

**2004 Report on
Roadside Vegetation Management
Equipment & Technology**

Project 2156: Section 9

By

Craig Evans
Extension Associate

Doug Montgomery
Extension Associate

and

Dr. Dennis Martin
Extension Turfgrass Specialist

Oklahoma State University
360 Agriculture Hall
Stillwater, OK 74078-6027

The contents of this report reflect the views of the authors who are responsible for the facts and the accuracy of the data presented herein. The contents do not necessarily reflect the views of the Oklahoma Department of Transportation or the Federal Highway Administration. This report does not constitute a standard, specification or regulation.

Oklahoma State University, in compliance with Title VI and VII of the Civil Rights Act of 1964, Executive Order 11246 as amended, Title IX of the Education Amendments of 1972, Americans with Disabilities Act of 1990, and other federal laws and regulations, does not discriminate on the basis of race, color, national origin, sex, age, religion, disability, or status as a veteran in any of its policies, practices or procedures. This includes but is not limited to admissions, employment, financial aid, and educational services.

Issued in furtherance of Cooperative Extension work, acts of May 8 and June 30, 1914, in cooperation with the U.S. Department of Agriculture, Director of Oklahoma Cooperative Extension Service, Oklahoma State University, Stillwater, Oklahoma. This publication is printed and issued by Oklahoma State University as authorized by the Dean of the Division of Agricultural Sciences and Natural Resources. 1/2004.

TABLE OF CONTENTS

<u>Section</u>	<u>Page</u>
1.0 Introduction.....	1
2.0 Herbicide Program Mesonet Weather Support Technologies	1
3.0 Mesonet Summary with Recommendations	2
4.0 ODAFF LCMS/MS Herbicide Program Support Technologies.....	2
5.0 LCMS/MS Summary with Recommendations	3
6.0 Diamond Mowers Wet Blade.....	3
7.0 Diamond Mowers Wet Blade Summary with Recommendations	4
8.0 Literature Cited	4

List of Figures

Figure 1. Mesonet home page image.	5
Figure 2. Image of Oklahoma Agweather page.	6
Figure 3. Image of Agweather page listing weather options.	7
Figure 4. Agweather image shown when “Forecasts” is selected under “Weather”.	8
Figure 5. Image shown after “MOS 60 Hour Forecast” option is selected.....	9
Figure 6. Image shown after a geographical site is selected from Figure 5.....	10

1.0 Introduction

The objective of this report is to provide Oklahoma Department of Transportation (ODOT) personnel with recommendations concerning the utilization of new technologies that will enable more effective management of Oklahoma roadside right-of-ways. Two new technologies that ODOT has access to and will benefit from are 1.) The Oklahoma Mesonet System and 2.) the Oklahoma Department of Agriculture, Food and Forestry's (ODAFF) acquisition of a Liquid Chromatography, Mass Spectrometry / Mass Spectrometry (LCMS/MS) unit. Additionally, we wish to notify ODOT of the sale of formerly recommended equipment technology, and the resulting new equipment name and new distributor.

2.0 Herbicide Program Mesonet Weather Support Technologies

The Mesonet is a network of 110 automated environmental monitoring stations. Each of Oklahoma's 77 counties have at least one Mesonet station located within each county. Environmental conditions are measured and every five minutes data is assembled as site observations. These bundles of observations are sent to a central data collection facility every fifteen minutes, twenty-four hours each day throughout the year. This information can be very useful to ODOT roadside vegetation managers as a decision making tool. Off-target drift of herbicides is an ongoing concern in the application of RVM herbicides. One of the considerations that applicators must take into account is whether or not environmental conditions exist that significantly increase the probability of off-target herbicide movement.

Wind speed and direction are two factors that affect herbicide application. Other environmental conditions can exist that can increase the chances of spray drift. Accurate forecast information concerning winds and dispersion potential can be retrieved from the Oklahoma Mesonet System.

Figure one shows the actual web page (www.mesonet.org/) that an ODOT manager would access to begin retrieval of wind speed, wind direction and dispersion information. In Figure 1, the black horizontal arrow indicates the location of the Agweather icon that a manager would select. Figure 2 is the web page displayed after selecting Agweather. The black vertical arrow denotes the key to accessing weather data from Agweather. Figure 3 displays the "drop down" options once weather has been selected. Next, the "Forecasts" option (indicated by the black arrow) would be selected. Figure 4 depicts the resulting web page once "Forecasts" has been selected. At this page the "MOS 60 Hour Forecast" would be selected. Figure 5 is the image shown after "MOS 60 Hour Forecast" option is selected. Each of the locations within the black circle are "hot" (hypertext linked) and can be selected for viewing. Figure 6 shows the data generated when Gage, OK is selected. Specific forecasted information of interest during herbicide application includes Wind Direction, Wind Speed, Dispersion Condition and Downwind Pollution Index on 3-hour intervals. From the data presented in Figure 6 regarding projected wind speeds, favorable conditions for herbicide application are not expected until approximately 50 hours later if ODOT's wind speed policy of herbicide applications below 10 mph is followed.

3.0 Mesonet-Summary with Recommendations

It is the recommendation of the OSU RVM program that ODOT personnel, along with OSU work with the Oklahoma Mesonet system to utilize the Mesonet for support of the RVM program. Through the utilization of the Agweather product, ODOT personnel can benefit from the features allowing a 60 hour forecast of wind speeds, wind direction, dispersion conditions and downwind pollution indexes. The benefits of the system include its use as a tool that managers can use to more accurately determine when and where RVM herbicides can safely be applied. This will allow more effective scheduling of work and spray applications if forecast data is accessible to county personnel. Officials representing Mesonet have expressed an interest in the possible development of Mesonet products tailored for use by ODOT for its specific needs. The OSU RVM program will continue to interact with Mesonet officials to further develop support programs that will assist ODOT decision making concerning safe and effective herbicide applications. While ODOT managers are encouraged to access Mesonet information to assist in decision making, this information will not replace applicator assessment (using hand held wind speed indicators) of environmental conditions at the site of herbicide application before and during a specific application. While not all ODOT facilities are currently capable of accessing the Mesonet system, we plan to overview the capabilities of the current Mesonet system in the late winter 2005 ODOT Pesticide Applicator Continuing Education Workshops.

4.0 ODAFF LCMS/MS Herbicide Program Support Technologies

The Oklahoma Department of Agriculture, Food and Forestry (ODAFF) is the state governmental agency charged with investigation of herbicide misuse. In the event a complaint is lodged with ODAFF accusing a particular party with off-target injury of crops or ornamental plantings, the basic protocol consists of assignment of a file number, assignment of a field inspector, and assignment of a program manager. It is the field inspector who travels to the complaint site and makes an assessment that is forwarded on to the program manager. The program manager makes a determination based upon information provided by the concerned parties and the assessment made by the field inspector. This format of complaint investigation has been dependant upon the field inspector's ability to make observation without the benefit of technologies that give quantitative evidence regarding the presence or absence of the herbicide/metabolites in plant tissue or surrounding soils. The acquisition of a Finnigan™ LCQ™Deca XP MAX mass spectrometry unit (LCMS/MS) should allow ODAFF to make herbicide drift judgments based upon quantitative scientific analysis instead of speculation and conjecture.

The identification of herbicides and or metabolites through the use of mass spectrometry has been a developing research field that has come to the point where scientific equipment such as the LCMS/MS can identify the molecules of herbicides or herbicide metabolites by atomic weight (Budde, 2004). In the event that ODOT herbicide applications were called into question regarding off-target crop or ornamental damage, ODAFF will have the capability to take both tissue and soil samples from the site and analyze the samples to see if herbicide markers implicate herbicide applications. Field inspectors will still need to be trained in the proper acquisition of samples from the site for analysis with LCMS/MS at ODAFF labs. The necessary training required for ODAFF employees operating the LCMS/MS unit will not be completed

until mid-spring 2005. Consequently, the LCMS/MS unit will not be available for herbicide and residue/metabolite detection until May-June. 2005.

5.0 ODAFF LCMS/MS – Summary with Recommendations

In the event ODOT herbicide applications are a potential cause for filing of a formal herbicide injury complaint, the OSU RVM program recommends that testing by ODAFF's Finnigan™ LCQ™ Deca XP MAX mass spectrometry unit (LCMS/MS) be requested by ODOT representatives. While utilization of a LCMS/MS unit is an advancement for ODAFF, the need for properly trained field inspectors responsible for sample collection remains. A properly trained inspector should be able to perform sample gathering in a fashion that respects "chain of custody" and understands how to take both plant and soil samples that can reflect herbicide presence in a graduated format from the point of application across terrain to the point of claimed off-target herbicide deposition.

OSU RVM program personnel will continue to work with ODAFF to review complaint inspection protocols and make recommendations where procedural weaknesses are found.

6.0 Diamond Mowers Inc. Wet Blade

"Wet blade technology" was reported upon in the 2001 Annual ODOT Report on Roadside Vegetation Management Equipment Report. Since that report, Diamond Mowers Inc. has purchased the technology rights and now produces this equipment. "Wet blade technology" continues to hold promise for use by ODOT in selected areas where brush control is needed. Initial contacts with the Oklahoma distributor, Green Country AG & Lawn Equipment, indicate the distributor is interested in establishing demonstration sites for ODOT evaluation. The contact person and address/phone number to which correspondence or communication should be directed to is as follows:

Manufacturer

Diamond Mowers Inc.
27134 Parklane Dr.
Sioux Falls, SD 57106
Office: 605-368-5865
Fax: 605-498-1222

Distributor

Green Country AG & Lawn Equipment
15615 E. Pine St.
Tulsa, OK 74116
Office: 918-437-3193
Fax: 918-437-0667

7.0 Diamond Mowers Inc. Wet Blade - Summary with Recommendations

As reported in 2001, as a part of Joint Project 2156 Section 6, our recommendations to ODOT are that if interested ODOT personnel would like to see one of these units demonstrated, they should contact the RVM Team at OSU to request a demonstration to be performed. We will then make the contacts/arrangements for conducting a demonstration as equipment availability allows. The RVM Team will monitor/assess the performance of the mowing/chemical application within the demonstration area and report the results to ODOT.

8.0 Literature Cited

Budde, William L. 2004. Analytical Mass Spectrometry of Herbicides. *Mass Spec Rev* 23: 1-24.

Figure 1. Mesonet home page image. www.mesonet.org/.

Oklahoma Mesonet

OVERVIEW HISTORY SITES INSTRUMENTS DATA QUALITY ASSURANCE SITE PASSES PROJECTS

Current: Fairview, OK

39°F

Wind Chill 31°F

Dewpoint: 32°F
Humidity: 76%
Rainfall: 0.00 in.
Wind from the southeast at 14.3 mph

[View Mesonet Data](#)

Oklahoma's **World-Class Network** of Environmental Monitoring Stations

Over 3,004,379,475 observations since January 1st, 1994

MESONET 2002 INFORMATION

MESONET 2002

Mesonet 2002 Presentation Videos now online.

Quicktime Plugin required to view the movies.

MOVIE

[VIEW MESONET 2002 VIDEOS](#)

MESONET FEATURE PROJECT

Oklahoma Agweather

Weather-Related Products for Agriculture and Natural Resources Management

[VISIT AGWEATHER](#)

OCS FEATURE SOFTWARE

WeatherScope™ 1.2
The Best Way to View Mesonet Data

[DOWNLOAD NOW](#)

The interactive features of the Mesonet Data pages require the free WxScope Plugin.

[Click Here to download the WxScope Plugin software.](#)

Figure 2. Image of Oklahoma Agweather page <http://agweather.mesonet.org/>.

Oklahoma Agweather

ABOUT | CONTACT

OSU

WEATHER SOIL LIVESTOCK RANGELAND CROPS HORTICULTURE FORESTRY MARKETS

WELCOME
to the all-new Agweather site!

ATTENTION NEW USERS!
WxScope Plugin 10.0 Required to use this site.
Download [here](#).

WxScope Plugin 10.0 Released!
Download Now

Weather-Related Products for Agriculture and Natural Resources Management

The products on these pages are designed to aid agriculturists in their decision-making process. Data from the Oklahoma Mesonet are employed to create county-specific information. In addition, scientists from Oklahoma State University have "tuned" the models for conditions specific to Oklahoma agriculture.

Select from current/recent weather maps, agricultural and natural resource models, weather forecasts, and related links.

Add the Agweather Link to Your Site

Oklahoma Agweather

Just save this image and link it to <http://agweather.mesonet.org/>.

Figure 3. Image of Agweather page listing weather options. <http://agweather.mesonet.org/weather/default.html>.

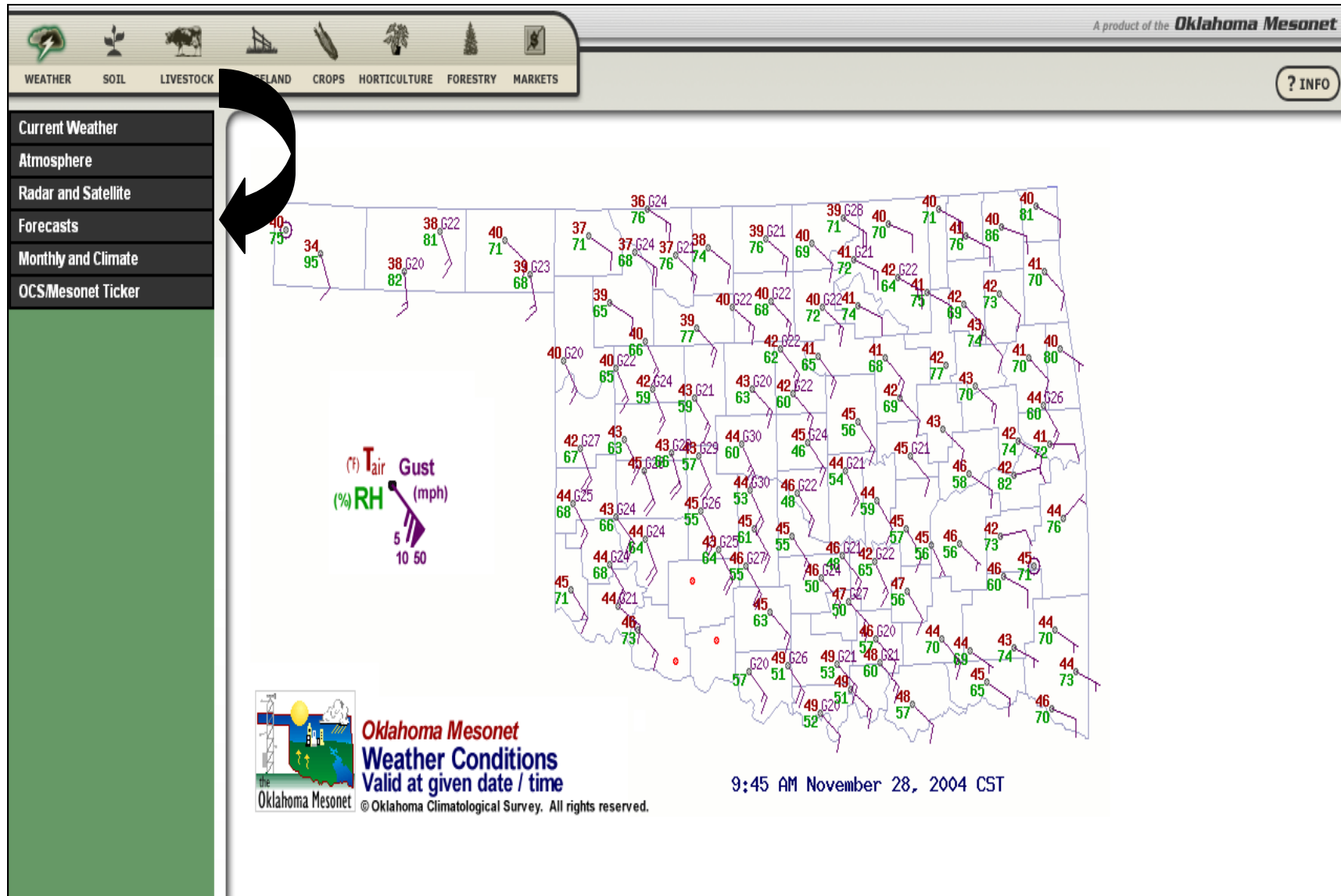


Figure 4. Agweather image shown when “Forecasts” is selected under “Weather”. <http://agweather.mesonet.org/weather/default.html>.

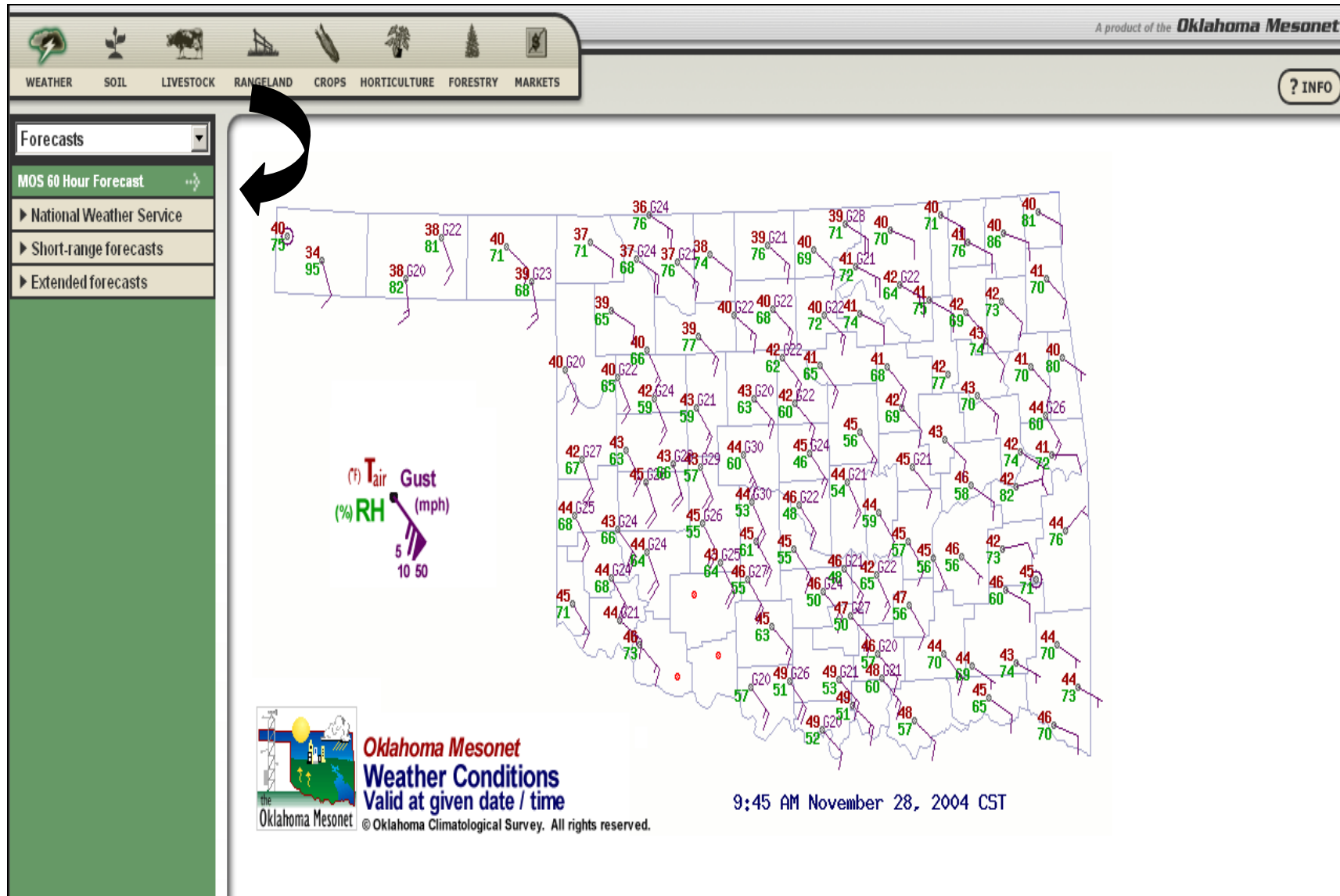


Figure 5. Image shown after “MOS 60 Hour Forecast” option is selected. <http://agweather.mesonet.org/weather/default.html>.

A product of the **Oklahoma Mesonet**

WEATHER SOIL LIVESTOCK RANGELAND CROPS HORTICULTURE FORESTRY MARKETS ? INFO

Forecasts

MOS 60 Hour Forecast

▶ National Weather Service

▶ Short-range forecasts

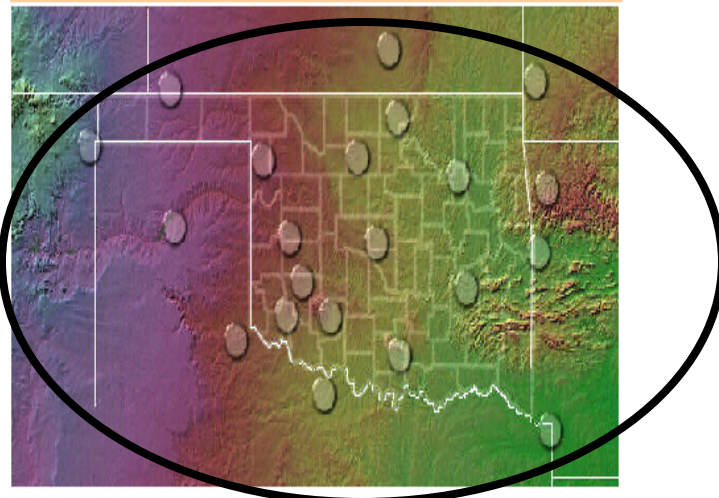
▶ Extended forecasts

Forecast Products

- ▶ [Oklahoma 60-hr. NGM MOS Digital Forecasts](#)
- ▶ [Oklahoma 60-hr. NGM MOS Forecast Maps](#)
- ▶ [NWS Text Products](#)

Oklahoma 60-hr. NGM MOS Digital Forecasts

Click on a button to retrieve the latest NGM MOS guidance



Altus	Ardmore	Clinton
Enid	Gage	Hobart
Lawton	McAlester	Oklahoma City
Ponca City	Tulsa	Fayetteville, AR
Fort Smith, AR	Texarkana, AR	Joplin, MO
Childress, TX	Amarillo, TX	Wichita Falls, TX
Clayton, NM	Elkhart, KS	Wichita, KS

Figure 6. Image shown after a geographical site is selected in Figure 5.

A product of the **Oklahoma Mesonet**

WEATHER SOIL LIVESTOCK RANGELAND CROPS HORTICULTURE FORESTRY MARKETS ? INFO

Forecasts

MOS 60 Hour Forecast

► National Weather Service

► Short-range forecasts

► Extended forecasts

Forecast for Gage, OK based on data taken on November 28, 2004, at 6:00 am CST

	/Nov 28				/Nov 29				/Nov 30									
HOUR OF DAY (CST)	12	15	18	21	00	03	06	09	12	15	18	21	00	03	06	09	12	15
MAX MIN TEMPS (F)							34				34				22			
TEMPERATURE (F)	46	50	44	44	43	40	38	34	32	33	31	29	26	25	24	23	27	30
RELATIVE HUMIDITY (%)	60	56	76	79	85	92	96	100	100	100	100	100	100	100	92	92	78	60
WIND DIRECTION	SSE	SSE	SE	E	E	NNE	N	N	N	N	N	N	N	NNW	NNW	NW	NW	NN
WIND SPEED (MPH)	19	18	14	18	16	13	14	16	19	16	13	11	13	12	11	9	17	11
DISPERSION CONDITION	MG	MG	MG	MG	MG	MG	MG	MG	MG	MG	MG	MG	MG	MG	MG	MG	MG	M
DOWNWIND POLLUTION INDEX	5	5	6	5	6	6	6	6	5	6	6	8	6	7	8	10	5	
SKY CONDITION	OV	OV	OV	OV	OV	OV	OV	OV	OV	OV	OV	OV	OV	OV	OV	OV	OV	B
CEILING	7	6	5	4	4	4	3	1	2	2	2	2	2	2	3	3	3	
CHANCE OF PRECIP (%)			20		24		52		44		30		34		23		18	
AMOUNT OF PRECIP (in)			0.00		0.00		0.05		0.17		0.05		0.05		0.05		0.00	
PRECIP TYPE (if any)	R	R	R	R	R	R	S	S	S	S	S	S	S		S		S	
DEW POINT TEMP (F)	33	35	37	38	39	38	37	34	32	33	31	29	26	25	22	21	21	2

<u>SKY CONDITION</u>	<u>PRECIPITATION TYPE</u>	<u>DISPERSION DOWNWIND</u>	<u>CEILING</u>
CL = Clear	R = Rain	EX Excellent < 2	1 = < 200 ft
SC = Scattered	Z = Freezing Rain	G Good 2 - 4	2 = 200 - 400 ft
BK = Broken	S = Snow	MG Moderately Good 4 - 10	3 = 500 - 900 ft
OV = Overcast		MP Moderately Poor 10 - 23	4 = 1000 - 3000 ft
		P Poor 23 - 53	5 = 3100 - 6500 ft
		VP Very Poor > 53	6 = 6600 - 12000 ft
			7 = > 12000 ft