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Engineering Success

A newsletter from Biosystems and Ag Engineering Extension

OSU Biosystems helps poultry producers save energy and money

By: Scott Frazier, Assistant Professor and Energy Management Specialist

For the past year Scott Frazier, BAE Extension Energy Specialist; and Josh Payne, Animal Waste Specialist; have been working together to provide Okla. poultry producers with recommendations to improve poultry house performance while saving energy costs. Poultry production is a large industry in Okla. and deserves a dedicated extension program.

Poultry houses are unique agricultural buildings because they must maintain very high ventilation rates in order to provide a prescribed level of fresh air in the living space for the birds. Excessive levels of pollutants such as ammonia can kill or harm birds and lower meat production rates. Ventilation is also used to keep proper temperature and moisture levels in the air and litter. This is a constantly changing process as the birds grow and produce more heat and waste. The dynamics of operating the poultry houses also change dramatically depending on the season and outdoor temperatures.

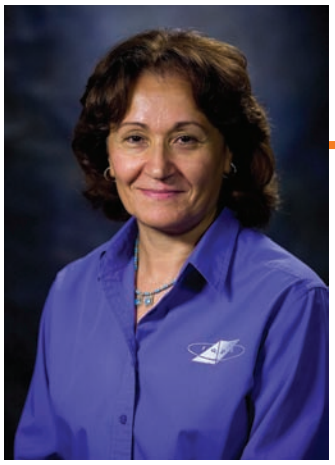
During the winter, poultry houses must ventilate valuable heated air to the outside. The houses are typically heated with propane and this can be the largest single yearly cost for the grower. Proper insulation and house sealing are critical to getting the most out of the energy dollars in the winter. During the summer, high ventilation rates are used to provide a wind-chill effect on the birds. However, poor insulation, operating procedures, ventilation design, and house sealing can result in stressed birded and high energy costs. In order to test the ability of the poultry houses to maintain a tight seal, pressure readings along with smoke generators are used (Figure 1). A FLIR® thermal imaging camera is used to determine building insulation effectiveness, bird temperatures, stratification of building heat and litter moisture concentration (Figure 2).

Frazier and Payne attended the University of Georgia Poultry Science Winter Ventilation workshops in Athens, Ga. in 2009 and the 2010 University of Georgia Summer Ventilation Workshops. They have designed programs for Okla. poultry producers that concentrate on energy and litter management and have presented early versions of the Okla. program at various poultry training sessions throughout the state. They have also toured poultry facilities in the state that use renewable energy sources (wood pellets) and were featured on an episode of SUNUP in fall 2009. Future plans include full-scale winter and summer Okla. poultry house energy and litter management workshops including on-farm demonstrations.

For more information, contact Scott Frazier at robert.frazier@okstate.edu or Josh Payne at joshua.payne@okstate.edu.

Figure 1: Photo of smoke test showing circulation pattern of air entering through building side vent.

Figure 2: Infrared image showing cold air at bottom of door in poultry house during winter.



Winter Canola: A promising rotation crop for wheat growers in Oklahoma and more…

By: Nurhan T. Dunford, Associate Professor and Oil/Oilseed Specialist

The vast majority of cropland in the Southern Great Plains, including Okla., has been in continuous wheat production for decades. Farmers in this area are disadvantaged because of growing wheat year after year. Through the years, insect and weed problems have intensified and yields failed to increase while significant yield increases were achieved elsewhere.

It is believed that winter canola may not only be a good rotation crop to improve crop yields but it also may be more profitable crop than winter wheat.

The original rapeseed cultivars had high levels of a fatty acid called "erucic acid" and a compound named "glucosinolates". Rapeseed oil feeding trials carried out with rodents indicated that high levels of erucic acid in oil led to fatty deposits in heart and skeletal muscles and impaired growth of the animals. The presence of glucosinolate in rapeseed meal was detrimental to poultry, swine and ruminants. Isothiocyanates and other sulphur-containing compounds are formed during hydrolysis of glucosinolates. These compounds interfere with iodine uptake by the thyroid gland, contribute to liver disease and reduce animal growth and weight gain.

Utilization of oilseed meal (seed residue after oil extraction) as animal feed is critical for the economic viability of oilseed processing operations. It was clear to Canadian plant breeders that erucic acid and glucosinolate content of the seeds had to be reduced if rapeseed meal is to be used as animal feed. In 1970s breeding efforts resulted in world's first low erucic acid and low glucosinolate cultivar of Brasicca napus, often called double-zero rapeseed.

The term "canola" was registered by the Western Canadian Oilseed Crushers in 1978 and then transferred to the Canola Council of Canada in 1980. Canola referred to those cultivars containing less than 5 percent erucic acid in the oil and 3 mg/g aliphatic glucosinolates in the meal. In 1986, the definition of canola was amended to Brasicca napus and Brasicca rapa lines with less than 2 percent erucic acid in the oil and less than 30 micromol/g glucosinolates in the air-dried, oil-free meal. Today

the name "Canola" is mainly used in the American continent and Australia. In Europe "rapeseed" is the term commonly used for both original high and low erucic acid rapeseed cultivars.

During the last two decades production of canola as an oilseed crop has exceeded that of peanut, cottonseed and sunflower. Today canola is second to soybean in oilseed production. Much like wheat, spring varieties of canola are grown in the northern states and Canada. The first winter canola variety adapted to the Southern Great Plains was released in 2001.

The Okanola project was initiated by the Oklahoma State University plant scientists and has been very successful by promoting canola as a rotational crop with winter wheat. The mission of Okanola is "to provide research, education and demonstration to stimulate the development of winter canola as a major profitable rotational crop in Oklahoma."

During the last cropping season about 80,000 acres of canola was planted and harvested in Okla. It is expected that canola acres will double in the state next year.

In order for a new crop to be successful in much of the state, the production equipment, agronomic practices and inputs should be similar to those required for wheat production. Canola fits well in a crop rotation system with wheat. With just a few combine adjustments canola can be harvested by small grains equipment that wheat farmers currently use. This eliminates the need for large investment in machinery.

Dual-purpose wheat has been an integral component of mixed farming operations in Okla. The ability for a new crop to be grazed by cattle also adds to likelihood of success. Yield will decrease if canola is grazed. Currently OSU Oilseed Extension personnel do not recommend grazing canola fields. However, research is underway to test the feasibility of this concept across a wider range of environments and to identify varieties with suitable characteristics for dual-purpose use.

Canola oil is considered as premium oil because of its widely recognized functional

and nutritional properties by nutrition experts, consumers and food industry. In 2000, U.S. Food and Drug Administration has affirmed the GRAS (Generally Recognized As Safe) status of canola oil. In 2006, FDA issued a rule that allows health claim labeling of food products made with canola oil. The approved health claim states that "Limited and not conclusive scientific evidence suggests that eating about 1 ½ tablespoons (19 grams) of canola oil daily may reduce the risk of coronary heart disease due to the unsaturated fat content in canola oil."

Canola oil is also a suitable base stock for biodegradable industrial product development because of its balanced fatty acid composition. Current canola oil related research and development activities focus on biodiesel, solvents, lubricants, engine oils, heat transfer oils, hydraulic fluids, demolding agents and inks.

Processing canola seeds for oil production is very similar to that used for other vegetable oils. For more information on oilseed processing and refining view OSU-DASNR Fact Sheet numbers FAPC-153, 159 and 160. These can be found at **http://www.oces.okstate.edu/extension-fact-sheets-2**.

In general canola seeds contain about 40 percent oil (38-45 percent and even higher). Because of their high oil content canola seeds are first mechanically pressed to expel 60 percent of the oil. Then partially defatted seeds are solvent extracted. Conventional oilseed extraction techniques utilize hexane as solvent. High oil solubility and low boiling point of hexane lower operating cost and energy requirement for both oil and meal desolventizing. Construction of solvent extraction plants requires a large capital investment. Hence, this technique might not be feasible for small or medium size oilseeds processors. For those operations mechanical oil expelling could be a better option. Although mechanical oil expression is not as efficient as hexane extraction there are new screw press designs that allow more than 90 percent oil recovery from canola seeds.

Both hexane and mechanical extraction produce crude oil which requires refining. Edible grade vegetable oils go through the following refining steps: degumming (removal of phospholipids-gums), deacification/refining (removal of free fatty acids), bleaching (color removal) and deodorization (removal of odor compounds). Oil to be used in salad dressings is winterized to remove waxes which cause hazy appearance at refrigerated conditions. Crude canola oil differs from most other vegetable oils by its relative high chlorophyll (green color) and sulfur compounds. It is very important to keep in mind that location, variety, agronomic practices (i.e. timing of swathing), seed maturity, handling and storage conditions all affect seed and consequently oil quality. Low quality seeds lead to very high oil loss during refining.

The degree of crude oil refining would depend on product end use. For example food industry and large biodiesel producers utilize highly refined oils (RBD (grade-Refined-Bleached-Deodorized)). A research project carried out in our group showed that although biodiesel yields from minimally refined canola oil (degummed oil) were slightly lower (94 percent) than that for RBD canola oil (96 percent), both oils produced acceptable quality products. These findings indicate

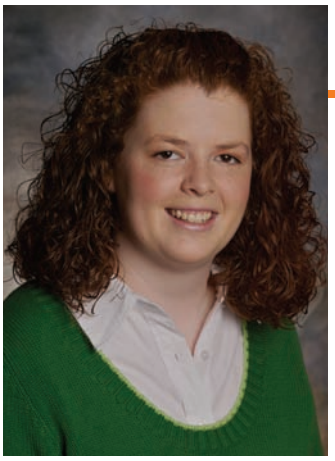
that degummed canola oil can be a viable feedstock for small processors and on-farm operations.

Canola brings value-added processing and product development opportunities to the state. Indeed, we have already started seeing positive impact of in state canola production on Oklahoma based processing industry. The largest oilseed processor operating in Oklahoma, the Producers Cooperative Oil Mill (PCOM), which has been processing cottonseed since 1944, expanded its operations to canola seed processing about two years ago. Availability of locally grown oilseeds has been a great opportunity for PCOM to utilize its excess oil production capacity and consequently improve economic viability of the operation. There are also a number of farmers and entrepreneurs processing, or interested in processing, oilseeds and converting the oil to biodiesel at small scale facilities even on their farm in Okla. Unfortunately, there is no vegetable oil refining facility operating in the state today. Oil extracted in the state is shipped to refining facilities in other states. However, it is highly likely that other oilseed processing and oil refining facilities will come on-line as canola acres increase in the state.

The Oklahoma Department of Agriculture, Food, and Forestry recently coordinated creation of the Oklahoma Oilseed Commission. The commission will represent and promote the oilseed industry in the state. With the support of state agencies and the producers it is plausible that canola will be the new cash crop and have a significant impact on the state economy.

For more information contact Nurhan Dunford at nurhan.dunford@okstate.edu.

The following references and websites were used to prepare this article:
1) John Kirkegaard, Susan Sprague, Hugh Dove, Walter Kelman and Steve Marcroft. Dual-purpose canola – a new opportunity in mixed-farming systems? Australian Journal of Agricultural Research, 2008, 59, 291–302.
2) Dunford, Nurhan T. and Su, Aihua. 2010. Effect of Canola Oil Quality on Biodiesel Conversion Efficiency and Properties. Trans ASABE, 53(3):993-997.
3) http://www.canola.okstate.edu/
4) Bishnoi, U. R., S. Kumar, E. Cebert, and R. S. Mentreddy. 2007. Agronomic and Economic Performance of Winter Canola in Southeastern US. World J. Agric. Sci. 3 (3):263-268.
5) FDA. 2009. Agency Response Letter GRAS Notice No. GRN 000033. United States Department of Agriculture, Food and Drug Administration, May 22 2000 [cited June 30 2009]. Available from http://www.fda.gov/Food/FoodIngredientsPackaging/GenerallyRecognizedasSafeGRAS/GRASListings/ucm154145.htm.
6) Rife, C. L., D. L. Auld, H. D. Sunderman, W. F. Heer, D. D. Baltensperger, L. A. Nelson, D. L. Johnson, D. Bordovsky, and H. C. Minor. 2001. Registration of 'Wichita' Rapeseed. Crop Sci. 41:263-264.



Oklahoma Mesonet: Your weather network

By: Maggie Hoey, Assistant Extension Specialist

Sometimes the weather information provided by television and radio isn't enough to keep up with Oklahoma's changing weather. Will Rogers joked, "If you don't like the weather in Oklahoma, wait a minute and it'll change." When Oklahoman's need more weather information, they turn to the Oklahoma Mesonet. This unique network provides statewide weather information, updated every five minutes. Anyone with Internet access can closely monitor a changing weather event on the Mesonet's website.

The Mesonet is Oklahoma's weather monitoring network, operating 120 weather stations across the state, and serves as the weather information link between the public and various organizations and state agencies. The Mesonet represents 20 years of cooperation between Oklahoma State University and the University of Oklahoma, and the Biosystems and Agricultural Engineering department plays a crucial role in this partnership.

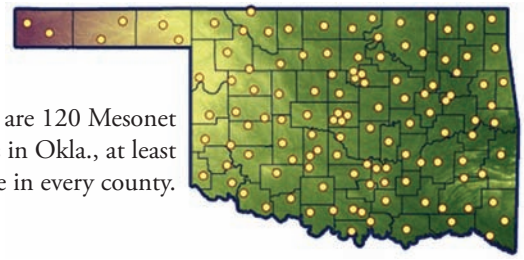
The Mesonet provides local, reliable weather information to decision makers and citizens of Okla. at no direct cost. Weather information is updated every five minutes, seven days a week, 365 days a year. The Mesonet website can be accessed at **www.mesonet.org**.

The Mesonet will be launching a new website in August. The new site will incorporate forecast information, thumbnail views of maps and a search feature. In addition, a mobile Mesonet website will be available to track weather from any internet-capable cell phone. When launched, users can access the mobile enhanced website by visiting www.mesonet.org on their mobile device.

In partnership with the Mesonet, the BAE department provides a range of decision support tools to aid farmers and ranchers, fire managers and homeowners.

The Agweather website features irrigation planners and disease advisors for crops grown in Oklahoma, a drift risk advisor, pest control advisors and other helpful resources and links. This site can be accessed at **agweather.mesonet.org**.

A new product on the Agweather website is the Drift Risk Advisor, a tool designed to aid spray applicators in identifying times of higher drift risk due to weather variables. This advisor, designed by professionals at OSU and OU, compares weather variable parameters with an 84-hour forecast matched to each Mesonet site.



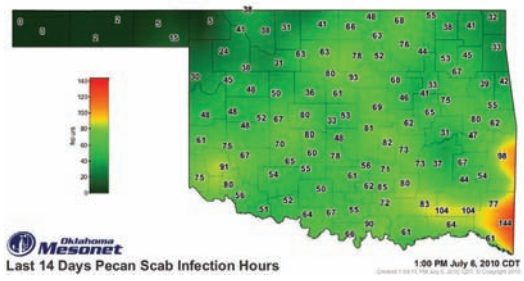
There are 120 Mesonet stations in Okla., at least one in every county.

The OK-FIRE website is a site specially designed to provide weather information to fire fighters and prescribed fire managers. This site includes products for fire weather, fire danger and smoke dispersion. Each year training is provided throughout the state to educate users about the OK-FIRE website and different fire weather components. This site can be accessed at **okfire.mesonet.org**.

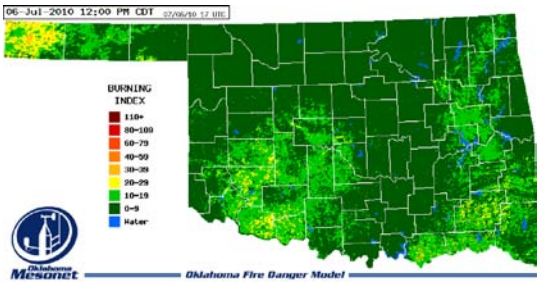
The Simple Irrigation Plan (SIP) website uses Mesonet data to scientifically estimate lawn grass water use, taking the guesswork out of when and how long to water a lawn. This site can be accessed at **sip.mesonet.org**.

In addition to farmers and ranchers, fire managers and homeowners, the Mesonet also works closely with teachers and emergency managers, providing weather training and information on how to interpret weather data. Emergency managers rely on information from the Mesonet to make critical decisions in their communities. Teachers use Mesonet data in the classroom to promote science enthusiasm and increase weather awareness. Whether there are severe storms, drought or rain in your area, the Mesonet will provide information to help you make decisions.

For more information, contact Albert Sutherland, Agweather and SIP at albert.sutherland@okstate.edu; J.D. Carlson, OK-FIRE at jdc@okstate.edu; or Maggie Hoey, General Mesonet website at maggie.hoey@okstate.edu.



Disease advisors analyze weather data and calculate "disease hours."



OK-FIRE features fire weather, fire danger and smoke dispersion maps to help manage fires.

Upcoming events

Kansas Ag Technology Field Day
August 10, 2010 • Airport and Exhibition Grounds
Great Bend, KS • www.ksagresearch.com

Continuous Improvement Tools workshop
August 25, 2010
Rm 120 • Robert M. Kerr Food & Agricultural Products Center, OSU
http://www.fapc.okstate.edu/continuousimprovement.html
Register by calling 405-744-6071, or register online at http://www.fapc.okstate.edu/forms/citbegin.htm

Subscription request

To receive a copy of the Engineering Success: A newsletter from OSU Biosystems and Ag Engineering Extension, e-mail Randy Taylor at randy.taylor@okstate.edu with **BAE Newsletter** in the subject line.

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Agricultural Machinery Systems website launched

Agriculturalists needing information regarding the efficient use of agricultural machinery now have a new resource to consult. Oklahoma State University's Agricultural Machinery Systems website at **www.agmachinery.okstate.edu** contains information from the department of biosystems and agricultural engineering as well as educational material generated at other universities.

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