Noncrop and Industrial Vegetation Management Weed Science

2007 Annual Research Report

UNIVERSITY
OF KENTUCKY

College of Agriculture
Department of Plant and Soil Sciences

M.P. Blair and W.W. Witt

University of Kentucky
College of Agriculture
Department of Plant and Soil Sciences
Lexington, KY 40546-0312

INFORMATION NOTE 2008 NCVM-1

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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 2006 and 2007. 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)

Any questions, concerns, complaints, or praise regarding this publication should be directed to:

Mitch Blair
Vegetation Management Research Scientist I

Dr. William Witt
Professor, Weed Science

University of Kentucky
College of Agriculture
Department of Plant and Soil Science
108 Plant Science Building
Lexington, KY 40546-0312
859.257.5020

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This work was accomplished with the help of Bryce Danhauer, a student at UK, who aided in study initiation, data collection and mining, and plot maintenance. Personnel in the Weed Science group who also aided in this project in terms of labor, equipment, and ideas include Charlie Slack, Ted Hicks, Jack Zeleznik, Sara Carter, Daisy Fryman, Dr. J.D. Green, and Dr. Jim Martin. Appreciation is also given to the farm crews at Spindletop Research Station for equipment and plot maintenance.

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

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
Conium maculatum L.	Poison hemlock
Dipsacus fullonum L.	Common teasel
Euonymus fortunei (Turcz.) Hand.-Maz.	Wintercreeper
Festuca arundinacea Schreb.	Tall fescue
Liriodendron tulipfera L.	Yellow-poplar
Lonicera maackii (Rupr.) Herder	Amur honeysuckle
Oxydendrum arboretum (L.) DC.	Sourwood
Phragmites australis (CAV.) Trin. *Ex* Steud.	Common reed
Pinus rigida Mill.	Pitch pine
Poa pratensis L.	Kentucky bluegrass
Quercus rubra L.	Northern red oak
Rubus allegheniensis Porter	Allegheny blackberry
Solidago altissima L.	Tall goldenrod
Sorghum halepense (L.) Pers.	Johnsongrass
Vernonia angustifolia Michx.	Tall ironweed

Herbicide List

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

Product	Active Ingredient(s)	Concentration	Manufacturer
Aquamaster	Glyphosate	5.4 lb a.i. per gallon	Monsanto
Arsenal	Imazapyr	2 lb a.i. per gallon	BASF
Edict	Pyraflufen ethyl	0.208 lb a.i. per gallon	Nichino America
Envoy	Clethodim	0.94 lb a.i. per gallon	Valent
Escort	Metsulfuron methyl	60 % w/w	DuPont
Forefront R & P	Aminopyralid + 2,4-D amine	0.33 lb a.i. + 2.67 lb a.i. per gallon	Dow AgroSciences
Formula 40	2,4-D amine	3.67 lb a.i. per gallon	NuFarm
Fusion	Fluazifop ethyl + Fenoxaprop ethyl	2 lb a.i. + 0.56 lb a.i. per gallon	Syngenta
Garlon 3A	Triclopyr amine	3 lb a.i. per gallon	Dow AgroSciences
Garlon 4	Triclopyr ester	4 lb a.i. per gallon	Dow AgroSciences
Habitat	Imazapyr	2 lb a.i. per gallon	BASF
Journey	Imazapic + glyphosate	0.75 lb a.i. + 1.5 lb a.i. per gallon	BASF
Krenite	Fosamine	4 lb a.i. per gallon	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
MSMA 6 Plus	Monosodium Acid Methanearsonate	6 lb a.i. per gallon	Loveland Industries
Outrider	Sulfosulfuron	75 % w/w	Monsanto
Overdrive	Diflufenzopyr + dicamba	21.4 % + 55 % w/w	BASF
Plateau	Imazapic	2 lb a.i. per gallon	BASF
Roundup Pro	Glyphosate	4 lb a.i. per gallon	Monsanto
Stronghold	Mefluidide + imazethapyr + imazapyr	1.46 lb a.i. + 0.35 lb a.i. + 0.01 lb a.i. per gallon	PBI Gordon
Telar	Chlorsulfuron	75 % w/w	DuPont
Tordon RTU	Picloram + 2,4-D	5.4% v/v + 20.9% v/v	Dow AgroSciences
Transline	Clopyralid	3 lb a.i. per gallon	Dow AgroSciences

2007 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/

		AIR TEMP				RH		SOIL TEMP GRASS		SOIL TEMP BARE		
STATION	DATE	MX	MN	AV	PRECIP	MX	MN	MX	MN	MX	MN	EVAP
Jackson	03-01-2007	55	45	50	1.04	69	44	46	42			
Jackson	03-02-2007	58	36	47	0.49	68	44	40	39			
Jackson	03-03-2007	50	30	40	T	65	44	37	36			
Jackson	03-04-2007	35	22	28	0.01	97	44	43	41			
Jackson	03-05-2007	55	26	40		83	36	44	41			
Jackson	03-06-2007	43	23	33		88	30	42	40			
Jackson	03-07-2007	67	35	51		67	32	45	42			
Jackson	03-08-2007	59	25	42		65	44	38	37			
Jackson	03-09-2007	73	38	56		84	29	48	44			
Jackson	03-10-2007	62	52	57	0.01	99	38	49	47			
Jackson	03-11-2007	60	40	50	0.01	90	28	50	47			
Jackson	03-12-2007	68	40	54		83	23	50	46			
Jackson	03-13-2007	80	56	68		82	34	51	48			
Jackson	03-14-2007	76	56	66	0.31	100	55	54	50			
Jackson	03-15-2007	66	39	52	0.13	69	44	44	42			
Jackson	03-16-2007	35	32	34	0.12	97	52	52	49			
Jackson	03-17-2007	41	27	34	T	90	37	50	46			
Jackson	03-18-2007	44	25	34		70	42	42	40			
Jackson	03-19-2007	63	32	48	0.03	87	26	50	46			
Jackson	03-20-2007	56	51	54	0.17	72	42	43	42			
Jackson	03-21-2007	76	47	62		96	50	53	49			
Jackson	03-22-2007	74	59	66		71	42	50	44			
Jackson	03-23-2007	80	57	68		70	41	47	45			
Jackson	03-24-2007	83	63	73	T	92	50	57	54			
Jackson	03-25-2007	84	60	72		70	28	57	55			
Jackson	03-26-2007	81	65	73		50	32	59	57			
Jackson	03-27-2007	81	66	74		61	34	57	55			
Jackson	03-28-2007	62	60	61	0.39	94	47	57	56			
Jackson	03-29-2007	72	56	64		97	54	63	60			
Jackson	03-30-2007	78	49	64		77	41	63	60			
Jackson	03-31-2007	76	60	68		83	43	63	61			

Summary for Jackson for the period 3-1-2007 through 3-31-2007:

	AIR TEMP			TOTAL	RH		SOIL TEMP GRASS		SOIL TEMP BARE		TOTAL
STATION	MX	MN	AV	PRECIP	MX	MN	MX	MN	MX	MN	EVAP
Jackson	64	44	54	2.71	80	40	50	47			
(Deviation from normal)	+10	+10	+10	-1.63							

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/

		AIR TEMP				RH		SOIL TEMP GRASS		SOIL TEMP BARE		
STATION	DATE	MX	MN	AV	PRECIP	MX	MN	MX	MN	MX	MN	EVAP
Jackson	04-01-2007	77	61	69	0.14	83	35	60	56			
Jackson	04-02-2007	77	61	69		83	23	58	57			
Jackson	04-03-2007	82	58	70		89	24	64	60			
Jackson	04-04-2007	52	42	47	0.09	94	47	66	65			
Jackson	04-05-2007	39	29	34	T	64	48	66	65			
Jackson	04-06-2007	41	28	34	0.04	85	25	66	65			
Jackson	04-07-2007	33	21	27	0.05	84	18	49	48			
Jackson	04-08-2007	39	21	30		68	40	45	44			
Jackson	04-09-2007	52	29	40		61	29	62	53			
Jackson	04-10-2007	62	32	47		58	20	52	48			
Jackson	04-11-2007	63	49	56	0.23	89	25	54	50			
Jackson	04-12-2007	49	43	46	0.08	83	53	46	45			
Jackson	04-13-2007	57	36	46		64	27	53	49			
Jackson	04-14-2007	57	39	48	0.52	100	51	52	49			
Jackson	04-15-2007	43	34	38	0.49	100	62	50	47			
Jackson	04-16-2007	56	38	47		62	27	50	49			
Jackson	04-17-2007	66	41	54		43	18	55	52			
Jackson	04-18-2007	68	48	58		55	28	56	53			
Jackson	04-19-2007	52	48	50		86	57	49	48			
Jackson	04-20-2007	69	43	56		89	28	59	54			
Jackson	04-21-2007	76	50	63		58	19	60	56			
Jackson	04-22-2007 E	81	52	66		54	18	55	54			
Jackson	04-23-2007	82	61	72	T	58	22	57	54			
Jackson	04-24-2007	81	58	70	T	93	40	57	55			
Jackson	04-25-2007	84	64	74	T	78	29	64	63			
Jackson	04-26-2007	72	61	66	0.09	90	47	64	63			
Jackson	04-27-2007	67	56	62	0.03	92	56	62	60			
Jackson	04-28-2007	72	49	60	T	83	36	62	59			
Jackson	04-29-2007	76	55	66		66	24	54	53			
Jackson	04-30-2007	87	56	72		52	20	68	63			

Summary for Jackson for the period 4-1-2007 through 4-30-2007:

	AIR TEMP			TOTAL	RH		SOIL TEMP GRASS		SOIL TEMP BARE		TOTAL
STATION	MX	MN	AV	PRECIP	MX	MN	MX	MN	MX	MN	EVAP
Jackson	64	45	55	1.76	75	33	57	55			
(Deviation from normal)	-2	+1	-1	-2.34							

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Agricultural Weather Center (Phone (859)257-3000 Ext245)
World Wide Web URL: http://wwwagwx.ca.uky.edu/

STATION	DATE	AIR TEMP MX	AIR TEMP MN	AIR TEMP AV	PRECIP	RH MX	RH MN	SOIL TEMP GRASS MX	SOIL TEMP GRASS MN	SOIL TEMP BARE MX	SOIL TEMP BARE MN	EVAP
Jackson	05-01-2007	88	62	75		54	25	68	65			
Jackson	05-02-2007	81	65	73	0.01	84	43	67	65			
Jackson	05-03-2007	65	59	62	0.32	100	84	69	66			
Jackson	05-04-2007	75	59	67	0.02	96	64	57	55			
Jackson	05-05-2007	72	61	66	0.51	100	73	58	57			
Jackson	05-06-2007	70	55	62	0.02	94	24	67	65			
Jackson	05-07-2007	74	48	61		41	18	59	57			
Jackson	05-08-2007	80	53	66		50	18	70	67			
Jackson	05-09-2007	86	57	72		54	21	70	64			
Jackson	05-10-2007	82	60	71		74	35	72	69			
Jackson	05-11-2007	85	66	76		80	31	59	57			
Jackson	05-12-2007	83	63	73	T	83	39	58	55			
Jackson	05-13-2007	72	50	61		68	27	72	69			
Jackson	05-14-2007	81	51	66		54	34	73	69			
Jackson	05-15-2007	81	62	72		70	43	73	70			
Jackson	05-16-2007	68	59	64	0.68	94	52	59	58			
Jackson	05-17-2007	68	41	54	0.08	93	43	69	66			
Jackson	05-18-2007	61	42	52		90	40	67	63			
Jackson	05-19-2007	70	41	56		93	28	66	63			
Jackson	05-20-2007	76	48	62		68	26	69	65			
Jackson	05-21-2007	82	53	68		71	32	70	66			
Jackson	05-22-2007	86	63	74		70	26	62	59			
Jackson	05-23-2007	84	64	74		67	34	65	60			
Jackson	05-24-2007	83	63	73	0.17	78	45	72	69			
Jackson	05-25-2007	83	64	74		90	39	74	71			
Jackson	05-26-2007	86	62	74		81	35	67	65			
Jackson	05-27-2007	85	64	74	0.01	87	40	74	71			
Jackson	05-28-2007	85	63	74		93	38	75	73			
Jackson	05-29-2007	87	62	74		90	38	76	72			
Jackson	05-30-2007	88	65	76		84	30	69	64			
Jackson	05-31-2007	87	63	75		80	29	70	68			

Summary for Jackson for the period 5-1-2007 through 5-31-2007:

STATION	AIR TEMP MX	AIR TEMP MN	AIR TEMP AV	TOTAL PRECIP	RH MX	RH MN	SOIL TEMP GRASS MX	SOIL TEMP GRASS MN	SOIL TEMP BARE MX	SOIL TEMP BARE MN	TOTAL EVAP
Jackson	79	58	68	1.82	78	37	68	65			
(Deviation from normal)	+3	+3	+3	-2.66							

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	AIR TEMP MN	AIR TEMP AV	PRECIP	RH MX	RH MN	SOIL TEMP GRASS MX	SOIL TEMP GRASS MN	SOIL TEMP BARE MX	SOIL TEMP BARE MN	EVAP
Jackson	06-01-2007	88	67	78		70	35	65	64			
Jackson	06-02-2007	83	65	74		84	48	72	70			
Jackson	06-03-2007	74	65	70	0.05	94	70	78	71			
Jackson	06-04-2007	80	61	70	0.12	94	48	71	69			
Jackson	06-05-2007	73	57	65	0.74	100	63	70	68			
Jackson	06-06-2007	78	54	66	0.01	100	39	69	62			
Jackson	06-07-2007	89	62	76		72	41	69	67			
Jackson	06-08-2007	87	71	79	0.17	90	55	72	70			
Jackson	06-09-2007	81	66	74		97	50	78	71			
Jackson	06-10-2007	79	59	69		72	35	71	69			
Jackson	06-11-2007	83	63	73		70	33	69	68			
Jackson	06-12-2007	83	61	72		62	36	69	67			
Jackson	06-13-2007	86	62	74		72	38	69	68			
Jackson	06-14-2007	85	61	73		80	36	70	67			
Jackson	06-15-2007	85	62	74		83	35	69	67			
Jackson	06-16-2007	85	60	72		80	30	70	68			
Jackson	06-17-2007	91	62	76		77	33	78	74			
Jackson	06-18-2007	94	68	81	T	68	25	71	64			
Jackson	06-19-2007	94	71	82	T	94	58	72	71			
Jackson	06-20-2007	82	65	74	T	97	27	72	70			
Jackson	06-21-2007	87	56	72		80	22	70	67			
Jackson	06-22-2007	75	61	68	0.10	94	45	69	67			
Jackson	06-23-2007	82	59	70		100	43	80	75			
Jackson	06-24-2007	89	64	76	0.63	93	43	73	69			
Jackson	06-25-2007	89	64	76		93	41	73	72			
Jackson	06-26-2007	90	67	78		87	38	74	72			
Jackson	06-27-2007	89	70	80		78	45	75	73			
Jackson	06-28-2007	86	70	78	T	90	53	75	74			
Jackson	06-29-2007	87	67	77	0.07	97	53	74	73			
Jackson	06-30-2007	81	66	74	0.06	97	57	79	78			

Summary for Jackson for the period 6-1-2007 through 6-30-2007:

STATION	AIR TEMP MX	AIR TEMP MN	AIR TEMP AV	TOTAL PRECIP	RH MX	RH MN	SOIL TEMP GRASS MX	SOIL TEMP GRASS MN	SOIL TEMP BARE MX	SOIL TEMP BARE MN	TOTAL EVAP
Jackson	84	64	74	1.95	86	42	72	70			
(Deviation from normal)	+2	+2	+2	-1.87							

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

STATION	DATE	AIR TEMP MX	AIR TEMP MN	AIR TEMP AV	PRECIP	RH MX	RH MN	SOIL TEMP GRASS MX	SOIL TEMP GRASS MN	SOIL TEMP BARE MX	SOIL TEMP BARE MN	EVAP
Jackson	07-01-2007	82	61	72		75	35	75	72			
Jackson	07-02-2007	83	57	70		69	35	73	69			
Jackson	07-03-2007	86	62	74		67	41	72	69			
Jackson	07-04-2007	86	67	76		93	50	79	76			
Jackson	07-05-2007	80	67	74	1.11	100	65	74	71			
Jackson	07-06-2007	87	68	78		90	36	74	73			
Jackson	07-07-2007	88	65	76		78	30	81	78			
Jackson	07-08-2007	89	61	75		90	33	73	71			
Jackson	07-09-2007	90	66	78		84	38	77	72			
Jackson	07-10-2007	87	71	79	0.05	83	62	74	73			
Jackson	07-11-2007	83	69	76	0.31	94	43	75	74			
Jackson	07-12-2007	79	60	70		75	37	75	72			
Jackson	07-13-2007	78	60	69	0.05	87	57	72	71			
Jackson	07-14-2007	87	61	74	T	87	39	77	74			
Jackson	07-15-2007	90	66	78		78	37	81	75			
Jackson	07-16-2007	89	68	78		84	43	74	71			
Jackson	07-17-2007	90	68	79	0.02	87	46	75	73			
Jackson	07-18-2007	90	69	80	0.01	90	40	82	79			
Jackson	07-19-2007	89	71	80	0.07	90	48	77	74			
Jackson	07-20-2007	79	66	72	0.62	96	40	76	74			
Jackson	07-21-2007	77	57	67		78	34	74	71			
Jackson	07-22-2007	82	58	70		72	31	79	75			
Jackson	07-23-2007	81	61	71	0.32	84	48	71	68			
Jackson	07-24-2007	74	61	68	T	90	63	79	76			
Jackson	07-25-2007	81	62	72		94	48	72	70			
Jackson	07-26-2007	86	62	74	0.01	90	48	73	71			
Jackson	07-27-2007	80	67	74	0.54	94	69	69	67			
Jackson	07-28-2007	72	65	68	0.91	100	87	78	75			
Jackson	07-29-2007	83	69	76	0.03	94	69	74	73			
Jackson	07-30-2007	86	68	77		96	56	74	73			
Jackson	07-31-2007	87	69	78		90	54	80	78			

Summary for Jackson for the period 7-1-2007 through 7-31-2007:

STATION	AIR TEMP MX	AIR TEMP MN	AIR TEMP AV	TOTAL PRECIP	RH MX	RH MN	SOIL TEMP GRASS MX	SOIL TEMP GRASS MN	SOIL TEMP BARE MX	SOIL TEMP BARE MN	TOTAL EVAP
Jackson	84	65	74	4.05	86	47	75	73			
(Deviation from normal)	-2	-0	-1	-1.20							

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STATION	DATE	AIR TEMP MX	AIR TEMP MN	AIR TEMP AV	PRECIP	RH MX	RH MN	SOIL TEMP GRASS MX	SOIL TEMP GRASS MN	SOIL TEMP BARE MX	SOIL TEMP BARE MN	EVAP
Jackson	08-01-2007	89	68	78		81	40	82	78			
Jackson	08-02-2007	90	69	80		90	43	77	75			
Jackson	08-03-2007	86	68	77	T	86	60	83	80			
Jackson	08-04-2007	90	68	79		94	41	80	78			
Jackson	08-05-2007	84	71	78	0.33	96	66	82	78			
Jackson	08-06-2007	91	72	82	T	93	55	77	75			
Jackson	08-07-2007	92	74	83	0.21	94	48	80	76			
Jackson	08-08-2007	94	74	84		94	41	72	70			
Jackson	08-09-2007	96	75	86		79	39	82	76			
Jackson	08-10-2007	90	74	82	0.07	91	46	83	82			
Jackson	08-11-2007	88	68	78		90	37	85	83			
Jackson	08-12-2007	93	64	78		72	25	82	78			
Jackson	08-13-2007	93	68	80		81	35	75	74			
Jackson	08-14-2007	90	62	76		69	24	76	75			
Jackson	08-15-2007	95	66	80		68	28	76	75			
Jackson	08-16-2007	99	76	88	0.05	90	26	82	79			
Jackson	08-17-2007	88	68	78	0.01	90	44	76	75			
Jackson	08-18-2007	85	63	74		72	24	84	81			
Jackson	08-19-2007	95	65	80	0.98	94	35	83	81			
Jackson	08-20-2007	92	70	81	0.85	94	42	75	74			
Jackson	08-21-2007	81	72	76	0.12	94	54	82	80			
Jackson	08-22-2007	94	70	82		90	40	84	80			
Jackson	08-23-2007	96	74	85		73	34	85	82			
Jackson	08-24-2007	95	76	86		71	35	86	83			
Jackson	08-25-2007	92	75	84		71	40	85	83			
Jackson	08-26-2007	87	71	79		87	45	76	75			
Jackson	08-27-2007	89	67	78		78	40	83	81			
Jackson	08-28-2007	93	70	82		75	31	83	81			
Jackson	08-29-2007	92	71	82		81	44	84	81			
Jackson	08-30-2007	92	68	80	T	90	58	84	81			
Jackson	08-31-2007	76	68	72	T	90	70	75	74			

Summary for Jackson for the period 8-1-2007 through 8-31-2007:

STATION	AIR TEMP MX	AIR TEMP MN	AIR TEMP AV	TOTAL PRECIP	RH MX	RH MN	SOIL TEMP GRASS MX	SOIL TEMP GRASS MN	SOIL TEMP BARE MX	SOIL TEMP BARE MN	TOTAL EVAP
Jackson	91	70	80	2.62	84	42	81	78			
(Deviation from normal)	+7	+7	+7	-1.39							

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STATION	DATE	AIR TEMP MX	AIR TEMP MN	AIR TEMP AV	PRECIP	RH MX	RH MN	SOIL TEMP GRASS MX	SOIL TEMP GRASS MN	SOIL TEMP BARE MX	SOIL TEMP BARE MN	EVAP
Jackson	09-01-2007	85	61	73		84	45	73	72			
Jackson	09-02-2007	87	65	76		78	45	73	72			
Jackson	09-03-2007	91	67	79		87	24	75	74			
Jackson	09-04-2007	94	62	78		67	19	82	80			
Jackson	09-05-2007	95	67	81		56	20	73	72			
Jackson	09-06-2007	94	70	82		54	27	74	73			
Jackson	09-07-2007	90	73	82	T	57	34	73	72			
Jackson	09-08-2007	94	69	82		65	24	73	72			
Jackson	09-09-2007	81	68	74	0.01	87	46	76	75			
Jackson	09-10-2007	76	70	73	0.12	94	83	76	75			
Jackson	09-11-2007	77	68	72	1.89	94	59	75	74			
Jackson	09-12-2007	77	55	66		89	30	71	70			
Jackson	09-13-2007	85	55	70		72	26	69	68			
Jackson	09-14-2007	69	63	66	0.09	94	41	70	68			
Jackson	09-15-2007	66	50	58		93	35	67	66			
Jackson	09-16-2007	70	48	59		68	29	64	63			
Jackson	09-17-2007	80	50	65		68	33	65	64			
Jackson	09-18-2007	82	56	69		80	37	65	64			
Jackson	09-19-2007	83	60	72		77	34	68	67			
Jackson	09-20-2007	83	60	72		75	37	68	67			
Jackson	09-21-2007	87	63	75		75	38	67	66			
Jackson	09-22-2007	86	67	76		81	41	70	69			
Jackson	09-23-2007	90	66	78		81	40	71	70			
Jackson	09-24-2007	92	66	79		81	30	73	72			
Jackson	09-25-2007	89	71	80		68	43	75	74			
Jackson	09-26-2007	86	66	76	0.13	90	45	73	72			
Jackson	09-27-2007	72	66	69	0.25	94	73	74	73			
Jackson	09-28-2007	74	58	66		94	27	70	69			
Jackson	09-29-2007	77	50	64		71	25	67	66			
Jackson	09-30-2007	83	53	68		63	19	66	65			

Summary for Jackson for the period 9-1-2007 through 9-30-2007:

STATION	AIR TEMP MX	AIR TEMP MN	AIR TEMP AV	TOTAL PRECIP	RH MX	RH MN	SOIL TEMP GRASS MX	SOIL TEMP GRASS MN	SOIL TEMP BARE MX	SOIL TEMP BARE MN	TOTAL EVAP
Jackson	83	62	73	2.49	78	37	71	70			
(Deviation from normal)	+6	+6	+6	-1.03							

2007 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	03-01-2007	55	43	49	0.67	100	40	43	38	46	40	
Spindletop	03-02-2007	53	36	44	0.01	93	25	43	40	46	42	
Spindletop	03-03-2007	43	26	34		100	39	41	37	43	39	
Spindletop	03-04-2007	33	22	28		100	51	37	36	39	37	
Spindletop	03-05-2007	53	26	40		73	33	38	35	41	36	
Spindletop	03-06-2007	38	20	29		75	30	38	36	41	37	
Spindletop	03-07-2007	58	28	43		94	35	41	37	45	39	
Spindletop	03-08-2007	52	21	36		100	29	41	37	45	38	
Spindletop	03-09-2007	71	30	50		70	26	43	38	47	40	
Spindletop	03-10-2007	57	45	51	0.03	100	51	45	43	48	46	
Spindletop	03-11-2007	56	36	46		73	24	44	41	49	43	
Spindletop	03-12-2007	68	30	49		65	16	45	41	49	43	
Spindletop	03-13-2007	77	58	68		61	33	50	45	54	48	
Spindletop	03-14-2007	72	56	64	0.13	100	63	52	49	56	53	
Spindletop	03-15-2007	62	36	49	0.12	100	61	51	47	55	49	
Spindletop	03-16-2007	39	28	34		100	62	47	43	48	44	
Spindletop	03-17-2007	42	25	34		100	33	42	41	45	41	
Spindletop	03-18-2007	44	22	33		94	21	42	39	46	40	
Spindletop	03-19-2007	62	29	46	0.27	100	34	44	40	47	41	
Spindletop	03-20-2007	61	52	56	0.01	100	64	48	45	52	47	
Spindletop	03-21-2007	74	52	63		100	40	52	48	56	51	
Spindletop	03-22-2007	69	57	63		100	54	52	51	56	54	
Spindletop	03-23-2007	75	58	66		100	47	54	51	58	54	
Spindletop	03-24-2007	79	59	69		100	45	57	53	60	56	
Spindletop	03-25-2007	82	55	68		100	35	58	54	62	57	
Spindletop	03-26-2007	78	63	70		83	47	58	55	61	58	
Spindletop	03-27-2007	79	60	70		100	39	59	56	62	59	
Spindletop	03-28-2007	67	57	62	0.73	100	75	58	57	61	60	
Spindletop	03-29-2007	67	55	61		100	100	58	57	61	59	
Spindletop	03-30-2007	75	49	62		100	62	60	56	62	58	
Spindletop	03-31-2007	74	62	68		100	57	60	58	63	61	

Summary for Spindletop for the period 3-1-2007 through 3-31-2007:

	AIR TEMP			TOTAL	RH		SOIL TEMP GRASS		SOIL TEMP BARE		TOTAL
STATION	MX	MN	AV	PRECIP	MX	MN	MX	MN	MX	MN	EVAP
Spindletop	62	42	52	1.97	93	44	48	45	52	47	
(Deviation from normal)	+8	+8	+8	-2.43							

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STATION	DATE	AIR TEMP MX	AIR TEMP MN	AIR TEMP AV	PRECIP	RH MX	RH MN	SOIL TEMP GRASS MX	SOIL TEMP GRASS MN	SOIL TEMP BARE MX	SOIL TEMP BARE MN	EVAP
Spindletop	04-01-2007	72	61	66	0.40	100	38	61	59	63	61	
Spindletop	04-02-2007	75	57	66		100	32	61	58	63	60	
Spindletop	04-03-2007	78	55	66	0.78	100	40	60	57	62	59	
Spindletop	04-04-2007	61	33	47	0.01	100	57	59	55	61	55	
Spindletop	04-05-2007	40	30	35		69	52	55	51	54	50	
Spindletop	04-06-2007	40	24	32		100	42	51	48	50	48	
Spindletop	04-07-2007	32	22	27		89	41	48	46	47	44	
Spindletop	04-08-2007	40	23	32		78	45	46	44	46	43	
Spindletop	04-09-2007	50	25	38		100	29	47	43	48	43	
Spindletop	04-10-2007	57	28	42		100	26	48	44	51	45	
Spindletop	04-11-2007	61	45	53	0.38	100	44	50	47	52	49	
Spindletop	04-12-2007	50	39	44		71	59	49	48	51	48	
Spindletop	04-13-2007	54	37	46		91	42	50	47	53	47	
Spindletop	04-14-2007	52	39	46	1.26	100	100	50	48	52	49	
Spindletop	04-15-2007	47	34	40		100	51	48	47	50	47	
Spindletop	04-16-2007	58	39	48		61	30	49	46	51	46	
Spindletop	04-17-2007	69	39	54		63	28	51	46	54	47	
Spindletop	04-18-2007	68	48	58	0.05	100	50	52	49	56	51	
Spindletop	04-19-2007	52	43	48		100	100	52	51	55	53	
Spindletop	04-20-2007	67	42	54		100	38	53	49	57	50	
Spindletop	04-21-2007	73	44	58		100	28	54	50	59	52	
Spindletop	04-22-2007	78	48	63		100	28	55	52	58	54	
Spindletop	04-23-2007	72	61	66		69	45	56	54	59	56	
Spindletop	04-24-2007	79	58	68	0.45	100	53	59	56	62	58	
Spindletop	04-25-2007	76	65	70		100	58	60	58	63	61	
Spindletop	04-26-2007	71	61	66	0.54	100	69	60	59	62	61	
Spindletop	04-27-2007	59	52	56		100	94	59	58	61	59	
Spindletop	04-28-2007	71	51	61		100	44	59	57	60	58	
Spindletop	04-29-2007	76	52	64		75	33	59	57	61	57	
Spindletop	04-30-2007	84	59	72		62	34	61	58	63	59	

Summary for Spindletop for the period 4-1-2007 through 4-30-2007:

STATION	AIR TEMP MX	AIR TEMP MN	AIR TEMP AV	TOTAL PRECIP	RH MX	RH MN	SOIL TEMP GRASS MX	SOIL TEMP GRASS MN	SOIL TEMP BARE MX	SOIL TEMP BARE MN	TOTAL EVAP
Spindletop	62	44	53	3.87	91	48	54	51	56	52	
(Deviation from normal)	-3	-1	-2	-0.01							

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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	05-01-2007	81	64	72		64	41	62	59	64	61	
Spindletop	05-02-2007	77	61	69	0.01	100	57	62	61	64	62	
Spindletop	05-03-2007	62	55	58	0.39	100	100	62	60	63	62	
Spindletop	05-04-2007	72	59	66	0.25	100	100	61	60	64	62	
Spindletop	05-05-2007	76	61	68	0.06	100	67	62	61	65	63	
Spindletop	05-06-2007	68	50	59		100	27	62	60	65	63	
Spindletop	05-07-2007	74	46	60		61	29	61	58	64	60	
Spindletop	05-08-2007	80	46	63		100	39	61	58	64	59	
Spindletop	05-09-2007	85	55	70		100	28	62	58	65	60	
Spindletop	05-10-2007	83	62	72		100	41	64	61	67	63	
Spindletop	05-11-2007	82	64	73		100	41	64	63	67	64	
Spindletop	05-12-2007	83	60	72		100	36	66	63	68	65	
Spindletop	05-13-2007	70	48	59		79	26	66	62	67	62	
Spindletop	05-14-2007	80	45	62		78	36	67	60	69	59	
Spindletop	05-15-2007	81	65	73		100	50	69	64	71	64	
Spindletop	05-16-2007	67	47	57	0.22	100	54	68	65	68	64	
Spindletop	05-17-2007	65	45	55	0.19	100	53	65	61	65	61	
Spindletop	05-18-2007	63	41	52		100	39	65	60	64	59	
Spindletop	05-19-2007	71	40	56		100	29	67	59	67	58	
Spindletop	05-20-2007	78	52	65		68	29	69	61	69	60	
Spindletop	05-21-2007	82	55	68		75	33	71	63	70	62	
Spindletop	05-22-2007	86	56	71		100	25	72	65	72	64	
Spindletop	05-23-2007	86	61	74		72	32	72	66	72	65	
Spindletop	05-24-2007	83	66	74		80	42	73	68	72	67	
Spindletop	05-25-2007	85	64	74		100	32	74	68	74	67	
Spindletop	05-26-2007	86	60	73		100	29	74	68	73	67	
Spindletop	05-27-2007	84	62	73		100	34	74	68	74	68	
Spindletop	05-28-2007	87	63	75	0.33	100	33	75	69	74	69	
Spindletop	05-29-2007	89	64	76		100	32	76	69	75	69	
Spindletop	05-30-2007	90	64	77		100	21	76	71	76	70	
Spindletop	05-31-2007	87	65	76		80	26	75	70	75	70	

Summary for Spindletop for the period 5-1-2007 through 5-31-2007:

	AIR TEMP			TOTAL	RH		SOIL TEMP GRASS		SOIL TEMP BARE		TOTAL
STATION	MX	MN	AV	PRECIP	MX	MN	MX	MN	MX	MN	EVAP
Spindletop	79	56	68	1.45	92	41	68	63	69	64	
(Deviation from normal)	+3	+1	+2	-3.02							

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STATION	DATE	AIR TEMP MX	AIR TEMP MN	AIR TEMP AV	PRECIP	RH MX	RH MN	SOIL TEMP GRASS MX	SOIL TEMP GRASS MN	SOIL TEMP BARE MX	SOIL TEMP BARE MN	EVAP
Spindletop	06-01-2007	89	68	78		100	30	75	70	75	70	
Spindletop	06-02-2007	83	66	74		100	48	73	70	74	70	
Spindletop	06-03-2007	81	66	74	0.03	100	49	74	71	74	71	
Spindletop	06-04-2007	77	62	70	0.37	100	56	72	69	73	70	
Spindletop	06-05-2007	75	58	66	0.15	100	80	72	68	72	69	
Spindletop	06-06-2007	81	54	68	0.01	100	33	73	66	73	66	
Spindletop	06-07-2007	90	64	77		76	36	74	68	74	68	
Spindletop	06-08-2007	86	70	78	0.25	100	63	73	71	74	72	
Spindletop	06-09-2007	81	62	72		100	44	76	70	75	71	
Spindletop	06-10-2007	78	56	67		100	30	73	69	74	69	
Spindletop	06-11-2007	84	62	73		75	24	75	69	76	69	
Spindletop	06-12-2007	84	58	71		100	27	74	69	76	69	
Spindletop	06-13-2007	87	58	72		100	31	74	69	76	69	
Spindletop	06-14-2007	87	62	74		100	30	76	70	78	71	
Spindletop	06-15-2007	84	62	73		100	27	76	70	78	71	
Spindletop	06-16-2007	88	58	73		100	24	76	70	78	71	
Spindletop	06-17-2007	94	64	79		70	27	77	71	80	72	
Spindletop	06-18-2007	92	70	81		63	26	76	72	79	73	
Spindletop	06-19-2007	82	67	74	0.33	100	56	75	73	77	75	
Spindletop	06-20-2007	82	60	71		100	27	77	71	78	71	
Spindletop	06-21-2007	88	56	72		100	21	77	69	79	70	
Spindletop	06-22-2007	73	61	67	0.02	100	55	73	71	75	72	
Spindletop	06-23-2007	82	58	70	0.04	100	39	73	68	75	70	
Spindletop	06-24-2007	86	65	76	0.05	100	48	75	70	77	72	
Spindletop	06-25-2007	88	68	78		100	45	76	71	78	72	
Spindletop	06-26-2007	91	68	80		100	45	76	72	78	73	
Spindletop	06-27-2007	91	68	80		100	38	78	72	81	74	
Spindletop	06-28-2007	85	70	78	0.52	100	58	76	74	78	75	
Spindletop	06-29-2007	84	69	76		100	59	77	73	79	74	
Spindletop	06-30-2007	81	68	74		100	56	77	73	78	74	

Summary for Spindletop for the period 6-1-2007 through 6-30-2007:

STATION	AIR TEMP MX	AIR TEMP MN	AIR TEMP AV	TOTAL PRECIP	RH MX	RH MN	SOIL TEMP GRASS MX	SOIL TEMP GRASS MN	SOIL TEMP BARE MX	SOIL TEMP BARE MN	TOTAL EVAP
Spindletop	84	63	74	1.77	96	41	75	70	76	71	
(Deviation from normal)	+2	+1	+1	-1.89							

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STATION	DATE	AIR TEMP MX	AIR TEMP MN	AIR TEMP AV	PRECIP	RH MX	RH MN	SOIL TEMP GRASS MX	SOIL TEMP GRASS MN	SOIL TEMP BARE MX	SOIL TEMP BARE MN	EVAP
Spindletop	07-01-2007	80	64	72		75	30	76	72	77	73	
Spindletop	07-02-2007	80	57	68		75	31	77	70	78	70	
Spindletop	07-03-2007	87	56	72		100	37	77	70	79	71	
Spindletop	07-04-2007	88	69	78	2.23	100	49	76	73	79	74	
Spindletop	07-05-2007	82	66	74	0.30	100	71	75	72	77	73	
Spindletop	07-06-2007	88	67	78		100	34	79	73	80	74	
Spindletop	07-07-2007	89	65	77		100	31	80	74	81	75	
Spindletop	07-08-2007	89	65	77		100	35	80	75	81	75	
Spindletop	07-09-2007	89	68	78		100	45	80	75	81	75	
Spindletop	07-10-2007	84	71	78	0.54	100	62	78	76	79	77	
Spindletop	07-11-2007	82	65	74	0.01	100	44	79	75	80	76	
Spindletop	07-12-2007	79	58	68		100	46	77	73	77	73	
Spindletop	07-13-2007	78	63	70	0.08	100	62	75	72	76	73	
Spindletop	07-14-2007	84	60	72		100	44	76	71	77	72	
Spindletop	07-15-2007	87	69	78		100	49	77	73	78	74	
Spindletop	07-16-2007	87	66	76		100	39	79	74	79	74	
Spindletop	07-17-2007	87	67	77	0.05	100	55	78	74	78	74	
Spindletop	07-18-2007	88	67	78	0.81	100	62	78	74	78	75	
Spindletop	07-19-2007	88	69	78	0.48	100	51	79	75	79	76	
Spindletop	07-20-2007	77	63	70	0.20	98	47	79	74	78	75	
Spindletop	07-21-2007	75	58	66		83	45	77	73	76	73	
Spindletop	07-22-2007	78	57	68		85	41	76	71	75	71	
Spindletop	07-23-2007	80	59	70		83	51	75	71	75	71	
Spindletop	07-24-2007	78	63	70		94	47	75	72	75	72	
Spindletop	07-25-2007	82	59	70		100	46	76	71	75	71	
Spindletop	07-26-2007	83	65	74		93	57	76	72	76	72	
Spindletop	07-27-2007	84	66	75	2.18	99	70	75	73	76	73	
Spindletop	07-28-2007	75	68	72	0.02	99	81	74	72	74	73	
Spindletop	07-29-2007	83	71	77		95	62	77	73	76	74	
Spindletop	07-30-2007	85	68	76		95	60	78	74	77	75	
Spindletop	07-31-2007	86	68	77		86	46	79	75	77	75	

Summary for Spindletop for the period 7-1-2007 through 7-31-2007:

STATION	AIR TEMP MX	AIR TEMP MN	AIR TEMP AV	TOTAL PRECIP	RH MX	RH MN	SOIL TEMP GRASS MX	SOIL TEMP GRASS MN	SOIL TEMP BARE MX	SOIL TEMP BARE MN	TOTAL EVAP
Spindletop	83	64	74	6.90	95	49	77	73	78	74	
(Deviation from normal)	-3	-0	-1	+1.90							

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STATION	DATE	AIR TEMP MX	AIR TEMP MN	AIR TEMP AV	PRECIP	RH MX	RH MN	SOIL TEMP GRASS MX	SOIL TEMP GRASS MN	SOIL TEMP BARE MX	SOIL TEMP BARE MN	EVAP
Spindletop	08-01-2007	87	64	76		88	48	78	74	77	73	
Spindletop	08-02-2007	90	66	78		94	47	78	74	78	74	
Spindletop	08-03-2007	90	70	80	0.12	94	47	79	75	78	75	
Spindletop	08-04-2007	92	70	81		95	45	79	75	78	75	
Spindletop	08-05-2007	92	72	82	0.73	98	57	79	76	79	76	
Spindletop	08-06-2007	94	75	84		82	49	79	76	80	77	
Spindletop	08-07-2007	95	77	86		81	42	79	77	80	78	
Spindletop	08-08-2007	96	76	86		87	45	80	77	81	78	
Spindletop	08-09-2007	96	77	86		91	43	80	78	81	79	
Spindletop	08-10-2007	90	74	82		90	44	80	78	80	79	
Spindletop	08-11-2007	87	66	76		94	42	80	76	79	76	
Spindletop	08-12-2007	90	62	76		94	43	79	74	78	74	
Spindletop	08-13-2007	91	68	80		89	46	79	75	79	75	
Spindletop	08-14-2007	87	58	72		80	24	77	73	77	73	
Spindletop	08-15-2007	98	67	82		76	28	77	73	78	73	
Spindletop	08-16-2007	99	70	84	0.11	95	31	78	75	79	76	
Spindletop	08-17-2007	87	65	76	0.02	98	34	77	74	78	75	
Spindletop	08-18-2007	81	60	70		76	37	75	72	75	73	
Spindletop	08-19-2007	91	63	77		94	50	75	72	78	72	
Spindletop	08-20-2007	93	73	83		91	40	77	74	81	75	
Spindletop	08-21-2007	83	68	76	0.74	98	63	75	73	78	75	
Spindletop	08-22-2007	94	73	84		91	47	79	73	83	75	
Spindletop	08-23-2007	95	73	84		93	38	80	75	84	78	
Spindletop	08-24-2007	94	77	86		71	38	79	76	84	78	
Spindletop	08-25-2007	88	73	80		86	53	79	76	83	78	
Spindletop	08-26-2007	84	69	76		92	44	78	75	83	77	
Spindletop	08-27-2007	89	63	76		90	36	78	73	82	75	
Spindletop	08-28-2007	95	65	80		85	35	79	73	83	75	
Spindletop	08-29-2007	93	71	82	0.52	89	42	79	75	84	77	
Spindletop	08-30-2007	85	68	76	0.32	97	63	77	75	81	77	
Spindletop	08-31-2007	79	63	71		89	59	75	73	78	75	

Summary for Spindletop for the period 8-1-2007 through 8-31-2007:

STATION	AIR TEMP MX	AIR TEMP MN	AIR TEMP AV	TOTAL PRECIP	RH MX	RH MN	SOIL TEMP GRASS MX	SOIL TEMP GRASS MN	SOIL TEMP BARE MX	SOIL TEMP BARE MN	TOTAL EVAP
Spindletop	90	69	80	2.56	89	44	78	75	80	76	
(Deviation from normal)	+7	+6	+6	-1.37							

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STATION	DATE	AIR TEMP MX	AIR TEMP MN	AIR TEMP AV	PRECIP	RH MX	RH MN	SOIL TEMP GRASS MX	SOIL TEMP GRASS MN	SOIL TEMP BARE MX	SOIL TEMP BARE MN	EVAP
Spindletop	09-01-2007	83	59	71		88	41	75	71	79	73	
Spindletop	09-02-2007	87	60	74		82	48	75	71	79	72	
Spindletop	09-03-2007	91	67	79		96	28	76	72	80	74	
Spindletop	09-04-2007	92	59	76		88	26	76	71	80	73	
Spindletop	09-05-2007	95	62	78		81	22	76	71	80	73	
Spindletop	09-06-2007	88	71	80		75	41	75	72	79	75	
Spindletop	09-07-2007	89	75	82		71	44	76	73	80	75	
Spindletop	09-08-2007	89	72	80		78	43	77	73	81	76	
Spindletop	09-09-2007	78	72	75	0.18	97	73	75	74	79	77	
Spindletop	09-10-2007	76	70	73	0.03	98	80	75	74	77	76	
Spindletop	09-11-2007	76	61	68	0.01	96	51	74	71	77	73	
Spindletop	09-12-2007	79	53	66		92	29	72	68	76	69	
Spindletop	09-13-2007	84	48	66		93	26	72	66	76	68	
Spindletop	09-14-2007	80	62	71	0.02	89	40	72	69	75	71	
Spindletop	09-15-2007	68	48	58		82	30	70	66	74	68	
Spindletop	09-16-2007	70	46	58		78	28	69	64	73	66	
Spindletop	09-17-2007	81	48	64		81	28	70	64	74	66	
Spindletop	09-18-2007	86	58	72		76	37	71	65	76	68	
Spindletop	09-19-2007	87	55	71		96	32	72	66	76	69	
Spindletop	09-20-2007	86	56	71		94	30	72	67	77	69	
Spindletop	09-21-2007	89	58	74		83	37	73	67	78	70	
Spindletop	09-22-2007	90	68	79		85	39	75	70	79	72	
Spindletop	09-23-2007	91	64	78		91	34	75	70	79	73	
Spindletop	09-24-2007	93	65	79		86	33	76	71	80	73	
Spindletop	09-25-2007	93	72	82		84	35	76	72	81	75	
Spindletop	09-26-2007	86	66	76		95	49	75	72	79	75	
Spindletop	09-27-2007	73	61	67	0.90	99	75	72	70	75	72	
Spindletop	09-28-2007	77	55	66	0.01	99	29	70	67	73	68	
Spindletop	09-29-2007	76	48	62		91	28	68	63	71	65	
Spindletop	09-30-2007	83	53	68		75	27	67	63	71	65	

Summary for Spindletop for the period 9-1-2007 through 9-30-2007:

STATION	AIR TEMP MX	AIR TEMP MN	AIR TEMP AV	TOTAL PRECIP	RH MX	RH MN	SOIL TEMP GRASS MX	SOIL TEMP GRASS MN	SOIL TEMP BARE MX	SOIL TEMP BARE MN	TOTAL EVAP
Spindletop	84	60	72	1.15	87	39	73	69	77	71	
(Deviation from normal)	+6	+5	+6	-2.05							

2007 Field Season Weather Data
Western Kentucky (Princeton Weather Station)

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STATION	DATE	AIR TEMP MX	AIR TEMP MN	AIR TEMP AV	PRECIP	RH MX	RH MN	SOIL TEMP GRASS MX	SOIL TEMP GRASS MN	SOIL TEMP BARE MX	SOIL TEMP BARE MN	EVAP
Princeton	03-01-2007	70	54	62	0.33	100	70	45	36			
Princeton	03-02-2007	63	29	46	0.02	60	20	46	39			
Princeton	03-03-2007	62	30	46	T	80	40	44	38			
Princeton	03-04-2007 E	41	24	32		97	44	43	41			
Princeton	03-05-2007	62	26	44		80	30	45	38			
Princeton	03-06-2007	62	30	46		95	30	43	35			
Princeton	03-07-2007	70	42	56		60	25	47	38			
Princeton	03-08-2007 E	62	30	46		88	43	44	41			
Princeton	03-09-2007	75	36	56		95	20	49	41			
Princeton	03-10-2007	75	51	63	0.07	100	35	50	45			
Princeton	03-11-2007	74	41	58		80	20	50	46			
Princeton	03-12-2007	73	34	54		75	20	50	44			
Princeton	03-13-2007	80	53	66	T	95	35	53	46			
Princeton	03-14-2007	74	58	66	0.15	95	70	54	46			
Princeton	03-15-2007	75	45	60	0.15	100	70	53	45			
Princeton	03-16-2007 E	50	36	43	T	100	70	53	45			
Princeton	03-17-2007	50	26	38		95	30	52	42			
Princeton	03-18-2007	53	28	40		85	20	53	42			
Princeton	03-19-2007	67	43	55	T	80	20	55	44			
Princeton	03-20-2007 E	69	54	62	0.13	100	75	55	44			
Princeton	03-21-2007	77	56	66		95	30	56	51			
Princeton	03-22-2007	76	62	69		80	60	56	52			
Princeton	03-23-2007	78	60	69		85	50	57	50			
Princeton	03-24-2007 E	78	60	69		85	50	57	50			
Princeton	03-25-2007 E	82	54	68		95	47	57	55			
Princeton	03-26-2007 E	83	51	67		91	44	59	57			
Princeton	03-27-2007	85	56	70		95	30	62	57			
Princeton	03-28-2007	83	61	72	0.89	100	40	62	56			
Princeton	03-29-2007	83	59	71		100	60	64	57			
Princeton	03-30-2007 E	83	59	71		100	60	64	57			
Princeton	03-31-2007 E	83	60	72	0.11	98	59	63	61			

Summary for Princeton for the period 3-1-2007 through 3-31-2007:

STATION	AIR TEMP MX	AIR TEMP MN	AIR TEMP AV	TOTAL PRECIP	RH MX	RH MN	SOIL TEMP GRASS MX	SOIL TEMP GRASS MN	SOIL TEMP BARE MX	SOIL TEMP BARE MN	TOTAL EVAP
Princeton	71	45	58	1.85	90	42	53	46			
(Deviation from normal)	+11	+10	+10	-3.09							

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STATION	DATE	AIR TEMP MX	AIR TEMP MN	AIR TEMP AV	PRECIP	RH MX	RH MN	SOIL TEMP GRASS MX	SOIL TEMP GRASS MN	SOIL TEMP BARE MX	SOIL TEMP BARE MN	EVAP
Princeton	04-01-2007	75	60	68	0.22	95	40	64	61			
Princeton	04-02-2007	81	50	66		95	30	66	58			
Princeton	04-03-2007	83	57	70		83	57	67	59			
Princeton	04-04-2007	83	39	61	0.64	100	40	65	54			
Princeton	04-05-2007	80	29	54		95	45	64	55			
Princeton	04-06-2007	45	31	38	T	85	30	59	47			
Princeton	04-07-2007	47	23	35		80	40	57	46			
Princeton	04-08-2007	50	19	34		95	20	51	40			
Princeton	04-09-2007	57	26	42		90	20	50	40			
Princeton	04-10-2007	62	28	45		85	20	52	42			
Princeton	04-11-2007	68	45	56	0.77	100	40	53	46			
Princeton	04-12-2007	68	45	56		60	40	53	49			
Princeton	04-13-2007	68	33	50	0.02	100	40	54	48			
Princeton	04-14-2007	67	41	54	1.61	100	95	55	48			
Princeton	04-15-2007	55	20	38	0.04	95	30	54	46			
Princeton	04-16-2007	67	39	53		95	20	52	44			
Princeton	04-17-2007	74	38	56		95	20	55	50			
Princeton	04-18-2007	74	54	64	T	95	35	58	51			
Princeton	04-19-2007	74	43	58		95	45	54	51			
Princeton	04-20-2007	75	39	57		95	25	59	50			
Princeton	04-21-2007	78	42	60		90	35	60	52			
Princeton	04-22-2007	80	52	66		85	20	61	52			
Princeton	04-23-2007	80	65	72		85	50	62	53			
Princeton	04-24-2007	83	63	73		95	55	64	54			
Princeton	04-25-2007	83	58	70		100	60	62	59			
Princeton	04-26-2007	82	57	70	0.62	100	55	64	59			
Princeton	04-27-2007	71	53	62		90	45	64	59			
Princeton	04-28-2007	78	54	66	0.03	95	40	65	60			
Princeton	04-29-2007	83	50	66		95	30	66	61			
Princeton	04-30-2007	87	55	71		95	30	70	60			

Summary for Princeton for the period 4-1-2007 through 4-30-2007:

STATION	AIR TEMP MX	AIR TEMP MN	AIR TEMP AV	TOTAL PRECIP	RH MX	RH MN	SOIL TEMP GRASS MX	SOIL TEMP GRASS MN	SOIL TEMP BARE MX	SOIL TEMP BARE MN	TOTAL EVAP
Princeton	72	44	58	3.95	92	38	59	52			
(Deviation from normal)	+1	-3	-1	-0.85							

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STATION	DATE	AIR TEMP MX	AIR TEMP MN	AIR TEMP AV	PRECIP	RH MX	RH MN	SOIL TEMP GRASS MX	SOIL TEMP GRASS MN	SOIL TEMP BARE MX	SOIL TEMP BARE MN	EVAP
Princeton	05-01-2007	88	60	74		95	40	72	62			
Princeton	05-02-2007	86	61	74	T	95	50	67	64			
Princeton	05-03-2007 E	75	64	70	0.49	97	79	69	66			
Princeton	05-04-2007 E	78	64	71	0.15	97	87	66	65			
Princeton	05-05-2007 E	81	61	71	0.18	90	78	65	64			
Princeton	05-06-2007	82	62	72		94	40	66	63			
Princeton	05-07-2007	84	53	68		75	50	70	62			
Princeton	05-08-2007	87	59	73		95	50	71	64			
Princeton	05-09-2007	90	61	76	0.76	100	40	73	63			
Princeton	05-10-2007	89	64	76		100	45	76	67			
Princeton	05-11-2007	85	63	74	0.06	100	50	75	68			
Princeton	05-12-2007	85	63	74		90	30	77	69			
Princeton	05-13-2007	81	61	71		90	25	76	68			
Princeton	05-14-2007	86	48	67		95	20	73	65			
Princeton	05-15-2007	86	68	77		95	50	74	69			
Princeton	05-16-2007	84	55	70	0.65	100	40	74	65			
Princeton	05-17-2007	69	46	58		95	35	69	62			
Princeton	05-18-2007	69	42	56		95	20	67	59			
Princeton	05-19-2007 E	75	42	58		96	33	66	63			
Princeton	05-20-2007	81	44	62		95	15	70	61			
Princeton	05-21-2007	85	47	66		95	20	70	59			
Princeton	05-22-2007	87	52	70		90	20	72	64			
Princeton	05-23-2007	87	61	74		65	30	72	65			
Princeton	05-24-2007	87	60	74		75	45	72	68			
Princeton	05-25-2007	86	59	72		95	30	74	65			
Princeton	05-26-2007	87	61	74		90	30	75	64			
Princeton	05-27-2007	87	60	74		90	35	77	66			
Princeton	05-28-2007 E	89	62	76		97	41	75	73			
Princeton	05-29-2007	88	60	74		95	30	75	67			
Princeton	05-30-2007	89	68	78		60	40	75	67			
Princeton	05-31-2007	86	64	75	T	95	40	76	67			

Summary for Princeton for the period 5-1-2007 through 5-31-2007:

STATION	AIR TEMP MX	AIR TEMP MN	AIR TEMP AV	TOTAL PRECIP	RH MX	RH MN	SOIL TEMP GRASS MX	SOIL TEMP GRASS MN	SOIL TEMP BARE MX	SOIL TEMP BARE MN	TOTAL EVAP
Princeton	84	58	71	2.29	91	40	72	65			
(Deviation from normal)	+3	+2	+2	-2.67							

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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
Princeton	06-01-2007	89	64	76		95	40	75	65			
Princeton	06-02-2007	88	63	76	T	95	40	74	66			
Princeton	06-03-2007	84	64	74	0.58	95	40	75	68			
Princeton	06-04-2007	83	60	72		95	40	76	69			
Princeton	06-05-2007	84	59	72		95	40	75	69			
Princeton	06-06-2007	88	55	72	T	95	40	75	65			
Princeton	06-07-2007	90	68	79		80	45	77	69			
Princeton	06-08-2007	90	68	79	0.48	100	60	77	66			
Princeton	06-09-2007 E	83	61	72		85	51	76	72			
Princeton	06-10-2007	82	56	69		95	30	75	65			
Princeton	06-11-2007	78	67	72		90	60	76	68			
Princeton	06-12-2007	86	60	73		95	25	76	65			
Princeton	06-13-2007	89	59	74		90	30	78	73			
Princeton	06-14-2007	92	63	78		95	30	79	69			
Princeton	06-15-2007	92	62	77		95	30	80	74			
Princeton	06-16-2007	91	60	76		95	20	79	73			
Princeton	06-17-2007	96	61	78		95	20	80	75			
Princeton	06-18-2007	95	65	80	0.02	100	40	81	74			
Princeton	06-19-2007	89	72	80	T	90	70	80	72			
Princeton	06-20-2007	87	62	74		75	20	80	70			
Princeton	06-21-2007	91	57	74		90	20	79	71			
Princeton	06-22-2007 E	91	64	78	0.01	91	43	76	73			
Princeton	06-23-2007	93	67	80		90	30	81	73			
Princeton	06-24-2007	85	68	76	0.61	90	70	80	72			
Princeton	06-25-2007	86	70	78	T	95	70	81	70			
Princeton	06-26-2007	90	68	79	0.26	100	60	81	73			
Princeton	06-27-2007	90	66	78	0.41	100	70	80	70			
Princeton	06-28-2007	92	70	81		90	40	80	75			
Princeton	06-29-2007 E	89	69	79	1.95	91	60	78	77			
Princeton	06-30-2007 E	86	69	78		97	73	79	78			

Summary for Princeton for the period 6-1-2007 through 6-30-2007:

	AIR TEMP			TOTAL	RH		SOIL TEMP GRASS		SOIL TEMP BARE		TOTAL
STATION	MX	MN	AV	PRECIP	MX	MN	MX	MN	MX	MN	EVAP
Princeton	88	64	76	4.32	93	44	78	71			
(Deviation from normal)	+1	+0	+1	+0.47							

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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	07-01-2007	77	70	74	T	95	70	77	74			
Princeton	07-02-2007	81	61	71		95	30	79	75			
Princeton	07-03-2007	88	58	73		95	30	80	70			
Princeton	07-04-2007 E	88	69	78	0.01	97	61	79	76			
Princeton	07-05-2007	88	71	80	0.10	100	90	80	73			
Princeton	07-06-2007	88	64	76	0.25	95	40	78	72			
Princeton	07-07-2007 E	90	66	78		99	50	81	78			
Princeton	07-08-2007	92	65	78		50	20	80	73			
Princeton	07-09-2007	93	66	80		60	45	81	73			
Princeton	07-10-2007	87	70	78	0.12	70	60	81	72			
Princeton	07-11-2007	87	72	80	0.09	75	30	80	75			
Princeton	07-12-2007	85	61	73		75	25	81	72			
Princeton	07-13-2007	87	58	72		75	30	80	75			
Princeton	07-14-2007	90	61	76		70	30	80	72			
Princeton	07-15-2007	94	66	80		65	30	81	72			
Princeton	07-16-2007	92	68	80		80	35	81	73			
Princeton	07-17-2007	94	70	82		80	35	82	75			
Princeton	07-18-2007	96	69	82		85	35	83	75			
Princeton	07-19-2007	95	75	85		85	35	85	76			
Princeton	07-20-2007	95	65	80	1.20	100	40	85	75			
Princeton	07-21-2007	82	59	70		85	30	82	76			
Princeton	07-22-2007	81	57	69		60	40	83	77			
Princeton	07-23-2007	85	56	70		80	25	82	76			
Princeton	07-24-2007	86	60	73		75	30	81	75			
Princeton	07-25-2007	87	61	74		80	35	80	74			
Princeton	07-26-2007	92	63	78		90	35	80	76			
Princeton	07-27-2007 E	90	72	81		87	52	77	75			
Princeton	07-28-2007 E	88	74	81		95	76	78	75			
Princeton	07-29-2007	89	69	79		95	75	79	74			
Princeton	07-30-2007	90	67	78		95	45	79	74			
Princeton	07-31-2007 E	91	68	80		96	50	80	78			

Summary for Princeton for the period 7-1-2007 through 7-31-2007:

STATION	AIR TEMP MX	MN	AV	TOTAL PRECIP	RH MX	MN	SOIL TEMP GRASS MX	MN	BARE MX	MN	TOTAL EVAP
Princeton	89	66	77	1.77	83	42	80	74			
(Deviation from normal)	-1	-1	-1	-2.52							

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STATION	DATE	AIR TEMP MX	AIR TEMP MN	AIR TEMP AV	PRECIP	RH MX	RH MN	SOIL TEMP GRASS MX	SOIL TEMP GRASS MN	SOIL TEMP BARE MX	SOIL TEMP BARE MN	EVAP
Princeton	08-01-2007	95	67	81		85	25	80	74			
Princeton	08-02-2007	95	70	82		95	35	80	75			
Princeton	08-03-2007 E	95	70	82	0.05	97	49	83	80			
Princeton	08-04-2007 E	97	70	84	0.03	96	47	80	78			
Princeton	08-05-2007	97	69	83		95	70	85	79			
Princeton	08-06-2007	100	74	87		95	30	85	81			
Princeton	08-07-2007	100	75	88		90	30	86	81			
Princeton	08-08-2007	102	78	90		95	30	87	83			
Princeton	08-09-2007	104	78	91		95	30	87	83			
Princeton	08-10-2007	95	71	83		95	30	87	83			
Princeton	08-11-2007	98	87	92		95	30	88	84			
Princeton	08-12-2007	101	65	83		90	30	87	81			
Princeton	08-13-2007	90	69	80	0.59	100	55	86	81			
Princeton	08-14-2007	98	68	83		95	20	86	81			
Princeton	08-15-2007	103	69	86		95	20	85	81			
Princeton	08-16-2007	105	69	87		95	15	85	80			
Princeton	08-17-2007 E	97	74	86		91	43	83	81			
Princeton	08-18-2007 E	97	68	82		83	45	84	81			
Princeton	08-19-2007 E	96	71	84		90	62	83	81			
Princeton	08-20-2007	100	72	86		95	25	86	81			
Princeton	08-21-2007 E	98	75	86		98	45	82	80			
Princeton	08-22-2007	102	72	87		95	25	86	83			
Princeton	08-23-2007	104	70	87		95	25	89	86			
Princeton	08-24-2007	103	72	88		95	20	89	86			
Princeton	08-25-2007 E	91	71	81		95	54	85	83			
Princeton	08-26-2007	99	69	84		95	20	87	85			
Princeton	08-27-2007 E	98	66	82		96	45	83	81			
Princeton	08-28-2007 E	98	73	86	0.20	94	53	83	81			
Princeton	08-29-2007	100	75	88		95	45	89	86			
Princeton	08-30-2007	96	69	82		95	60	88	84			
Princeton	08-31-2007	87	64	76		95	30	89	83			

Summary for Princeton for the period 8-1-2007 through 8-31-2007:

STATION	AIR TEMP MX	AIR TEMP MN	AIR TEMP AV	TOTAL PRECIP	RH MX	RH MN	SOIL TEMP GRASS MX	SOIL TEMP GRASS MN	SOIL TEMP BARE MX	SOIL TEMP BARE MN	TOTAL EVAP
Princeton	98	71	85	0.87	94	37	85	82			
(Deviation from normal)	+11	+7	+9	-3.14							

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	AIR TEMP MN	AIR TEMP AV	PRECIP	RH MX	RH MN	SOIL TEMP GRASS MX	SOIL TEMP GRASS MN	SOIL TEMP BARE MX	SOIL TEMP BARE MN	EVAP
Princeton	09-01-2007	90	60	75		85	25	87	85			
Princeton	09-02-2007	95	65	80	T	85	40	87	83			
Princeton	09-03-2007 E	95	71	83		95	30	88	83			
Princeton	09-04-2007	97	67	82		95	20	85	82			
Princeton	09-05-2007	95	71	83		95	30	86	79			
Princeton	09-06-2007	90	69	80	0.59	95	30	85	78			
Princeton	09-07-2007	88	72	80	0.02	95	85	81	76			
Princeton	09-08-2007	86	72	79	0.66	95	60	80	77			
Princeton	09-09-2007	78	72	75	0.63	95	80	79	76			
Princeton	09-10-2007	84	70	77	T	95	80	78	71			
Princeton	09-11-2007	84	63	74	0.75	95	45	77	72			
Princeton	09-12-2007	81	55	68		95	20	75	70			
Princeton	09-13-2007	85	52	68		90	20	76	71			
Princeton	09-14-2007	86	68	77	T	95	40	74	67			
Princeton	09-15-2007 E	73	66	70		80	30	72	72			
Princeton	09-16-2007	79	47	63		95	20	73	64			
Princeton	09-17-2007	85	53	69		90	25	75	69			
Princeton	09-18-2007	87	62	74		95	35	71	66			
Princeton	09-19-2007	86	57	72		35	20	73	65			
Princeton	09-20-2007	90	41	66		40	19	74	67			
Princeton	09-21-2007	89	57	73		95	30	73	68			
Princeton	09-22-2007	91	63	77		95	40	76	71			
Princeton	09-23-2007	91	68	80		95	30	75	70			
Princeton	09-24-2007 E	92	71	82		95	40	75	67			
Princeton	09-25-2007 E	90	55	72	0.15	80	60	75	68			
Princeton	09-26-2007	84	71	78	0.44	95	50	75	70			
Princeton	09-27-2007 E	83	67	75	0.28	95	55	74	70			
Princeton	09-28-2007 E	83	55	69		20	10	75	66			
Princeton	09-29-2007 E	85	58	72		80	50	74	66			
Princeton	09-30-2007	85	50	68		70	20	75	67			

Summary for Princeton for the period 9-1-2007 through 9-30-2007:

STATION	AIR TEMP MX	AIR TEMP MN	AIR TEMP AV	TOTAL PRECIP	RH MX	RH MN	SOIL TEMP GRASS MX	SOIL TEMP GRASS MN	SOIL TEMP BARE MX	SOIL TEMP BARE MN	TOTAL EVAP
Princeton	87	62	75	3.52	85	38	77	72			
(Deviation from normal)	+6	+4	+5	+0.19							

Comparison of Nitrogen Containing Fertilizers and Tall Fescue (Festuca arundinacea Schreb.) Response

Introduction

Land managers have used nitrogen containing fertilizers to increase the overall health and vigor of turfgrass species. One of the potential benefits of a fertilized, and therefore healthier and thicker, stand of turf is the possibility of the turf to outcompete broadleaf weed species and therefore reduce the need for herbicide applications. There are several formulations and concentrations of nitrogen containing fertilizers on the market. Research has shown that, regardless of packaged concentration, an application of 1 lb of nitrogen per 1000 ft^2 should be the standard application rate.

Along with the standard commercial formulations of fertilizer readily available in the marketplace today, the Louisville / Jefferson County Municipal Sewer District has been formulating biosolids into a packaged nitrogen containing fertilizer called Louisville Green. When wastewater is treated, two of the results are clean water and organic solids. These organic solids can be further processed into fertilizer. Louisville Green is a 5-3-0 slow release pelletized fertilizer available in bulk and 40 lb bags. A trial was initiated to compare the effect 2 common fertilizer formulations and Louisville Green on tall fescue.

Methods and Materials

The study was located at the University of Kentucky Agricultural Experiment Station Spindletop Farm in Lexington, KY. Three fertilizer treatments were compared to an untreated check in a randomized complete block design with 4 replications (Table 1). Plots were 10' X 30' in a predominately tall fescue stand. Past management of the site was mowing only. Application rates for each fertilizer followed manufacturer or industry recommendations. Ammonium nitrate and Triple 19 were applied one time at 1 lb of nitrogen per 1000 ft^2. Louisville Green was applied with 2 applications of 1 lb of nitrogen per 1000 ft^2 2 months apart for a total application of 2 lb of nitrogen per 1000 ft^2. Louisville Green manufacturer recommendations are 2 applications of 1 lb of nitrogen per 1000 ft^2 4 t 6 weeks apart. Initial applications were made on October 24, 2006 for all treatments with the follow up application of Louisville Green done on January 9, 2006. Data collection included harvesting 3 random 1 ft^2 square subplots per plot and recording tall fescue live (fresh) weight Live weight data were analyzed in ARM and treatment means separation was performed using Fisher's LSD at p = 0.05.

Results

There were no significant differences in tall fescue response between any of the fertilizer applications (Table 1). There was also no statistically significant difference between the Triple 19 fertilizer application and the untreated check. Operationally, all fertilizers resulted in an increase of tall fescue live weight compared to the untreated check. The highest percent increase of live weight over the untreated check came from Louisville Green at a 63 % increase, which had twice the amount on nitrogen applied as ammonium nitrate or Triple 19. The lowest increase of fresh weight over the untreated check came from Triple 19 at a 37 % increase.

Table 1: Treatments and results for the fertilizer comparison trial

Treatment	Formulated Nitrogen Concentration	Application Rate (nitrogen per 1000 ft^2)	Fresh (live) weight (lb/ac)	Percent increase over untreated
Ammonium nitrate	33 %	1 lb	8483 a	51 %
Louisville Green	5 %	1 lb followed by 1 1b	9123 a	63 %
Triple 19	19 %	1 lb	7693 ab	37 %
Untreated	n/a	n/a	5602 b	0 %

Note: Fresh weight means followed by the same letter are not significantly different using Fisher's LSD at p = 0.05.

Effect of Timing of Mowing after Herbicide Application on Johnsongrass (Sorghum halepense L.) Control

Introduction

Johnsongrass is an invasive grass species distributed throughout continental United States. It is a common and problematic weed in forests, roadside rights-of-way, and pastures. Several herbicides have been shown to be effective at suppressing or controlling johnsongrass. Roadside vegetation managers have the unenviable task of timing herbicides applications along their rights-of-way in between mowing cycles. Lack of communication can confound this problem if one task, spraying for example, is performed by in house crews and mowing is performed by contract crew. A study was initiated in the summer of 2007 to examine the effect that timing of mowing johnsongrass after a herbicide application would have on herbicide efficacy.

Methods and Materials

The trial was located at the University of Kentucky Spindletop Farm in Fayette County, Kentucky in a moderately uniform and dense stand of johnsongrass. The study design was a 2-way factorial with timing of mowing after herbicide application and herbicide application as the 2 factors. Timing of mowing included same day after herbicide application, 24 hours after application (HAA), 48 HAA, 1 week after application (WAT), 2 WAT, and no mowing after application. Herbicide application was Outrider at 0.5 oz / ac or 1 oz / ac. Twelve treatments with 4 replications were marked off in 10’ X 30’ plots. The plots were treated with 2,4-D amine at 2 qt / ac approximately 3 weeks before the Outrider application to prevent broadleaf weeds from being released. Outrider applications were made June 12, 2007 with mowing regimes beginning immediately after. An 8’ mower was used in the 10’ plots which allowed for an unmowed but treated running check for comparison and evaluation. Plots were evaluated 37, 71, and 92 days after treatment (DAT) for visual percent control of johnsongrass. Data were analyzed using ARM software for factorial analysis and treatment means were separated using Fishers LSD at $p = 0.05$.

Results

Due to the 2-way factorial design of this trial, results will be discussed in 3 parts: effect of mowing on johnsongrass control, effect of herbicide rate on johnsongrass control, and the combined effect of the 2 factors on johnsongrass control.

Effect of Timing of Mowing Regardless of Herbicide Treatment

Johnsongrass control levels ranged from 80 % to 91 % at 37 DAT (Table 1). Mowing did not have a significant treatment effect at this time ($p(F) > 0.05$). Control levels resulting from mowing 24 HAA were lower than those of mowing 48 HAA, 1 WAT, and the no mowing treatments. A significant treatment effect from timing of mowing did appear at 71 and 91 DAT ($p(F) < 0.05$). Control levels ranged from 11 %

(mowing immediately after application) and 59 % (no mowing after application). Mowing immediately after application resulted in lower control than all other mowing timings except 24 HAA. At 91 DAT, mowing immediately after application or 24 HAA resulted in the lowest control levels at 11 % for both timings. The highest levels of control were realized with the 48 HAA and the no mowing timings (45 % and 42 %, respectively) and were higher than the immediately following application and the 24 HAA timings. Regardless of mowing timing, johnsongrass control decreased from 37 DAT through 92 DAT. This is attributed to the extreme drought that occurred in the summer of 2007 and its effects on herbicide efficacy.

Table 1: Results and statistics for timing of mowing after herbicide application on johnsongrass control

Mowing Timing	Percent Control of Johnsongrass		
	37 DAT	71 DAT	92 DAT
Immediately	84	11	11
24 HAA	80	26	11
48 HAA	89	49	45
1 WAT	91	50	32
2 WAT	87	39	20
No Mowing	89	59	42
$LSD_{(0.05)}$	*7.6*	*21.8*	*25.6*
Treatment $prob(F)_{0.05}$	*0.0637*	*0.0008*	*0.0305*

Effect of Herbicide Treatment Regardless of Mowing Timing

Johnsongrass control levels with Outrider at 1 oz / ac were significantly higher than Outrider at 0.5 oz / ac at 37, 71, and 92 DAT (Table 2). These results coincide with past research on Outrider efficacy trials on johnsongrass control. A significant treatment effect was present for herbicide application throughout the entire trial as well. As with timing of mowing above, control levels decreased throughout the trial, regardless of herbicide rate. This again is attributed to the drought in 2007.

Table 2: Results and statistics for herbicide application on johnsongrass control

Treatment	Rate per acre	Percent control of johnsongrass		
		37 DAT	71 DAT	92 DAT
Outrider	0.5 oz / ac	81	22	12
Outrider	1 oz / ac	93	57	42
$LSD_{(0.05)}$		*4.4*	*12.8*	*14.8*
Treatment $prob(F)_{0.05}$		*0.0001*	*0.0001*	*0.0002*

Note: Herbicide treatments included a non-ionic surfactant at 0.25% v/v.

Effect of timing of mowing in combination with herbicide treatment

There was no significant treatment interaction between mowing and herbicide at any time during the entire trial (prob(F) > 0.05) (Table 3). This allows the treatments listed below to be statistically compared. Trends in data follow the same trends presented above. There were high levels of control noted at 37 DAT and these levels all decreased throughout the trial regardless of combination of mowing and herbicide treatment. Control levels appear to be the highest from the high rate of Outrider and waiting at least 48 HAA for mowing.

Table 3: Results and statistics for the effect of timing of mowing after herbicide application on johnsongrass control

Mowing timing	Outrider rate per acre	Percent control of johnsongrass		
		37 DAT	71 DAT	92 DAT
Immediate	0.5 oz / ac	78 de	3 d	0 d
Immediate	1 oz / ac	90 abc	20 cd	26 bcd
24 HAA	0.5 oz / ac	69 e	5 d	3 d
24 HAA	1 oz / ac	91 abc	46 abc	20 bcd
48 HAA	0.5 oz / ac	83 cd	30 cd	25 bcd
48 HAA	1 oz / ac	96 a	68 ab	65 a
1 WAT	0.5 oz / ac	86 a-d	39 bc	15 cd
1 WAT	1 oz / ac	95 a	61 ab	50 abc
2 WAT	0.5 oz / ac	83 bcd	5 d	0 d
2 WAT	1 oz / ac	91 abc	73 a	40 abc
No mow	0.5 oz / ac	85 a-d	48 abc	30 a-d
No mow	1 oz / ac	94 ab	71 a	54 ab

Recommendation

The drought of 2007 confounded the results of this trial and will therefore be repeated in 2008. However, trends are apparent in the data presented above that indicates that extending the time period between herbicide application and mowing of johnsongrass beyond 48 hours will improve efficacy versus less than 24 hour. The best control of johnsongrass will undoubtedly result from not mowing the treated stand of johnsongrass in the same season as herbicide application.

Comparison of Non-crop Herbicides for Johnsongrass (Sorghum halapense L.) Control

Introduction

Johnsongrass is a perennial warm season grass common to row-crop, pasture, and right-of-way sites. There are a large number of herbicides labeled and available for control in all of these sites. These range for the nonselective herbicide glyphosate, grass specific (ACCase family) herbicides such as clethodim, fluazifop, and fenoxyprop, and broadleaf and grass herbicides such as imazapyr and imazapic. All of the products available for johnsongrass control can be effective; however, each 'group' does come with some limitations. For example, glyphosate is nonselective and will damage all vegetation it comes in contact with. The ACCase herbicides can damage fescue, bluegrass, or other desirable grasses if treated. Imazapyr and imazapic can damage desirable species as well as be persistent in the soil environment. Given that each 'group' has limitations a trial was installed to compare several herbicides for johnsongrass control. The trial was designed to compare several herbicides from the aforementioned groups for strictly johnsongrass control. This may allow the end-user to decide which herbicide(s) would be appropriate for a given site.

Methods and Materials

The study was located at the University of Kentucky Research and Education Center in Princeton, KY. Previous management was a wheat research field that had been recently harvested and remaining vegetation mowed. The site was dominated by johnsongrass, volunteer wheat from the previous crop, and tall fescue. Sixteen treatments were installed in a RCBD with 3 replications with plots measuring 10' X 30'. Applications were made on August 14, 2007 using a CO_2 powered sprayer mounted on an ATV. Johnsongrass was approximately 6 – 10 inches tall when treated. The site was under extreme drought conditions prior and following application. Plots were evaluated for visual percent control at 9 and 28 DAT. Data were analyzed using ARM and treatment means were separated using Fisher's LSD at $p = 0.05$.

Results

Arsenal at 2 pt / ac provided the highest level of control (75 %) 9 DAT (Table1). There was a high degree of variance noted at this evaluation interval as the Arsenal treatment was only significantly higher than 2 other treatments, Fusion at 7 fl oz / ac an Envoy at 13 fl oz / ac, 9 DAT. This result did not persist 28 DAT as control levels for Arsenal decreased to 63 % and was not statistically different than any other treatment at that evaluation interval.

All 3 rates of Outrider tested resulted in consistent levels of control (45 – 50 %) 9 DAT; however all 3 rates decreased in control at 28 DAT (Table 1). The high rate of Fusion tested, 7 fl oz / ac, resulted in higher, although not statistically different, control levels than Fusion at 7 fl oz / ac 9 DAT. This difference was not apparent 28 DAT as both rates of Fusion resulted in 50 – 55% control. There was no statistical difference between the 3 rates of Envoy 9 DAT and the only treatment to increase in control from 9 DAT to 28 DAT was the high rate of Envoy, 27 fl oz / ac.

There were no statistical differences between the 3 rates of Roundup Pro tested 9 DAT and all 3 treatments decreased in control from 9 to 28 DAT (Table 1). Plateau at 12 fl oz / ac and Journey at 32 fl oz / ac resulted in similar control (45 % for each) at 9 DAT. Plateau increased its control levels to 58 % 28 DAT while Journey held steady at 45 % 28 DAT. This may be indicative of the higher concentration of imazapic in 12 fl oz of Plateau as compared to 32 fl oz of Journey as well as the relatively low concentration of glyphosate in 32 fl oz of Journey as compared to 48 fl oz of Roundup Pro although no statistical difference existed between any Roundup Pro treatment, Plateau, or Journey at 28 DAT. The 2 rates of MSMA tested, 32 and 64 fl oz / ac, showed similar results 9 DAT (58 and 63 % respectively). The higher rate of MSMA decreased in control 28 DAT more drastically than the low rate of MSMA although no statistical difference was apparent.

The severe drought in western Kentucky in 2007 affected the results of this trial. A high degree of variability was noted especially at 28 DAT. This trial, although not resulting in the expected control levels, does show what effects an extreme drought can have on herbicide efficacy. It is the intent of researchers at the University of Kentucky to repeat this trial in the summer of 2008.

Table 1: Treatments and Results for Western Kentucky Johnsongrass Trial

Treatment	Rate per acre	Percent control	
		9 DAT	28 DAT
Outrider	0.5 oz	50 abc	38 a
Outrider	0.75 oz	45 abc	41 a
Outrider	1 oz	48 abc	35 a
Fusion	7 fl oz	28 c	50 a
Fusion	9 fl oz	45 abc	55 a
Envoy	13 fl oz	40bc	40 a
Envoy	20 fl oz	58 abc	45 a
Envoy	27 fl oz	53 abc	60 a
Roundup Pro	16 fl oz	66 ab	58 a
Roundup Pro	32 fl oz	55 abc	40 a
Roundup Pro	48 fl oz	65 ab	55 a
Arsenal	3 pt	75 a	63 a
Plateau	12 fl oz	45 abc	58 a
Journey	32 fl oz	45 abc	45 a
MSMA	32 fl oz	58 abc	50 a
MSMA	64 fl oz	63 ab	33 a

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

Identification and Control of Common Reed (Phragmites australis (CAV.) Trin. ex Steud.)

Introduction

Common reed, often referred to as phragmites, is a perennial invasive terrestrial grass that occurs across the United States. Although widely distributed across Europe, it is unclear as to the exact origin and method of introduction of this species. Categorized as a facultative wetland and obligate wetland species (USFWS 1996), phragmites can occur in a variety of moist to wet environments. The species can tolerate stagnant and flowing water, salt and alkaline conditions, and is commonly found in roadside ditches, marshes, and other wet area (Uva et al 1997). Individual stems can become very large (2 – 4 m in height) and form large monotypic stands. Stems are hollow, round, and become thicker towards the base of the plant. Leaves are fairly long (20 – 60 cm), flat, hairless, and have rough or sharp margins. Plants flower by mid summer in plume-like panicles with feathery spikelets that are purple at emergence and turn light brown with age. Plants rarely produce viable seed and reproduce mainly vegetatively through rhizomatous sprouting. This aids in its invasibility and spread as it is easily moved across sites through disturbances such as mowing, flooding, and road construction. Infestations of phragmites can be problematic in terms of degrading aquatic and terrestrial wildlife habitat and preventing roadside ditches and other waterway channels form operating efficiently.

Control options for phragmites are somewhat limited due to its usual proximity to aquatic environments. Miller (2004) recommended a 4 % glyphosate solution or a 1 % imazapyr solution applied as a foliar spray to control giant reed (*Arundo donax*), a species very similar to common reed. These herbicides are available for use for aquatic situations. These applications may cause unwanted damage to desirable grasses and forbs in the understory. This non target damage would be problematic since common reed can not readily establish itself in vegetated soil. Revegetation practices should be addressed when managing common reed infestations. Foliar applications of imazapyr and glyphosate have been shown to be influenced by mowing regimes as well. Hipkins and Witt (2007) showed that 2, 4, and 6 pt of Habitat resulted in 10, 0, and 15 % control respectively 1 YAT for unmowed phragmites. These same treatments resulted in 43, 67, and 57 % control, respectively, when the phragmites was mowed 5 weeks prior to treatment.

Applying glyphosate or imazapyr through unconventional methods, such as ‘wicking’ or ‘wiping’ herbicide applicators may allow for effective control of common reed while allowing desirable vegetation to survive and compete against common reed regrowth. Kay et al (1999) realized effective control 1 YAT (1.2 live shoots / m^2 versus 29.3 live shoots / m^2 in the untreated) with imazapyr at 6 pt / ac when applied through a Weed Sweep, a type of cut – wipe herbicide applicator. Glyphosate, applied at 6 pt / ac, was ineffective in reducing live shoot counts 1 YAT (33.9 live shoots / m^2).

A trial was installed in June of 2006 to examine the efficacy of glyphosate, formulated as Aquamaster®, and imazapyr, formulated as Habitat®, in combination with either a nonionic surfactant (NIS) or methylated seed oil (MSO)for their ability to control phragmites.

Methods and Materials

The trial was located in the cloverleaf of exit 53 on the Western Kentucky Parkway at County Road 181 just west of Central City, Kentucky. Phragmites stems were approximately 8 to 10 feet tall and was concentrated along the drainage areas through the cloverleaf area. Plots were linear and arranged in a randomized complete block to take advantage of the highest concentration of phragmites while minimizing desirable species damage. Plots measured 30 feet in length and averaged 10 feet in width. Treatments were applied on June 21, 2006 at 25 GPA using a CO_2 powered sprayer mounted on an ATV and a TeeJet® XP BoomJet® boomless nozzle (size 25) to broadcast over the top of the phragmites. Data were collected 72 and 352 DAT and included visual percent control of phragmites. Data were analyzed in ARM software and treatment means were separated using Fisher's LSD at p = 0.05.

Results

Aquamaster at 2 qt / ac resulted in significantly higher control of phragmites than Habitat at 2 pt / ac plus NIS and Habitat at 4 pt / ac + MSO 72 DAT (Table 1). There was also a high degree a variability noted at 72 DAT (CV = 110).
There were no differences in control of phragmites between any treatments 352 DAT (Table 1). Control ranged from 83 % with Habitat at 2 pt / ac plus MSO at 1 % v/v and 72 % worth Habitat at 4 pt / ac plus MSO at 1 % v/v. The high variability noted at 72 DAT was not present 352 DAT (CV = 17). There were a number of small green phragmites sprouts present across the entire treated area indicating the need for a follow-up treatment to completely control or suppress the phragmites.
Future research should include the effect of mowing prior to application, the use of sequential treatments for higher control, and the planting of desirable species to compete with phragmites.

Table 1: Treatments and results for Central City phragmites trial

Treatment	Rate per acre	Percent Control	
		72 DAT	352 DAT
Aquamaster + NIS	2 qt + 0.25 % v/v	50 a	77 a
Aquamaster + MSO	2 qt + 1 % v/v	15 ab	75 a
Aquamaster + MSO	4 qt + 1 % v/v	27 ab	78 a
Habitat + NIS	2 pt + 0.25 % v/v	7 b	78 a
Habitat + MSO	2 pt + 1 % v/v	23 ab	83 a
Habitat + MSO	4 pt + 1 % v/v	7 b	72 a
Habitat + MSO	6 pt + 1 % v/v	20 ab	80 a
CV		110	17

Note: Treatment means in the same column followed by the same letter are not statistically different using Fisher's LSD at p = 0.05. CV = coefficient of variation.

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Evaluation of Wet-Blade and Broadcast Spray Applications for Tall Fescue Seedhead Suppression

Introduction

Tall fescue is a common roadside and other unimproved turf cool season grass in Kentucky. Frequent mowing is the most common management regime for departments of transportation and the Kentucky Transportation Cabinet (KTC) is no exception. On average, the KTC mows their rights-of-way 3 to 5 times a season at a cost ranging from \$25 to \$50 an acre, depending on site characteristics and added services (litter pick-up, etc). Plant growth regulators, or PGRs, have been researched in the past at the University of Kentucky for their ability to inhibit seedhead growth of tall fescue and therefore reduce mowing cycles. Common herbicides for tall fescue seedhead suppression include Stronghold™ and Plateau®. Some of the limitations of seedhead suppression herbicide applications include the timing of the application and the need for a broadcast sprayer in the early spring.

New application technologies have also been researched in the past at University of Kentucky. One of these technologies is the Wet-Blade by Diamond Mowers™. The Wet-Blade is an application system which incorporates a traditional deck mower and herbicide delivery system to perform cut surface applications while performing standard mowing operations. Although marketed mainly for brush control, the technology may be used for unimproved turf management. The use of a Wet-Blade for PGR applications could allow a roadside manager to perform the necessary task of mowing while applying a seedhead suppression product and therefore reducing the need for future mowing cycles.

A trial was installed in the spring of 2007 to examine the efficacy of the Wet Blade versus traditional broadcast applications for tall fescue seedhead suppression.

Methods and Materials

The trial was located in a predominately tall fescue stand at the University of Kentucky Spindletop Research Farm in Fayette County, Kentucky. Two herbicide treatments (Stronghold™ + Arsenal® and Plateau®) were evaluated using 2 different application methods (Wet-Blade and broadcast spray) at 2 different application timings (April and May) in a 3-way factorial design with 4 replications. Plots measured 10’ X 50’ and were treated at 8’ X 50’ which left a 4’ running check for comparison purposes at evaluation. Broadcast spray plots were mowed prior to the May applications. The first application occurred on April 13 and the second occurred on May 11. Broadcast spray applications were performed at 20 GPA while the Wet-Blade applications were done at 2 GPA. Data was collected on May 21, June 13, July 6, and August 16. Data collected included color ratings and percent control of tall fescue seedheads. Color ratings were taken on a 0 – 9 scale with 0 being dead turf and 9 being fully green turf. Percent control of seedheads were taken using a 0 – 100 % scale. Ratings were taken general broadleaf weed control was taken on August 16. Data were analyzed using ARM software and means were separated using Fisher’s LSD at p = 0.05.

Results

Due to the factorial design of this trial, results will be presented for each single factor and followed by all 3 factors combined.

Effect of Timing of Application on Turf Color and Seedhead Suppression Regardless of Herbicide or Application Method

A significant treatment effect for timing of application was seen in the May, June, and July evaluations (Table 1). This effect was not present in the August evaluations as color ratings for both timings approached 8. The April application timing had unacceptable color damage in May and the May application followed suit in the June ratings. April applications regained their near normal color appearance in June and July and then began to brown as the drought continued. Color ratings were not significantly different for either application timing at the August evaluations. Control of seedheads followed the same trend as color ratings. April applications resulted in control consistently above 90 % (Table 1). May applications did not reach 90 % until the August evaluation. April applications resulted in significantly higher control of tall fescue seedheads than the May applications for every evaluation except August. Weed control at the August evaluation was unremarkable as to be expected with the herbicides and rates used.

Table 1: Results and statistics for timing of application

	Rating Date								
Treatment date	May 21	June 13	July 6	August 16	May 21	June 13	July 6	August 16	August 16
	Turf color				Percent control of seedheads				Percent broadleaf weed control
April 13	5.5	8.6	8.2	7.8	95	93	94	95	31
May 11	7.6	4.5	6.0	7.6	78	79	83	90	27
$LSD_{0.05}$	*0.6*	*0.3*	*0.3*	*0.3*	*4.7*	*5.8*	*4.7*	*5.6*	*8.9*
$Prob(F)_{0.05}$	*0.0001*	*0.0001*	*0.0001*	*0.6951*	*.0001*	*0.0001*	*0.0001*	*0.0562*	*0.3179*

Effect of Method of Application on Turf Color and Seedhead Suppression Regardless of Application Timing or Herbicide

There was no significant treatment effect for application method on turf color at any evaluation interval (Table 2). Color ratings for both application methods ranged from 6.5 to 7.8 throughout the trial.

There was a significant treatment effect noted for the control of seedheads. The broadcast spray resulted in significantly higher levels of control throughout the entire trial. Broadcast spray applications resulted in control consistently above 90 % while the Wet-Blade application ranged from 76 % at the May evaluation to 87 % in August. This may be due to lack of herbicide dispersal directly under the two gear boxes on the Wet-Blade mower which allowed for some tall fescue flowering. The Wet-Blade applications did result in significantly higher general broadleaf weed control regardless of herbicide or timing of application at the August evaluation; however, these levels of control would be considered operationally unacceptable for either application method.

Table 2: Results and statistics for method of application

	Rating Date								
Application Method	May 21	June 13	July 6	August 16	May 21	June 13	July 6	August 16	August 16
	Turf color				Percent control of seedheads				Percent broadleaf weed control
Spray	6.5	6.6	7.0	7.8	97	92	93	95	18
Wet-Blade	6.6	6.5	7.2	7.7	76	79	84	87	40
$LSD_{0.05}$	*0.6*	*0.3*	*0.3*	*0.3*	*4.7*	*5.8*	*4.7*	*5.3*	*8.9*
$Prob(F)_{0.05}$	*0.8203*	*0.7034*	*0.2176*	*0.6951*	*0.0001*	*0.0001*	*0.0008*	*0.0048*	*0.0001*

<u>Effect of Herbicide on Turf Color and Seedhead Suppression Regardless of Timing or Method of Application</u>

The only significant difference, and subsequent treatment effect, between the 2 herbicide treatments and turf color occurred at the July evaluation (Table 3). This treatment effect was not maintained as there was no difference in turf color at the August evaluation. The only time of significant treatment effect for seedhead suppression occurred at the July evaluation as well and this effect, as with turf color, was not maintained through the August evaluation. Overall, there were no major differences between the 2 herbicides tested and their effect on either turf color or control of seedheads regardless of timing or method of application. General weed control, although not operationally acceptable for either herbicide treatment, was significantly higher at the August evaluation for the Stronghold + Arsenal treatment than the Plateau treatment. This can be attributed to the residual activity of Arsenal versus the low rate of Plateau used.

Table 3: Results and statistics for herbicide

	Rating Date								
Herbicide (rate per acre)	May 21	June 13	July 6	August 16	May 21	June 13	July 6	August 16	August 16
	Turf color				Percent control of seedheads				Percent broadleaf weed control
Stronghold (14 fl oz) + Arsenal (1.5 fl oz)	6.7	6.6	6.9	7.7	84	84	86	90	35
Plateau (4 fl oz)	6.4	6.5	7.3	7.8	88	87	92	92	23
$LSD_{0.05}$	*0.6*	*0.3*	*0.3*	*0.3*	*4.7*	*5.8*	*4.7*	*5.3*	*8.9*
$Prob(F)_{0.05}$	*0.26*	*0.70*	*0.05*	*0.69*	*0.06*	*0.24*	*0.02*	*0.28*	*0.01*

<u>Combined Effect of Timing of Application, Method of Application, and Herbicide on Turf Color and Seedhead Suppression</u>

Three of the April applications resulted in significantly lower color ratings than the May applications in the May evaluations (Table 4). This trend reversed itself in the June evaluations as all May applications had significantly lower color ratings than all the April applications. This is directly a function of timing of application; the April applications had recovered from treatment. This pattern continued through the June evaluations. The only statistical difference that occurred in terms of color ratings at the August evaluation was the April spray application of Plateau resulted in higher color ratings than the May spray applications of either Stronghold + Arsenal and Plateau.

May Wet-Blade applications, regardless of herbicide, were significantly lower in control of seedheads than all other applications at the May evaluation (Table 4). The April Wet-Blade application of Stronghold + Arsenal were significantly higher than the May Wet Blade applications of either herbicide but significantly lower than the April and May spray applications of either herbicide and the April Wet-Blade application of Plateau at the May evaluation. The April Wet-Blade application of Stronghold + Arsenal continued this trend through the trial as it resulted in significantly lower control levels in August than all treatments except the May Wet-Blade applications of either herbicide. April spray applications of either herbicide provided consistent control greater than 95 % throughout the study. The April Wet-Blade application of Plateau, along with the May spray applications of either herbicide, resulted in control levels greater than 90 % at the August evaluation.

Overall Efficacy

It appears that the WetBlade system has potential for plant growth regulator applications for seedhead suppression. The results of this trial indicate that applications of Plateau at 4 fl oz / ac through the WetBlade in April result in statistically similar control levels as those provided by broadcast spray applications of Plateau at 4 fl oz / ac or Stronghold at 14 fl oz / ac plus Arsenal at 1.5 fl oz / ac. May applications of either herbicide using the WetBlade were not as operationally effective as the April broadcast spray applications or the April WetBlade Plateau application indicating the importance of application timing for cool season grass seedhead suppression.

Table 4: Results and statistics for timing of application, method of application, and herbicide for tall fescue seedhead suppression

	Rating Date								
Treatment	May 21	June 13	July 6	Aug 16	May 21	June 13	July 6	Aug 16	Aug 16
	Turf color				Percent control of seedheads				% BLWC
April Spray Stronghold (14 fl oz) + Arsenal (1.5 fl oz)	5.0 d	8.8 a	8.0 a	7.8 ab	100 a	100 a	99 a	98 a	20 bc
April Spray Plateau (4 fl oz)	5.5 cd	8.5 a	8.3 a	8.3 a	100 a	98 ab	96 ab	98 a	13 c
April Wet-Blade Stronghold (14 fl oz) + Arsenal (1.5 fl oz)	6.5 bc	8.5 a	8.0 a	7.8 ab	81 b	83 cd	86 c	81 c	48 a
April Wet-Blade Plateau (4 fl oz)	5.0 d	8.5 a	8.5 a	7.5 b	96 a	90 abc	96 ab	95 ab	45 a
May Spray Stronghold (14 fl oz) + Arsenal (1.5 fl oz)	7.8 a	4.5 b	5.8 b	7.5 b	94 a	87 bcd	90 abc	92 ab	31 ab
May Spray Plateau (4 fl oz)	7.8 a	4.5 b	6.0 b	7.5 b	93 a	85 cd	88 bc	92 ab	10 c
May Wet-Blade Stronghold (14 fl oz) + Arsenal (1.5 fl oz)	7.5 ab	4.5 b	6.0 b	7.8 ab	61 c	66 e	69 b	88 abc	43 a
May Wet-Blade Plateau (4 fl oz)	7.3 ab	4.5 b	6.3 b	7.8 ab	65 c	76 de	86 c	85 bc	24 bc

WetBlade Applications for Broadleaf Weed Control in Cool Season Grasses

Introduction

Land managers who are actively involved in weed management have looked to new herbicide and herbicide application technologies as a means to improve weed control, increase labor efficacy, and decrease long term maintenance costs. One of these new application technologies, the WetBlade, allows for a combination of mowing and herbicide application in 1 machine. The herbicide solution is applied by a wiping or wicking principle as the mowing blades cut vegetation. This technology holds promise for land managers, especially roadside vegetation managers. The WetBlade could allow for a mowing cycle that has already been scheduled and an herbicide application to be performed in a low visible manner. The WetBlade has been tested previously in Kentucky for woody plant control but not for herbaceous broadleaf weeds. A trial was installed in 2007 to examine several herbicide treatments applied through the WetBlade system for Canada thistle and goldenrod control.

Methods and Materials

The trial was located in a tall fescue field at the University of Kentucky Agricultural Experiment Station Spindletop Farm in Lexington, KY. Previous management of the site was frequent mowing although no mowing was performed after the spring of 2007. The area was dominated by tall fescue. Dominate weeds included Canada thistle and tall goldenrod while amur honeysuckle, tall ironweed, and other species were present as well. Five herbicide treatments were evaluated in a randomized complete block design with 3 replications. Plots measured 20’ by 100’ with the WetBlade mower having an 8’ effective width. This left a 4’ running check for comparison purposes after 2 passes per plot. Plots were treated at 2.5 GPA on June 15, 2007. Data were collected 20 and 62 DAT and included visual percent control of Canada thistle, Canada goldenrod, and overall broadleaf weed control. Data were analyzed in ARM and treatment means were separated using Fisher’s LSD at $p = 0.05$.

Results

The initial evaluation of weed control 20 DAT showed promising and effective results. There were no differences between treatments for Canada thistle control, Canada goldenrod control, and overall weed control 20 DAT (Table 1). Canada thistle control ranged from 87 % to 92 %. Canada goldenrod control was not as high nor a s equally consistent as Canada thistle as control levels ranged from 43 % to 67 %. Overall weed control levels ranged from 72 % to 75 %. Control levels decreased dramatically from 20 DAT to 62 DAT for both Canada thistle and Canada goldenrod as well as for overall weed control. An unacceptable amount of resprouting was noted with Canada thistle across all treatments. Control levels ranged from 27 % with ForeFront R & P to 10 % with 2,4-D amine. There were no significant differences in Canada goldenrod control between treatments and control levels ranged from 24 % with the ForeFront R & P treatment and 10 % with the 2,4-D amine treatment. ForeFront R & P resulted in a significantly higher level of overall weed control than 2,4-D amine 62 DAT; however, control levels for all treatments were unacceptable.

The effective burndown of Canada thistle and the appearance on Canada goldenrod control 20 DAT showed much promise. The decrease in control levels may be indicative of a too high of application rate (i.e. 2.5 GPA). Further testing is needed to determine if a lower application rate (1 – 1.5 GPA or less) would prove to be effective.

Table 1: Treatments and results for WetBlade applications on broadleaf weed control

Treatment	Rate per acre	v/v rate	Percent Control					
			20 DAT			62 DAT		
			Canada thistle	Canada goldenrod	Overall	Canada thistle	Canada goldenrod	Overall
Milestone VM	7 fl oz	2.19 %	90 a	53 a	72 a	22 ab	18 a	20 ab
ForeFront R&P	42 fl oz	13.1 %	88 a	67 a	73 a	27 a	24 a	25 a
2,4-D amine	64 fl oz	20 %	87 a	67 a	72 a	10 b	10 a	10 b
Garlon 3A	85 fl oz	26.6 %	88 a	63 a	75 a	20 ab	20 a	20 ab
Banvel	24 fl oz	7.5 %	92 a	43 a	72 a	17 ab	17 a	17 ab

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

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

Introduction

Musk thistle is a biennial or long –lived annual 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 to visually estimate percent control of musk thistle rosettes. 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 high degree of variance in control levels. Control levels for this treatment ranged from 50 % to 90 % by replication (Figure 1). This variance decreased as the rate of Milestone VM Plus increased. This shows that more consistent control of musk thistle rosettes is seen with Milestone VM Plus if the rate is kept at 6 pt / ac or above.

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
Milestone VM Plus	4 pt	Milestone VM + Garlon 3A	3 fl oz + 21 fl oz	74 b
Milestone VM Plus	6 pt	Milestone VM + Garlon 3A	5 fl oz + 32 fl oz	89 ab
Milestone VM Plus	8 pt	Milestone VM + Garlon 3A	6.4 fl oz + 42 fl oz	93 a
Milestone VM	5 fl oz	n/a	n/a	90 a
Garlon 3A	32 fl oz	n/a	n/a	35 c
2,4-D amine + Telar	32 fl oz + 0.25 oz	n/a	n/a	31 c
Untreated	n/a	n/a	n/a	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.

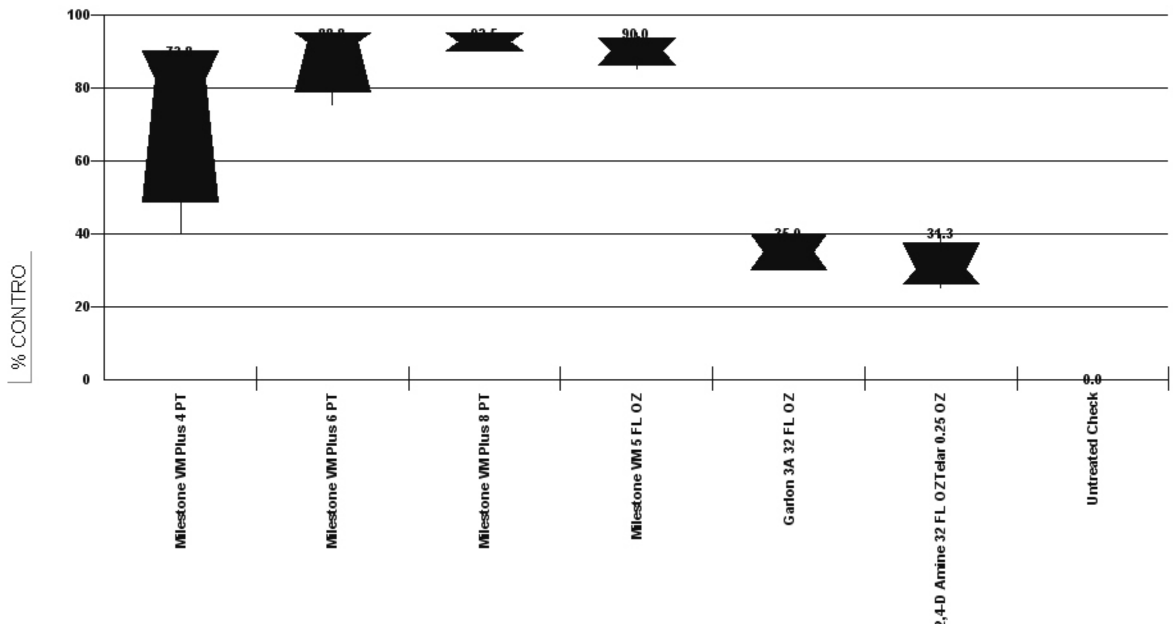

Figure 1: Box Whisker Plot for Treatment Variance

Large Plot Research for Milestone VM and Milestone VM Plus

Introduction

Small plot research with Milestone VM has occurred every growing season in Kentucky since 2005. These plots usually measured 10' by 30' and collected efficacy ratings for one or two specific species. These species included musk thistle, Canada thistle, horsenettle, tall ironweed, and a few others. These small plot replicated trials can provide useful information to land managers on short and long term control of specific species; however, no trials have been installed in Kentucky examining Milestone VM efficacy in large plot replicated trials. A study was installed in the summer of 2007 to evaluate Milestone VM and Milestone VM plus in combination with other herbicides for general weed control and long term effects on Kentucky roadsides. Milestone VM Plus is a new product from Dow AgroSciences that combines 0.1 lb a.i. (2.22 % v/v) of aminopyralid and 1 lb a.i. (16.22 % v/v) of triclopyr per gallon.

Methods and Materials

The study is located in Jefferson County, Kentucky on the southbound shoulder of the Gene Snyder Expressway (I-265) north of the I-64 / I-265 interchange. Predominant vegetation included tall fescue, johnsongrass, tall goldenrod, tall ironweed, and sticktights. Species not occurring as frequently included musk thistle, woody plants such as Bradford pear, green ash, and amur honeysuckle, Canada thistle, and common lambsquarters. The area is not in the active mowing zone for the Kentucky Transportation Cabinet and therefore is mowed once in the spring and again the late summer early fall. Seven treatments were evaluated in a randomized complete block design with 3 replications with plots measuring 40' by 150'. Treatments were applied on August 9, 2007 using a CO_2 powered sprayed mounted on an ATV with 2 TeeJet® BoomJet boomless nozzles (size 25) mounted next to each other with an overall effective spray swath of 20'. All treatments included Outrider at 0.5 oz / ac for johnsongrass suppression. Plots were evaluated 40 DAT for tall ironweed, tall goldenrod, and Bradford pear burndown / necrosis as well as overall broadleaf (herbaceous and woody) weed necrosis. Data were analyzed in ARM and treatment means were separated using Fisher's LSD at $p = 0.05$.

Results

There were no statistical differences in tall ironweed control for any treatments evaluated 40 DAT. (Table 1). Control levels ranged from 78 % with Milestone VM at 7 fl oz plus Garlon 3A at 16 fl oz to 57 for Milestone VM at 7 fl oz. Milestone VM at 7 fl oz plus Garlon 3A at 16 fl oz resulted in significantly higher control of tall goldenrod than all other treatments other than Milestone VM at 7 fl oz plus 2,4-D amine at 32 fl oz. Control levels for all treatments for Canada goldenrod were unremarkable at 40 DAT as treatment means ranged from 20 % for Milestone VM at 7 fl oz and Milestone at 7 fl oz plus Garlon 3A at 32 fl oz to 35 % for Milestone VM at 7 fl oz plus Garlon 3A at 16 fl oz.

Treatments that included 2,4-D amine and the Milestone at 7 fl oz plus Garlon 3A at 16 fl oz resulted in significantly higher necrosis of Bradford pear than Milestone VM at 7 fl oz 40 DAT. This indicates Milestone VM's inability to control certain woody plants, like Bradford pear, alone and the need to incorporate effective woody plant herbicides, like triclopyr, to perform herbaceous and woody plant weed control with one treatment. Milestone VM Plus at 6 pt resulted in operationally higher control levels of Bradford pear than Milestone VM at 7 fl oz. There were no statistical differences across all treatments for overall weed control at 40 DAT. Treatments that included triclopyr or 2,4-D amine did result in operationally higher necrosis levels than Milestone VM at 7 fl oz. Treatments that included triclopyr or 2,4-D had efficacy ratings ranging from 65 % for Milestone VM at 7 fl oz plus Garlon 3A at 16 fl oz to 55 % for Milestone VM at 76 fl oz plus Garlon 3A at 32 fl oz while Milestone VM alone at 7 fl oz had an efficacy rating of 42 % 40 DAT.

The trial will be evaluated in the summer of 2008 for overall weed control in an attempt to ascertain long term efficacy of aminopyralid in combination with triclopyr or 2,4-D amine in an operational setting.

Table 1: Treatments and results for Milestone VM and Milestone VM Plus large plot trial

Treatment	Rate per acre	Percent Necrosis / Burndown 40 DAT			
		Tall ironweed	Tall Goldenrod	Bradford pear	Overall weed control
Milestone VM	7 fl oz	57 a	20 b	0 b	42 a
Milestone VM Plus**	6 pt	68 a	22 b	32 ab	57 a
Milestone VM + Garlon 3A	7 fl oz + 32 fl oz	68 a	20 b	33 ab	55 a
Milestone VM + Garlon 3A	7 fl oz + 16 fl oz	78 a	35 a	67 a	65 a
Milestone VM + 2,4-D amine	7 fl oz + 32 fl oz	65 a	28 ab	55 a	60 a
2,4-D amine	64 fl oz	73 a	20 b	48 a	60 a

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 Outrider at 0.5 oz / ac and a NIS at 0.25 % v/v.

**Treatment is equivalent to Milestone VM at 5 fl oz / ac plus Garlon 3A at 32 fl oz / ac.

Broadleaf Weed Control with Milestone® VM and Garlon® 3A

Introduction

Milestone VM, a relatively new compound introduced by Dow AgroSciences for non-crop and invasive vegetation control, has become an effective herbicide option for roadside managers. Milestone VM provides a fairly wide spectrum of control and has residual activity to control some undesirable broadleaf species. Even though Milestone has a fairly wide spectrum of control, it is somewhat slow to kill on certain species and ineffective on others. This can be seen with its rangeland and pasture counterpart, Milestone and ForeFront® R&P. Milestone is the pasture equivalent to Milestone VM while ForeFront R&P is an aminopyralid plus 2,4-D amine combination labeled for pasture applications. Milestone has been shown to be weak on certain species such as dandelion and buckhorn plantain while the combination product, ForeFront R&P, is quite effective on these species indicating the benefit of adding another herbicide such as 2,4-D to aminopyralid to broaden its spectrum. Dow AgroSciences has introduced such a product into the non-crop and invasive species market, Milestone VM Plus. Milestone VM Plus is a combination of aminopyralid (0.1 lb a.i. / gal) and triclopyr (1.0 lb a.i. / gal). A 6 pt / ac rate of Milestone VM Plus is equivalent to 5 fl oz / ac of Milestone VM combined with Garlon 3A at 32 fl oz. The addition of triclopyr to aminopyralid should increase efficacy on species such as poison hemlock and broaden the weed control spectrum in one product. A trial was installed in the spring of 2007 to evaluate several rate combinations of Milestone VM and Garlon 3A for biennial and general broadleaf weed control.

Methods and Materials

The trial is located in Frankfort, KY at the intersection of U.S. 60 and S.R. 127. The area was previously a managed wildlife habitat area but was released from management. Invasive herbaceous plants such as johnsongrass, common teasel, and poison hemlock established themselves shortly thereafter. Desirable species included a scattering of tall fescue and Kentucky bluegrass. Nine treatments were evaluated in a randomized complete block design with 4 replications. Plots, measuring 10’ by 30’, were treated on April 17, 2007 using a CO2 powered sprayer mound on an ATV. The entire study area was treated with Outrider at 0.75 oz / ac on May 10, 2007 in an attempt to suppress the johnsongrass in the area. Data were collected 14, 30, 58, and 87 DAT for visual percent control of common teasel, poison hemlock, and general broadleaf weed control. Data were analyzed in ARM software and treatment means were separated using Fisher’s LSD at p = 0.05.

Results

<u>Common teasel</u>

2,4-D amine at 64 fl oz resulted in significantly lower common teasel control 14 DAT than all other treatments except Milestone VM at 5 fl oz plus Plateau at 3 fl oz (Table 1). There were no statistical differences between Milestone VM alone at either rate and any Milestone VM in combination with Garlon 3A treatments or the Milestone VM plus Plateau treatment 14 DAT. At 30 DAT, there were no statistical differences between the Milestone VM alone treatments and the Milestone VM plus Garlon 3A treatments. 2,4-D amine at 64 fl oz resulted in significantly lower control than all treatments except Milestone VM at 7 fl oz plus Garlon 3A at 32 fl oz and Milestone VM at 5 fl oz and Garlon 3A at 16 fl oz. There were no statistical differences for common teasel control across all treatments 58 DAT. Control levels ranged from 96% to 98%. No data were taken 87 DAT as all treatments effectively controlled common teasel.

<u>Poison hemlock</u>

All treatments were statistically similar for poison hemlock control 14 DAT except for 24,D amine at 64 fl oz, which was significantly lower (53%) than Milestone VM at 5 fl oz plus Garlon 3A at 16 fl oz (73%) (Table 1). This difference did not persist 30 DAT and beyond. Milestone VM at 7 fl oz resulted in significantly lower control of poison hemlock then all treatments except Milestone VM at 5 fl oz plus Garlon 3A at 16 fl oz and 2,4-D amine at 64 fl oz 30 DAT. Milestone VM at 5 fl oz showed significantly lower control than all of the Milestone VM plus Garlon 3A treatments and the Milestone VM plus 2,4-D amine treatment 58 DAT. This is indicative of the benefit of combining Milestone VM with triclopyr or 2,4-D amine to aid in speed of or overall efficacy or possibly broaden the weed control spectrum. This difference did not persist; however, as there were no statistical differences between any treatment for poison hemlock control 87 DAT.

<u>General broadleaf weed control</u>

Milestone VM at 5 fl oz resulted in significantly lower control overall for broadleaf weeds than all treatments except 2,4-D amine at 64 fl oz 14 DAT (Table 1). Milestone VM alone at 5 fl oz began to ‘catch up’ with other treatments 30 DAT as it was significantly lower only to Milestone VM at 5 fl oz plus Garlon 3A at 32 fl oz. Milestone VM alone at 5 fl oz never realized the same level of overall weed control as the Milestone VM / Garlon 3A tank mixes and 2,4-D amine at 64 fl oz through 58 DAT as it was significantly lower than all treatments except Milestone VM at 7 fl oz and Milestone VM at 5 fl oz plus Plateau at 3 fl oz at this evaluation interval.

<u>2008 Evaluation</u>

The trial will be evaluated in the summer of 2008 to rate the treatments for weed control and cool season grass release.

Table 1: Treatments and results for biennial and general weed control with Milestone VM and Garlon 3A

Treatment	Rate per acre	Percent Control									
		Common Teasel			Poison hemlock				Broadleaf weed control		
		14 DAT	30 DAT	58 DAT	14 DAT	30 DAT	58 DAT	87 DAT	14 DAT	30 DAT	58 DAT
Milestone VM	5 fl oz	65 ab	92 a	96 a	56 ab	73 ab	76 b	95 a	50 c	79 b	81 b
Milestone VM	7 fl oz	69 ab	92 a	97 a	58 ab	70 c	86 ab	95 a	64 ab	86 ab	90 ab
Milestone VM + Garlon 3A	5 fl oz + 32 fl oz	68 ab	93 a	97 a	63 ab	95 a	95 a	95 a	66 ab	96 a	95 a
Milestone VM + Garlon 3A	7 fl oz + 32 fl oz	74 a	89 ab	96 a	68 ab	88 ab	95 a	95 a	74 a	89 ab	95 a
Milestone VM + Garlon 3A	5 fl oz + 16 fl oz	70 ab	86 ab	96 a	73 a	85 abc	95 a	95 a	73 a	90 ab	95 a
Milestone VM + Garlon 3A	7 fl oz + 16 fl oz	71 a	91 a	96 a	65 ab	88 ab	95 a	95 a	69 a	90 ab	95 a
Milestone VM + 2,4-D amine	5 fl oz + 32 fl oz	71 a	97 a	97 a	70 ab	88 ab	95 a	95 a	70 a	92 ab	95 a
Milestone VM + Plateau	5 fl oz + 3 fl oz	61 bc	97 a	98 a	62 ab	73 bc	88 ab	95 a	61 abc	79 b	90 ab
2,4-D amine	64 fl oz	53 c	75 b	96 a	53 b	80 abc	95 a	95 a	55 bc	80 b	95 a

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.

Comparison of 2,4-D + Edict, Milestone, Overdrive, and Transline for Canada Thistle (Cirsium arvense L.) Control

Introduction

Canada thistle is a problematic invasive weed species along Kentucky highways. Mowing infestations can increase densities as this perennial species can reproduce via seed as well as rhizomatous sprouts. Chemical control options in the past have included picloram, clopyralid, and dicamba with results being average to moderately good at best. Introduction of Milestone VM (a.i. aminopyralid) in 2006 provided another control option for this particular species. Edict (a.i. pyraflufen) has been introduced in the non-crop market from the cereal market as a possible tank mix partner to increase efficacy of compounds such as 2,4-D. A study was conducted in 2006 to compare industry standards to the new introductions for Canada thistle control.

Methods and Materials

The study was located at the UK Spindletop Research Farm in Lexington, KY. Six (6) chemical treatments and one (1) untreated check were evaluated in a randomized complete block design with four (4) replications (Table 1). Evaluation of the trial 1 YAT showed that the 4th replication had been lost and therefore only the first 3 were used in analysis. Treatments included 2,4-D + Edict, Milestone VM, Overdrive (a.i. dicamba + diflufenzopyr), and Transline (a.i. clopyralid). The study was installed on May 15, 2006 in a tall fescue stand with an even distribution of Canada thistle. Canada thistle plants were either pre or post bolt with no visible flower parts on any plant. Application volume was 25 GPA and all treatments included Activator 90 surfactant at 0.25 % v/v. Visual percent control ratings were taken at 21, 44, 81, and 114 DAT. Canada thistle counts were taken 364 DAT using a 1 m^2 sampling square and 3 random samples per plot. Average Canada thistle counts per plot were then compared to the average untreated plot in the same replication and transformed into percent control with the following formula:

*Percent control = (1 – (treated response / untreated response)) * 100.*

Data were analyzed using ARM software and treatment means were compared using Fisher's LSD at p = 0.05.

Results and Discussion

Milestone VM provided higher levels of control at all evaluation dates than all other treatments (Table 1). Milestone VM at 7 fl oz / ac resulted in 75 % control at 21 DAT, increased to ~ 95 % control at 44 and 81 DAT, then decreased to 86 % control 114 DAT. Milestone VM resulted in 93 % control as compared to the untreated 364 DAT. Transline at 10.67 fl oz / ac (2/3 pt / ac) provided the second highest level of control at any given evaluation throughout the study with its highest level of control coming at 81 DAT. Transline maintained satisfactory control levels through 364 DAT.

Overdrive at 6 oz / ac provided marginal control with its highest level of suppression being 60 % at 81 DAT. Past research has shown Overdrive to be effective at controlling Canada thistle at this rate and at 4 oz / ac when tank mixed with Transline[1].

The addition of Edict at 1.4 fl oz / ac did not appear to increase efficacy of 2,4-D amine at either rate tested for Canada thistle control. 2,4-D alone at 1.5 qt / ac provided similar control levels to that of 2,4-D at 1.5 qt .ac + Edict at 1.4 fl oz / ac.

Table 1: Summary Statistics for 2006 Canada Thistle Trial

Treatment	Rate per acre	Percent Control				
		21 DAT	44 DAT	81 DAT	114 DAT	364 DAT
2,4 D amine + Edict	1 qt + 1.4 fl oz	42 cd	38 c	17 e	33 bc	35 b
2,4-D amine + Edict	1.5 qt + 1.4 fl oz	53 bc	67 b	33 de	25 c	43 b
2,4-D amine	1.5 qt	53 bc	55 bc	50 cd	33 bc	73 ab
Milestone VM	7 fl oz	77 a	97 a	95 a	85 a	93 a
Overdrive	6 oz	40 d	47 bc	63 bc	45 bc	38 b
Transline	10.67 fl oz	57 b	69 b	85 ab	58 ab	75 ab
Untreated Check		0	0	0	0	0

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

[1] *Blair, M.P. and Witt, W.W. 2004. Noncrop and Industrial Weed Science Annual Research Report.*

Control of Amur honeysuckle (Lonceria mackaii L.) Using Different 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 repsrout 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. Due to its ability to survive in a wide array of site conditions, there are several herbicide application techniques available for control. Several trials were installed in 2006 and 2007 to screen 3 different application methods and herbicide combinations for amur honeysuckle control. This includes a cut surface trial combined with a basal or foliar application, a cut surface alone trial, a low volume foliar trial, and a chemical side trimming trial. The following is a summary of the 4 trials.

<u>Cut surface followed by basal or foliar treatments</u>

A trial was installed in the summer of 2006 to examine the efficacy of several cut surface herbicide treatments on amur honeysuckle. The site was located at the intersection of I-275 and Three Mile Road in Campbell County, KY. Slopes on the site ranged from 20 % to 45 %. Initial cutting occurred in late July 2006 at 4 – 8 inches to allow for a follow up cutting at application. After the initial cutting, it was realized that several young (< 1 year old) amur honeysuckle saplings were left standing across the entire site. The treatment list was then altered to pair 6 cut surface treatments with different basal or foliar applications to treat the saplings left (Table 1). Eighteen plots were marked using rebar to mark corners and string to delineate plot edges and plots measured 15' X 15'. The trial was installed as a randomized complete block design with 6 treatments and 3 replications. Amur honeysuckle stumps were cut again August 19, 2006 and treated with cut surface treatments. Young saplings were treated at the same time using a hand held sprayer. Basal treatments were applied to the lower 12-18 inches and foliar treatments were applied at operational standards. Efficacy was not measured in 2006 due to the application being so late in the growing season. Plots were evaluated in July 2007 for percent control of stump sprouting and percent control of saplings. Data were analyzed using ARM software and treatment means were compared using Fisher's LSD at p = 0.05.

Results

Table 1: Treatments and Results of Northern Kentucky Amur Honeysuckle Cut Surface Trial

<table>
<tr><th rowspan="2">Treatment</th><th rowspan="2">Herbicide(s)</th><th rowspan="2">Rate</th><th rowspan="2">Application Method</th><th colspan="2">325 DAT</th></tr>
<tr><th>Percent control sprouts</th><th>Percent control saplings</th></tr>
<tr><td>1</td><td>Tordon RTU</td><td>100 % v/v</td><td>Cut surface</td><td>92 a</td><td>62 a</td></tr>
<tr><td rowspan="2">2</td><td>Roundup Pro</td><td>25 % v/v</td><td>Cut surface</td><td rowspan="2">63 a</td><td rowspan="2">83 a</td></tr>
<tr><td>Roundup Pro</td><td>2 % v/v</td><td>Foliar</td></tr>
<tr><td rowspan="2">3</td><td>Arsenal</td><td>20 % v/v</td><td>Cut surface</td><td rowspan="2">97 a</td><td rowspan="2">97 a</td></tr>
<tr><td>Arsenal + NIS</td><td>2 % v/v</td><td>Foliar</td></tr>
<tr><td rowspan="2">4</td><td>Garlon 4 + HyGrade</td><td>20 % v/v + 80 % v/v</td><td>Cut surface</td><td rowspan="2">73 a</td><td rowspan="2">93 a</td></tr>
<tr><td>Garlon 4 + HyGrade</td><td>20 % v/v + 80 % v/v</td><td>Basal</td></tr>
<tr><td rowspan="2">5</td><td>Tordon RTU</td><td>100 % v/v</td><td>Cut surface</td><td rowspan="2">79 a</td><td rowspan="2">72 a</td></tr>
<tr><td>Garlon 3A + Escort + NIS</td><td>2 qt/ac + 0.5 oz/ac</td><td>Foliar</td></tr>
<tr><td>6</td><td>Roundup Pro + Arsenal</td><td>49 % v/v + 1.5 % v/v</td><td>Cut surface</td><td>83 a</td><td>77 a</td></tr>
</table>

Note: Treatment means in the same column followed by the same letter are not significantly different using Fisher's LSD at p= 0.05. All mixes contain water except RTU or Garlon 4.

Arsenal at 20 % v/v provided the highest level of control of stump sprouting of bush honeysuckle at 97 %. This was not statistically higher; however, than the lowest level of control of 63 % of Roundup Pro at 25 % v/v. A foliar application of Arsenal at 2 % v/v after stumps were treated with the 20 % Arsenal solution resulted in the highest level of control of amur honeysuckle saplings at 97 %. This was not significantly higher than the lowest control levels resulting from no treatment of the saplings (treatments 1 and 6). A high degree of variability was noted in the results in this trial. This may be due site conditions or root grafting between saplings and cut stumps influencing control levels.

<u>Cut surface alone trial</u>

A trial was installed in the late spring of 2007 to examine cut surface applications on bush honeysuckle. This was a result of the variance in control noticed in the northern Kentucky trial described above. 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 and 109 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
Garlon 4 + Ax-it Oil	15 % + 85 %	87 a	91 a
Stalker + Ax-it Oil	3 % + 97 %	86 a	64 b
Stalker + HyGrade Oil	3 % + 97 %	91 a	91 a
Garlon 4 + Stalker + Ax-it Oil	15 % + 3 % + 82 %	100 a	100 a
Tordon RTU	100 %	92 a	100 a
Accord + water	50 % + 50 %	91 a	98 a
Cut	n/a	4 b	24 c

Note: Treatment means in the same 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 at 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. This trial will be reevaluated in the summer of 2008 for 1 YAT information.

<u>Foliar application trial</u>

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. Twenty one plots were marked measuring 15' X 30'. Six herbicide treatments and 1 untreated check were installed in a randomized complete block design with 3 replications (Table 3). Plots 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 was evaluated at 48 and 86 DAT. Data were analyzed using ARM and Fisher's LSD was used for treatment means separation at p = 0.05.

Results

Table 3: Treatments and Results for Amur Honeysuckle Foliar Trial

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

Note: Treatment means in the same 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 3). 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 trial will be reevaluated in the spring of 2008 to obtain 1 YAT ratings. Further testing is also needed in the rate response of amur honeysuckle to lower rates of Escort alone and in combination with other herbicides.

<u>Chemical side trimming trial</u>

Due to its propensity to occur along roadsides, a trial was installed in the summer of 2008 to examine the efficacy of several herbicides as a chemical side trim option for amur honeysuckle. The study was located at Spindletop Research Station in Lexington, KY in an approximately 4 acre woodlot dominated by amur honeysuckle in the understory. Amur honeysuckle, ranging from 10 to 20 feet in height, dominated the understory along the perimeter of the woodlot which allowed for realistic side trim application. Seven herbicide treatments were evaluated in a randomized complete block design with 3 replications (Table 4). Plots were linear, measuring 50' in length, and were treated with a boomless tip mounted on an ATV with a 20' extension which allowed for a 15' effective spray swath. Plots were treated on July 3, 2007 at 30 GPA. Percent necrosis and defoliation were recorded 48 and 86 DAT for the area treated, not the entire plant. Data were analyzed using ARM and Fisher's LSD for treatment means separation at p = 0.05.

Results

Table 4: Treatments and Results for the Spindletop Chemical Side Trim Trial

Treatment	Rate per acre	Percent Necrosis / Defoliation	
		48 DAT	86 DAT
Krenite	3 gal	5 c	10 d
Krenite + Escort	3 gal + 1 oz	90 a	83 a
Krenite + Arsenal	3 gal + 12 fl oz	32 b	25 cd
Escort + Arsenal	1 oz + 12 fl oz	32 b	38 bc
Escort	1 oz	50 b	53 b
Arsenal	12 fl oz	3 c	12 d
Milestone	7 fl oz	0 c	5 d

Note: Treatment means in the same 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.

Krenite in combination with Escort resulted in the highest level of brownout / defoliation at 48 DAT with 90 %. This was significantly higher than all other treatments. This level of control decreased only slightly from 48 to 86 DAT. Escort alone resulted in 50 % burndown at 48 DAT which was significantly higher than Krenite alone, Arsenal alone, and Milestone. Escort alone maintained this level of control from 48 to 86 DAT. The results for Krenite alone are to be expected. This trial will be reevaluated in the spring of 2008 to obtain information of 1 YAT.

Imazapyr Combinations for Utility Brush Control

Introduction

Utility and other non-crop vegetation managers rely on herbicides as an effective tool to properly 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 is located on a 3-year-old transmission line managed by East Kentucky Power near Clay City, Kentucky. Predominant woody species include 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. 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

Results presented here are 35 DAT. This information is useful for initial burndown but will have little importance for woody plant control 1 YAT.

<u>Yellow Poplar</u>

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.

<u>Red Maple</u>

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

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 on 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.

2008 Data

The trial will be evaluated in the summer of 2008 for 1 YAT data. This information will prove more useful for the overall efficacy levels of the treatments.

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

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 + 4 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.