Engineering Update

Biological Systems Engineering

December 2010

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

Dear Co-Workers: Engineering Update is a joint effort of Biological Systems Engineering and other interested parties. 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 and interested parties. Engineering Update is electronically accessible at: (http://intra.ext.vt.edu/anr/bse/index.html).
Safety in confined spaces

The Occupational Safety and Health Administration (OSHA) and the National Institute of Occupational Health (NIOSH) states that a space may be considered "confined" because its configurations hinder the activities of employees who must enter into, work in or exit from them. In many instances, employees who work in confined spaces also face increased risk of exposure to serious physical injury from hazards such as entrapment, engulfment and hazardous atmospheric conditions. Confined itself may pose entrapment hazards and work in confined spaces may keep employees closer to hazards such as machinery components than they would be otherwise. For example, confinement, limited access and restricted airflow can result in hazardous conditions that would not normally arise in an open workplace.

By definition, a confined space: (1) is large enough for an employee to enter fully and perform assigned work; (2) is not designed for continuous occupancy by the employee; and (3) has a limited or restricted means of entry or exit. Examples of confined spaces include underground vaults, tanks, storage bins, pits and diked areas, manholes, vessels, silos, underground utility vaults, and pipelines.

Some confined spaces may require workers to have permits to enter. The terms "permit-required confined space" and "permit space" refer to spaces that meet OSHA's definition of a "confined space" and contain health or safety hazards. For this reason, OSHA requires workers to have a permit to enter these spaces. By definition, a permit-required confined space has one or more of these characteristics:

- Contains or has the potential to contain a hazardous atmosphere
- Contains a material with the potential to engulf someone who enters the space
- Has an internal configuration that might cause an entrant to be trapped or asphyxiated by inwardly converging walls or by a floor that slopes downward and tapers to a smaller cross section
- Contains any other recognized serious safety or health hazards.

The bottom-line is all employers are responsible for providing a safe and healthy workplace for their employees. Confined spaces present many unique and serious challenges that employers, managers and operators/workers need to understand and prepare for.

Provide adequate ventilation
Before entering a confined space, test the atmosphere for hazards and provide adequate ventilation before entering, during and at the time of exiting the space to provide maximum safety. Use of self-contained breathing apparatus (SCUBA) may be necessary to ensure safety. Remember, lack of oxygen is one of the main causes of fatalities in these spaces. Some symptoms for oxygen deficiencies include: memory loss, poor judgment inattention, loss of motor coordination. Any of these symptoms can render a person unable to assist or complete a job or exit the space under his or her own power. Sometimes, lack of oxygen is not the problem, for example, in a manure pit, other gases that prevent the uptake of oxygen such as hydrogen sulfide, carbon monoxide, and methane may be the problem.

Maintain safety
Be aware of and address fire and explosion risks in confined spaces. Some hazardous gases are flammable, thus energy sources such as, cigarette lighters, torches, cell phones, motors, hand tools and other sparking equipment must be used with caution.

Comfort - ambient temperatures, humidity, adequate hydration.
Maintaining tools: other physical hazards include rain, snow, cold, and falling. Clothing shoes, personal protective equipment, and proper number of staff/people for a job must be allocated to minimize risk. Consider fall protection measures such as harnesses, hard hats, gloves, and removal of slip and fall hazards, proper clothing and footwear. How equipment is moved into and out of confined spaces must also be considered.

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Keeping fit is a desirable quality. The physical condition of people who work in confined spaces can help reduce the risk of injuries. Encourage communication through proper training and education on known risks to ensure that management and staff have safety as a priority. Remember, the attributes of those assigned high risks duties should include good attitude, pay close attention to detail, follow rules, and responsible.

Working in confined spaces intensifies the risks that operators already face on a daily basis. Thus precaution and training need to be intense to promote safety and prevent avoidable injuries.

Resources:
- Pest control and pyrotechnics: http://www.osha.gov/Publications/OSHA_pest_control_pyro.pdf
- Permit required confined spaces: http://www.osha.gov/Publications/osha3138.pdf

(J. Ogejo)
A water footprint is a measure of how much water is used (directly or indirectly) by an individual, business, or a community. Some definitions only consider the amount of fresh water required to produce a good or service. To calculate your water footprint, a full accounting of the source, process, and discharge waters is required. Water footprinting will tell you where water use is heaviest in your operation. A water footprint will tell you the volumes of water consumption and pollution associated with your consumption.

Evaluation of a water footprint is necessary where fresh water is a scarce resource, availability (annual) is limited, and demand is growing. It is also necessary to consider water footprint from the point of view of being a good environmental steward.

While water may be “cheap” and available in many locations in the US, some areas of the world are experiencing non sustainable levels and unequal distribution of water footprint among people. Also, there are many spots in the world where serious water depletion or pollution (contaminated water) are causing rivers to run dry, lake and groundwater levels to drop, and demise of endangered species because of contaminated water.

Reducing water footprint at home
You can reduce your water footprint as a consumer (home) by installing water saving toilets; water-saving showerhead; minimizing running the tap during teeth brushing, shaving, and cleaning dishes; using less water in the garden; and by not disposing medicines, paints or other pollutants through the sink.

Services. Many businesses may have a supply-chain water footprint that is much larger than the operational water footprint. This is particularly true for companies that provide outlets or markets for agricultural products such as crops, meat, milk, eggs, leather, cotton, wood/paper, but do not have any agricultural activities of their own. An example of a water footprint of a retailer is given below

Water use is measured in terms of water volumes consumed (including evaporated) and/or polluted per unit of time. Both the operational and supply-chain water footprint split up into (1) the blue water footprint, which is the volume of freshwater that evaporated from the global blue water resources (surface water and ground water); (2) the green water footprint which is the volume of freshwater evaporated from the global green water resources (rainwater stored in the soil as soil moisture); and (3) the grey water footprint which is the volume of polluted water, calculated as the volume of water required to dilute pollutants to agreed water quality standards.

Other facts about water footprint
- The water footprint is a geographically explicit indicator showing volumes of water use and pollution, including locations and timing. The ecological or social impact of a water footprint obviously depends not only on the volume of water use, but also on where and when the water is used.
- Water footprint accounting is relevant for any sort of business, private or public. Business water footprint accounting can be applied for any coherent entity producing goods and/or services that are supplied to consumers or other businesses. It can be done for a private company or corporation, but also a governmental or non-governmental organization or a public utility. It can be applied to various levels of scale, for instance a specific division of a company, an entire company or a whole business sector. Water footprint accounting can also be done for a project (e.g. construction of a piece of infrastructure) or activity (e.g. the organization of a large sports event).
- By definition, the water footprint of a business is equal to the sum of the water footprints of the business output products. The supply-chain water footprint of a business is equal to the sum of the volumes of the water footprints of the business input products.

(adapted from Water Footprint Network - J. Ogejo)
Low back pain is among the most common musculoskeletal complaint of people seeking health care. Severe, chronic, or acute low back injuries are a major problem in the industrialized world and they account for 25% of workers’ compensation claims in the US. The total cost of low back pain disorders in the US has been estimated to be approximately $72 billion and it is steadily increasing.

Typically, musculoskeletal pain appears early in young workers and after short exposure times of 6–12 months. In addition, injuries persist throughout a worker’s life with highest frequency of symptoms reported between 35 and 55 years of age, with days lost to injury tending to increase with age. Despite growing awareness and implementation of ergonomics in the workplace, the prevalence of musculoskeletal disorders (MSD) has not decreased.

Physically demanding work such as lifting frequent or heavy loads is still present in most jobs and has been associated with an increase in low back pain and increased risk of disc prolapse. Repetitious exertions fatigue the musculature ultimately affecting the resiliency of the tissue and increasing the chance for pain or injury.

To reduce the incidence of pain and injury in these manual materials handling occupations without affecting productivity, mechanical off-body lifting aids (i.e., hoists or trolleys) are commonly implemented for loads that are heavy, awkward to lift, or exceed human capability. However, the use of on-body devices has been limited to the widely-marketed back belts, which are touted as an assistive device to reduce the risk of low back pain and injury. Prior to the release of back belts for use in industry, no research had been performed to assess the ability of these belts to reduce low back pain. After their release, researchers endeavored to determine the effectiveness of these devices, but no conclusive evidence was found to suggest that these belts were safe or effective in the protection and rehabilitation of workers involved with manual materials handling tasks.

Queen’s University researchers developed personal lift assist device (PLAD) to assist human muscles through the use of elastic elements. This study investigated if the PLAD could reduce the level of general and local back muscle fatigue during a cyclical lifting task.

The PLAD is a passive system that utilizes elastic energy to produce an assistive moment about the low back. These elastic elements act in a similar line of action to the erector spinal muscles to enable a portion of the forces and moments from the spinal column to be transferred to the shoulders, pelvic girdle and knees. When a person wears the PLAD during lifting activities, the elastic components are stretched to create elastic energy during forward bending of the trunk. This stored energy is released on the upward portion of a lift, reducing the energy demand on the muscles involved in lifting.

Electromyography of two erector spinal sites (T9 and L3) was recorded during a 45-min lifting session at six lifts/lowers per minute in which ten males lifted a box scaled to represent 20% of their maximum back extensor strength. The PLAD device reduced the severity of muscular fatigue at both muscle sites. RMS amplitude increased minimally (22% and 26%) compared to the no-PLAD condition (104% and 88%). Minimal median frequency decreases (0.33% and 0.41%) were observed in the PLAD condition compared to drops of 12% and 20% in the no-PLAD condition. The PLAD had an additional benefit of minimizing pre–post changes in muscular strength and endurance. The PLAD also resulted in a significantly lower rate of perceived exertion across the lifting session. It was concluded that the PLAD was effective at decreasing the level of back muscular fatigue.

Source:
Biomass-harvesting equipment for the ethanol market

The market for corncobs for cellulosic ethanol production is still new in the market for other types of biomass. But new research and collection equipment designs are proposed for the use of biomass in the commercial production of biofuels and bioenergy.

Vermeer Corporation has been developing biomass-harvesting equipment for the ethanol market from the outset. Vermeer has a new dealership in an area developing a Project Liberty project and can see what's happening firsthand with this industry. POET's Project Liberty project is a 25-million-gallon-per-year cellulosic ethanol facility, which will be attached to its existing corn ethanol plant. POET expects the facility will begin producing commercial-scale cellulosic ethanol by the end of 2011. The plant will use corncobs and corn residue as their primary feedstocks.

Vermeer has been working with about 20 producers to field test its CCX770 cob-collection wagon, which is towed behind a Class 7 or higher combine. They are moving beyond prototypes and the system will collect 2/3 to 1 dry ton/acre in a cornfield that yields an average 200 bu/ac of grain. The amount of dry matter will correspond to the amount of grain yield harvested.

Cobs and other corn residue are caught from the back of the combine. The best time to catch this material is while harvesting. Farmers observe that the additional collection has not slowed them down. Using this system, one would unload cobs every third grain dump (about every five to seven acres), and it takes about 90 seconds to offload cobs. With a Class 7 harvester and 12-row head, this would add about 30 minutes to harvesting on a typical farm. Vermeer points out that because the corncob and corn residue market is still developing, the price of equipment, efficiency of harvest and the value of a ton of biomass will change annually.

Case IH meanwhile has been evaluating the economics and harvest capacity of multiple cornstalk- and cob-collection methods and is pursuing second-pass baling technology using round balers. Case IH notes that after taking into account a grower's capital investment and operating costs, round balers were the best economic solution. Round balers have more versatility, which could mean better resale value than either cob carts or square balers. If the market for biomass weakens, this could be a problem for single-purpose equipment like a cob cart.

Pulling a large square baler behind the combine produces a dense package of biomass, but the large square balers also represent a significant investment and require more power to operate. Round balers are generally about a third of the initial cost of a large square baler and Case IH feels this will make more economic sense to make a second pass with a round baler. They see grain harvest will be more productive without the combine towing a collection cart or baler.

Case IH is introducing the RB564 Premium baler. It features a five-bar pickup with reinforced rubber-mounted tines (60 teeth, 82 in. tine to tine). It also features a roller windguard, external expeller roll, front belt guides, pickup flares and a duckbill trash baffle brush.

As part of its biomass initiative, AGCO Corporation is testing harvest equipment in corn stover, switchgrass, miscanthus and energy cane throughout North America.

AGCO debuted a combine and large square baler combination prototype last January and expanded the testing and validation during the 2010 harvest, with additional units operating in various crops. This included acres contracted with POET's Project Liberty. The Challenger 680B (Class 8) combine and LSB34B (3x4-ft.) baler single-pass system is capable of packaging nearly 1 dry ton of biomass/ac into bales weighing between 1,000 and 1,400 lbs.

The bale can be easily collected, transported and stored on the farm or at the ethanol producer. Compared to second-pass baling, the combination unit collects less tonnage per acre, but it produces a cleaner bale without dirt or other debris from the ground. By taking a high percentage of the available cob and just the top part of the corn plant in the single-pass system, the material baled represents a lower amount of phosphorous and potash content, which would need to be replaced with fertilization.

John Deere, in collaboration with Hillco Technologies is testing a prototype, using Hillco's Cob Collection System and John Deere STS (models 9670, 9770 and 9870) combines. The system enables growers to use either a combine-pulled cart or a tractor-pulled cart, depending on the farming operation and field conditions.

Deere reports that this single-pass collection system maximizes cob cleaning and collection capabilities with minimal impact on harvesting speed and efficiency.

The Hillco system provides flexibility and efficiency in a cob- and biomass-harvesting system. It features push-button control for turning on and off the collection of the cobs and allows quick, easy changeover between crops. It also features variable cleaning technology and uses an easy-to-dump cart that can be towed by the combine or tractor.

Among other new biomass technology is the Glenvar Bale Direct System ( BDS), manufactured by Tuthill Drive Systems, Brookston, IN. The system can be used with all leading brands of combines and large square balers.
Corncobs are a potential future energy source, a recent Purdue University study indicates that most farmers would need to receive about $100/dry ton from ethanol producers to add a cob-collection operation during harvest.

Purdue examined the cost of cob-harvest equipment, the amount of time harvest slowed by adding a cob-collection operation, the volume of cobs that could be collected per acre, and other factors. In addition to the $100/ton price, they determined that farmers would be most likely to collect cobs if they made up at least 20% of the corn stover and if rental charges for cob-collection wagons were half the standard lease rate of $28,000 (seasonal).

Purdue also surveyed farmers who supplied cobs to a Minnesota ethanol company in 2009. This information was used to create a cob-harvesting operation for Purdue's Farm Plan Model, a computer program that determines the return on a specific farm operation from production and other data.

Anonymous data from 55 farms were used as the base for the computer simulation. These farms harvested a combined 100,264 acres of corn without cob collection in 2008. The computer program provided the farms the choice between corn harvest with and without cob collection and projected that none of the farms would collect cobs if wagon rental was $28,000 and cobs brought $40/ton. If farmers received $100/ton, however, the simulation projected 22 of the 55 farms would collect cobs.

The research suggested wagon rental rates often were the make-or-break factor in harvesting cobs. The typical $28,000 lease covers the harvest period, regardless how many acres are involved. If rental was reduced to $14,000, cob harvest became much more attractive.

The Purdue study also indicated:

- Farms with 2,000 or more corn acres were better able to offset cob-collection costs than smaller farms because of reduced unit costs.
- If paid $100/ton for cobs, farmers likely would collect 96% more cobs under the most favorable operating conditions and costs than the least favorable operating conditions and costs.
- Break-even prices for cobs differ significantly from farm to farm, depending on corn yield, farm size and production practices.
- Government subsidies might be necessary to encourage more farmers to collect cobs if the public decides cellulosic biofuels are an important energy alternative.

The study findings are available for free download at: https://mdc.itap.purdue.edu/item.asp?itemID=19701 (adapted by R. Grisso)
Under Pressure... Understanding your tractor’s hydraulic system

Take a U-shaped tube, fill it with water, and put a plunger in either end. Push down on one plunger, and the other goes up, that’s elementary hydraulics. It’s a simple concept, but without it, your tractor wouldn’t be much more than four wheels and an engine.

Every hydraulic system owes its effectiveness to a basic rule of physics. Liquid can’t be compressed. It can, however, transfer power from one place to the other; that’s why one plunger moves up when you push the other down, the fluid is transferring power.

The mechanics of a tractor’s hydraulic system are, of course, a bit more complicated. The tractor’s system uses oil and a pump pressurizes the oil and sends it to a value; the valve then sends pressurized oil wherever it’s needed. And every component is built to withstand the pressure required to lift a loaded bucket, bale fork, or other implement. Remember, the hydraulic system has to lift not only the bale or the load of dirt, but also the bale fork or the loader bucket. Even a small tractor’s hydraulic system is under enormous pressure, so it’s important to make sure you’ve got the right system for the job.

Choose wisely when you’re choosing your tractor and the hydraulic system. The hydraulic system is one of the most important considerations depending on the range of duties you’ll need it to perform.

Lifting and stacking hay bales will require more hydraulic capacity than occasional mowing or tilling.

There are three primary considerations:

1. The flow rate in gallons per minute (GPM)
2. The maximum pressure in pounds per square inch (PSI)
3. The number of selective control values (SCVs) or attachment points for hydraulic implements.

The flow rate affects how fast the implement responds to operator input; the higher the flow, the faster the response. Pressure determines the system’s lifting capacity; more pressure means more capacity. The number of SCV’s will determine how many hydraulic actuators can be attached to the tractor at any one time.

Once you have the right tractor and the right system, there’s not much maintenance to be done on the hydraulics. Dirt and water are the biggest enemies of a hydraulic system. Regular replacement of the air filter on the fluid reservoir will help keep dirt out; most of the water that gets in naturally through condensation will evaporate out, as long as the hydraulic system is used regularly. So keep these contaminants out, change the hydraulic fluid at the recommended interval, and the system should last.

(Source: Adapted from Hotline Guides—R. Grisso)
KEITH is a 39 year old male who resides on a farm with his wife Angela in rural Sussex County, Virginia. Approximately 75 to 80% of the income in Sussex County is generated from farming. At the age of 28, for undetermined reasons, Keith suffered from Avascular Necrosis in both hips. This condition, caused by impaired blood supply to the bone, resulted in Keith’s hip bones deteriorating and becoming brittle. Keith’s first surgeon tried to correct the problem by utilizing an operation procedure called core decompression, which can spur regeneration of the bone. In this procedure, the surgeon drills out the damaged section of the bone up to the head of the femur. This opens up channels for blood vessels to reach the diseased area and foster the production of new bone. Hip pain is relieved and as many as 75% of patients avoid joint replacement later on. However, the procedure did not work for Keith, so his only other option was to have a double hip replacement to correct the problem.

Keith farms and raises corn, soybeans, wheat, and twenty head of beef cattle on 1800 acres. He has been medically advised not to climb ladders, which makes it impossible for him to climb the narrow steps on his three grain bins to check the level, the moisture content and temperature of grain in the bins. So he contacted someone to come out to his farm and climb the grain bins for him. Keith also has three tractors with high steps that made it unsafe and uncomfortable for him to climb on and off.

Keith learned about AgrAbility and the services offered while he was attending a field demonstration at which AgrAbility had an exhibit and presentation. Keith did not make himself known at the gathering, but called AgrAbility Service Coordinator, Joe Young, a couple of weeks later, and shared that he has a double hip replacement that limits his ability to climb the ladders on his grain bins and wanted to know if AgrAbility could help his situation.

AgrAbility Project Coordinator, Kirk Ballin, and Joe Young met with Keith on his farm and conducted an on-farm assessment of his needs. In conjunction with Keith, goals were set to: acquire a step system that would allow Keith to walk up steps to access his grain bins, instead of climbing narrow ladders; acquire a system that would allow him to check the grain bins temperature, moisture content, and grain level from ground level; and modify tractor steps on three of his tractors.

AgrAbility made a referral to the Department of Rehabilitative Services (DRS) counselor, Dolores Heisler, in Richmond. Dolores made an assessment of Keith’s situation and determined that he qualified for DRS assistance. Keith’s case was assigned to DRS Occupational Therapist, John Allen, and DRS Engineer, Michael Anderson, to work with Keith to make the modifications necessary to make his work easier, accessible, and safer.

DRS installed a set of steps to one grain bin and installed and connected the newly installed steps to a catwalk across the top area of the other two grain bins so Keith can now walk up once and then walk across to the other two grain bins. DRS also furnished three rigid mount step kits for three of his tractors. AgrAbility referred Keith to the Newell Fund to seek a loan for purchasing an Utility Vehicle, which would allow him to get in and out of tight places on his farm. The Newell Fund approved Keith for a Telework Loan. Telework loans are made to applicants who already have an existing business. Keith said, prior to buying the Gator, when he took soil samples, he would ride on the tailgate of his pickup truck and take soil samples while his father drove the truck, which was not safe or a pleasant ride. With the Gator UTV 4x4, he is able to take the soil samples himself. He takes the samples and reaches back and place them in a bucket on the dump area of the Gator without having to get out of the driver’s seat. He also has installed a grain spreader on the back of the Gator that allows him to apply seed and do light fertilizing. Keith said, “The process for acquiring the loan to buy the Gator is the easiest process he has ever experienced.” He said, “the people at Newell really seem like they want to help people.” The bin and tractor modifications and the acquisition of the Gator have not only allowed him to be able to do his work, but have made it easier and safer.

Keith is very pleased and thankful for the assistance that AgrAbility, DRS, and the Newell Fund have given him. He just wishes that more people would take advantage of the help that AgrAbility offers.
West Virginia AgrAbility hosted this year’s National AgrAbility Training Week (NATW) at the Charleston Marriott Town Center, October 11-14. This year’s conference had approximately 190 participants. The conference also set a new record for the number of farmer/rancher who attended, with 32 present. Most farmers who attend are consumers of AgrAbility services, and a big draw for many farmers this year was the small farmers/ranchers information track, a new initiative this year.

Representatives from AgrAbility’s currently funded 23 state and regional projects attended. In addition to welcoming state projects that have been awarded renewed funding, the NTW was happy to welcome new state and regional projects, including Arkansas, and Maine. Also in attendance where stakeholders from Idaho, North Carolina, and Guam who want to bring AgrAbility to their state or territory, with an interest in finding out more about the National AgrAbility Project (NAP) and how to apply for funding.

In addition to greeting old faces and meeting new friends, attendants discussed new issues and persistent challenges facing farmers with disabilities, general project administration, and project outreach. Success stories were also shared. Funding sources for farm modifications; implementing assistive technology and ergonomics, safer farming practices; and preventing secondary injuries were frequently discussed topics. New topics included outreach for veterans, caregivers, and people who have traumatic brain injuries. Also new to the agenda were formal discussions on small farm operations; implementing peer support networks for farmers with disabilities; and increased interest and demand for accessible gardening. Staff from WVU’s Extension Service Small Farm Center presented the small farmer/rancher information track. This track addresses unique challenges facing small farm operations and specific management techniques. Some examples of topics were: marketing, financial and business management, season extension, irrigation, and small farm risks and taxes.

As always, AgrAbility mixed a little fun with business. An auction during the conference helped raise money for AgrAbility’s Farmer/Rancher Scholarship Fund. Scholarships help pay travel and conference registration fees for farmers. Each state project donates items to the auction. Bids generally come from staff of all state and regional AgrAbility projects. This year’s auction made a record amount for the scholarship fund, $4,600.00.

Traditionally, the last day of the conference is a ‘tour day’ conducted by the hosting staff. Highlighting the hosting state. Conference attendees were treated to tours of the USDA Research Center outside of Beckley and the Exhibition Coal Mine. Tamarac was also a stop for lunch and shopping.

Next year’s conference will be hosted by the National Project in Indianapolis, November 7-11, 2011 marks AgrAbility’s twentieth anniversary of being federally funded through the 1991 Farm Bill. Please mark your calendars to join AgrAbility in marking this tremendous milestone.
Stack Bales Just So

Stacking small square bales is a blend of art and science. The proper method of stacking square hay bales is a skill more likely to be passed down from one farmer to another than read about in a book or an extension guide sheet. Still, it is a farm skill that has some definite do's and don'ts.

As a guideline for doing the job right, take a look at Stacking Pattern #2 at: http://www.wikihow.com/Stack-Hay and then making a few modifications as follows:

√ Stack bales flat (twines up) rather than on edge to better hold the stack together. The bottom layer could be stacked on edge, if desired, to reduce twine rot from moisture wicking.

√ Build the stack to its full footprint and then build from the corners toward the middle, making sure to keep the corners square and plumb. This gets really important when the stack gets 20 layers high.

Follow the same pattern for the second layer, except that it is flipped on its side. Put a bale in the corner lengthwise, then stack a row of two bales in front of it width-wise, etc.

√ For stability, make sure stack height does not exceed 1.5 times the shortest base dimension. For example, if the stack is 20' wide and 40' long, the height should not exceed 30'. (R. Grisso)

Windshield Wiper

Mary Anderson, of Birmingham, AL, is credited with inventing the first effective windshield wiper. It was during a visit to New York City in 1902 that she noticed trolley car drivers forced to open a side window and lean out to see when sleet or heavy rain obscured their view. When she returned to Alabama, she worked with a local mechanic to develop a rubber blade held on a spring-tensioned metal arm that could be operated by a lever from inside a vehicle. She obtained Patent 743,801, "Window Cleaning Device," in November of 1903. Her attempt to sell the rights to this invention was met with frustration because the agent she chose did not believe that the invention was "of such commercial value as would warrant undertaking its sale." The patent expired in 1920, but her design became the basis of the windshield wiper that is still used in virtually all cars today. (safety trivia—R. Grisso)

Plans

Building and facility plans are now available for download from the 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 access these files. Please visit: http://www.intra.ext.vt.edu/anr/bse/index.html
10 Tips for Staying Festively Flu-Free

The holidays are a time of parties, festive get-togethers, family reunions and catching up with old friends, all of which adds up to a lot of personal contact. With the flu season and the holiday season converging, you may be tempted to put your holiday plans on hold to avoid getting sick. But don’t worry – you can still be a social butterfly while protecting yourself from germs in the process.

Simply follow these precautions, as offered by experts at Ryerson University, to stay healthy this holiday season:

1. **Do the air kiss.** Greet your family and friends by giving them a hug and kissing the air near their cheeks. If there’s mistletoe dangling between you and a friend, eschew the smack on the lips with a fake peck on the cheek instead.

2. **Wash your hands.** Always wash your hands before you start digging into the appetizers at a party. You should always wash your hands after you’ve finished to keep your hands as germ-free as possible.

3. **Don’t use your fingers.** As a party guest, use serving spoons or forks to put food on your plate instead of just reaching for it. As a party host, be sure to put out plenty of serving utensils and provide people with alternatives to reaching into bowls, such as creating individual servings of your offerings.

4. **Get creative with your cups.** When hosting a party, come up with fun ways of personalizing cups so there aren’t any mixups. Avoid serving beverages in their original containers for the same reason, so there aren’t multiple identical cans or bottles floating around.

5. **Carry hand sanitizer with you.** Remember: the person who sneezes into her hands transfers mucus and viruses onto public doorknobs, handrails, that product you just picked up or the change the cashier gave you. Viruses can survive hours to days on surfaces or your skin. If there isn’t a place to wash your hands nearby, use alcohol gel to sanitize your hands before you eat any food or even touch your face, particularly your nose or mouth. Keep some in your purse or pocket for those holiday shopping excursions.

6. **Cough in your sleeve.** If you feel a cough or sneeze coming on, be sure to cough in your sleeve or the inside of your jacket to avoid spreading any microbes to people standing near you at a party. A cough or sneeze can spray droplets of water containing viruses that can contaminate surfaces as far as 6 feet away. Virus then can be transferred to someone if he touches his mouth or nose after coming in contact with that area.

7. **Attending a religious service?** Try to keep between 3 to 6 feet away from other people and politely refuse to share the communion wine goblet. Instead of shaking hands or hugging, try greeting others with a friendly wave or the new health-inspired “elbow greeting,” which consists of a friendly – and germ-dissemination-free – elbow bump.

8. **Get enough sleep.** Lack of sleep weakens your immune system and makes you more susceptible to illness. Aim for a consistent 6 to 8 hours of sleep every night, even during the busy season of shopping, planning and entertaining.

9. **Sick? Stay away.** If you feel like you are coming down with a cold or flu, stay at home until you feel better. There is always next year’s round of holiday shindigs to host or attend. Plus there are plenty of holiday specials on the tube to give you a boost of merriment.

10. **Cold or flu?** A cold can strike anytime, but October to March is flu season. If your symptoms include a headache and high temperature, contact your health care provider.

(Adapted from EHS Today—R. Grisso)
The rate of childhood injury on farms and ranches has declined by nearly 60% since 1998, an encouraging sign that research and public awareness efforts are making an impact in one of the nation’s most hazardous industries.

This marked decline is a testament to the dedicated efforts of many individuals, organizations and agribusiness sponsors, along with several federal agencies. Injuries and deaths affecting children on farms are no longer viewed as unavoidable accidents, but rather as predictable and preventable events.

The rate of injuries fell 59%, from 16.6 to 6.8 per 1,000 farms (includes all children who live on, visit, or are hired to work on farms) during the period 1998-2009. Injury rates calculated for just youth who live on farms also showed a significant decline, from 18.8 to 9.9 per 1,000 farms, or 47.3%, according to a scientific survey conducted by USDA.

Total number of injuries to youth ages 19-and-under dropped from 37,774 to 15,011, while the number of youth living on farms dropped from 1.46 million to 1.03 million.

Rate of injury is the most meaningful method for judging progress because it takes into account the reduced number of farms and the fewer numbers of children who live on, visit or are hired to work on farms.

The progress is attributed to factors including:
- Congressional approval and funding of the National Action Plan for Childhood Agricultural Injury Prevention, facilitated by Congressman David Obey in 1996.
- Leadership and funding provided by NIOSH.
- High-quality research that provided evidence of strengths and limitations of various interventions and policies.
- Significant levels of private donations to organizations such as Farm Safety 4 Just Kids and Progressive Agriculture Foundation for community-based safety programs.
- “Keep Kids away from Tractors” and other campaigns supported by media coverage.
- National Children’s Center initiatives to establish consensus-driven guidelines, most notably the North American Guidelines for Children’s Agricultural Tasks (NA GCAT) and Creating Safe Play Areas on Farms.
- A willingness of farm owners and parents to bury unsafe traditions and adopt new practices involving children and young workers.

ATVs and horses, that likely contribute to the higher injury rates seen in farm household children ages 10-15 relative to other age groups. For youth younger than 10, the majority of injuries were non-working injuries.

Although this injury information helps us maintain momentum and target future interventions, we do not have timely data regarding fatalities, thus it is not clear whether deaths to children on farms are decreasing.

The data are based on a telephone survey of 50,000 randomly selected farms. Farm operators were asked questions about injuries to youth less than 20 years of age that occurred on their farm during the survey year. An injury was defined as any condition occurring on the farm operation resulting in at least 4 hours of restricted activity.

For NIOSH-NASS childhood agricultural injury data, check the NIOSH website.

Beneath the overall declining non-fatal injury rates, however, challenges remain, such as higher relative injury rates for all-terrain-vehicles (ATVs) and horses. An in-depth analysis of 2006 data revealed a mixture of work and non-work exposures, including

www.cdc.gov/niosh/childag
The pounds of high density polyethylene bottles recycled in the US increased for the second straight year, but the HDPE recycling rate stayed virtually flat.

The amount of HDPE bottles recycled increased in 2009 by 44.9 million pounds, or 4.9 percent, to 982 million. That followed an increase of 16.1 million pounds in 2008.

But the main reason the HDPE recycling rate is higher in 2007 is not the increased amount of material collected. It's that the amount of HDPE used to make bottles in 2009 was roughly 160 million pounds below 2007 levels.

The recycling rate is calculated by dividing the number of pounds recycled by the number of pounds of resin, both virgin and recycled, used to make bottles.

Plastic bottle light-weighting continues. Many HDPE bottle applications are using product concentrates, which means an increasing number of smaller bottles — or fewer bottles made for a specific bottle category such as laundry bottles.

That's good for sustainability, but reduces the amount of pounds available to be recycled, the report said.

The all-bottle report calculated the overall plastic bottle recycling rate for 2009 at 27.8 percent, up from 27 percent a year ago, with HDPE and PET accounting for 98.8 percent of all the bottles recycled, and polypropylene another 1.1 percent.

The total pounds of plastic bottles recycled in 2009 increased by 46 million, or 2 percent, to just under 2.5 billion pounds, the report said. This was largely from the increase in HDPE, polypropylene, PVC and low density polyethylene bottles as the amount of PET bottles recycled declined slightly from 1.451 billion to 1.444 billion.

The other barrier to increased plastic bottle recycling, according to the report, is a "lack of sufficient access to recycling collection opportunities for product used away from home. Consumer data continue to show that the public wants additional opportunities to be able to recycle at public venues, offices, recreational sites, schools and retail establishments."

Unlike in 2008 when HDPE reclaimers nearly tripled the amount of material they imported from 54 million to 141 million pounds in order to have enough material to process, they only needed to import 40 million pounds in 2009.

HDPE recycled resin exports increased to 234 million pounds — which represents 23.8 percent of all HDPE bottles collected and recycled. That's up from 214 million pounds the past two years.

By contrast, approximately 725.7 million pounds — or 55.6 percent of all PET bottles and containers recycled in 2009 — were exported, almost all of it to China. That's the fourth straight year that China has purchased more than half of the PET bottles collected in the United States.

Overall HDPE recycling capacity decreased slightly to 1.017 billion pounds in 2009 and the total utilized capacity in 2009 — that is, the amount of HDPE resins processed in the U.S. — fell nearly 10 percent to 788 million pounds from 864 million the year before.

The highest end-market application for recycled HDPE continued to be nonfood bottles at 45 percent — up slightly from the 43 percent market share they have had for the past four years. Pipe was the second-largest end-use category, accounting for 25 percent, up from 17 percent last year and two percentage points higher than in 2007.

(adapted from plasticsnews.com - R. Grisso)
Are you looking for a low-cost way to serve your organizational mission, meet local challenges and take advantage of new policy and practice opportunities? Two of the biggest hurdles organizations face as they seek to expand services to their communities are the basic cost of labor and a lack of staffing.

Some organizations have met these challenges by hosting volunteers from the Corporation for National Service (CNS). CNS places volunteers in organizations across the country via their Senior Corps, AmeriCorps and Learn and Serve America programs. These volunteers are a low-cost, high-yield asset for the host agencies. Several RuFES Action Network members have used these volunteers to help launch Earn It, Keep It and Grow It programs and coordinate partnerships.

What is being offered?

CNS has recently released a Notice of Funds Availability (NOFA) to distribute $311 million in funding for the Serve America Act, a significant expansion of the federal investment in national service. The Serve America Act works through the AmeriCorps program to recruit, train, and manage AmeriCorps volunteers to address community needs. Your rurally-focused organization may want to host an AmeriCorps volunteer during 2011. With an application deadline of January 25, 2011, the time to consider this option is now.

In 2011, CNS expects to invest a significant amount of its available funding in programs working in the following six focus areas of:

- Disaster Services—designed to help communities with disaster mitigation, preparation, response and recovery
- Education—includes programs that seek to contribute to the number of students who graduate from high school and college or university
- Environmental Stewardship—includes programs that protect human health and the health of ecosystems by conserving natural resources and restoring the nation’s air, water, and land
- Healthy Futures—designed to meet health needs within communities including access to care, aging in place, and addressing childhood obesity
- Opportunity—designed to meet the needs of economically vulnerable Americans, their families and their communities. Opportunity programs may include activities that assist individuals and families that are homeless or at risk of homelessness; provide financial literacy training and tools designed to improve financial security; and expand employment possibilities
- Veteran and Military Families—meets the needs of veterans and family members of active duty and deployed military personnel

Who is eligible to apply?

- Public or private nonprofit organizations
- Faith-based and other community organizations
- Institutions of higher learning
- Indian tribes
- Labor organizations
- Partnerships or consortia
- Both new and renewing applicants are eligible

How to apply

- Organizations that seek to operate in one state only must apply through their state commission
- Organizations that seek to operate in more than one state may apply directly to CNS
- Application Deadline: January 25, 2011 at 5:00pm, ET
- Letter of Intent: Applicants are encouraged to send an e-mail by December 15, 2010 to americorpsnational@cns.gov for national applicants or state commissions for statewide applicants, stating their intent to apply

Where can you get more information?

To find out more please visit CNS’ NOFA page (see below). There you will be able to click to see the NOFA itself, a list of state CNS commissions and a list of frequently asked questions.

We hope these Action Alerts energize your RuFES deeds and aspirations. Help us spark more RuFES action! How? Simply email us (jmol@aspeninst.org) with any news, ideas or opportunities that can help your RuFES colleagues across the nation.

(from EDEN news items—R. Grisso)
10 Technologies Changing Planters

1. **Planter section control**
   Turns individual planter sections or rows on and off based on field boundaries, no-plant zones, or previously planted areas to minimize overlap and skips during planting and to prevent wasted seed.

2. **Variable-rate drive**
   Varies the rate of seed planted in a given area based on a prescription map.

3. **Implement steering**
   Steers the planter based on GPS coordinates to keep the planter unit over the row.

4. **Bulk fill**
   Used in place of row-unit seed hoppers to reduce time spent loading seed.

5. **Pneumatic or hydraulic down pressure**
   Provides even pressure across all row units in rolling or uneven terrain to ensure consistent seed depth in planting.

6. **ISOBUS seed population monitor/controller**
   Allows a grower to use one monitor in the tractor cab that will communicate and control numerous implement functions.

7. **Hydraulic steering**
   A sensor on the front axle of the tractor tells a computer onboard the planter how much to turn, thereby eliminating the need for the rear wheels to castor and adding to the planter’s maneuverability and flotation.

8. **Narrow rows (20-in. and twin-row)**
   Works with new genetics to increase yields. Helps growers achieve higher yield without the crowding of 30-in. rows.

9. **Implement braking**
   As planters get larger, hydraulic or air brakes may be required in addition to tractor braking as an added safety measure for over-the-road transport.

10. **Air seed transfer**
    Use of pressurized air to transfer seed from the central hopper to individual row units, which keeps hoses from plugging with seed and requires fewer moving parts. (Adapted R. Grisso)

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New BSE Extension Factsheets

- **Nutrient Management for Small Farms** (442-305)
- **Predicting Tractor Diesel Fuel Consumption** (442-073)
- **Virginia Prepares Plan to Meet Chesapeake Bay TMDL**
- **Biochar in Agricultural Systems** (442-311)
- **Evaluation of Household Water Quality in Rockbridge County** (3010-15014)
- **Evaluation of Household Water Quality in Rockingham County** (3010-15015)
- **Evaluation of Household Water Quality in Prince George County** (3010-15013)
- **Evaluation of Household Water Quality in King George County** (3010-15012)
- **Evaluation of Household Water Quality in Greene County** (3010-15011)
- **Evaluation of Household Water Quality in Dinwiddie County** (3010-15010)
- **Evaluation of Household Water Quality in Culpeper County** (3010-15009)
- **Evaluation of Household Water Quality in Caroline County** (3010-15008)
- **Evaluation of Household Water Quality in Bedford County** (3010-15007)
- **Evaluation of Household Water Quality in Bath and Highland Counties** (3010-15006)
- **Evaluation of Household Water Quality in Augusta County** (3010-15005)
- **Evaluation of Household Water Quality in Appomattox and Campbell Counties** (3010-15004)
- **Evaluation of Household Water Quality in Amherst County** (3010-15003)
- **Evaluation of Household Water Quality in Albemarle and Fluvanna Counties** (3010-15002)
Governor Bob McDonnell has announced that the US Secretary of Agriculture has designated 59 Virginia counties and the city of Suffolk primary natural disaster areas because of reductions in farm production caused by drought and excessive heat that occurred in 2010.

Farmers in the independent city of Suffolk, as well as in the following counties, have received primary natural disaster designation and may also be eligible for federal assistance: Accomack, Albemarle, Amelia, Amherst, Appomattox, Bedford, Brunswick, Buckingham, Campbell, Caroline, Carroll, Charlotte, Clarke, Culpeper, Cumberland, Dinwiddie, Essex, Fauquier, Fluvanna, Franklin, Frederick, Green, Greensville, Goochland, Halifax, Hanover, Isle of Wight, James City, King and Queen, King George, King William, Lancaster, Louisa, Lunenburg, Mecklenburg, Middlesex, Montgomery, Nelson, Northampton, Northumberland, Nottoway, Orange, Page, Patrick, Pittsylvania, Powhatan, Prince Edwar, Pulaski, Rappahannock, Richmond, Rockbridge, Shenandoah, Southampton, Spotsylvania, Stafford, Surry, Warren, Westmoreland and York.

Commenting on the designations, Governor McDonnell noted, “Excessive heat and drought reduced crop yields in many localities causing farmers hardship and impacting their operations. With approval by the USDA, they are now eligible to be considered for assistance by the Federal Government.”

An additional 24 counties and 19 independent cities received designations as contiguous disaster areas because of their location next to a primary disaster area. Those include the counties of Alleghany, Augusta, Bath, Bland, Botetourt, Charles City, Chesterfield, Craig, Floyd, Giles, Gloucester, Grayson, Henrico, Henry, Loudoun, Madison, Mathews, New Kent, Prince George, Prince William, Roanoke, Rockingham, Sussex and Wythe and the independent cities of Bedford, Buena Vista, Charlottesville, Chesapeake, Danville, Emporia, Franklin, Fredericksburg, Galax, Hampton, Lexington, Lynchburg, Newport News, Petersburg, Poquoson, Portsmouth, Radford, Williamsburg and Winchester.

Disaster declarations make farm operators in both primary and contiguous areas eligible to be considered for low-interest emergency loans from the Farm Service Agency (FSA) of the USDA, provided they meet certain eligibility requirements. This assistance includes FSA emergency loans and the Supplemental Revenue Assistance Program. Farmers in eligible counties have eight months from the date of a disaster declaration to apply for emergency loan assistance.

FSA will consider each application on its own merits by taking into account the extent of the losses, security available and repayment ability. Local FSA offices can provide affected farmers with additional information.

Requests for primary disaster designations are currently pending for these seven counties: Botetourt, Charles City, Craig, Gloucester, Henrico, Matthews and New Kent. These counties already have received a contiguous designation but are seeking a primary declaration in case Congress appropriated direct aid.