University of Minnesota Extension Service

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Minnesota/Wisconsin

Engineering Notes

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Alternative Energy

Postharvest and Alternative Energy Info on Web

Bill Wilcke, Minnesota Extension Engineer

If you are looking for basic information on crop drying, storage, or handling, you might look first at the University of Minnesota Biosystems and Agricultural Engineering Department's postharvest website at: http://www.bae.umn.edu/extens/postharvest/. The website includes access to University of Minnesota Extension publications on crop drying and storage, lists of materials that can be obtained from the BAE Department, access to handouts and fact sheets written by University of Minnesota BAE faculty and staff, ordering information for MidWest Plan materials, access to a fan selection computer program, and links to other postharvest websites.

If you are looking for information on agricultural and alternative energy sources, take a look at the University of Minnesota Biosystems and Agricultural Engineering Department's energy website at: http://www.bae.umn.edu/extens/energy/. The website is divided into sections for different sources of energy and it includes links to a wide variety of information.

Let us know if you have questions about anything on the websites or if you would like to suggest additional resources to add to the websites.

In This Issue

Manure Management

Your Farm Doesn't Have to Smell that Bad

Brian J. Holmes, Wisconsin Extension Engineer

Complaints about farm odors have increased in recent years, especially for larger livestock operations. There are several reasons for this including increasing population in rural areas and adoption of technologies that increase odor production. Practices such as building freestall barns with wide manure alleys, maintaining large outside yards, storing manure, and applying large amounts of manure from storage onto large fields can increase odorous compounds released from manure.

The odorous compounds can be reduced 50-90% while using these technologies by adopting different management practices. For example, an Iowa study found the odor detection threshold (ODT*) for swine manure was reduced from 2820 down to 32 by switching from surface spreading to injection during application. Disking following surface application reduced the ODT to 130. Field application of manure results in many complaints about odor. If a livestock producer wants to reduce odors (and complaints) during manure application, injection or incorporation within an hour after surface application will go a long way toward accomplishing that objective.

Odors can originate from many sources in addition to those mentioned above. Feed storages, deteriorating feed, dead animals, burning trash, as well as wet and dirty animals can contribute to odors emanating from a farm.

Adopting specific management practices can reduce the im-

**Odor Detection Threshold or ODT is an estimate of the number of dilutions of clean air needed to make the odor "non-detectable" by the human nose. A lower number is more desirable.*

pact of odors on neighbors and the community. These practices include reducing the source, reducing the odor production rate, and removing odorants from the air. Examples of reducing the source include manipulating animal diets to limit odorous-compound production from manure, cleaning manure frequently from alleys and yards, preserving feed properly and disposing of waste feed, managing so as to limit the number of animal deaths and removing dead animals from the farm as quickly as possible, and halting trash burning.

Some examples of reducing the odor production rate are covering the surface of a manure storage, incorporating manure into the soil during application, reducing the size of the animal lot, constructing lots that drain runoff water, treating manure to make it more biologically stable (composting, anaerobic digestion, aeration, etc.), and spraying oil onto surfaces in swine barns to suppress dust release into the air. Odorants can be removed from the air by blowing exhausted ventilation air through a biofilter, intercepting dust on vegetation, biomass walls, and air scrubbers, and treating with ozone.

So, there are methods for reducing the impact of odors on neighbors and the community. You can learn more about options for reducing odors and doing a management assessment in *Outdoor Air Quality*, MWPS-18, Section 3. For ordering information see *Resources* on page 7.

Science-Based Information on Manure Management Issues

Regulatory and public scrutiny of our animal industry's management of manure continues to increase. Having access to good science-based information with sound management recommendations is critical to implementing high stewardship standards as well as responding to the often biased claims.

The Livestock and Poultry Environmental Stewardship, or LPES, curriculum, consists of 26 lessons that address achieving high environmental standards relative to the following topics: nutrient management; animal dietary strategies; manure storage and treatment; land application; and outdoor air quality. National experts on manure management issues from land-grant universities, EPA, and USDA developed the lessons specifically for the producer. This resource provides a comprehensive review with supporting recommendations for ensuring a farm's environmental stewardship.

The LPES curriculum will be most valuable to producers as a reference for answering a multitude of questions including:

- What is a Phosphorus Index?
- How is odor measured?
- What is the value of phytase in the diet of a monogastric animal?
- Are new technologies for reducing odor available?
- What issues should be reviewed in a manure storage inspection?

This educational product provides answers, on-farm assessment tools, and optional record keeping forms for a wide range of manure management topics.

The curriculum is available as a printed document or as a CD. The CD offers unique capabilities for quickly accessing information of immediate interest. By typing in a single word or simple phrase, one can quickly access all related information within the LPES product specific to a topic of interest. The CD and three ring notebook versions of the LPES curriculum can be invaluable reference tools for the producer and advisor.

In addition to the original 26 lessons in the curriculum, the LPES team has recently released a series of 24 fact sheets on the Environmental Protection Agency's new Concentrated Animal Feeding Operations (CAFO) regulations. Each fact sheet addresses a common producer question about these regulations with a non-technical review of the regulations and recommendations for achieving compliance. Questions such as "Does my farm need an NPDES permit?" "What is the timeline for achieving compliance?" "Will I need a nutrient management plan?" and others are answered succinctly by a group of authors from the land grant universities and USDA/NRCS.

The individual LPES lessons and CAFO fact sheets can be reviewed, free of charge, at the LPES website at www.lpes.org. Copies of the LPES CD and the printed document, as well as the CAFO fact sheets can be purchased from MWPS (MidWest Plan Service). For ordering information see *Resources* on page 7.

Funded by the U.S. EPA National Agriculture Assistance Center with program oversight through the USDA, the LPES curriculum is intended to foster the voluntary achievement of environmental stewardship principles within the animal industry.

Livestock Systems

Competitive Milking?

Douglas J. Reinemann, Wisconsin Extension Engineer

Perhaps if we invoke the pride and competitive spirit of midwestern dairymen, we can close the milking performance gap with Western dairy states. Some interesting comparisons between major dairy regions of the United States emerge from the results of the 2003 Dairy Wage Survey conducted by Gregorio Billikopf and reported in the November issue of *Agribusiness Dairyman*. Highlights of the survey are:

	West	Midwest	Southeast	Northeast
Avg. wage $/hr	$10	$8.60	$9.30	$8.70
Avg. yrs worked	5.8	3.5	3.9	3.6
Foreign born	81%	49%	34%	22%
Female	8%	15%	8%	30%
Avg. cows milked	1001	437	536	444
Avg. hrs/shift	7.6	6.4	5.6	4.8
Avg. Milkers/shift	2.3	2.2	1.6	2

Several interesting points emerge from these numbers.

1. Milking parlors in the Midwest are "overpopulated" compared with other regions (particularly the southeast and northeast)
2. The efficiency of our milking parlors is way behind every other region in the country.
3. The Midwest lags behind other regions in the wages we pay our milkers.

Labor efficiency can be expressed as the cows milked per person per hour while economic efficiency can be expressed as the cost of milking each cow. Using the results of the labor survey these efficiencies can be calculated for the four dairy regions of the United States.

	West	Midwest	Southeast	Northeast
Whole Parlor Avg. Cows milked /hr	132	68	96	93
Per person Avg Cows milked /hr	57	31	60	46
Avg. labor cost to run parlor $/hr	$23	$19	$15	$17
Labor cost Cents/cow milked	2.3	4.3	2.8	3.9

The productivity of labor in the Midwest is only about half of that in the western and southeastern regions and two thirds of that in the Northeast. The cost of milking a cow in the Midwest is the highest of all regions and almost double that of the western region. The Midwest has a lot of catching up to do if we want to stay in the ball game. There are three very simple solutions to this problem.

1. Don't put the extra person in the pit. Adding a second or third milker to a milking parlor smaller than a double 12 or so is never a good economic move.
2. The cows milked per hour never increases proportionately to the added labor cost.
3. Build reasonably sized parlors. The economic optimum for herds up to about 600 cows is a double eight.
4. Pay good workers a decent wage. Inspire excellence and reward it. It pays.

How about a milker's Olympics?

References

2003 Dairy Wage Survey Results. Agribusiness Dairyman, 22(12)12-13, November 2003, Gregorio Billikopf, UC labor management farm advisor, gebillikopf@ucdavis.edu

Visit the UW milking lab web page for tools to help make you milking parlor more efficient. www.uwex.edu/uwmril

Bedded Pack Housing For Dairy Cows

David W. Kammel, Wisconsin Extension Engineer

For dairy producers who are looking for low cost systems as alternatives for housing cows, consider using bedded pack housing. This form of loose housing allows the cow free access between the resting, feeding, and watering spaces.

The bedded resting space should provide between 50 and 100 square feet per cow depending on cow weight. The publication *Dairy Freestall Housing and Equipment* (MWPS-7) recommends a minimum of 50 square feet for a dry cow. Most experts recommend 75 square feet per Holstein milking cow and 60 square feet per Jersey milking cow for well-managed systems.

The bedded area should be rectangular, with a maximum dimension of 36 feet from the feeding alley to the back of the bedded area. Cows tend to lie around the perimeter of the bedded space. Additional space for a feeding alley and water access also must be included in the overall system design.

The bedded pack is commonly used during the winter housing period from December 1 through the end of March, or approximately 4 months. In this situation, the bedded pack acts as a manure storage system. It is common to clean out the pack at the end of the winter housing season or at three to four month intervals if used continuously. To facilitate cleanout and other operations, the base (macadam, asphalt, concrete) under the pack must be able to handle vehicle traffic in wet conditions.

To manage cow cleanliness, producers can adjust either the group size or the quantity of bedding used per day. As the bedded area per cow decreases, the amount of bedding and the frequency of adding bedding required to keep the cows clean increases. MWPS-7 recommends a minimum of 11 pounds of chopped straw per 1,000 pounds of animal weight. Experiential data from Wisconsin farms found 15 to 25 pounds of bedding per day per cow should be added to the pen every day to maintain clean cows. Wood shavings, clean straw, corn fodder, and waste grass hay are common bedding choices. To simplify cleaning, waste hay should be chopped before being added to the pack.

You can't skimp on the amount or frequency of bedding if you want clean cows. Depending on current prices, however, the bedding cost can be $.25 to $.50 per cow per day. When

producers find actual bedding costs to be higher than projected costs, they sometimes cut back on bedding, and this results in problems with dirtier cows.

Other management strategies can help maintain clean cows. For small herds (30 to 40 cows), policing the bedded area daily by removing manure patties can help maintain cleaner cows and minimize the amount of bedding required to keep the cows clean. Some experiential data from Europe suggests policing the area can reduce the amount of bedding needed to keep cows clean by 50%.

Daily removal of accumulated manure from the alleys adjacent to feed and water areas also can help maintain cleaner cows. It is helpful to have an area designed to collect the removed manure.

MWPS-7 has plans for a bedded pack barn for replacement heifers that could be adapted to cows. The width of the building shell should allow room for a two- or three-row freestall platform (26 feet or 34 feet from the alley to the back of the pen respectively). Plan so both options are possible and start with the bedded pack but providing the option to convert the building into a freestall barn at some future time.

In either the bedded pack or freestall pen layouts, a concrete feed alley is placed between the feed platform and the resting area.

The waterer for the bedded pack arrangement is placed adjacent to the bedded resting space. Put a fence around the sides of the waterer to create a barrier that prevents cows from accessing the water and splashing it into the bedded pack area. You should allow cows to access the waterer only from the alley adjacent to the feed bunk.

The options for a building shell include roofing over the bedded area only, roofing over the bedded area and the cow alley, or roofing over the entire area including the feed platform. Although these options increase the area per cow, the ability to manage feeding is improved. Putting a roof over the cow resting and walking areas also can eliminate the need to handle the contaminated manure from rainfall runoff events from unroofed cow confinement areas.

The lowest cost system option could be to develop a windbreak system on the north and west sides of a bedded space with drive-by feeding on the south side. *The Beef Housing and Equipment Handbook* (MWPS-6) has conceptual plans that could be adapted for use on a dairy. The option of no roof with a windbreak, cattle mounds, and drive-by feeding is similar to feed lot operation. But you also need to consider the cost of cleaning up lot runoff water.

Dairy Freestall Housing and Equipment (MWPS-7) and *The Beef Housing and Equipment Handbook* (MWPS-6) have additional information on barn design. Both books are published by MidWest Plan Service, for more information see *Resources* on page 7.

Livestock Ventilation Design—Indoor and Outdoor Air Quality Concerns

Larry D. Jacobson, Minnesota Extension Engineer

For the past 50 years, designers of livestock ventilation systems have worried only about indoor environments. However, with the recent concerns over outdoor air quality, specifically odor near livestock and poultry operations, and potential regulatory thresholds of certain gas emissions from animal production sites, designers of livestock production and ventilation systems need to be concerned with the amount of ammonia, hydrogen sulfide, odor, and other pollutants that are being emitted from these buildings.

As with other industrial sources, state and federal regulators are beginning to examine air emissions from animal production systems to see if they exceed Clean Air Act thresholds. The U.S. Environmental Protection Agency (EPA) typically limits hazardous air pollutants such as ammonia, hydrogen sulfide, and PM_{10} (particulate matter under 10 μm or 10^{-6} m in size) to 100 tons / year or 100 lbs / day. This means that designers of livestock and poultry operations may soon need to monitor the amounts of these pollutants being emitted into the atmosphere. In the past, if the indoor concentration of a certain gas or pollutant was too high, one could simply increase the ventilation rate since the atmosphere was viewed as an infinite sink for gas, dust, and odor pollutants. In the near future, this may not be the case. Besides the need to control indoor conditions for both human and animal health and productivity, the amount (mass) of certain compounds will also need to be controlled to meet air emissions standards.

Table 1 lists the mean and standard deviations for continuous 2+ weeks measurements of ammonia from a recent study of two barn types in the winter and summer. The ammonia concentration values are similar for both barn types with nearly equal levels in the winter (8 to 9 ppm) and in the summer (5 to 6 ppm). These ammonia concentrations are within the range (less than 10 ppm) that many extension agricultural engineers recommend in pig housing units in the United States. However, when expressed as emissions on a per pig basis, values for the deep-bedded barn are roughly 10 times larger then for the slatted barn in both winter and summer. Thus, assuming the estimated emission rates are similar throughout the year and there were enough pigs to reach

Table 1. Mean and Standard Deviation of NH_3 Concentrations and Emissions for a Deep-bedded Hoop finishing barn and for a slatted floor curtain-sided finishing barn.

	Winter		Summer	
Barn Type	Conc. (SD) ppm	Emissions (SD) mg/s/pig	Conc.(SD) ppm	Emissions (SD) mg/s/pig
Deep-bedded Hoop barn	9.3 (5.0)	0.39 (0.20)	5.9 (6.0)	0.43 (0.45)
Slatted floor barn	8.5 (3.1)	0.02 (0.006)	5.1 (2.9)	0.06 (0.06)

ammonia emission thresholds, you would need to either reduce the generation of ammonia inside the barn or capture and remove some ammonia as it was being exhausted.

Safety and Health

EDEN – Extension Disaster Education Network

John Shutske, Minnesota Agricultural Safety and Health Specialist

The Extension Disaster Education Network (EDEN) is a collaborative multi-state effort by extension services across the country to improve the delivery of services and research-based information to citizens affected by disasters.

Within the United States, 45 of the 50 state extension services are official EDEN members. Wisconsin's EDEN "point of contact" person is Dr. Patrick Walsh, Professor and Environmental Specialist in the Department of Biological Systems Engineering at UW-Madison. John Shutske serves as Minnesota's point of contact.

EDEN's website is located at: http://www.agctr.lsu.edu/eden/ This site is designed to serve extension personnel, the media, and citizens by providing them access to resources on disaster preparedness, recovery, and mitigation that will enhance their short- and long-term programming efforts.

Most member states have contributed publications, presentations, and other content to the EDEN website. Currently, the EDEN site highlights issues that include homeland security, crop and plant security, and BSE (Mad Cow Disease). A series of additional issue pages are being created that will cover the entire range of disasters and emergencies that could impact or have impacted the United States. These will be available in mid-2004.

The EDEN Network was a 2003 recipient of USDA Secretary Ann Veneman's Honor Award for "providing a university-based database and network for extension service professionals as they prepare for and respond to disasters in their communities." I invite you to check out the EDEN website and let me know if you have questions, suggestions, or ideas on how we can reach additional people with this key extension resource.

Workshops on Food System Terrorist Threats

John Shutske, Minnesota Agricultural Safety and Health Specialist

Six regional workshops dealing with terrorist threats to our agriculture and food processing industries will be held in Minnesota's major agricultural regions this March. The workshops are scheduled for Marshall (March 9), St. Cloud (March 10), Mankato (March 17), Rochester (March 24), Crookston (March 30), and Fergus Falls (March 31).

The workshops are designed to meet the programming and planning needs of county emergency managers, public health directors, veterinarians, law enforcement officials, food producers, processors, retailers, FSA directors, county commissioners, and Extension Educators. Each four-hour workshop will include a 45-minute segment in which participants will develop a local hazard and threat assessment and prepare for intentional and unintentional emergency events.

In a November 2003 report to Congress, the U.S. General Accounting Office (GAO) reported that the nation's agriculture and food sectors have several characteristics that make them uniquely vulnerable to terrorist attacks. The GAO report states that these attacks could be aimed at several targets "in the farm-to-table food continuum—including crops, livestock, food products in the processing and distribution chain, wholesale and retail facilities, storage facilities, transportation, and food and agriculture research laboratories." Most people believe that terrorists would attack livestock and crops if their primary intent was to cause severe economic dislocation. Such an attack would cause severe disruption—the U.S. agriculture sector accounts for about 13 percent of the gross domestic product and 18 percent of domestic employment. On the other hand, terrorists would choose to contaminate finished food products and fresh fruits and vegetables if harm to humans was their motive.

The March workshops will cover all segments of the food system, and will include a basic overview of the primary threats and hazards, as well as an opportunity to work in teams to plan specific actions and outcomes. The program will be sponsored by the University of Minnesota Center for Public Health Preparedness with a grant from CDC, and by the University of Minnesota Extension Service. Assistance is also provided by the Minnesota Departments of Agriculture and Public Safety. A $10 workshop fee will be charged to cover local facility and logistical costs. For more information about specific times, locations, and payment information, visit the "EMERGENCY PREPAREDNESS WORKSHOPS" link on our main webpage at: http://safety.coafes.umn.edu, or contact: John Shutske 612/626-1250 or shutske@umn.edu.

Water Management

Irrigated Acres Update

Jerry Wright, Minnesota Extension Engineer

The water appropriation permit data from Minnesota Department of Natural Resources files this fall shows that Minnesota irrigated acreage for 2002 was slightly less compared to 2001. According to the DNR's annual pumping reports for the 2002 growing season from Minnesota irrigators 422,474 acres were irrigated during 2002 season compared to 440,843 acres in 2001 and 432,888 in 2000.

The DNR database currently lists that there are 551,399 acres permitted (this includes 27,111 wild rice acres) across the state from a total of 4,157 registered irrigation permits within 80 counties.

In the 2002-DNR pumpage reports, Minnesota irrigators reported they irrigated at least 177,000 acres of corn; 95,000 acres of soybeans; 40,000 acres of potatoes; 32,000 acres of dry beans; 22,000 acres of alfalfa; 6,900 acres of sugar beets and 15,000 acres of canning crops. The 2002 reports indicate that irrigated soybean and potato acreages were down around 10% from the 2001 season while irrigated sugar beet and dry beans acres were slightly larger than in 2001.

The table below lists irrigated data for the largest 15 irrigated counties in the state:

If you would like a more detailed summary of permitted and irrigated acres by county contact Jerry Wright, Extension Engineer, at 320-589-1711 or e-mail jwright@umn.edu at the West Central Research and Outreach Center, University of Minnesota near Morris.

Publications

New Book and Companion CD Focus on Dairy Replacements

Raising Dairy Replacements, a new publication from MidWest Plan Service (MWPS), contains educational information and specific recommendations for the dairy industry regarding calf and heifer nutrition, health, reproduction, housing, and management. The publication provides an overview of current research-based management practices. It is designed to provide dairy industry educators, consultants, producers, and heifer growers with a technical reference to improve management of dairy calves and heifers.

Patrick Hoffman, a professor in the Dairy Science Department at the University of Wisconsin, wrote or co-wrote several of the book's chapters and served as technical editor and project coordinator for the team that developed the publication. Other authors are Richard Wallace, University of Illinois; Howard Tyler, Larry Tranel, and Leo Timms, Iowa State University; Sandra Godden, and Hugh Chester-Jones, the University of Minnesota; and Larry Baumann, David Kammel, Brian Holmes, Paul Fricke, and Pamela Ruegg, the University of Wisconsin.

The four-color publication contains more than 80 photos and other graphic images along with 60 tables to help illustrate and clarify technical concepts. Hoffman says the group wanted to produce "a comprehensive publication and decision aid for the dairy industry." The photos, charts, and

	2002 Reported Irrigated Acres						2002	2003
COUNTY	**Irrigated**	**Corn**	**Potato**	**Soybeans**	**Dry Beans**	**S Corn**	**Permits**	**Permits**
Otter Tail	57,991	21,403	9,882	11,226	8,565		68,195	67,367
Pope	43,443	19,711	887	12,958	2,085	2,187	42,986	42,700
Dakota	43,166	21,570	834	13,300	20	3,142	50,624	50,969
Sherburne	34,824	14,635	8,106	7,262	1,472	1,569	40,373	40,210
Stearns	33,446	16,109	815	8,598	1,678	597	43,865	43,584
Swift	25,670	14,861	454	8,946	766		31,530	31,410
Wadena	20,410	8,825	3,039	1,790	2,748		23,276	23,361
Hubbard	19,037	6,175	4,355	942	5,822	30	20,205	20,340
Morrison	14,133	6,185	2,289	875	2,647		18,780	19,022
Stevens	12,766	6,864		4,549	303		14,156	14,207
Benton	11,596	5,239	2,990	674	1,641	21	14,614	14,711
Todd	10,816	4,900	1,862	1,664	1,322	40	17,422	17,161
Becker	9,039	738	2,783	2,606	1,671		10,477	10,618
Kandiyohi	5,769	3,576	65	1,066	180	198	10,287	10,077
Polk	4,724	168	191	140	62		12,530	11,629
State Total	**422,474**	**177,035**	**40,094**	**94,983**	**32,542**	**9,085**	**554,385**	**551,399**
2001 Total	440,843	177,077	43,916	113,473	27,420	9,442		
2000 Total	432,888	182,448	47,688	95,856	31,268	9,543		
1996 Total	401,101	191,954	41,640	49,221	37,154			
1984 Total	301,755	150,662	19,114	48,971	11,784	7000?		
1974 Total	111,233							
1960 Total	20,000							

graphs, he says, help to make the book more readable and a more useful educational resource.

A companion CD contains an electronic version of the book plus supplemental photos, charts, and graphs. The electronic book has been designed so that educators can excerpt material from it to develop presentations based on the publication. Special markers in the text of the book direct readers to the CD for additional information about certain topics. The CD also contains software from ProfitSource, a Wisconsin company specializing in developing computer-based management tools for the dairy industry. The software, called Heifer Suite, can be downloaded from the CD and installed on the user's computer.

Among the programs in the suite are Ration Cost Analyzer, Heifer ProQWIK Chart, and Raising Cost Evaluator. Ration Cost Analyzer calculates the cost and nutrient content of replacement heifer diets. Heifer ProQWIK Chart compares heifer growth with industry standards and can compare growth rate within a pen and under different management variables. Raising Cost Evaluator calculates the cost of raising calves or heifers and can be used when an individual cost-of-production analysis is desired. In discussing this unique combination of text and software, Hoffman says, "The intent of the new *Raising Dairy Replacements* publication was to place as much technical information as possible in a single reference source."

This publication is an adaptation of the 1991 edition of *Raising Dairy Replacements*; it was sponsored in part by gifts from Alpharma and ProfitSource and by a grant from the USDA. The book and the CD are available from MWPS and can be purchased separately. For ordering information see *Resources* on page 7.

Resources

Page 1: Postharvest and Alternative Energy Info on Web

University of Minnesota Biosystems and Agricultural Engineering Department's postharvest website:
http://www.bae.umn.edu/extens/postharvest/

University of Minnesota Biosystems and Agricultural Engineering Department's energy website:
http://www.bae.umn.edu/extens/energy/index.html

Page 2: Science-based Information on Manure Management Issues

The individual LPES lessons and CAFO fact sheets can be reviewed, free of charge, at the LPES website at www.lpes.org.

Page 5: EDEN – Extension Disaster Education Network

EDEN's website is located at: http://www.agctr.lsu.edu/eden/

Page 5: Workshops on Food System Terrorist Threats

Visit the "EMERGENCY PREPAREDNESS WORKSHOPS" link on our main webpage at: http://safety.coafes.umn.edu, or contact: John Shutske 612/626-1250 or shutske@umn.edu.

Page 6: Irrigated Acres Update

If you would like a detailed summary of permitted and irrigated acres by county contact Jerry Wright, Extension Engineer, at (320) 589-1711 or e-mail jwright@umn.edu at the West Central Research and Outreach Center, University of Minnesota near Morris.

Midwest Plan Service Publications

MWPS-18, Section 3, *Outdoor Air Quality*
LPES CD and printed document
CAFO fact sheets
Raising Dairy Replacements
MWPS-7, *Dairy Freestall Housing and Equipment*
MWPS-6, *Beef Housing and Equipment Handbook*
NRAES-23, *Heating with Wood and Coal*

Minnesota residents should order MWPS materials from:

MWPS
122 Davidson Hall
Iowa State University
Ames IA 50011-3080
mwps@iastate.edu
http://www.mwpshq.org
800-562-3618 or 515-294-4337

Wisconsin residents should still order MWPS materials from:

MWPS Orders
Biological Systems Engineering Department
University of Wisconsin
460 Henry Mall
Madison WI 53706
608-262-3310

Calendar of Events

February 18-19, 2004, North Dakota Wind Conference, Fargo, ND. See www.undeerc.org/WindV, e-mail afiala@undeerc.org, or call 701-777-3119.

February 24-26, 2004, Agricultural Drainage Design and Water Management Workshop, Crookston, MN. See http://d-outlet.coafes.umn.edu, or call 320-589-1711.

February 26, 2004, Manure Management III Workshop, Marshall, MN. See http://manure.coafes.umn.edu/workshops, or call 612-625-7024 or 800-646-2282.

February 26-28, 2004, 15th Annual Upper Midwest Organic Farming Conference, LaCrosse, WI. See http://www.mosesorganic.org/umord/umordntro.htm.

March 3-4, 2004, Agriculture and the Environment, Ames, IA. Call 515-294-4333 or e-mail soil@iastate.edu.

March 4-5, 2004, 42nd Annual Midwest Rural Energy Conference, Eau Claire, WI. See http://www.mrec.org/confer.htm.

March 9,10, & 11, 2004, Managing Your Unseen Employee: The Ventilation System workshops, LaCrosse, WI, St. Cloud, MN, & Mankato, MN respectively. Contact Pork Central at the University of Nebraska 1-800-767-5287.

March 18-19, 2004, Minnkota Agri-Builders and Equipment Assoc. Annual Meeting and Seminar, Willmar, MN. Contact Larry D. Jacobson at 612-625-8288.

March 18-20, 2004, North American Farm & Power Show, Owatonna, MN. Contact Tradexpos at 800-949-3976, 507-437-4697, or see http://www.tradexpos.com/farmpowr/.

March 23 & 24, 2004, Animal Agriculture and Air Quality I & II, Owatonna, MN. See http://manure.coafes.umn.edu/workshops/schedule.html

March 25, 2004, Biofilter Design and Construction. Waseca, MN. See http://manure.coafes.umn.edu/workshops/schedule.html

Minnesota/Wisconsin

Engineering Notes

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Our mission is to conduct research and educate people to solve engineering problems in agricultural and biological environments.

The Department of Biosystems and Agricultural Engineering is affiliated with the College of Agricultural, Food and Environmental Sciences; the Institute of Technology; the University of Minnesota Extension Service; and the Agricultural Experiment Station of the University of Minnesota. The University of Minnesota is committed to the policy that all persons shall have equal access to its programs, facilities, and employment without regard to race, color, creed, religion, national origin, sex, age, marital status, disability, public assistance status, veteran status, or sexual orientation.

University of Minnesota, United States Department of Agriculture, and Minnesota Counties Cooperating

University of Minnesota Newsletter Team: John M. Shutske, Deb Hansen, and Christy McKibben. This publication is available in alternative formats upon request.

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Mission: to provide internationally-recognized teaching, research and outreach programs of excellence in the development and application of biological, engineering, and management principles to solve problems relating to biological systems for the benefit of the citizens of Wisconsin, the Nation, and the world.

The Department of Biological Systems Engineering is affiliated with the College of Agricultural and Life Sciences of the University of Wisconsin–Madison. University of Wisconsin–Extension, United States Department of Agriculture and Wisconsin Counties Cooperating providing equal opportunities in employment and programming including Title IX requirements.

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