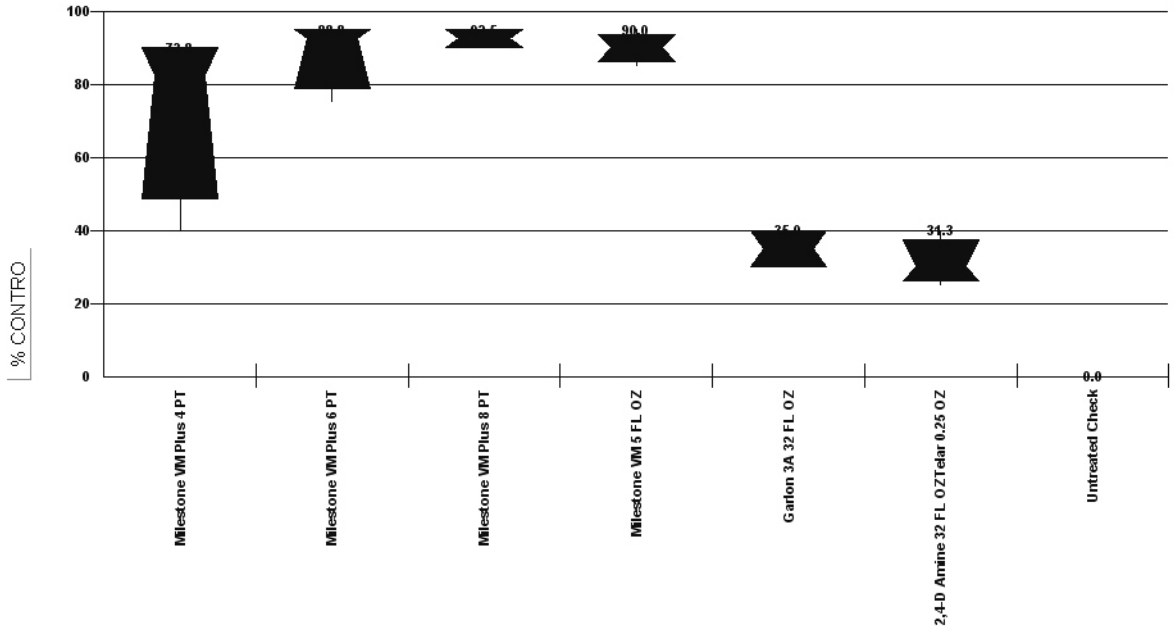

Figure 1: Box Whisker Plot for Treatment Variance 39 DAT

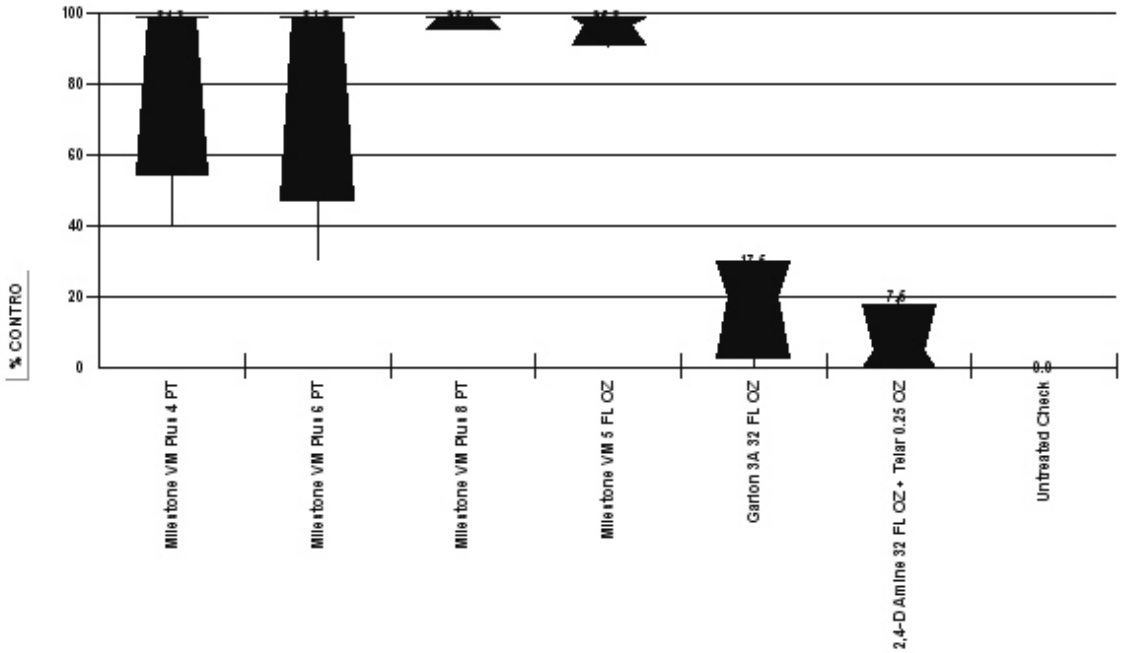

Figure 2: Box Whisker Plot for Treatment Variance 197 DAT

Imazapyr Combinations for Utility Brush Control

Introduction

Utility and other non-crop vegetation managers rely on herbicides as an effective tool to control undesirable woody vegetation. Common tank mixes include imazapyr plus glyphosate, imazapyr plus fosamine, and other combinations that may include metsulfuron methyl or triclopyr. Unfortunately, the introduction of new herbicides or reformulations of existing chemistry in the woody plant market has been slow to nonexistent over the past 10 years. Arsenal® Powerline™, a new formulation of the 2lb active ingredient per gallon Arsenal, was introduced by BASF Corp. in 2007. The new formulation boasts increased uptake and faster efficacy through 'patented uptake technology' than the older Arsenal. A trial was installed in 2007 to compare Arsenal Powerline to Arsenal both alone and in combinations with fosamine and glyphosate. For discussion purposes, the new formulation of Arsenal Powerline will be referred to herein as Powerline while the old formulation of Arsenal will be referred to as Arsenal.

Methods and Materials

The study was located on a 3-year-old transmission line managed by East Kentucky Power near Clay City, Kentucky. Predominant woody species included yellow poplar, red maple, sourwood, pignut hickory, northern red oak, pitch pine, and Alleghany blackberry all with variable density. Height of target woody plants ranged from 1' to 8'. Plots measured 15' by 30' and were installed to maximize woody plants per plot in a randomized complete block design with 3 replications. A preapplication census was taken to record total number of target stems by species for each plot. Plots were treated at 30 GPA using a CO_2 backpack and an adjusted cone tip handgun on August 17, 2007. Plots were evaluated for necrosis 35 DAT on September 21, 2007 and 1 YAT on August 4, 2008. Control data by species and average control across all species were analyzed using ARM software and treatment means were separated using Fisher's LSD at $p = 0.05$.

Results
35 DAT

Yellow Poplar

Arsenal at 16 fl oz / ac in combination with 4 qt / ac of Accord resulted in the highest level of control of yellow poplar 35 DAT (Table 1). This was significantly higher than the 12 fl oz of Powerline, Arsenal at 16 fl oz, Powerline at 16 fl oz plus Krenite at 3 qt, and Powerline at 12 fl oz plus 2 qt of Accord.

Red Maple

Powerline alone at 16 fl oz resulted in significantly higher burndown or necrosis than Arsenal alone at the same rate of red maple 35 DAT. Powerline at 16 fl oz in combination with Accord at 2 qt resulted in significantly greater burndown than all other treatments except Arsenal at 16 fl oz and the higher 4 qt rate of Accord.

Sourwood

There were no differences in the initial sourwood burndown between the Powerline and Arsenal alone treatments 35 DAT. Powerline at 12 fl oz plus Krenite at 6 qt and Arsenal at 16 fl oz plus Krenite at 6 qt resulted in significantly higher initial burndown of sourwood 35 DAT than Powerline at 16 fl oz and the lower 3 qt rate of Krenite.

Pitch Pine

The only significant difference in burndown of pitch pine 35 DAT occurred between Arsenal at 16 fl oz plus Accord 4 qt (53 %) and Powerline at 16 fl oz plus the low 3 qt rate of Krenite (10 %). It is known that imazapyr has little to no effect pines at the rates tested and results presented here are in agreement.

Pignut Hickory

There were no statistical differences between any treatments for pignut hickory control 35 DAT. Burndown / necrosis ranged from 15 % for Arsenal at 16 fl oz to 40 % for Powerline at 12 and 16 fl oz.

Northern Red Oak

There were no statistical differences between the Powerline alone treatments and the Arsenal alone treatment for northern red oak burndown 35 DAT. Burndown percentages for these treatments were fairly low compared to other species tested as percentages ranged from 10 % for Powerline at 12 fl oz to 20 % for Powerline at 12 fl oz. The addition of Krenite or Accord appears to hasten burndown of northern red oak as Powerline at 12 fl oz plus Krenite at 6 qt, Arsenal at 16 fl oz plus Krenite at 6 qt, Powerline at 16 fl oz plus Accord at 2 qt, and Arsenal at 16 fl oz plus Accord at 4 qt resulted in significantly higher percent necrosis than Powerline alone at 16 fl oz and Arsenal alone at 16 fl oz.

Overall Woody Plant Necrosis 35 DAT

Arsenal at 16 fl oz plus Accord at 4 qt resulted in significantly higher average necrosis for all species evaluated. There were no differences between Powerline at 16 fl oz plus the low rate of Accord at 2 qt, Powerline at 16 fl oz plus the low rate of Krenite at 3 qt, Powerline at 12 fl oz plus the high rate of Krenite at 6 qt, and Arsenal at 16 fl oz + the high rate of Krenite at 6 qt. The low rate of Powerline (12 fl oz) plus the low rate of Accord (2 qt) resulted in one of the lowest average necrosis percentages across all species at 29 %. This was not statistically different than Powerline alone at 16 or 12 fl oz. Arsenal alone at 16 fl oz resulted in the statistically lowest percent necrosis 35 DAT at 19 %. This is indicative of Arsenal's traditionally long time to visual symptomology.

1YAT

Red Maple

Powerline at 12 and 16 fl oz per acre resulted in significantly higher control of red maple than Arsenal at 16 fl oz / ac 1 YAT (Table 2). This was indicative of the increased herbicide uptake through BASF's 'patented uptake technology'. All combinations of

Arsenal and Accord, Arsenal and Krenite, Powerline and Accord, and Powerline and Krenite resulted in statistically similar control of red maple 1YAT.

Sourwood

There were no statistical differences in control between any herbicide treatment for the control of sourwood 1 YAT (Table 2). There appears to be an operational difference; however, as Arsenal alone at 16 fl oz / ac resulted in 67 % control of sourwood 1 YAT while the 2 Powerline alone treatments resulted in control > 95% 1 YAT.

Pitch Pine

A high degree of variance existed in the control of pitch pine 1 YAT data set (CV = 100.84, Table 2). This was influenced by the selectivity imazapyr has to pine species as well as the wide range of control levels of the tank mix treatments. Although not statistically different, tank mixes that included Krenite generally had higher control of pitch pine 1 YAT than tank mixes using Accord.

Northern Red Oak

There were no statistical differences between any treatments for the control of northern red oak 1 YAT (Table 2). All treatments resulted in control levels > 95%.

Overall Harwood Species Control

All treatments were effective in controlling hardwood species 1 YAT (Table 2). Although no statistical differences were detected across any treatment, Arsenal alone at 16 fl oz / ac resulted in the lowest control of hardwood species (88 %). This is undoubtedly influenced by the poor red maple control provided by Arsenal alone discussed earlier.

Table 1: Treatments and results for Clay City Powerline /Arsenal Utility Brush Trial 35 DAT

Treatment	Rate per acre	Percent Brownout / Necrosis 35 DAT							
		Yellow-poplar	Red maple	Sourwood	Pitch Pine	Pignut hickory	Northern red oak	Overall	Allegheny blackberry
Powerline	16 fl oz	25 ab	45 cd	65 ab	0 c	40 a	10 c	34 de	22 cd
Powerline	12 fl oz	20 b	31 de	60 ab	0 c	40 a	20 bc	36 de	17 d
Arsenal	16 fl oz	20 b	26 e	60 ab	0 c	15 a	13 c	19 f	13 d
Powerline + Krenite	16 fl oz + 3 qt	20 b	61 b	55 b	10 bc	40 a	25 b	41 cd	43 ab
Powerline + Krenite	12 fl oz + 6 qt		68 ab	80 a	37 ab	30 a	30 ab	47 bc	25 bcd
Arsenal + Krenite	16 fl oz + 6 qt	50 ab	54 bc	80 a	40 a	40 a	30 ab	50 b	50 a
Powerline + Accord	16 fl oz + 2 qt	30 ab	81 a	60 ab	33 ab	20 a	30 ab	48 bc	40 abc
Powerline + Accord	12 fl oz + 2 qt	10 b	30 e	60 ab	0 c	20 a	20 bc	29 e	27 bcd
Arsenal + Accord	16 fl oz + 4 qt	70 a	67 ab	70 ab	53 a	35 a	40 a	60 a	33 a-d
Std Dev		18	8	11	16	16	6	5	12
CV		59	16	17	84	50	25	12	41

Note: Treatment means in the same column followed by the same letter are not statistically different using Fisher's LSD at p = 0.05. All treatments included a NIS at 0.25 % v/v.

Table 2: Treatments and results for Clay City Powerline /Arsenal Utility Brush Trial 1 YAT

Treatment	Rate per acre	Percent Control 1 YAT				
		Red maple	Sourwood	Pitch Pine	Northern Red Oak	Overall Hardwood Control
Powerline	16 fl oz	100 a	100 a	0 b	99 a	98 a
Powerline	12 fl oz	94 a	96 a	0 b	100 a	99 a
Arsenal	16 fl oz	35 b	67 a	0 b	96 a	88 a
Powerline + Krenite	16 fl oz + 3 qt	88 a	100 a	67 a	100 a	96 a
Powerline + Krenite	12 fl oz + 6 qt	89 a	100 a	61 ab	99 a	97 a
Arsenal + Krenite	16 fl oz + 6 qt	93 a	100 a	81 a	100 a	99 a
Powerline + Accord	16 fl oz + 2 qt	80 a	100 a	51 ab	100 a	98 a
Powerline + Accord	12 fl oz + 2 qt	94 a	100 a	33 ab	100 a	99 a
Arsenal + Accord	16 fl oz + 4 qt	60 ab	100 a	38 ab	100 a	93 a
Std Dev		23.28	19.72	37.05	2.84	7.25
CV		28.62	20.57	100.84	2.86	7.51

Note: Treatment means in the same column followed by the same letter are not statistically different using Fisher's LSD at p = 0.05. All treatments included a NIS at 0.25 % v/v.

Control of Amur Honeysuckle with Foliar and Cut Surface Application Techniques

Introduction

Amur honeysuckle is a non-native federally listed woody invasive species that, originally from Asia, has become extremely problematic in the midwestern United States. In Kentucky, populations of this species are generally concentrated in the central part of the state, stretching from Fayette and surrounding counties north to Kenton and surrounding counties. Although not remarkably tall (plants rarely exceed 20' in height), amur honeysuckle can become problematic due to its prolific seed production and ability to sprout from rootstocks if cut. Infestations usually become extremely dense and thus form monocultures by outcompeting other species. Infestations can occur in a variety of sites from roadside rights-of-way, waste areas, parks, and in the understory of a hardwood stand. Two trials were installed in 2007 to determine if a broadcast foliar application of Escort alone and in combination with Krenite would be effective in controlling amur honeysuckle infestations and to examine several options for cut surface applications on amur honeysuckle.

Low Volume Foliar Trial

Methods and Materials

A trial was initiated in the summer of 2007 to examine the efficacy of Escort and Krenite, both alone and in combination, for amur honeysuckle control in a low volume foliar broadcast application. The site was located at River Hill Park which is owned and managed by the Lexington-Fayette Urban County Government Parks and Recreation. A dense stand of amur honeysuckle had been mowed 2 – 3 years prior in between two fence rows approximately 15' apart. Six herbicide treatments and 1 untreated check were installed in a randomized complete block design with 3 replications (Table 3). Plots, measuring 15' X 30', were treated at 40 GPA on July 3, 2007 using a CO_2 powered sprayed and an adjustable cone nozzle handgun. Percent brownout and defoliation were evaluated 48, 86, and 308 DAT. Data were analyzed using ARM and Fisher's LSD was used for treatment means separation at p = 0.05.

Results

Table 1: Treatments and Results for Amur Honeysuckle Foliar Trial

Treatment	Rate per acre	Percent Brownout / Defoliation		
		48 DAT	86 DAT	308 DAT
Escort	1 oz	77 a	78 a	37 ab
Escort	2 oz	72 a	63 a	55 a
Escort	3 oz	83 a	70 a	62 a
Krenite	128 fl oz	12 b	12 b	0 c
Krenite	256 fl oz	7 b	18 b	3.3 bc
Escort + Krenite	1 oz + 128 fl oz	80 a	72 a	60 a
Untreated	n/a	0	0	0

Note: Treatment means in a column followed by the same letter are not significantly different using Fisher's LSD at p = 0.05. All treatments included a non-ionic surfactant at 0.25 % v/v.

All Escort alone treatments resulted in acceptable levels of brownout and defoliation at 48 DAT (Table 1). These levels did not improve from 48 to 86 DAT. Krenite alone did not result in acceptable levels of brownout and both treatments were significantly lower than the Escort alone or the Escort / Krenite tank mix. This was to be expected; however, as Krenite does not show visual symptomology in the same season as application on woody plants except pines. Escort at 1 oz / ac was the only treatment of the Escort treatments that did not decrease in control from 48 to 86 DAT. The decrease in control in the other treatments is indicative of resprouting and may be a rate response (i.e. too high of a rate will not allow for complete translocation and result in 'flashback').

The 1 YAT evaluation showed a definite rate response with the Escort treatments. As the rate of Escort increased, the percent control of amur honeysuckle increased as well. Escort at 2 or 3 oz / ac resulted is significantly greater control than the Krenite alone treatments. The combination of Escort at 1 oz / ac plus Krenite at 128 fl oz / ac 1 YAT resulted in control levels similar to that of Escort alone at 3 oz / ac 1 YAT. This was indicative of the synergism that exists between Escort and Krenite.

Although the control levels were not operationally acceptable 1 YAT, these results do show promise for Escort alone at 3 oz / ac and the Escort plus Krenite treatment. These two treatments are possible options for an integrated management plan to manage amur honeysuckle by providing initial suppression to allow follow up treatments, whether foliar or cut surface.

Cut surface trial

Methods and Materials

A trial was installed in the late spring of 2007 to examine cut surface applications on bush honeysuckle. The trial was located on the Spindletop Research Station in Lexington, KY. The site is an approximately 4 acre woodlot dominated by hackberry, white oak, and bur oak in the overstory and amur honeysuckle and wintercreeper in the understory. Plots were installed along the edge of the woodlot by cutting approximately 8 to 15 amur honeysuckle stems and marking stumps with pin flags. A buffer was left between plots to avoid cross contamination and plots were of variable dimensions. Seven treatments were evaluated in a randomized complete block design with 3 replications (Table 2). Plots were initially cut from April through May and the final cut and herbicide application were made on May 21, 2007. Amur honeysuckle stumps were cut at ground level and the outer cambium layer was treated with a handheld sprayer. All plots were sprayed with 4 % v/v solution of Garlon 4 to control wintercreeper in early June. All attempts were made to avoid treating amur honeysuckle sprouts. Plots were evaluated for sprouting 31, 109, and 388 DAT. Counts of sprouts were taken by plot, converted into a percent, then subtracted from 100 to obtain percent control by plot. Data were analyzed in ARM using Fisher's LSD for treatment means separation at $p = 0.05$.

Results

Table 2: Treatments and Results of Spindletop Amur Honeysuckle Cut Surface Trial

Treatment	Rate (v/v)	Percent Control		
		31 DAT	109 DAT	388 DAT
Garlon 4 + Ax-it Oil	15 % + 85 %	87 a	91 a	68 a
Stalker + Ax-it Oil	3 % + 97 %	86 a	64 b	76 a
Stalker + HyGrade Oil	3 % + 97 %	91 a	91 a	79 a
Garlon 4 + Stalker + Ax-it Oil	15 % + 3 % + 82 %	100 a	100 a	93 a
Tordon RTU	100 %	92 a	100 a	96 a
Accord + water	50 % + 50 %	91 a	98 a	96 a
Cut	n/a	4 b	24 c	11 b

Note: Treatments means in a column followed by the same letter are not significantly different using Fisher's LSD at p = 0.05.

All herbicide treatments resulted in greater than 80 % control of sprouting and there were no statistical differences across herbicide treatments 31 DAT . The Garlon 4 + Stalker tank mix resulted in 100 % control of sprouting 31 DAT and maintained these control levels through 109 DAT. Tordon RTU resulted in 100 % control 109 DAT. Stalker at 3 % v/v combined with Ax-it oil decreased in control between 31 and 109 DAT from 86 to 64 % and was statistically lower at 109 DAT than all other herbicide treatments. Accord at 50 % v/v mixed with water resulted in excellent control 109 DAT.

Although no statistical difference was present between any of the herbicide treatments 388 DAT, the Tordon RTU, Garlon 4 + Stalker, and Accord treatments resulted in excellent control of amur honeysuckle sprouts. The Accord and Tordon RTU treatments are limited to the warmer spring, summer, and fall months as these treatments are water based and would not be effective in the cold temperatures, whereas the Garlon 4 + Stalker mix is oil based. Another benefit to the Garlon 4 + Stalker mix is that is offers a broader spectrum of control in terms of species.

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

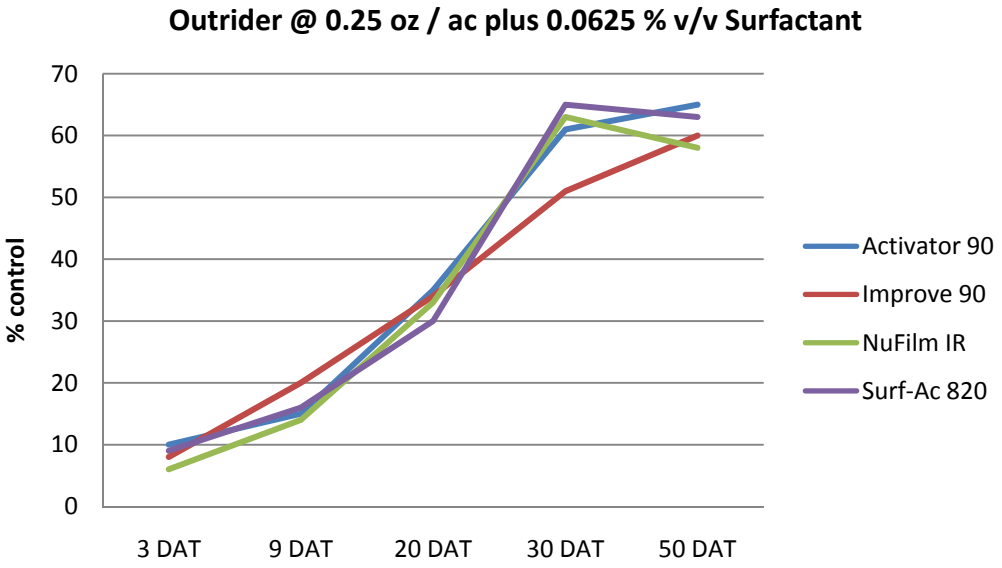

Figure 1: Control of johnsongrass with low rates of Outrider and surfactant

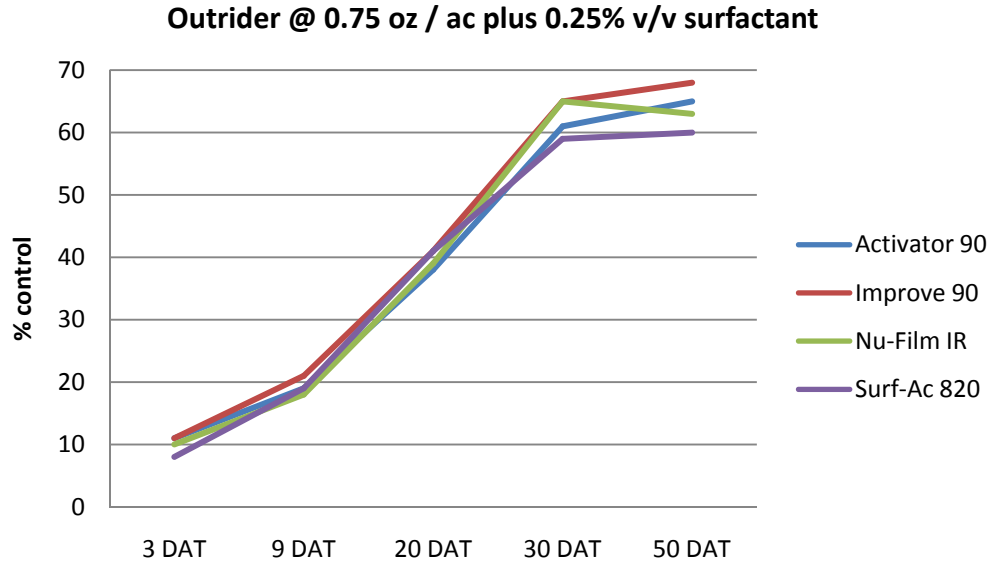

Figure 2: Control of johnsongrass with standard rates of Outrider and surfactant

Growth Regulator Herbicide Damage on Tobacco (*Nicotiana tabacuum*)

Introduction

Non-crop vegetation managers rely on herbicides as one component of an effective integrated vegetation management program. Auxin-type, or growth regulator, herbicides are a mode of action based family of herbicides commonly used in non-crop vegetation management. This family of herbicides includes 2,4-D, aminopyralid, dicamba, and triclopyr and many others. When used in the correct and labeled manner, these products are an extremely safe and effective option for vegetation management. These products, effective on target weeds, are also effective in damaging desirable plants and crops. Minimal concentrations of active ingredient, like those present in a drift or off-target situation, can result in enough crop damage to render a crop unmarketable.

In the rights-of-way vegetation management industry, off-target crop damage, although infrequent when vegetation management products are used correctly, can occur through either physical drift or off target applications. Some products can even cause crop damage even if physical movement of the product occurs to a site before the crop is planted. Certain crops, such as tobacco, tomatoes, and grapes are especially sensitive to even the smallest concentrations of active ingredient of these products.

There is a lot of concern and misconceptions of about herbicide drift and subsequent crop injury. Some active ingredients, such as picloram, have the reputation of always causing severe crop damage, if not plant death. Others, such as 2,4-D, are considered much safer and will cause little damage to many species. The reality of the situation is somewhere between the above generalizations. Aminopyralid and aminocyclopyrachlor (KJM44 duPont) are new herbicides that are either on the market or soon will be. We have less experience with these products related to drift onto growing crops and onto fields before planting of crops. With these issues in mind, a trial was installed at the University of Kentucky College Agriculture Research Station in Lexington, KY (Spindletop Farm) to evaluate the potential of four growth regulator herbicides commonly used in non-crop vegetation management to cause damage to tobacco in a pre-plant situation.

Methods and Materials

Four herbicides, 2,4-D (Formula 40), aminopyralid (Milestone VM), dicamba (Banvel), and triclopyr amine (Garlon 3A), were screened at 2 rates and applied at 2 times before tobacco transplanting (Tables 1 and 2). The high rate was based on the rate normally used under Kentucky conditions. The lower rates were 1/10th of this normal rate and were selected in an attempt to mimic an off-target drift situation. The study site was a field that was prepared using standard tobacco production techniques. This included moldboard plowing, soil finishing, and a broadcast application of Spartan and Command 3 weeks preplant (WPP) at 8 fl oz / ac and 2 pts / ac, respectively. The field was also fertilized 3 WPP with 600 # / ac of 34-0-0 and 100 # / ac of 0-0-60. All of these standard preparation treatments were done to mimic a traditional tobacco planting.

Herbicide treatments were applied at one of two timings, 3 WPP, hereby referred to as the early treatments, and 4 days preplant (DPP), hereby referred to as the late treatments (5/13/2008 and 5/29/2008, respectively). Plots were 10' X 30' and herbicides applied at 20 GPA using a CO_2 powered sprayer mounted on an ATV. Four herbicides at 2 rates each at 2 timings plus 1 untreated check, for a total of 17 treatments, were installed in a randomized complete block design with 3 replications. Tobacco was set in the plots using a 2 row transplanter on June 2, 2008. The burley tobacco variety KT204 was used in this trial.

Data were collected 16, 37, 58, and 92 days after planting (DAP). Data collected included a vigor rating at every evaluation and an injury rating at every evaluation. Vigor ratings were taken on a 1 to 10 scale with 1 being extremely low vigor and 10 being a healthy and vigorous plant. Injury ratings were taken on a 1 to 10 scale with 1 being no damage and 10 being dead or extremely severe damage. Data were analyzed in ARM® software and treatment means were separated using Fisher's LSD at p = 0.05.

Results

Vigor

The untreated plots showed a decrease in vigor (i.e. < 10) at every evaluation (Table 1). This may indicate that, even though no herbicide solution was applied directly to the untreated plots, the close proximity and general topography of the treated plots influenced the growth of the untreated tobacco. All simulated drift treatments ($1/10^{th}$ normal rate) decreased vigor of the tobacco plants, some treatments being more severe than others. The Milestone at 0.7 fl oz / ac severely decreased vigor, regardless of timing. Full rates of 2,4-D, Banvel, Milestone, and Garlon 3A affected vigor of the tobacco plants with the late treatments having a higher degree of influence.

Table 1: Treatments and plant vigor response (0 = complete loss of vigor, 10 = no apparent effect)

Treatment	Rate per acre	Vigor			
		16 DAP	37 DAP	58 DAP	92 DAP
2,4-D early	2 qt	6.3 ab	6.0 ab	7.3 a	7.0 a
2,4-D Late	2 qt	3.3 c-f	4.7 a-d	6.3 abc	5.7 abc
2,4-D early	0.2 qt	6.3 ab	7.0 ab	7.0 ab	7.3 a
2,4-D late	0.2 qt	5.7 abc	5.3 abc	6.0 a-d	6.0 ab
Banvel early	1 qt	3.7 b-f	6.0 ab	6.0 a-d	5.7 abc
Banvel late	1 qt	1.7 def	2.3 de	3.0 de	3.7 bcd
Banvel early	0.1 qt	5.0 bc	6.3 ab	5.3 a-d	6.3 a
Banvel late	0.1 qt	5.3 bc	4.7 a-d	5.3 a-d	5.3 a-d
Milestone early	7 fl oz	1.3 ef	1.3 e	3.7 cd	0.7 e
Milestone late	7 fl oz	1.0 f	1.0 e	0.0 e	0.7 e
Milestone early	0.7 fl oz	4.0 b-e	3.0 cde	4.0 bcd	3.3 cd
Milestone late	0.7 fl oz	3.7 b-f	2.7 cde	3.0 de	3.0 de
Garlon 3A early	2 qt	4.0 b-e	6.0 ab	5.0 a-d	6.3 a
Garlon 3A late	2 qt	1.3 ef	4.3 bcd	5.0 a-d	5.3 a-d
Garlon 3A early	0.2 qt	4.7 bc	6.0 ab	6.0 a-d	7.0 a
Garlon 3A late	0.2 qt	4.3 bcd	6.3 ab	5.3 a-d	6.7 a
Untreated		8.3 a	7.3 a	7.0 ab	6.7 a

Note: Treatment means followed by the same letter are not statistically different using Fishers LSD at p = 0.05. All treatments included a non-ionic surfactant at 0.2% v/v.

Damage

As with plant vigor discussed earlier, untreated plots appeared to be damaged by their proximity to the treated plots (Table 2). The untreated check resulted in damage similar 2,4-D and Garlon 3A at the low rate tested at the early application 92 DAP. The Milestone treatments, whether early or late treatments and either rate tested, severely damaged tobacco at every evaluation. All treatments tested affected quality of the tobacco grown.

Table 2: Tobacco damage and percent flowering plants (Damage: 0 = no damage, 10 = dead plant)

Treatment	Rate per acre	Vigor			
		16 DAP	37 DAP	58 DAP	92 DAP
2,4-D early	2 qt	4.0 def	4.3 d	3.7 cde	4.0 def
2,4-D Late	2 qt	4.7 c-f	5.0 cd	3.0 e	5.7 b-e
2,4-D early	0.2 qt	2.3 f	2.7 d	3.0 e	4.3 c-f
2,4-D late	0.2 qt	3.7 def	5.0 cd	3.7 cde	5.7 b-e
Banvel early	1 qt	5.3 b-e	5.0 cd	4.3 b-e	5.7 b-e
Banvel late	1 qt	7.3 ab	8.3 ab	7.0 ab	6.3 bc
Banvel early	0.1 qt	3.3 def	4.0 d	3.7 cde	5.0 c-f
Banvel late	0.1 qt	4.0 def	5.7 bcd	4.7 b-e	6.0 bcd
Milestone early	7 fl oz	8.0 a	9.0 a	6.7 bc	9.3 a
Milestone late	7 fl oz	8.0 a	9.0 a	10.0 a	9.3 a
Milestone early	0.7 fl oz	5.7 a-d	7.7 abc	6.3 bcd	7.3 ab
Milestone late	0.7 fl oz	7.0 abc	8.3 ab	7.0 ab	7.7 ab
Garlon 3A early	2 qt	4.7 c-f	3.3 d	4.0 b-e	4.7 c-f
Garlon 3A late	2 qt	8.0 a	4.7 cd	5.0 b-e	5.7 b-e
Garlon 3A early	0.2 qt	3.7 def	3.0 d	3.3 de	3.3 f
Garlon 3A late	0.2 qt	4.0 def	3.7 d	3.7 cde	4.0 def
Untreated		3.0 e-f	3.0 d	2.7 e	3.7 ef

Note: Treatment means followed by the same letter are not statistically different using Fishers LSD at p = 0.05. All treatments included a non-ionic surfactant at 0.2% v/v.

Summary

There is no "safe" herbicide when discussing physical drift of the tested herbicides to soil before tobacco transplanting. No attempt was made in this trial to quantify the effect that the treatments would have on the marketability of the tobacco. The ratings used above, especially damage, show that all treatments would have decreased the marketability, if not rendered the final tobacco product unmarketable.

Products used in non-crop and invasive vegetation management are extremely safe to non-target plants when applied correctly. The data presented above is intended to show that when errors in application occur in proximity to unplanted tobacco fields that the potential for damage to the crop is great. Great care and vigilance should be employed when using any type of herbicide in areas where sensitive crops, such as tobacco, are known to exist.