



# Biological Systems Engineering

Engineering Update

Summer 2007

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## Engineering Update

Biological Systems Engineering  
June 2007



VirginiaTech  
*Invent the Future*

**To:** Extension Unit Directors, Extension District Directors, Extension Program Directors, and ANR Agents

**Dear Co-Workers:** Engineering Update is a joint effort of Biological Systems Engineering and other interested agents. Subject matter areas include timely information on water quality, natural resource management, TMDL, air emissions, animal waste management, machinery management, precision farming, application technology, farm safety, energy, engineering education, and technology. Please use this information in your on-going Extension programs and circulate to all Extension staff. Engineering Update is electronically accessible via the VCE Intranet World Wide Web site

(at <http://www.ext.vt.edu/vce/anr/bse/index.html>).



Virginia Cooperative Extension

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## Novel sugar-to-hydrogen technology promises transportation fuel independence

The hydrogen economy is not a futuristic concept. The U.S. Department of Energy's 2006 Advance Energy Initiative calls for competitive ethanol from plant sources by 2012 and a good selection of hydrogen-powered fuel cell vehicles by 2020.

Researchers at Virginia Tech, Oak Ridge National Laboratory (ORNL), and the University of Georgia propose using polysaccharides, or sugary carbohydrates, from biomass to directly produce low-cost hydrogen for the new hydrogen economy.

According to the DOE, advances are needed in four areas to make hydrogen fuel an economical reality for transportation: production, storage, distribution, and fuel cells.

Most industrial hydrogen currently comes from natural gas, which has become expensive. Storing and moving the gas, whatever its source, is costly and cumbersome, and even dangerous. And there is little infrastructure for refueling a vehicle.

"We need a simple way to store and carry hydrogen energy and a simple process to produce hydrogen, said Y.H. Percival Zhang, assistant professor of BSE.

Using synthetic biology approaches, Zhang and colleagues Barbara R. Evans and Jonathan R. Mielenz of ORNL, and Robert C. Hopkins and Michael W.W. Adams of the University of Georgia, are using a combination of 13 enzymes never found together in nature to completely convert polysaccharides and water into hydrogen when and where that form of energy is needed.

Polysaccharides like starch and cellulose are used by plants for energy storage and building blocks and are very stable until exposed to enzymes. Just add enzymes to a mixture of starch and water and "the enzymes use the energy in the starch to break up water into only carbon dioxide and hydrogen," Zhang said.

A membrane bleeds off the carbon dioxide and the hydrogen is used by the fuel cell to create electricity. Water, a product of that fuel cell process, will be recycled for the starch-water reactor. Laboratory tests confirm that it all takes place at low temperature--about 86°F--and atmospheric pressure.

The vision is for the ingredients to be mixed in the fuel tank of your car, for instance. A car with an approximately 12-gallon tank could

hold 27 kilograms (kg) of starch, which is the equivalent of 4 kg of hydrogen. The range would be more than 300 miles, Zhang estimates. One kg of starch will produce the same energy output as 1.12 kg (0.38 gallons) of gasoline.

Since hydrogen is gaseous, hydrogen storage is the largest obstacle to large-scale use of hydrogen fuel. The DOE's long-term goal for hydrogen storage was 12 mass percent, or 0.12 kg of hydrogen per one kg of container or storage material, but such technology is not available, said Zhang. Using polysaccharides as the hydrogen storage carrier, the research team achieved hydrogen storage capacity as high as 14.8 mass percent, they reported.

The idea began as a theory. The research was based on Zhang's previous work pertaining to cellulosic ethanol production and the ORNL and University of Georgia researchers' work with enzymatic hydrogen production. UGA Distinguished Professor Adams is co-author of the first enzymatic hydrogen paper in Nature Biotechnology in 1996. The researchers were certain they could put the processes together in one pot. They tested the theory using Oak Ridge's hydrogen detectors and documented that hydrogen is produced as they predicted.

Mielenz, who heads the Bioconversion Group in ORNL's Biosciences Division, attributed the successful research to a unique collaborative working relationship between scientists, lab divisions, and universities.

"Pairing our biomass conversion capabilities with facilities for studying renewable hydrogen production in the lab's Chemical Sciences Division was a key to this project," Mielenz said. "This also shows the value of partnerships with universities such as Virginia Tech and the University of Georgia."

It is a new process that aims to release hydrogen from water and carbohydrate by using multiple enzymes as a catalyst, Zhang said. "In nature, most hydrogen is produced from anaerobic fermentation. But hydrogen, along with acetic acid, is a co-product and the hydrogen yield is pretty low--only four molecules per molecule of glucose. In our process, hydrogen is the main product and hydrogen yields are three-times higher, and the likely production costs are low--about \$1 per pound of hydrogen.

Over the years, many substances have been proposed as "hydrogen carriers," such as methanol, ethanol, hydrocarbons, or ammonia--all of which require special storage and distribution. Also, the thermochemical reforming systems require high temperatures and are complicated and bulky. Starch, on the other hand, can be distributed by grocery stores, Zhang points out.

"So it is environmentally friendly, energy efficient, requires no special infrastructure, and is extremely safe. We have killed three birds with one stone," he said. "We have hydrogen production with a mild reaction and low cost. We have hydrogen storage and transport in the form of starch or syrups. And no special infrastructure is needed."

"The next R&D step will be to increase reaction rates and reduce enzyme costs," Zhang said. "We envision that in the future we will drive vehicles powered by carbohydrate, or energy stored in solid carbohydrate form, with hydrogen production from carbohydrate and water, and electricity production via hydrogen-fuel cells.

"What is more important, the energy conversion efficiency from the sugar-hydrogen-fuel cell system is extremely high--greater than three times higher than a sugar-ethanol-internal combustion engine," Zhang said. "It means that if about 30 percent of transportation fuel can be replaced by ethanol from biomass as the DOE proposed, the same amount of biomass will be sufficient to provide 100 percent of vehicle transportation fuel through this technology."

In addition, the use of carbohydrates from biomass as transportation fuels will produce zero net carbon dioxide emissions and bring benefits to national energy security and the economy, Zhang said.

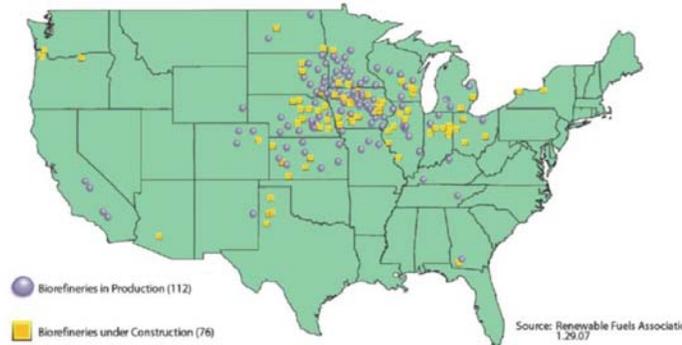
Contact corresponding author Y.H. Percival Zhang at 540-231-7414. Learn more at The Zhang Lab <http://filebox.vt.edu/users/ypzhang/research.htm>

(By Susan Trulove, (540) 231-5646, [strulove@vt.edu](mailto:strulove@vt.edu), BLACKSBURG, VA., May 23, 2007)

# Factsheet on Fuel Ethanol

An extension fact-sheet on fuel ethanol has been published by Zhiyou Wen, John Ignosh, and Jactone Arogo. The publication is to response the recently increasing interests across the nation in using domestic, renewable fuel ethanol.

Figure 2. U.S. ethanol refinery locations



and address some myths and answer some questions about fuel ethanol before consumers use this type of fuel. It starts with the explanation of some terminologies about fuel ethanol, and then covers engine warranty, fuel performance, environmental benefits, energy balance, U.S. annual production, tax incentives. The current status of fuel ethanol development in Virginia was also discussed.

Nationwide, it is expected that a 20% replacement of petroleum usage will happen over the next ten years. This is equivalent to 35 billion gallons of alternative fuel use by 2017, with fuel ethanol playing an important role in this transition. Fuel ethanol can be blended with gasoline (from

10-85%), and thus reduce the amount of gasoline used.

In the United States, corn kernels are commonly used for producing fuel ethanol, and thus reduce the nation's dependence on foreign oils. The purpose of this publication is to disseminate the basic knowledge of fuel ethanol

and then covers engine warranty, fuel performance, environmental benefits, energy balance, U.S. annual production, tax incentives. The current status of fuel ethanol development in Virginia was also discussed.

Find the factsheet at: (<http://www.ext.vt.edu/pubs/bse/442-884/442-884.html>)

# Making Your Own Biodiesel

Biodiesel is another renewable fuel which has drawn a great attention in Virginia. It is an excellent alternative fuel for diesel engines. Biodiesel is made from agricultural products grown within the Commonwealth and can be used by Virginia farmers. It is most commonly made from oil extracted from soybeans, one of the top agricultural products in Virginia, and there is a lot of interest in biodiesel production across Virginia.

In a previous extension publication (<http://www.ext.vt.edu/pubs/ageng/442-880/442-880.html>) by BSE extension specialists, the basics of biodiesel

has been discussed, including the ASTM standard; the engine performance and engine warranty; storage; cold temperature concern; and tax incentives.

In response to the broad interest in making biodiesel by small producers/home brewers, BSE extension specialists developed a factsheet describing the detailed protocols to make biodiesel.

In summary, the biodiesel can be produced from a variety of pure vegetable oil (soybean, canola, sunflowers); rendered animal fats; or waste cooking oil. The oil is converted to biodiesel

through a chemical process called transesterification. Glycerin is removed as a byproduct of the reaction, and the resulting fuel can be blended with petroleum diesel, or used directly as a neat fuel. The produced biodiesel should be evaluated according to the protocols outlined in the Biodiesel Standard ASTM (American Society for Testing and Materials) D6751 before use. This new publication presents the procedures for producing biodiesel, with particular emphasis on small-scale production.

For detailed information go to [http://filebox.vt.edu/users/rgrisso/Papers/Ext/Make\\_Biodiesel.pdf](http://filebox.vt.edu/users/rgrisso/Papers/Ext/Make_Biodiesel.pdf)

# Inventing & Growing the Future

More than likely, when you hear the word switchgrass visions of bioenergy, cellulosic ethanol, and energy independence flash through your head. Much of this imagery is associated with the considerable buzz created last year when President Bush referred to switchgrass as a means to break our addiction to foreign oil. However, few Hokies (or anyone else) know

that the development of switchgrass as a bioenergy crop began right here at Virginia Tech.

Back in the mid-1980s, the US Department of Energy (DOE) began funding research on plants that could be grown to produce fuels through their Herbaceous Energy Crops Program (HECP). Virginia Tech's team was led by Dr. Dave Parrish and was one of five institutions to participate in this project. When these groups met in 1985 to coordinate efforts, they discovered there was no overlap of candidate species between each of their lists of targeted species. At that point, Dr. Dale Wolf, retired professor from VT's CSES, proposed that



One Round Bale of Switchgrass

switchgrass be used as a common benchmark across the five different studies. Virginia Tech had originally included switchgrass in its proposal because Dr. Wolf had many years of experience cultivating this prairie grass at his boyhood home in Nebraska. Dr. Wolf's experience paid off. In fact, switchgrass emerged from the five-year HECP study as the most productive species across several sites. These results caused the DOE to focus entirely on switchgrass for the next 10 years of their herbaceous energy crop work. Building upon this work, Dr. John Cundiff (BSE) worked with Dr. Wolf to establish an 11 acre field of switchgrass in 1993. The follow-

ing year, Dr. Cundiff also conducted research on the effects of delayed harvesting and explored storage options with Dr. Lori Marsh.

Today, faculty from Virginia Tech and VCE are collaborating with private organizations throughout the state to capitalize on the inherent potential of switchgrass, and the emerging lignocellulosic con-

version methods and logistical management systems being developed at BSE. This summer, these groups will be working with farmers to assess their interest in cultivating switchgrass through a series of surveys and focus groups. As these technologies mature, and farmers gain a better understanding of the market, the group is hopeful that the visions inspired by President Bush's speech will be witnessed firsthand in a ride through rural Virginia.

For more information please contact John Ignosh (jignosh@vt.edu).

## Upcoming papers on the Biomass Engineering Issues:

Raula, P.R., R.D. Grisso, and J.C. Cunduff. 2007. Comparison between two policy strategies for scheduling in a biomass logistic system. ASABE Paper No. 071095. St. Joseph, MI:ASABE <http://filebox.vt.edu/users/rgrisso/Papers/071095.pdf>  
Cundiff, J.C., H. Shapouri, and R.D. Grisso. 2007. Economic analysis of two receiving facility designs for a bioenergy plant. ASABE Paper No. 076051. St. Joseph, MI:ASABE <http://filebox.vt.edu/users/rgrisso/Papers/076051.pdf>  
Cundiff, J.S. and R.D. Grisso. Influence of operating variables on mean hauling cost to delivery herbaceous biomass to a plant in upper southeastern USA. Biomass & Bioenergy (*in review*) [http://filebox.vt.edu/users/rgrisso/Papers/Hauling\\_Cost.pdf](http://filebox.vt.edu/users/rgrisso/Papers/Hauling_Cost.pdf)  
Cundiff, J.S. and R.D. Grisso. Containerized handling to minimize hauling cost of herbaceous biomass. Biomass & Bioenergy (*in review*) [http://filebox.vt.edu/users/rgrisso/Papers/Container\\_Hauling.pdf](http://filebox.vt.edu/users/rgrisso/Papers/Container_Hauling.pdf)

# Temporary Storage of Corn Grain

Existing grain storage capacity is not sufficient to contain the volume of corn anticipated in 2007. As a consequence, more corn will be stored in existing structures such as silos, machinery storage buildings, warehouses, or even livestock buildings. These structures can be used successfully for short-term storage of cool, dry grain if good management practices are used - that is, if the grain is in good condition when placed in storage and the challenges of grain handling, aeration and pest control can be met. If grain in temporary

storage is managed improperly, much of it could be lost to molds, rodents and insects.

Conventional corn storage bins have clear advantages: they are rainproof, vented, and resist insects, animals and other pests. Temporary grain storage structures may share all, or none of these characteristics.

For successful storage, the critical grain storage requirements not contained in the temporary structure must be added by the user. Even so, some experts caution that

grain losses or discounts may reach 10% and that the storage period may often be shorter than desired in temporary storage structures vs. standard grain bins. In fact, some temporary structures may only hold grain in condition for three to four months or less unless extensive modifications or improvements are made.

These materials are developed by (c)2007, Pioneer Hi-Bred International, Inc. Refer to Crop Insights #5, or request a copy from rgrisso@vt.edu

## Improving Morale During Difficult Times

The events of 4-16-07 at Virginia Tech have shown lots of examples about how to face difficult times.

1. Let the workforce express their feeling about the difficulties and changes that are occurring. Telling them to move and get over it will only foster anger and resentment and could disengage the workforce.
2. Don't focus all your efforts on getting buy-in to the changes. People need to know that their perspective is understood and their feeling respected before they listen to your exhortations.

3. Support constructive criticism. Make it safe for employees to express dissent without being labeled. Lack of support will create persons that learns not to care.
4. Give employees space to solve problems and take constructive action. Action is a strong antidote to fear of the future.
5. Establish and communicate short-term goals to build confidence and a sense of purpose. Celebrate small tasks that are accomplished in the transition.
6. Communicate frequently and provide details about what is going on during each step of the process. People feel vul-

- nerable when their tolerance of ambiguity decreases.
7. When talking about the vision and challenges, use stories and analogies, rather than statistics. Inspiring leaders move people with compelling stories.
8. Listen to feedback and form effective strategies for executing and communicating changes.
9. When asking for input, comments and ideas, clearly define the parameters of their input.
10. Celebrate victories and examples of excellence during difficult times.

*Taken from David Lee founder of HumanNature@Work*

## Safety Videos, Slide Sets, and Films

BSE has a loan library of safety presentation materials available on a short-term loan basis for educational programs. Users are required to pay return postage fees.

Following is a categorical listing of safety presentations currently available:

- ATV Safety
- Automobile Safety
- Bicycle Safety
- Chain Saw Safety
- Chemical & Pesticide Safety
- Electrical Safety
- Falls
- Fire Safety

- General Farm Safety
- Gun Safety
- Home Safety
- Garden, & Landscaping
- Spraying Systems
- Tool & Shop Safety
- Tractors & Machinery
- Water & Recreation
- Wood Stoves
- Miscellaneous

Descriptions are found at:  
<http://www.ext.vt.edu/vce/anr/bse/farmsafety/videos.html>

To request: Phone (540) 231-6809, Fax (540) 231-3199 or  
E-mail: [tlcox@vt.edu](mailto:tlcox@vt.edu)

### Prohibited Work

Hazardous Occupations Order in Agriculture (HOOA) deems the following tasks as too dangerous for all hired youth **15 years** of age and under with NO exemptions:

- Handling animal sires or sows and cows with newborns within a pen or corral;
- Working more than 20 feet above the ground;
- Handling Category I (identified by the word "Danger" and/or "Poison" with skull and crossbones; or Category II (identified by the word "Warning") agricultural chemicals or chemical containers;
- Handling and using explosives and anhydrous ammonia.

## PLANS

In response to numerous requests, building and facility plans are now available for download from the Virginia Cooperative Extension (VCE) Intranet. Plans are categorized under five main categories: Forage Storage and Feeding, Grain Handling and Feeding, Beef, Horse, and Sheep. You will need Adobe Acrobat to download these files. For the building and facility plans, as well as additional resources, please visit:

<http://www.ext.vt.edu/vce/anr/bse/index.html>

## Keep Kids Safe Over the Summer

Summer is a time that is high in kid-related injuries. Safe Kids Worldwide (<http://www.usa.safekids.org/>) has released a report studying child deaths during summer. The informative report along with child safety information and reminders for summertime. Previous Safe Kids Worldwide research indicates that five of the most common causes of children's accidental injury deaths in summer are:

- Drowning (increases 89% in the summer over the annual monthly average)
- Biking (increases 45%)
- Falls (increases 21%)
- Motor vehicle passenger injuries (increases 20%)
- Pedestrian injuries (increases 16%).



In fact, almost 60% of total children's accidental injury deaths from May to August from 2001 to 2004 came from these risk areas. The report also demonstrates a 18% drop in children's accidental injury deaths in summer across the nation (comparing data from 1997-1999 to 2002-2004), yet children's accidental injury deaths continue to spike in the summer.

**Safety Tips** when visiting amusement parks are provided in a recent report from the National Safety Council. See

page 7 entitled "Tips for Visiting an Amusement Park or Attraction."

Youth workers in agriculture requirements are summarized in the Penn State's Ag Safety and Health Newsletter found at:

<http://www.agsafety.psu.edu/newsletters/MarApr07.pdf>

For children or youth engaged in farm-related tasks, use the North American Guidelines for Children's Agricultural Tasks. <http://www.nagcat.org/nagcat/pages/default.aspx>

(R. Grisso)

## Tips for Visiting an Amusement Park or Attraction

Summer is the time when many people visit their local amusement park or attraction and a bit of thought and planning can go a long way! Here are some helpful tips that will assist guests in making their visit both safe and fun.

- Dress comfortably, but avoid open-toed shoes and dangling clothing or jewelry. Very long hair should be put up. Protect yourself from the sun with sunscreen and headgear, even on cloudy days.
- Eat normally and take any medications that might be necessary before visiting a park or attraction. Bring medications with you that might be needed during the day. Drink plenty of water and be sure not to skip meals, but only consume food and other beverages, including alcoholic beverages, in moderation prior to enjoying rides. Stop riding before you get excessively tired.
- Observe all posted rules, and follow all verbal instructions given by park personnel or ride operators/attendants.
- Be considerate of others ... amusement parks and attractions are unique environments designed for your enjoyment. Don't let your exuberance ruin the day for you, your friends or neighbors. Queue lines permit guests to experience popular attractions in a comfortable and orderly manner; while in a queue line be especially consid-



- erate of others, observe no smoking and other queue line signage, and never break into line, as this is a flagrant violation of basic park policy and a reason for expulsion in most parks and attractions.
- When enjoying rides and attractions, obey posted age, height, and weight restrictions, as well as notices concerning such health matters as heart conditions, back/neck conditions, pregnancy, recent surgery, and high blood pressure. Always use common sense ... if you don't feel well, if there has been an abrupt change in your physical status, or any other unusual or unexplained symptoms, skip the ride.
  - Remove personal items such as glasses, hats, cell phones, pagers, etc. before boarding a ride. Keep hands, arms, legs, and feet inside the ride at all times, and remain in the ride until it comes to a complete stop and you are instructed by a ride operator/attendant to exit. If a personal item falls outside the vehicle while you

are on the ride, ask an operator/attendant for assistance in retrieving it once you have disembarked from the ride. Do not attempt to retrieve any lost articles yourself.

- Always use the safety equipment provided and DO NOT attempt to alter or free yourself from any safety restraint in search of a "better" thrill or an opportunity to show off. Restraints are provided for both your safety and the safety of others.
- Taking an active safety role is especially important in the case of parents with young children: upon your arrival, identify a meeting point in case you are separated during your visit; observe each ride in operation and note the rules regarding age, height and weight; explain appropriate behavior on a ride; and read the rules of the ride together before the child boards the ride.
- Prior to visiting a park or attraction, visit their web site or contact the Guest Relations office for a guide or map that includes general information about rides, entertainment, accessibility information for guests with disabilities, etc.

*(Source: International Association of Amusement Parks and Attractions—R. Grisso)*

# Creating Management Zones with Soil EC Data

To best utilize Precision Ag (PA) concepts, management zones need to be established for the field. Management zones have been defined as "regions of a field that have been differentiated from the rest of the field for the purpose of receiving individual management attention." In other words, these zones, for some reason, are areas that you want to manage differently from the other parts of the field.

To delineate zones, a grower would likely consider the variability of various attributes of the field. These attributes could include topography/elevation, soil type, soil texture, depth to clay layer, field boundary, pivot coverage, non-cropped areas, previous yield history, etc.

Soil texture (% sand/silt/clay) is often a key attribute as texture is directly related to soil water holding capacity. However, getting a handle on soil texture all across a field is a difficult proposition. However, a tool is available that can make mapping soil texture across a field much easier. The Veris 3100 Soil EC

sensor pulls behind a pickup truck, small tractor or ATV and measures soil electrical conductivity (EC) over two depths, 0-30 cm and 0-90 cm. In soils found in the Southeast, EC data provides a good representation of soil texture - the lower the EC value,

Figure 1 shows 0-90 cm EC data from a field with the zones drawn in to indicate areas of similar values. The lighter tan colors indicate more sandy soils while the darker brown regions indicate a higher clay content. These zones can now be used to develop management practices that match these soil textures.

Despite the wealth of data it can provide, the Veris 3100 is likely too expensive for all but the largest growers to own individually. Consultants and some co-operatives are considering offering Veris EC mapping as a service to their clients on a cost per acre

fee. Plus, unlike yield or disease, soil texture isn't likely to change much from year to year, so a grower can have a Veris EC sensor run over their field and not have to repeat this measurement, possibly ever again. Virginia Tech has a Veris 3100 system and is using it to map soil EC in fields.

*(VCE factsheet is drafted and can be found at: <http://filebox.vt.edu/users/rgrisso/Papers/Ext/P442-508%20PF%20EC.pdf>  
R. Grisso)*

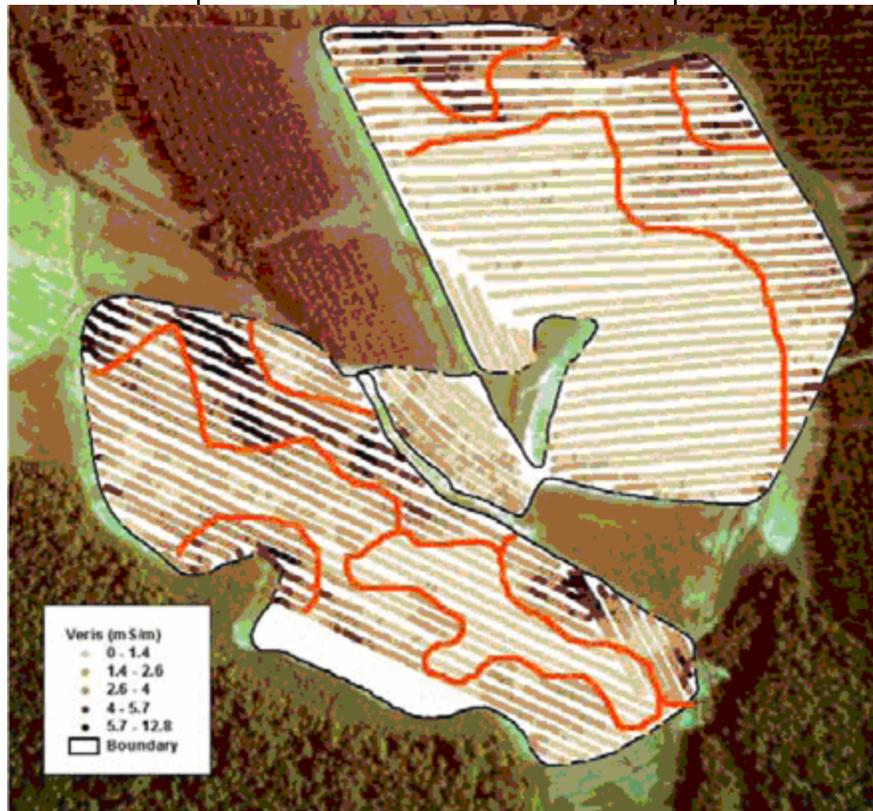


Figure 1. Soil EC Data from Veris 3100 with management zones delineated in orange

the greater the sand content; the higher the EC value, the higher the clay content.

Once the EC data is obtained, maps showing the data across an entire field can be created. Once the maps have been created, management zones can be delineating by visually observing areas in the field with approximately the same level of EC values.

# Eye Protection

A few of the most common eye injuries in agricultural settings are:

- Chemical** - Wear safety glasses or goggles to protect against splashes or fumes. Contact lens users should be especially cautious because the lens may trap chemicals and their vapors.
- Impact** - Flying particles from chain saws, grinders, chippers, sanders and many other farm, industrial, home and garden tools can pose serious eye hazards. Always wear safety glasses. Side shields are recommended for added protection against flying objects. Ensure that machinery is suitably shielded.
- Dust** - Wear safety glasses or



goggles to protect the eyes when working in dusty conditions.

- Optical radiation (welding)** - Ensure that the correct filters, welding goggles or full-face shields are worn when welding. Safety glasses with side shields worn underneath a helmet provide increased protection from flying particles.

Protective eyewear should meet American National Standards Institute (ANSI) approval and of-

fer both front and side protection and enough ventilation to prevent fogging.

What to do if an eye injury occurs? Prompt evaluation by an optometrist is necessary to determine the extent of the injury and subsequent treatment. For chemical injuries, the chemical should be identified if possible.

Those in the agricultural field are also at risk of eye damage from too much sunlight while working long hours outdoors. Sunglasses are an important item to help prevent damage from the sun's rays.

(see <http://www.ext.vt.edu/news/releases/081104/eyes.html>  
R. Grisso)

# Lightning Safety Week, June 24-30

The theme for this year's Lightning Safety Week is "when lightning roars, go indoors".

Personal Lightning Safety Tips:

1. **PLAN** in advance your evacuation and safety measures. When you first see lightning or hear thunder, activate your emergency plan. Now is the time to go to a building or a vehicle. Lightning often precedes rain, so don't wait for the rain to begin before suspending activities.
2. **IF OUTDOORS...**Avoid water. Avoid the high ground. Avoid open spaces. Avoid all metal objects including electric wires, fences, machinery, motors, power tools, etc. Unsafe places include underneath canopies, small picnic or rain shelters, or near trees. Where possible, find shelter in a substantial

building or in a fully enclosed metal vehicle such as a car, truck or a van with the windows completely shut. If lightning is striking nearby when you are outside, you should:

- Crouch down. Put feet together. Place hands over ears to minimize hearing damage from thunder.
  - Avoid proximity (minimum of 15 ft) to other people.
3. **IF INDOORS...** Avoid water. Stay away from doors and windows. Do not use the telephone. Take off head sets. Turn off, unplug, and stay away from appliances, computers, power tools, & TV sets. Lightning may strike exterior electric and phone lines, inducing shocks to inside equipment.
  4. **SUSPEND ACTIVITIES** for 30 minutes after the last observed lightning or thunder.

5. **INJURED PERSONS** do not carry an electrical charge and can be handled safely. Apply First Aid procedures to a lightning victim if you are qualified to do so. Call 911 or send for help immediately.
6. **KNOW YOUR EMERGENCY TELEPHONE NUMBERS.**

Lightning safety fact sheets and other information is available at these two sites:

<http://www.lightningsafety.noaa.gov/>  
[http://www.lightningsafety.com/nlsi\\_pls/lst.html](http://www.lightningsafety.com/nlsi_pls/lst.html)



(R. Grisso)

## Guidance Systems Improve Field Operations

Knowing when to dig peanuts is always a management challenge for growers. In years when vine growth is excessive, knowing where the rows are can be a big challenge. Growers shared their experiences with different auto guidance systems used in peanut production at a recent production meeting.

Plant growth inhibitors, used to more distinctly form the crown, or top, of peanut rows. A treated field of peanuts looked like an ocean with waves. Now that plant growth regulators are rarely used, a lush field of peanuts often looks more like a flat ocean of green with no waves and rows are hard to identify.

A farmer who farms about 500 acres of peanuts, bought a auto steer guidance system in 2004. "It will do everything it was advertised to do, but its main advantage is to allow me to know more every day about every tank load of material and monitor my planter much better," he says.

Eventhough he did not see himself as very computer savvy, he found the software easy to understand, and easy to teach his labor force. He suggested that these systems can be expensive, but you may not know how much time it takes to learn how to use them properly.

Another farmer owns about a thousand acres of peanuts, has been using a RTK system for three years. A big advantage he says is to avoid driver fatigue. When you dig your own peanuts, and stay on a tractor 12-14 hours a day, "the guidance system makes life much easier," he says.

He uses two six-row planters, and the guidance system takes 5-10 minutes to set it up. Both planter are use in the same field and uses a single base station.

For growers planning to use an auto-guidance system, farmers stress to not throw away your row markers. Because if a signal is lost during field operation, with row markers you can lose the signal for 15-20 foot spot, and will not driving blind.

An owner of a auto-guide system allows them to get a second cutting on ryegrass that is used for their dairy operation, and still have sufficient time to plant peanuts in early May. They use a system on which a subscription system is paid, much like Direct TV. The signal comes from a satellite, and when traveling under a tree limb or behind a tree, one can lose the satellite signal. So, he suggested keeping row markers for some parts of the field.

One of the biggest benefits some farmers have found from using the guidance system is that

it allows them to spend more of their time looking back, which gives the driver a more consistent idea of how a planter, or sprayer or digger is working.

A farmer that purchased an RTK system in 2006 considers himself pretty conservative, and not one who would make an investment in high tech equipment. He explains that in the first three years they grew peanuts, finding the row was difficult, and sometimes impossible. They used all kinds of markers, but with this system, he could plant peanuts straight and dig peanuts straight.

Several members of the panel mentioned having problems losing signals in some spots of a field. A recent announcement may provide equipment to greatly reduce this problem.

With more satellite signals to access, the receiver improves the farmer's ability to work in tough GPS environments with faster initialization times, and provides for increased productivity and reduced downtime in the field. Trimble improves signal availability for high accuracy real-time kinematic (RTK) agricultural applications that rely heavily vertical axis satellite positioning data. It also aids RTK applications in difficult satellite scenarios such as geographic areas with limited periods of GPS signal availability.

*(Taken from Farm Press and modified by R. Grisso)*

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<http://www.bse.vt.edu>**

## Lightbar versus Assisted Steering

If you didn't jump on the lightbar manual-steering guidance bandwagon early in the decade, fear not. Why?

- You can now buy assisted-steering technology for the price of an early lightbar system.
- Or, you can still ease yourself and your wallet into GPS-based steering accuracy by buying an improved lightbar system.

However, if you ask any farmer who has upgraded from a lightbar — which requires you to steer — to hands-free, assisted-steering technology, most will tell you to jump right into assisted steering. Some growers say it is harder to steer via lightbar than watching a planter mark. But perhaps you're not ready to let go of the wheel yet.

Why buy a lightbar?

- A lightbar with any GPS signal will improve your driving and quickly pay for itself.
- It's a lower-cost initial investment than assisted steering.
- It's more reliable and accurate than foam markers, at higher speeds.
- With an ability to upgrade, it may offer all the features you currently want.
- You can farm more acres with the same equipment. Research shows a 1,800-acre farm could expand to 2,600 acres with the same 12-row planter while maintaining the same planting timeliness.

Why skip the lightbar for assisted steering?

- You focus on the operation, not the driving, except to turn around (and new Deere technology will

handle the turnaround, too).

- Assisted steering offers greatly reduced stress without the common arm/shoulder/neck aches from steering and looking back and forth.
- Assisted steering gives greater accuracy, reduced overlap and greater input cost savings compared to a lightbar.
- Controller technology usually offers more features and add-ons to handle more tasks compared to a lightbar.
- You can farm even more acres with the same equipment. Research says a 1,800-acre farm could expand to 3,100 acres with the same 12-row planter while maintaining the same planting timeliness.

(modified from FIN- Farm Industry News by R. Grisso)

## Consider Safety of Animals and Operator in Corral Design

**Cattle have a flight zone (the personal space they will not permit anyone to enter). The size of the zone can vary from animal to animal.**

As you try to enter this zone, cattle will move away to keep you out of the zone. But if you enter the zone too quickly, the animal may charge toward you. Knowing about flight zones can be useful, especially when moving cattle.

### CIRCLE MOVEMENT

Take advantage of certain known cattle characteristics when moving them. For example, cows have a natural tendency to move in a circle. Using that knowledge in the design of a corral can lead to an arrangement that is safer for the animals and operator.

One reason cattle move in a circle is that they are looking for other herd members. Another reason is they are turning to see what is going on behind them. Using natural circular movements then, makes for convenient flow.

### VISION & HEARING

Cattle have nearly 360-degree panoramic vision. This means cattle can hold their heads straight ahead and still see all around - with

the exception of directly below and behind the rear - without moving the head.

How about their hearing? High frequency, loud noises scare cattle. Gates banging, hydraulic controls, clanging headgates, barking dogs, cracking whips and screaming children are all examples of noises that scare them.

Eliminate as much noise as possible. Once the cattle are contained in a corral, the dogs should be kept out of sight and nowhere near the cattle. For safety sake, small children shouldn't be involved in rounding up or working the cattle through the handling facility.

Bright spots and shadows will also spook cattle. Moving them from bright sunlight into a dark barn, for example, will cause cattle to balk. Because of depth perception problems, they have difficulty judging distances.

Man-gates are a seldom-used feature that should be included in every facility plan. They offer greater safety to the operator by providing an easy escape path from charging cattle. Rather than climbing the fence or going all the way around, a man-gate built into the corral could be used.

### NOISE REDUCTION

Take steps to eliminate as much noise as

possible around the loading chute. The squeeze chute and scales, hydraulic controls and pumps could be located a short distance away from the squeeze rather than on top of it to reduce noise. A rubber cushion can be used between gates and posts to reduce clanging noises. A hazardous area for the operator is around the squeeze. By-standers and the operator could be injured by the headgate, particularly one with hydraulic controls.

Guards around the headgate can prevent injuries. A solid, horizontally-sliding blocking gate between a palpation cage and the lead-up alley blocks the view of the next animal. It is easier to use and probably safer than raising a vertical sliding gate with a rope.

### LOADOUT

Looking at loadout, it might be wise to provide separate loading for fifth wheel trailers. Ramping up 15 inches in 10 to 15 feet allows easier loading into a fifth wheel.

*DVD is available at the Cattle Learning Center Web site:*

[www.cattlelearningcenter.com](http://www.cattlelearningcenter.com)

## A Quick Tip on Hand Tools

When buying new wrenches, pliers, pruners, or other hand tools, find ones with handles coated in a soft material. Increasing the diameter of the handle with tool wrap tape also improves gripping. Avoid tools featuring handles with finger grooves. The odds are that you weren't the hand model that developed the handle mold, so you may find the ridges uncomfortable or inappropriately sized for your grip.

Learn more about the many types of ergonomic hand tools and han-



dle wraps by visiting the National AgrAbility Project's Assistive Technology Database at: [www.agrabilityproject.org/search/category.cfm?categoryid=11](http://www.agrabilityproject.org/search/category.cfm?categoryid=11)



(R. Grisso)

### Nonfatal Ladder Injuries Increasing, According to Study

According to a new study, the number of nonfatal ladder injuries treated in emergency rooms jumped by 50 percent between 1990 and 2005, and the popularity of home improvement may explain the spike in injuries.

The exact reasons for the increase are unclear. Still, the findings suggest that there needs to be more education about ladder safety. It's alarming that the numbers are so high and that they've increased over time. Prevention strategies and interventions that would reduce these numbers are needed.

The researchers found that 2,177,888 people suffered ladder injuries from 1990 to 2005, and their ages ranged from as young as one month to as old as 101 years. Three-quarters of the injured were male. An average of 135,000 people sustained ladder injuries each year.

The actual number of injuries per year rose by about 50 percent over the 15 years. On the bright side, injured ladder users only required hospitalization or transfer to other hospitals 10 percent of the time. Ninety-seven percent of those cases happened in "non-occupational" settings like homes and farms.

This may show that a lot of people are doing do-it-yourself home repairs. Most people like to think of a ladder as a fairly benign piece of equipment, but the injuries that result are serious. Many fractures are very complex and require extensive surgery. That's only part of the problem. These fractures of hands, wrists, ankles and feet can require future surgeries, rehab and lifelong arthritis or chronic pain. Patients frequently who are still bothered by pain from complex fractures after falls many years ago. We should treat ladders like a potentially dangerous tool, like a power saw or razor-sharp plane.

**Source:** D'Souza AL, Smith GA, Trifiletti LB (2007). Ladder-related injuries treated in emergency departments in the United States, 1990-2005. *American Journal of Preventive Medicine* 32(5), 413-418.

**For Ladder Safety see:** [http://www.cdc.gov/nasd/menu/topic/ladder\\_safety.html](http://www.cdc.gov/nasd/menu/topic/ladder_safety.html)

## Tips to Prevent, Treat Poison Ivy

The old adage "leaves of three, let them be" is often easier said than done, especially if you plan on spending a lot of time outside this summer.

Each year, an estimated 25 million to 40 million people in the US will feel the infamous itch of poison ivy, a plant found throughout North America that typically grows in the form of a vine, often along riverbanks. For most people, this itchy rash will appear one or two days after they have been exposed to the plant, and condition can last anywhere from 10 days to three weeks.

The allergic reaction from poison ivy is caused by oil in the plant and the reaction usually starts with redness and swelling of the skin, which is then followed by either bumps or blisters. More than 50 percent of people are sensitive to this oil -- a colorless, odorless resin called urushiol -- contained in the leaves of poison ivy.

To take the "itch-out" for both kids and adults, use these tips to help treat poison ivy and advice on how to avoid contact.

- **Wash the area.** When in contact with poison ivy, the best advice is to wash your skin as quickly as possible with soap and cold, running water. Do this within minutes of coming into contact with the plant to prevent the oil from

absorbing into the skin. Also, avoid vigorously scrubbing the area or using hot water since this may further open pores or cause more irritation to the skin.

- **Cool off.** People with poison ivy tend to find relief from cool baths or cool compresses. Massage the affected area with an ice cube for relief. However, don't forget to let the area air dry after soaking or massaging it with an ice cube. Allowing it to air dry will reduce itching and oozing of blisters.
- **Use oral or topical antihistamines.** Oral antihistamines such as Benadryl will help to reduce the itch of poison ivy. Use of topical creams such as calamine lotion to ease itching.
- **Wash clothing and shoes.** Be sure to wash the items you were wearing when you came into contact with the poison ivy. Use soap and hot water to remove any oil that may still be on these items.
- **Give pets a bath.** The rash caused by poison ivy can spread if there are oils from the plant on your pet's fur, or even on other items around the yard such as gardening tools. Wash both pets and other items that may have come into contact with poison ivy to remove the oils.

- **Stop the rash from spreading.** The fluid from the sores caused by poison ivy is not contagious. The rash caused by poison ivy will only spread to other areas of the body if the oil from the plant is still on your skin. Rash will only spread to another person if you have oil on your hand and touch the individual. Once the oil has been removed from your skin, it is no longer possible to spread the rash to other areas of your body.
- **If the reaction is severe, seek medical attention.** Most cases of poison ivy can be handled at home. In rare cases, however, poison ivy can be extremely serious or even fatal. Occasionally, poison ivy can become a more severe situation in someone who's highly sensitized to the reaction, or if someone is exposed to a large amount of the oil, either by breathing in fumes when the plant is being burned or having the oils enter areas of broken skin.
- **Avoid contact with poison ivy.** Familiarize yourself with the plants growing in your area of the country and how they look at different times of the year so you can steer clear of poison ivy and other plants that may cause an allergic reaction.

**F**or more information concerning treating poison ivy, visit these Web sites:

University of Michigan Health Topics A-Z -- Poison ivy, poison oak and poison sumac:  
[http://www.med.umich.edu/1libr/pa/pa\\_tnpoisiv\\_hhg.htm](http://www.med.umich.edu/1libr/pa/pa_tnpoisiv_hhg.htm)

U.S. Food and Drug Administration -- Outsmarting poison ivy and its cousins:  
[http://www.fda.gov/fdac/features/796\\_ivy.html](http://www.fda.gov/fdac/features/796_ivy.html)

KidsHealth -- Poison ivy: [http://www.kidshealth.org/kid/health\\_problems/skin/poison\\_ivy.html](http://www.kidshealth.org/kid/health_problems/skin/poison_ivy.html)

Medline Plus --Poison ivy, oak and sumac rash: <http://www.nlm.nih.gov/medlineplus/ency/article/000027.htm>

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