Biological Systems Engineering

Engineering Update   Fall 2007

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Engineering Update

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Biological Systems Engineering
September 2007

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*).

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Predicting Diesel Fuel Consumption

Generalized models for fuel consumption are useful for budget and management scenarios, however; several managers of these budgets questioned whether the fuel estimates were reflective of the new engine designs and improved fuel economy. A review of tractor test data from the past 20 years and discussions within the PM-43 Machinery Management committee has recommended changes in the ASABE Standards for predicting fuel consumption. New expressions and the inclusion of fuel consumption estimates from reduced engine speed operations are under review.

According to Siemens and Bowers, "depending on the type of fuel and the amount of time a tractor or machine is used, fuel and lubricant costs will usually represent at least 16 percent to over 45 percent of the total machine costs…" Most cropping and machinery budgets developed by state extension specialists contain estimates from the ASABE Standards.

Currently the most widely used component of the standard for budget models is from respective sections 6.3.2.1, 6.3.2.1.1, and 6.3.2.1.2 of ASAE EP496.3. Diesel fuel consumed over the year for a tractor is characterized by the following equations:

$$Q_{avg} = a' \times P_{pto} \quad (1)$$

Where:
Q_{avg} = average diesel consumption, gal/h;
P_{pto} = rated PTO power, hp;
a' = 0.044 gal/hp-h

Bowers (2001) stated that equation 1 was estimated from the varying PTO power tests from the Nebraska Tractor Test Reports. The fuel consumption over the varying PTO power tests (approximately 100%, 85%, 65%, 45%, 20%, and 0% of rated PTO power) were averaged and then the average was divided by the rated PTO power. This calculation was included on a line at the bottom of the varying PTO power data in the Nebraska Tractor Test Reports prior to 1970. One implication of this method is that the estimated annual fuel consumption is based on operation of the tractor for equal amounts of time at each of these partial loads. Due to this assumption, budget managers have observed that the fuel consumption estimates are conservative and underestimate the fuel consumption actually observed within actual farming systems.

A new diesel fuel consumption equation was developed:

$$Q_F = (a\ X + b) \cdot P_{pto} \quad (2)$$

Where:
Q_F = diesel fuel consumption at full/partial load and full throttle, gal/h;
X = the ratio of equivalent PTO power to rated PTO power, decimal; and
P_{pto} = rated PTO power, hp

$$Q_R = Q_F \cdot (1 + (\ c\ X\ N_{Red} - d\ N_{Red})) \quad (3)$$

Where:
Q_R = diesel fuel consumption at partial load and reduced throttle, gal/h;
N_{Red} = percentage of reduced engine speed for a partial load from full throttle, %;

The coefficients (a, b, c, and d) for the generalized equation were developed from fuel consumption observations from 20 years of Nebraska Tractor Test data. This generalized equation is useful to predict fuel consumption for diesel engines during full and partial loads and under conditions when engine speeds are reduced from full throttle. The generalized coefficients are:

a = 0.0434 gal/hp-h (4)
b = 0.019 gal/hp-h
c = 0.0045
d = 0.00877

The coefficients can also be calculated for a specific tractor model. The coefficients from over 535 tractors with complete drawbar performance tests (both 50 and 75% pull tests) were computed using these procedures. Significant improvement in accuracy was shown in calculating the coefficients for each individual tractor. These computed coefficients can be downloaded (Excel spreadsheet - http://filebox.vt.edu/users/rgrisso/Tractor.htm) for a desired tractor model.

As an example, a John Deere 7610 tractor listed in Nebraska OECD Tractor Test 1725, Summary 225, had the following computed coefficients by using used the fuel consumption data, power levels and engine speed from 4 partial-load drawbar tests and maximum drawbar power at rated engine speed:

a = 0.0390 gal/hp-h (5)
b = 0.0203 gal/hp-h
c = 0.0052
d = 0.0093

Table 1 shows the comparisons of

(Continued on page 3)

Predicting Diesel Fuel Consumption (cont.)

(Continued from page 2)

the individual and general model with the measured test results. Both the generalized and individual coefficients show excellent agreement.

These estimates will give mangers of crop budgets a more accurate fuel consumption rate. For example, the multiple factor (a') for a 50% load for equation 1 would be 0.0407 gal/hp-h. While the multiplier factor at 75% load would be 0.0515 gal/hp-h.

These equations can be employed to estimate the fuel consumption of a diesel engine at several work load levels and patterns as well as estimate the fuel saving of "Gear-up, Throttle-Down" practices (VCE Publication 442-450) for partial loads (equation 3). To estimate the savings from employing the practice "Gear-Up and Throttle Down," several engine speed reduction schemes can be examined. For example, if a tractor operates at 75% load and the engine speed is reduced by 10 and 20%, the decrease in fuel consumption is estimated as:

$D_{10} = (1 + (0.0045 \cdot 0.75 \cdot 10 - 0.00877 \cdot 10))$

$D_{10} = 0.946$ or a 5.4% fuel saving for reducing the throttle by 10%.

Likewise:

$D_{20} = 0.892$ or a 10.8 % fuel saving for reducing the throttle by 20%.

As fuel price increases, the ability to predict fuel consumption becomes more critical for making decisions in all agricultural operations. These equations based on the Nebraska Tractor Test data will increase accuracy and decision made from this information.

For Tractor Test Information Contact:

University of Nebraska Tractor Test Laboratory
35 & East Campus Loop
P.O. Box 830832
Lincoln, NE 68583-0832
(402) 472-2442
FAX: (402) 472-8367
http://tractortestlab.unl.edu/
email: tractortestlab@unl.edu

VCE Publication 442-450 found at: **http://www.ext.vt.edu/pubs/bse/442-450/442-450.pdf**

(by Bobby Grisso)

Table 1. Fuel consumption measured and predicted by the individual coefficients and the generalized model for Nebraska OECD Tractor Test 1725, Summary 225.

	Fuel Consumption, gal/h		
	Measured	**Individual (5)**	**General (4)**
PTO Power Test, Rated	6.821	6.882	7.236
Drawbar Test, Maximum Pull, Rated	6.714	6.882	7.236
Drawbar Test, 75% Pull, Full Throttle	5.916	5.916	5.978
Drawbar Test, 75% Pull, Red Throttle	5.185	5.185	5.176
Drawbar Test, 50% Pull, Full Throttle	4.776	4.776	4.719
Drawbar Test, 50% Pull, Red Throttle	4.031	4.031	3.977

Automated vehicle navigation becomes reality for production agriculture

For more than 80 years, innovators worldwide have dreamed of using automated methods to navigate agricultural machines.

Guidance aid inventors throughout history have been motivated to develop methods to improve farm productivity. For example, a patent from the early 1920s depicted tractors that automatically follow furrows across a field. In the late 1930s, piano wire wound on a large spool positioned centrally in a field guided a tractor. In the 1970s, a wire carrying a low-current, low-frequency signal identified pathways a machine would follow in controlled-traffic applications. Despite these innovations, guidance system commercialization has had little success over the years.

Early automation technologies proved too costly, application specific and difficult to apply. Often the savings in productivity came at the cost of complicated implementation.

During the past 20 years, agricultural equipment manufacturers have infused electronics and electro hydraulics into off-road equipment to create new opportunities for navigation automation. The industry motivation for these mechatronic technologies has been to improve machine performance characteristics while reducing manufacturing, assembly and maintenance costs.

Today, automated navigation benefits are associated with increased field efficiency and field capacity through faster travel speeds and increased accuracy. Increased productivity can also be achieved in some cases by extending the work day into night time or during low-light operation.

Automation is supported by various sensors to support positioning needs. Global positioning system (GPS) technology uses sensors to provide for more complex applications. Several companies offer GPs-based guidance products being made available throughout the world.

A challenge for engineers is to devise automation and navigation systems that also provide a safe working environment. Current products and opportunities available for vehicle navigation include:

- *Parallel swathing* — Precision positioning systems based on GPs technologies that reduce overlap between spray vehicle passes. The commercial need is for systems that function in straight- and curved-path tracking.
- *Crop-edge tracking* — In cultivation, forage and combine harvesting, tracking row crops or crop edges while an operator is in the machine or on the row is technology under development.
- *Precision path tracking* — Planting based on a navigation map is an operation requiring a high accuracy positioning sensor such as real-time kinematic GPS. For conventional planting, row markers are extended to indicate the guidance course to follow. Precision map-based systems require no row markers so field efficiency is increased by reducing turning time losses. If system accuracy is guaranteed, eliminating row markers can reduce planting equipment costs.
- *Turning assists functions* — Systems that automatically turn a machine at the row end reduce unproductive time an operator spends aligning equipment for the next field pass.
- *Remote guidance* — Remote control guidance systems can remove the operator from dangerous tasks. A mower tractor uses such technology to mow steep hillsides along highways. Wireless computer networking is inexpensive and can provide line-of-site vehicle observation and control.
- *Operator aids for the handicapped* — Assisted guidance tools allow disabled farmers to perform field operations using navigation technology or cooperative automation.
- *Multi-vehicle cooperation* — Cooperative navigation between machines can enhance productivity for operations typically coordinated between operators in different vehicles. Coordinating unloading between a moving combine and grain cart is an example. Master-slave multiple harvester control is another.

Automated vehicle navigation may be the next revolution in agricultural production. Industry is in the early stages of commercializing technologies built on absolute position sensing technologies that sparked interest in precision agriculture. Safety and machine function sensing issues that pose barriers for implementing autonomous technologies will be priorities for research.

(adapted by Bobby Grisso)

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

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***

Farm Safety and Health Week

National Farm Safety and Health Week is September 16-22.

The theme "It's easier to bury a tradition than a child" for 2007 Farm Safety and Health Week emphasizes the importance of keeping our youngest farmers safe. The farm is a great place for children to live, work, and play. Unfortunately, the natural characteristics of children and the hustle and bustle of the farm and ranch, can sometimes result in disastrous consequences. Riding on the tractor can lead to one of those tragic results.

Resources and PSAs can be found at: http://www.nsc.org/necas/

Fire Prevention Week

October 7-13 is fire prevention week. The theme is **"Practice Your Escape Plan"**. The National Fire Protection Association Web site includes resources and teaching materials for home and schools.

Fire safety materials of interest to farm and rural families include:

Fire Safety in Horse Stables publication from Penn State Extension *http://pubs.cas.psu.edu/freepubs/pdfs/ub034.pdf*

Fire Safety around the farm from Illinois Fire Safety Alliance *http://www.ifsa.org/Education/Fire_Safety_Resource_Guide/Farm_Fire_Safety.html*

(adapted by Bobby Grisso)

September is National Preparedness Month

The Extension Disaster Education Network (EDEN) provides information about National Preparedness Month (NPM) in September. The materials have an Extension focus. Because others may want to brand these pieces with their own name, they are flexible enough for an identity to be placed within the context of the information or design.

This year, the campaign has been divided into four themes, one for each week of the month:

Week 1 – Back to School
Week 2 – Ready Business
Week 3 – Multicultural Awareness
Week 4 – Family Preparedness

The EDEN NPM Web page has a number of resources that are specific to each week's theme. In addition, there are suggested activities for each week in which Extension can participate.
www.eden.lsu.edu/npm/

Preparedness Resources For Seniors, People With Disabilities and Pet Owners

September 2007
National Preparedness Month

Department of Homeland Security Releases New Preparedness Resources For Seniors, People With Disabilities and Pet Owners…

The Homeland Security's Ready Campaign has released three new demonstration videos designed to highlight the specific steps older Americans, individuals with disabilities and special needs, and pet owners should take to prepare for emergencies.

Homeland Security developed these new emergency preparedness videos, which are available online at **www.ready.gov**, to remind individuals to get an emergency supply kit, make a family emergency plan and be informed about the different types of emergencies while considering the unique needs of these individuals, their families and caregivers. The videos recommend seniors include any necessary prescription medications in their emergency supply kits.

They encourage Americans with disabilities or special needs to create a personal support network that they can rely on during an emergency. Pet owners are advised to learn which emergency shelters in their area and/or along their evacuation route will allow pets.

The new videos are released in time for National Preparedness Month 2007, a nationwide effort held each September to encourage Americans to take simple steps to prepare for emergencies.

The goal of National Preparedness Month is to increase public awareness about the importance of family preparedness and to encourage individuals to take action in their homes and schools. The U. S. Administration on Aging encourages everyone to take steps now in order to be prepared in the event of a disaster or national emergency.
(adapted by Bobby Grisso)

http://www.ready.gov

Noise and Hearing Loss Prevention

NIOSH has developed a Noise and Hearing Loss Prevention Workplace Solutions Web site (*http://www.cdc.gov/niosh/topics/noise/workplacesolutions/workplaceSolutions.html*) on noise and hearing loss.

One of the many items included is an informational database on commonly used power tools in occupational settings. The database is particularly helpful in determining the "real-world" noise level of power tools as they are used on the job.

Information on noise levels and hearing loss for agricultural producers and workers can be found on NASD at: *http://www.cdc.gov/nasd/menu/topic/hearing.html.*

A fact sheet from Kentucky's program is at*: http://www.cdc.gov/nasd/docs/d000101-d000200/d000153/hear9.html*

Of special interest is the 'two-arm' rule. If you need to raise your voice to be heard when you are two arm-lengths from the other person, the noise level is probably high enough that you need to protect your hearing. The video, "Sound Advice for Farming", can be viewed at: *http://www.cdc.gov/nasd/videos/v000001-v000100/v000001.html.*

(adapted by Bobby Grisso)

Tree Cutting Tips

Here are tips from tree service professional who teach others how to cut wood safely:

- PPE—Personal Protective Equipment, such as steel-toed shoes, gloves, eye protection, ear protection and pants or chats designed to limit bodily injury if touched by a moving chain.
- Proper Safety Equipment on every chain saw, including throttle lock, chain brake, chain –catching pin, and a bar an chain combination designed to reduce potential kick-back.
- Working knowledge of the bar and chain, including proper chain tension, sharpening, lubrication, freeing a pinched chain, detecting damage and knowing when to replace a chain.
- Familiarization with how a saw feels during operation, including normal cutting, push-back (when the saw want to back out of the wood); pulling in (when the saw wants to pull itself into the wood); and kickback (when the saw want to jump out of the cut and toward the operator).
- Planning for the specific tree being worked on. Deciding what needs to be done, such as whether just one limb must come off or the whole tree must come down, and figuring out each step needed to achieve the goal. This includes knowing where limbs or trees will fall and learning to spot leans, snags, binds and limbs under pressure that may act like a giant spring when the tension is relieved.

(adapted by Bobby Grisso)

Self-Administered Stress Test Find your stress level by checking the events you have experienced in your life in the last year. Check any event that applies to you then click on "**Calculate My Total Stress Units**" to get your score.
http://www.healthcentral.com/sleep-disorders/stress-test-3454-143.html

Safety Resources for Aquaculture Producers

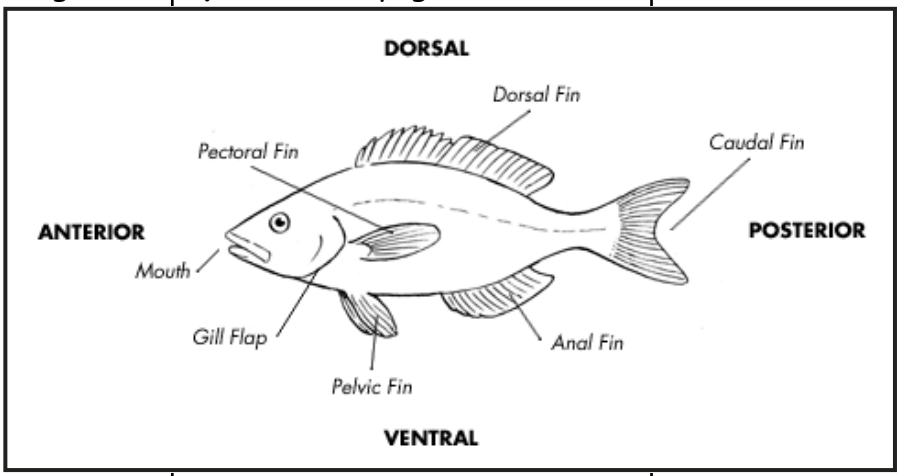
"**Safety for Fish Farm Workers**" video, produced by Catfish Farmers of America and the Arkansas State University, covers hazards posed by many kinds of equipment and environments encountered by fish farm workers, including tractors, PTO shafts, electrical hazards, night operations, seine reels, boom trucks, handling boats, handling catfish, batteries, cooling systems, and hydraulics.

View the entire video (English or Spanish) on NASD http://www.cdc.gov/nasd/videos/v001401-v001500/v001433.html

Safety for Fish Farm Workers -- English and Spanish brochures http://www.cdc.gov/nasd/docs/d001701-d001800/d001756/d001756.html

Safety for Fish Farm Workers -- 21-page booklet (the title page is at the end)

"**Spawn, Spat, and Sprains**" (http://seagrant.uaf.edu/bookstore/pubs/AN-17.pdf) is a production of Alaska Sea Grant College Program. It is the only book on the market that describes the dangers faced by shellfish farmers and salmon hatchery workers at the aquaculture worksite, and tells how to reduce the chance of injury. Marine safety experts wrote the manual in response to numerous requests from the industry. Chapters include physical and chemical hazards, proper lifting techniques, airplane and boat safety, basic first aid, electrical hazards, fire fighting, cold water survival, and coping with bears. Although written for Alaskan aquaculture, many of the problems addressed are the same regardless of type of fish or area of the country. View or Download "**Spawn, Spat, and Sprains**" (93 pages!)



Training materials (http://www.flsart.org/library/index.htm#AQU) developed for Florida's State Agricultural Response Team (SART) program include:

Introducing Florida Aquaculture

Aquatic Animal Disease -- Aquaculture may be Florida's least known, important commodity. This unit introduces participants to diseases that can affect aquatic animals in Florida's aquaculture industry.

Emergency Management and Quarantine of Aquaculture Facilities -- This unit introduces participants to needs and procedures in helping an aquaculture facility respond to a man-made or natural disaster.

Aquaculture Table-Top Simulation: What Goes Around -- This activity provides an opportunity to analyze a fictional emergency management and quarantine situation at an aquaculture facility. It can be used to enhance knowledge and critical thinking skills needed to assist in an emergency situation.

(adapted by Bobby Grisso)

New BSE Publication: Electrical Conductivity

Farmers practicing precision agriculture can now collect more detailed information about the spatial characteristics of their farming operations than ever before. In addition to yield, boundary and field attribute maps, new electronic, mechanical and chemical sensors are being developed to measure and map many soil and plant properties.

Soil Electrical Conductivity (EC) is one of the simplest, least expensive soil measurements available to precision farmers today. Soil EC measurement can provide more measurements in a shorter amount of time than traditional grid soil sampling.

This new factsheet discusses soil EC measurements as an alternative to intensive soil sampling and could both improve the resolution (increased sampling density) and reduce the cost of soil maps. Soil EC maps can be used to define management zones reflecting obvious trends in soil properties. Then each zone can be sampled and treated independently.

VCE Publication 442-508

Get Mower Ready for Winter

Mowers that are properly prepared for winter storage are less likely to have maintenance problems when you're ready to mow again in the spring.

Most manufacturer's offer these following storage tips but following the operator's manual instructions:

- Always disconnect the spark plug wire before storing or performing any type of maintenance.
- Empty the gas tank, add fuel stabilizer and run the engine until all gasoline is cleared from the fuel lines and carburetor. Add fuel stabilizer to any gasoline remaining in the gas can. Untreated gasoline will deteriorate after 60 days. Never use left-over gasoline in your mower next spring.
- Empty the oil crankcase or change the oil. If you drain the oil, be sure to refill the crankcase in spring. When changing the oil, replace with manufacturer recommended weight and grade.
- Remove any caked on grass clippings from beneath the deck.
- Lubricate all moving parts, and use a rust preventive on all metal parts,
- Store mowers in a dry place.

To get your mowers ready in the spring:

- Review the operator's manual. Brush up on mower maintenance requirements and safety features before putting mowing back into service.
- Check the spark plug, and change or clean the air filter.
- Refill the oil crankcase to the proper level.
- Refill the fuel tank with clean, fresh gasoline.
- Tighten all screws and brackets. Loose parts could result in an accident.

Season-long maintenance also is important. Changing oil after 20-25 hours of use, clean the air cleaner unit regularly, and check to see that all nuts and blots are tight. Have an experienced service technician give your mower a safety and maintenance inspection periodically.

Safety Signs for Dairy Producers

An incident at the beginning of July made national headlines when a manure pit and its deadly gases were the scene of the deaths of 5 people in Virginia -- four family members, including two girls ages 9 and 11, and a hired man. Apparently one person went in to repair a clog and was overcome, then the hired man attempted a rescue, then the wife, and then the two daughters.

Bi-lingual signs for dairy producers provide for better safety and better communication

Manejo Lechero Dairy Management (http://store.manejolechero.com/ME2/dirmod.asp?sid=9B6FFC446FF7486981EA3C0C3CCE4943&nm=&type=EcomBB&mod=E-Comerce::Product+Catalog&mid=D30FB4BBE3764A5694C4972616B7262A&tier=2&cat=Bilingual%20Signs&ntier1=Bilingual%20Signs) has a Hispanic Resource Center with a bilingual signs covering safety and security issues.

Gemplers (http://www.gemplers.com/safety/labels/polysigns/1) has a "Danger -- Liquid Manure Storage" sign. Two other signs that should be posted are: "Danger -- Deadly Manure Gases Possible" and "Danger -- Drowning Hazard."

The signs shown here can be obtained from:
U.S. Municipal Supply, Inc, R.D. 1, Box 7B, Huntingdon, PA 16652, Phone: PA – 800-222-1980
Others – 800-331-3812, Email: sar@usmuni.com
Web site: www.usmuni.com

Price: $5.20 ea., $5.00/100, plus S. & H

Note that the signs are not shown on their Web site postings.

The Canadian Farm Safety Association offers A Safety Manual for Ontario Dairy Farms (http://www.farmsafety.ca/manuals/manual-dairy.pdf). It contains excellent reminders and useful information for dairy producers. Although Canadian laws may not apply in the States, the hazards, animal behavior issues, and equipment and tasks are the same for any dairy operation.

Cornell has a fact sheet Hydrogen Sulfide in Manure Handling Systems: Safety and Health Issues. (http://www.manuremanagement.cornell.edu/Docs/H2S%20Safety%20fact%20sheet%20FINAL%204-30-07.htm)

MMWR (CDC) Case reviews of manure pit asphyxiation due to methane gas (http://www.cdc.gov/mmwr/preview/mmwrhtml/00001448.htm)

In the events reported, hot humid weather may have contributed to the generation of methane gas and increased the amount of gas in the manure pits. The possible connection between hot weather and increased gas accumulation in manure tanks is also suggested by research data. All 16 deaths identified in the NTOF file occurred in April through September, with the highest number occurring in August. Farmers should be made aware of the particular hazards of entering manure pits during the summer months.

(adapted by Bobby Grisso)

Proper Inflation Pressure

Ensuring proper inflation pressure is the single most important thing you can do to maximize tractor tire performance. What air is to a tire, oil is to an engine, and water is to a radiator. If you do not have it in the proper amount, tire failure can occur.

Too much air decreases flexing of the casing and results in a smaller footprint, increased compaction and a rougher ride. Too little air stresses the tire casing and leads to rapid wear.

Either extreme hurts performance and can ruin a tractor tire. Proper inflation, on the other hand, can more than double the life of an ag tire. Longer life means you will not have to buy a new set of tires as often.

To help farmers optimize the performance and extend the life of their ag tires, here are some factors to consider:

Inflation

Most ag tires are designed to run at low inflation pressures. A low inflation pressure allows the tire to flex and makes for a larger footprint on the ground to maximize traction and minimize compaction.

Each manufacturer recommends its own pressures based on standards set by the Tire and Rim Association, but the steps to getting to that pressure are all basically the same. The only way to know for sure is to take the air pressure and see if it matches what is recommended for your load and speed.

Weight and load

The first step is to weigh the tractor and determine the load placed on each tire.

Question: How do I weigh my tractor? Use the grain or truck scale if one is available. Then weigh each axle of the tractor with the implement on it to get the maximum weight.
If the implement is on a 3-pt. hitch, weigh the front axle with the implement down and weigh the rear axle with the implement up to ensure you get the maximum load on each axle. Make sure the weight and weight distribution across each axle are correct. This is called "ballasting." The purpose is to keep the tractor balanced in the field, ensure the maximum traction for the front, and rear tires.

The recommended weight split will depend on the size of the tractor. If the tractor is not at that weight, suitcase weights should be added in front or wheel weights should be added in back to get to the desired distribution.

Next, measure air pressures using a calibrated pressure gauge and record inflation pressure.

Factor in roading

Inspect the tires and answer the following questions: How far are you traveling from field to field? How fast do you travel on the road and in the field? Roading is one of the most extreme uses for an ag tire, because a tire's worst enemy besides the hard pavement is heat. Therefore, the amount of air you need to add will depend on maximum speed.

Use different load tables according to the maximum speed of the machine. The tire data book lists weight capacities and air pressures along with maximum travel speeds.

The load table corresponds to the size of the tires. It shows you that your front tires need to be set at this pressure for this weight and speed, and your rear dual tires need to be at this pressure for their weight and speed. These combinations of factors optimizes your performance.

Check tires often

Ensuring proper inflation pressure is something farmers do not do often enough. Some might check it once per month or once per operation. Some have their servicing dealer set the pressure when they buy the tire or tractor and never check it again. Check more frequently.

Once the recommended pressure has been determined, check air pressures once a day, preferably in the morning before your tires heat up. Warm tires can have two to three pounds more pressure than cold air. Inflation recommendations are based on cold air pressures.

Inspect the tire for cracks, damages and irregular wear. If any issues are apparent, it is more economical for the farmer to catch an issue early than it is to wait and all of a sudden have a situation in the field. Checking the air pressure in your tires once a day and inspecting them will increase their life and decrease your overall expense.

Dos and don'ts of tire inflation
Follow these tips to ensure the life of your ag tire.

Do: Check air pressure often, ideally once a day or at minimum every two weeks during the working season.

Do: Use a calibrated pressure gauge to measure inflation.

Do: Measure tire pressure in the morning before you operate the machine.

Do: Ballast your tractor each time you change implements.

Don't: Put fluid for weight in radial tires. Fluid prevents the sidewall from flexing and reduces the tire footprint and ride comfort.

(Continued on page 12)

Proper Inflation Pressure (cont.)

(Continued from page 11)

Do: Use cast or suitcase weights in front and wheel weights in back when needed to ensure proper weight distribution between the front and rear axles.

Don't: Underinflate. Underinflation causes the sidewall to deflect more than it was designed to do and will cause premature failure.

Don't: Grossly overinflate. Although slight overinflation is sometimes needed to accommodate severe service conditions, gross overinflation makes the sidewall stiff and prone to impact breaks.

Do: Look for the characteristic "belly" on radial tires, which is a sign of proper inflation.

Do: Visually inspect tires every day for cracks or irregular wear.

Tire pressure

Take these steps to determine the optimal inflation pressure of your tractor tires.

1. Weigh the tractor. Determine the front and rear axle weight and the weight per tire.

2. Determine the total tractor weight and number of pounds required per horsepower to transmit wheel torque efficiently. Weight requirements are determined by the rated PTO horsepower (pto-hp) of the tactor and the type of tractor. For instance, a 2-WD tractor should weigh 145 lbs/pto-hp; a 4-WD should weigh 105 lbs/pto-hp; and a MFWD tractor should weigh 130 lbs/pto-hp.

3. Ensure the tire size is right for the engine horsepower. Tire sizes are based on engine horsepower.

4. Determine the proper weight distribution required for the front and rear axles. If needed, use cast weights to ensure the proper weight distribution on each axle. In general, the following weight distributions are recommended:

   - *2-WD:* 25% of weight on front axle, 75% on rear
   - *MFWD:* 35% front, 65% rear
   - *4-WD:* 55% front, 45% rear

5. See the manufacturer's load-inflation tables or ask your local tire dealer to determine the recommended inflation pressure for your load and speed.

Exercise Prevents Worker Back Pain

A Finnish report has concluded that employer attempts to push training programs that offer lifting advice and material handling devices in an effort to alleviate worker back pain do not prevent the injury, which is said to be the top cause of workers' compensation claims.

The study from more than 18,000 employees in 11 studies showed that attempts made by employers to teach workers specific lifting methods or to have employees use devices such as hoists for lifting hospital patients, were "not effective" in preventing back pain or reducing disability claims or sick leave.

One explanation for the negative findings could be that "safer" lifting techniques do not really exist, so teaching particular tactics would be unlikely to help. Another possibility is that elevated risk for back pain might not be related to lifting or moving heavy objects themselves, but to other aspects of work. High stress, for example, might link jobs that require lifting to back pain, rather than the lifting itself.

Alternatively, it could be that the way lifting and ergonomic techniques are taught is the problem and that workers do not actually adopt better habits. However, the studies looked at many different training methods and did not find any to have a particular advantage.

It's not a lack of adequate teaching methods. One complication of assuming there is a "correct" lifting technique is that "when an employee has back pain, there's a tendency to blame the victim because he didn't use the techniques or devices correctly.

Exercise: The "Only Known Effective Intervention"

This study confirms that much of what is happening at the workplace is well-intentioned but probably pointless. Employers make the mistake of concentrating on equipment and policies that don't work such as back belts, lifting devices and workplace re-design and fail to focus on the "only known effective intervention," which is exercise. Exercise has health benefits beyond prevention of back pain, so you are getting two health benefits (or more) for the price of one.

(adapted by Bobby Grisso)

Dangers of Used Equipment

In a research article, "A Safety Survey of Auctioned Farm Equipment, " authors found that equipment offered for sale at auction often lacks important safety equipment. Over an 8-month period, they surveyed 36 of 43 auctions advertised in New York State. Using ASABE standards, they found that over 97% of tractors and over 85% of implements offered for sale had defects, lacking such essential safety equipment as slow-moving vehicle (SMV) emblems, ROPS, seat belts, lights, PTO master shields, starter solenoid covers, or steering components. (Journal of Agricultural Safety and Health, 4(4): 246-253.)

The condition of equipment sold at auctions or transferred from person to person varies widely, so it's important to examine used equipment carefully.

When equipment is purchased through a dealership, the purchase usually includes a warranty, directions for maintenance and operation, warning signs, "seals of approval" and assurances that the equipment conforms with voluntary or federal standards.

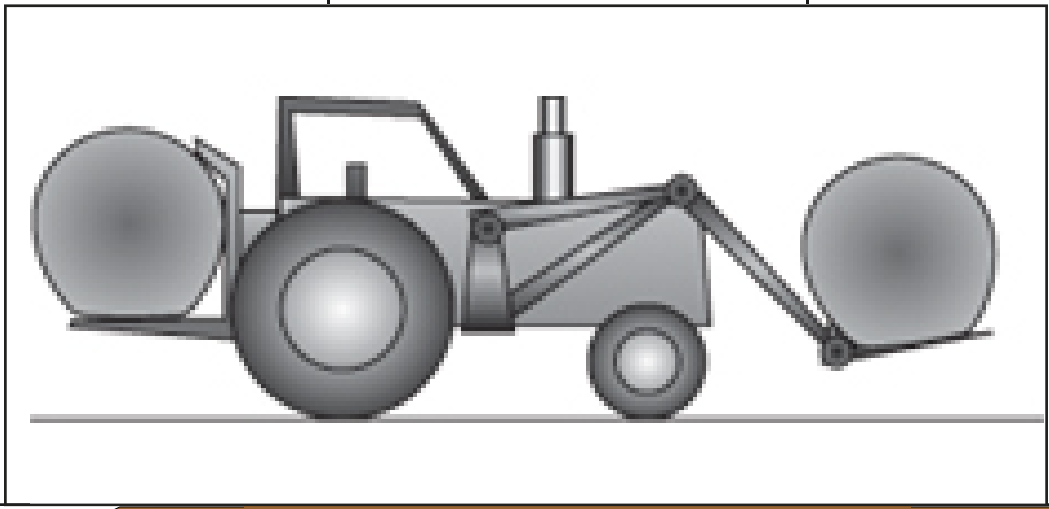
But regardless of where you buy your equipment, look for items that may detract from safety. They include missing shields and poor upkeep.

A bargain price may not be worth the risks involved. Don't be blinded by a "sale" and end up with equipment for which you didn't bargain.

Ask yourself the following questions when you're buying used equipment.

- Are operating manuals included?
- Are shields and guards in place?
- Is the equipment in decent condition? Breakdowns due to poor maintenance could cause unsafe working conditions.

If you're buying a tractor, is it equipped with a ROPS? If it isn't, determine who's responsible for making sure it's installed. Remember, tractors manufactured after October 1976 that are used by employees are required to have ROPS and seat belts per OSHA Standard 1928.51 (Rollover protective structures (ROPS) for tractors used in agricultural operations).



Switchgrass Survey Is Under Way

Bioenergy has been getting a lot of attention recently among farmers and the general public. National wide, there have been several pilot-scale plants demonstrating production of ethanol from various cellulosic biomass; however, there has been no such a plant in Virginia. Virginians are interested in seeing how we can create new markets for agricultural products and become less dependent on foreign sources of oil. Developing a bioenergy industry in rural Virginia could serve as a means to reach both of these goals while fostering rural economic development.

Switchgrass as a bioenergy crop is a native warm-season, perennial grass indigenous to southern central Virginia. Its high cellulosic content makes switchgrass a candidate for ethanol production. To facilitate the establishment of such a demonstration plant in Virginia, and create a liaison between farmers and industry, Virginia Cooperative Extension recently launched a survey on farmers' interests in growing switchgrass which can be supplied as feedstock for cellulosic ethanol production plant in Virginia. The major survey team member are John Ignosh, Zhiyou Wen, and John Cundiff. In Mid-July, the team had two focus group meetings with Bob Jones (Charlotte County) and Jamie Stowe (Pittsylvania County). These two meetings enabled researchers at VT to meet with farmers and discuss their interest or apprehension toward growing switchgrass. Based on the feedback from the two groups, a complete survey had been designed to target farmers throughout the Southwest and Central Districts to assess their interest in growing switchgrass, with the goal being that a regional survey will complement the work being done by other groups in these areas. The team used VCE Producer Contact Lists to contact farmers. The survey is currently underway, the results of this survey will help industry/investors understand at what prices farmers would consider growing switchgrass, gauge their interest in producing switchgrass at different contract lengths, and other variables.

(*by John Ignosh, and Zhiyou Wen)*

Switchgrass Profile

Switchgrass utilization is an emerging market currently in the research and demonstration-project arena. Switchgrass is a summer perennial grass that is native to North America. Switchgrass production can benefit farmers, taxpayers, industrial-fiber producers, energy producers and consumers of energy. Switchgrass is a valuable soil-protection cover crop. It binds loose soils and provides valuable wildlife habitat. Additionally, it has been demonstrated that it could become a valuable fiber source for manufactured composite "wood" products and fiber-plastic composite materials. "Bioenergy" can be produced by co-firing switchgrass with coal to produce electricity in existing power plants offers a near-term energy production alternative, as does eventually using switchgrass as a feedstock in bio-reactors that produce bio-based fuels or industrially important chemicals.

http://www.agmrc.org/agmrc/commodity/biomass/switchgrass/switchgrassprofile.htm

Changes in WAAS satellite coverage can affect GPS performance

Changes in the recent WAAS satellite coverage can affect your GPS performance.

Before heading to the fields you may want to check to see if your Wide Area Augmentation System (WAAS) capable GPS receiver is accepting the new satellites. As of July 30, 2007 the Atlantic Ocean Region West (PRN#122) and the Pacific Ocean Region (PRN#134) satellites were decommissioned by the Federal Aviation Administration (FAA).

Taking it's place on July 11 included a new WAAS (PRN#138) and an existing reconfigured PanAmSat (PRN#135) geostationary satellite. The new satellite will provide better WAAS performance for the US east coast. This will expand WAAS coverage into northeastern Canada. The US will still have dual WAAS coverage as before.

What does this mean to growers and other users of WAAS capable GPS receivers? It means that many older receivers may not locate the new WAAS satellite signals and you will not receive the desired differential correction and accuracy you need for specific field operations. Depending on how old your receiver is, some receivers can be updated with a simple firmware upgrade while others may not. The best advice is to contact your manufacturer about this issue and learn if your GPS receiver can read the new WAAS signals or can accept a firmware upgrade to read the new satellites.

When contacting the manufacturer make sure to indicate the model and latest firmware version. Many manufacturer's web sites provide a list of GPS receivers affected by the change in WAAS satellite signals. Some manufacturers will provide you the necessary instructions to download, install, and setup the firmware for free.

Make sure to field test the GPS receiver after installing the firmware to make sure you are picking up the new WAAS signals. If you are in the market for purchasing an older GPS receiver you will want to make sure it accepts the new signal. GPS receivers that are not able to read the new WAAS signals will still read the other GPS satellite signals but will not be as accurate. In addition, other fee-based commercial services like Omnistar can still be used to maintain higher levels of accuracy for specific GPS receivers.

WAAS was first implemented by the FAA to improve reliability and accuracy of GPS for aviation users throughout the US. It is a free signal and provides a level of differential correction for various agriculture, natural resources, and other general applications. It consists of a network of geostationary satellites and 25 ground reference stations around the US. More information on the changes in WAAS coverage and outages for the US can be found at *http://gps.faa.gov* and *http://www.nstb.tc.faa.gov/*.