



Biological Systems Engineering

Engineering Update

Spring 2008

BSE Named a University Exemplary Department!

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Engineering Update

Biological Systems Engineering
March 2008



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

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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VIRGINIA STATE UNIVERSITY

Nutrient Planning for Small Farms

When properly managed, manure can be a valuable resource on a farm. Manure can be a source of nutrients for crop production and can improve soil quality. The organic matter present in manure can improve both tilth and water holding capacity of the soil.

When improperly managed, manure can pollute the environment; mainly as ground or surface water pollution due to the nutrients nitrogen, phosphorus, and carbon (organic matter). In addition manure can lead to air quality concerns, pathogens in water supplies, and odors, dust, and the presence of vermin.

- Manure nutrients, particularly nitrogen (N) and phosphorus (P) can be major pollutants in lakes and estuaries as well as rivers. These nutrients can reach waterways as surface runoff or leachate from manure piles. When reaching lakes and estuaries they can cause eutrophication. This can result in waters rich in mineral and organic nutrients that promote a proliferation of plant life, especially algae, which reduce the dissolved oxygen content and often may cause



the death of other aquatic life. Impairment of water bodies come from siltation, nutrients, oxygen depleting constituents, trace elements, pesticides, and other chemicals. The quality of the soil can also be impacted from soluble salts in the manure as well as the concentrations of arsenic, copper, and zinc. The soil quality may also be affected by phosphorus saturation due to continued unplanned use of manure.

- *Pathogens and Vermin:* In addition to the above concerns, pathogens may be present in manure. Some examples of the pathogens are *E. coli*, *Salmonella*, and *Cryptosporidium parvum*. These can impair water bodies and potentially be human health risks. Flies and rodents are other manure related concerns on livestock farms. These problems can be minimized by proper design of animal housing and manure storage and proper handling procedures when turning or moving manure piles.

- Air quality concerns arising from odors, particulate matter, and aerial pathogens. Ammonia released from manure can cause odor and can have other consequences that may effect the environment and public health. There are a variety of other compounds released from manure such as hydrogen sulfide, green house gases (methane and nitrous oxide), and some volatile organic compounds that can also cause air quality concerns. Particulate matter that arises from dust and reaction of ammonia with some other compounds in the atmosphere are also a concern.

The purpose of nutrient management is to implement practices that permit the efficient use of manure for crop production while protecting potential environmental damage that may be caused by nutrients. Nutrient management planning is a site specific exercise and if the recommendations are followed, nutrient losses should be minimal. In general nutrient management considers how much nutrients are available on a farm, how

(Continued on page 3)

Nutrient Planning for Small Farms

(Continued from page 2)

best to use them and the potential impacts of the nutrients on the environment. Usually considered in nutrient management planning are: goals of farming as well as any constraints; available farm resources (land, equipment, financial resources); potential critical areas on the farm (sensitive water bodies, neighbors concerns, erosion, manure storage etc); and nutrient balance (shown in the figure below).

feed again. The optimal goal is for the farm to remain in balance between inputs and outputs without losses either as runoff from manure and soil to surface water or by leaching into the groundwater. Soil can store nutrients assuming that the amount of manure applied to the soil is not excessive.

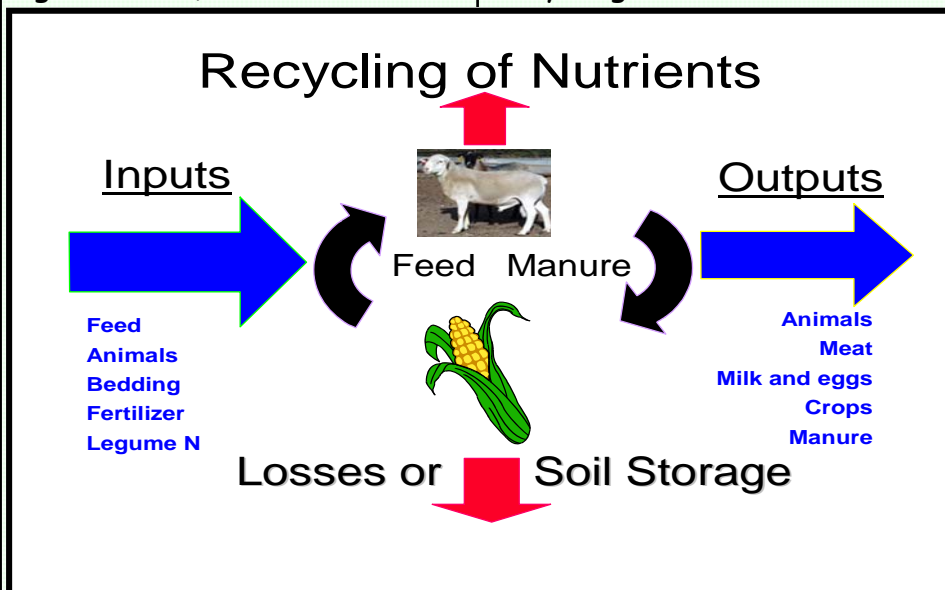
The challenges of managing manure nutrients are different on a small farm than on many larger farms. Small

to feed animals and manage their diets; how much manure is produced; basic soil science and soil fertility; and nutrient (manure) management - manure use on and off the farm as well a nutrient management plan.

Announcement

Looking for Manure

We are looking for manure from sheep, goats, alpaca, and horses. This is part of a Mid Atlantic Water Quality, project in which we would like to determine the characteristics of these manures, prevalence of these animals in the Mid Atlantic region to assess their impact on water quality. After determining the manure characteristics, we plan to conduct an educational workshop on manure management for these animals sometime in September this year.



Farm nutrient inputs consist of feed, animals, fertilizer, legume nitrogen, and bedding. Outputs are animals, milk, meat, eggs, manure, and crops. Recycling also occurs on the farm, from feed to livestock to soil to plant and back to

farms have fewer animals and sometimes several animal species on the same farm, but may have limited acreage and/or lack equipment for spreading manure. The nutrient management planning section provides information about how

This article was prepared for the Livestock and Poultry Environmental Learning Center to address manure management on small farms as part of the *extension* community of practice.

(by Jactone Arogo Ogejo)

For more details go to http://www.extension.org/pages/Nutrient_Planning_on_Small_Farms

Tips Can Help Trim Energy Costs

Natural gas prices are expected to rise 30 percent (or more) this winter, but there are ways homeowners can take the sting out of utility bills.

Several factors point towards utility bill shock for those who use natural gas for almost any purpose. Weather impacts on production and transport facilities, increased demand for electric generation and other purposes, and the unknown severity of winter weather all combine to set the stage for staggering increases.

Reducing energy consumption in the home can help homeowners and, in some cases, apartment dwellers, hold down utility bills. Here are some of these cost-saving tips:

- Have the furnace cleaned and tuned up annually. A tune-up may include resetting the fuel-air mixture and cleaning the burners and blower to allow maximum airflow and complete combustion necessary for peak performance.
- Check the furnace filter monthly and clean - or replace - a dirty or otherwise clogged filter that may hamper airflow, making it harder - and more costly - for a furnace to do its job.
- Lower the thermostat 10 degrees at night or when the family is away at work or school

during the day to save as much as 15 percent on home heating costs. Installing a programmable thermostat, which costs about \$50, can ensure the home will be warm in the morning or when the family returns. Lowering the setting on the thermostat a few degrees, from 72 to 68 degrees F also can result in a cost savings.

- Check for air leaks around windows and doors and add weather stripping or caulking as needed.
- If you have windows to the south, open curtains and blinds on sunny days to let the sunshine warm your rooms. Close curtains or blinds as the day begins to cool down.
- Check the owner's manual and manufacturer's recommendations for setting the thermostat on your hot water heater. A setting of 115 to 120 degrees F will typically provide hot water that is comfortable, yet cost-saving.
- Water heaters can last 10 to 15 years, but may become clogged with sediment that interferes with the heat transfer and increases operating costs. Draining as little as a quart of water from the water heater every three months can reduce the build-up. If, however, a hot water heater is seven to 10 years old, consider replacing it with a new, more energy efficient model.
- Installing blanket-style insula-

tion on a water heater can further trim costs generally. One caution: Follow manufacturer's instructions for installation.

- Opt for a shower, rather than a bath. A five-minute shower typically requires about 10 gallons of water, whereas a bath may require 15 to 25 gallons of water. For additional savings, install a low-flow showerhead.
- For laundry, opt for a cold-water wash with detergents formulated to get the job done.
- With a dishwasher, avoid using the rinse-and-hold feature and wait until you have a full load before using the dishwasher. To save more, allow dishes to air dry.
- Use kitchen and bathroom vents sparingly. The vents are designed to remove moisture from the interior of the home, but may also remove warm air and increase overall energy costs. Indoor air tends to be dry during winter months. Consider excessive condensation on windows as a signal to use the vent.
- Close doors, including the garage door, promptly. If a garage is attached to the house and the door is left open, a blast of cold air can chill rooms close by.

More information on energy conservation in the home link to: www.energyguide.ext.vt.edu/

(R. Grisso)

Save Energy On-Farm

Farmers do not have to wait for "green" technologies or other advanced energy conservation techniques to conserve fuel and save money on their farm. Farmers do not have to wait for new technology. Money-saving ideas are out there and they can practice energy conservation, often with little or no investment.

In the area of crop production, here are several tips:

- Practice conservation tillage, either with no-till or other tillage-limiting techniques. The fuel used for getting the crop established in no-till is about half compared to using intensive tillage.
- Grow cover crops as a partial replacement for commercial fertilizer. Making use of cover crops to capture nitrogen can cut commercial purchases by 50 to 100 pounds per acre. Whether farmers grow legumes or non-legumes as cover crops, they are reducing the need for purchased nitrogen. The value of a legume is that you are growing nitrogen, and the value of a non-legume, like ryegrass, is that you are storing nitrogen. Either way that's less commercial fertilizer you have to add to the soil, and there will be less available nitrogen over-winter to leach and end up in a stream or lake. Many farmers report that the savings on purchased nitrogen is enough to cover the cost of establishing a cover crop.
- Practice crop rotation. Soybeans rotated with corn supplies nitrogen for the corn crop. Yields are usually higher compared to continuous corn.

- Practice controlled traffic, especially if precision technology is already in place on the farm. As RTK (real-time kinetic) auto-steering becomes more affordable, it makes controlled traffic a much easier decision for farmers. The accuracy of auto-steering makes it easier for farmers to drive in the same path year after year. Controlled traffic saves money on fuel, labor, crop inputs and equipment costs. It can virtually eliminate yield loss from compaction, and makes continuous no-till more economical.
- Farmers can also save energy by managing their farmstead facilities, from their maintenance shop to their livestock buildings, more efficiently. One key is managing ventilation and heating systems. The ventilation system inlets and exhaust fans should be checked. An inlet opening that's too wide could result in poor distribution of fresh air in winter. Any excess ventilation above the minimum required for the animals is using more fuel to heat the air.
- Farmers can also conserve energy through more efficient lighting by switching from incandescent to fluorescent lights, both in farm buildings and in their homes.

Proper maintenance of equipment and vehicles can also lead to energy savings. Here are some tips:

- Maintain the right kind of tires at the proper inflation. Tractor tires can be a major source of fuel loss. On the average farm, the majority of tires are over-inflated. Over-inflation causes excess slippage. Keeping tires at the correct pressure improves traction, floa-

tation and wear. Check tire pressure once a week during times of heavy usage. Tractors need the proper weight for traction, and the correct balance between front and rear axles for peak performance. Have enough weight to eliminate excess slippage, but remove ballast when it is not needed. When pulling a load, the correct amount of slippage is 8 to 12 percent on a firm surface and 10 to 16 percent on soft ground.

- Maintain regular maintenance on equipment. Regular upkeep includes changing air and fuel filters.
- Shut off idling engines. Do not let a diesel engine idle more than about 10 minutes. Research shows it is less efficient to keep an engine idling for warmth than it is to re-start it. Of course, results may change in extremely cold weather.
- Be mindful of fuel-wasting use of the equipment. For example, when subsoiling, do not go any deeper than necessary to break up compacted soil. The deeper you go, the more power it takes.
- Replace worn equipment parts. Keep ground-engaging tools sharp makes a big difference when it comes to saving fuel and improving speed and field efficiency.

For many situations, every dollar saved in fuel can save a farmer \$5 to \$10 in total production costs.

Some of these are common sense tips and most people are probably already practicing. But when gas and diesel are around \$3 a gallon, folks don't object to being reminded of ways to save money.

(R. Grisso)

Sprayer Maintenance

Keep your sprayer equipment in good working order. Proper maintenance of your application equipment will promote safe and effective pest control, lower repair costs, and prolong the life of the sprayer and spreader.

Before Spraying

- At the beginning of each spraying season, fill the tank with water and pressurize the system. This will tell you whether all parts are working and if there are drips or leaks that need correcting.

- Make sure the check valves are working properly. These check valves will prevent dripping when flow to the nozzle drops below a certain pressure.
- Measure the distance between the nozzle tip and the target, and adjust the boom height accordingly. Nozzle height may affect the uniformity of the spray pattern in broadcast applications.
- Fill the tank with clean water that is free of sand and silt.
- Do routine maintenance of the plumbing system (hoses, pumps,

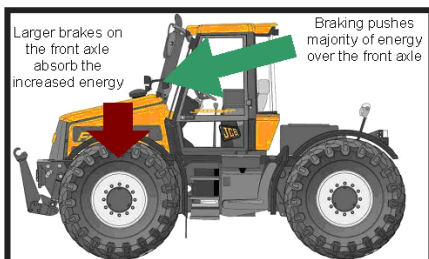
- and nozzles).
- Clean and check nozzles and screens. Check the flow rate and pattern on a schedule. Replace nozzles that are worn. The nozzle orifice will enlarge with wear, especially if abrasive materials are used. Nozzle wear changes both the spray pattern and the flow rate. If the flow rate of a nozzle is off by 10%, replace it. In addition, replace any nozzle that is producing a nonstandard pattern.

(R. Grisso)

High-Speed Tractors

The number of tractors manufactured with road gears (high gear setting) exceeding 30 kph (20 mph) has increased. A review the Nebraska Tractor Test Summary reports show that from over 500 tractors tested that a increase of road gear speed have dramatic increased in the last 5 year (see figure below). Currently between 40-45% of the tractor tested can exceed 40 kph (25 mph).

Previous tractor designs had been largely restricted to optimizing in-field performance with limited development to optimize performance at higher speeds for roadways. It is recognized that high-speed road travel of new tractors has not common in North America. Although, there are areas and applications, which do fit, such as hay handling contractors, or operators hauling manure from swine or dairies using tractor drawn tankers or moving biomass for energy processing.

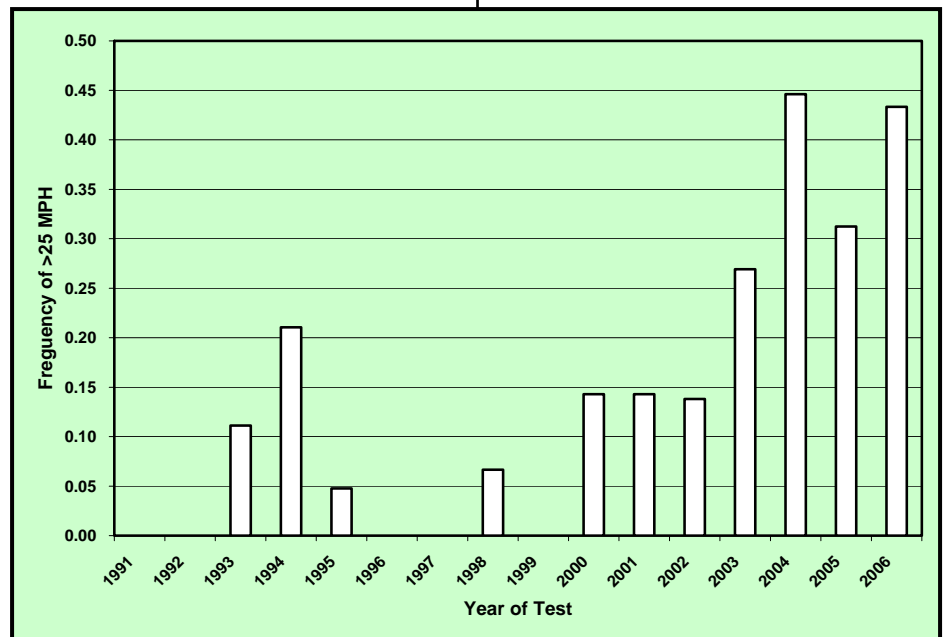


The major challenge manufacturers face is how to maintain control of the vehicle along with the implements, and operate safety as these vehicles approach the highway. Practically, farmers in US face the issues of implementation and operation routine with the high-speed tractors. They must make adjustments when they operate the tractor on highway, country road, and field for different purposes. The related safety concern is different than from the slower moving tractors.

The manufacturers of high-speed tractor need to design systems that have improved vehicle ride and handling, wheel and tire technology, steering, suspension and braking systems, ROPS, towed equipment and operator licensure.

New standards and regulation will be forth coming to accommodate these new developments.

(R. Grisso)



Rotary Spreader Calibration

To apply granular pesticides according to label directions, calibrate your spreader. Calibrating granular application equipment requires measuring the amount of granules spread over a known area.

If possible, catch your output. Alternatively, check the application rate of the rotary spreader by loading the spreader with a known weight of product. Rely on your experience to choose a starting point. Select a test setting that will deliver half of the labeled rate. Apply the material to 1,000 square feet. Then, weigh the remaining product to determine how much you actually used. Adjust the size of the gate opening if/as needed. Repeat this procedure until your application rate is within plus or minus 5% of the recommended label rate. The table below will help you flag off a test course:

Swath width (feet)	*Travel distance (feet)
6	167
8	125
10	100
12	83
14	71
16	63
18	56
20	50
*Round to the nearest whole number.	



If your rotary spreader has a different width, use the following formula to calculate the travel distance:

$$\text{Travel distance in ft} = \frac{1,000 \text{ sq ft}}{\text{swath width (ft)}}$$

For example, if you have a spreader that covers a swath of 9 feet, the distance to travel is:

$$\frac{1,000 \text{ sq ft}}{9 \text{ ft}} = 111.1 \text{ ft}$$

The travel distance is ~111 feet.

Multiply the amount of dry material collected in 1,000 sq ft x 43.56 to determine the application rate in pounds per acre.

1. Start with a clean spreader.
2. Mark off a test area. Set up a linear course, based on the swath width of the spreader.

Use flags or other markers to denote the start and endpoints of the course. The table above will help you choose the right travel distance for your spreader.

3. Fill your spreader about half full with granules.
4. Walk the course at your normal pace, releasing granules and catching them in the tray.
5. Weigh the granules used. (Don't forget to subtract the weight of the empty container.) Use a scale that can accurately measure to the nearest ounce.
6. Compare the weight of the particles you collect to the application rate you calculated in advance. They should be within 5% (plus or minus) of each other.
7. Make adjustments if/as necessary, and try again.
8. When your output matches your target, make one or two more trials to confirm your results.



Apply half the chemical over the lawn and apply the other half at right angles to the first pattern to minimize skips and overlaps.

(R. Grisso)

Spray Adjuvants

The first step in understanding adjuvants is clear definition. Adjuvants are spray additives that have beneficial properties of enhancing performance of the active ingredient or improving the performance of the spray solution. Adjuvants really are the overarching term for all additives to an agrochemical spray solution.

Within the classification, there are essentially two groupings - activator and utility adjuvants. Activator adjuvants enhance the performance of active ingredients of pesticides while utility adjuvants have some beneficial effect on the spray solution, but do not directly affect active ingredients performance.

Utility adjuvants have numerous uses, but they basically improve the ease of applying the spray solution. Definitions of utility adjuvants are presented in Table 1. If herbicides do not mix well, if you have hard water, or if you have to

spray at a high rate of speed, utility adjuvants can be added to the spray solution to improve performance.

Activator adjuvants have a beneficial effect on the active ingredient (see Table 2). Absorption is the movement of the active ingredient through the plant cuticle, translocation is the movement of the active ingredient throughout the plant vascular system, and metabolism is the break-down of the active ingredient. By increasing the absorption or translocation, or decreasing

metabolism, an adjuvant can increase the activity of an active ingredient. The opposite effect would occur if the opposite occurs.

"Surfactant" is often used synonymously with the term adjuvant; however, these terms are not the same. Adjuvant refers to any additive to an agrochemical spray mixture; surfactant is a term describing a classification of chemicals.

Surfactants, shortened from surface-active-agent, is a

classification of chemicals that produce physical changes in the interface of two dissimilar liquids - primarily hydrophobic (water-hating) and hydrophilic (water-loving) liquids. Hydrophobic liquids such as oil are primarily non-polar molecules that

Table 1. Definition of Common Utility Adjuvants.

Water conditioning agents	Reduces the interaction of ions in the spray solution to interact with the active ingredient.
Compatibility agents	Improves the mixture and uniformity of the application liquid.
Defoamers	Eliminates or reduces foam in the application liquid.
Drift control agents	Reduces the driftable portion of the application liquid once sprayed.
Deposition agents	Deposition agents: Improves the ability of the applied liquid to apply to the target.
Acidifiers	Lowers the pH of the spray solution
Buffers	Aids the spray solution by preventing change in pH when other chemicals are added to the mixture.
Colorants	Changes the color of the spray mixture. Also referred to as dyes or paints used for marking spray patterns and areas.

(Continued on page 9)

Spray Adjuvants

(Continued from page 8)

do not mix with water or other polar, hydrophilic liquids. Surfactants bridge the polarity gap by virtue of their own chemical structure.

Surfactants have both hydrophilic and hydrophobic portions to their chemical structure that allow them to bridge between dissimilar liquids. The hydrophobic portion is a long, hydrocarbon chain often referred to as the tail. Whereas, the hydrophilic portion is a short, carboxylic group referred to as the head. The tails of the surfactant molecules imbeds itself into the oil droplet forming a micelle while the head interacts with the water allowing the oil molecule to dispense in the water.

Due to this chemical action, many surfactants function as adjuvants, primarily activator adjuvants. Surfactants can decrease the surface tension of water allowing the spray

droplet to spread and wet. Surfactants can also promote interaction of the spray droplet with the hydrophobic leaf surface allowing for greater active ingredient absorption.

The *Compendium of Adjuvants* lists 523 spray adjuvants available for purchase from 39 companies in 2006. Trying to sort through such a vast number of products can seem impossible.

The best answer to which adjuvant to buy is to follow the recommendation on the pesticide label. Companies want their product to work, so they are going to tell you exactly how to use it. Research is conducted to determine exactly how much pesticide needs to be applied for pest control and desired plant/turf safety.

Another answer to which adjuvant to buy is to understand

how the active ingredient works. If you are applying a foliar absorbed active ingredient with effective translocation, you do not need an adjuvant that extends soil life or that improves translocation. Most likely, the pesticide label will recommend an adjuvant to improve foliar absorption.

(R. Grisso)

Wetting-spreading agents	Lowers surface tension of the spray droplet increasing droplet coverage of the leaf surface.
Sticking agents	Viscous materials that improve adhesion of spray droplets to leaf surface.
Humectants	Reduce evaporation speed of the spray droplet on the leaf surface potentially improving active ingredient absorption.
Absorption agents	Improve movement of the active ingredient through the leaf surface. Improves absorption by softening or dissolving epicuticular wax or improving stomatal infiltration.
Safener	Reduces phytotoxicity to desirable plants. Potentially increases metabolism of the active ingredient, reduces translocation, or reduces absorption of the herbicide.
Synergist	Increases the activity of the active ingredient. Potentially decreases metabolism of the active ingredient, reduces translocation, or reduces absorption of the herbicide.
Extender	Increases the longevity of the herbicide in the soil often by decreasing microbial activity.

Corn Planter Adjustment - Last Minute Tips

Uneven plant spacing and emergence may cause significant yield losses in corn. Seed should be spaced as uniformly as possible within the row to ensure maximum yields and optimal crop performance. Corn plants next to a gap in the row may produce a larger ear or additional ears (if the hybrid has a prolific tendency), compensating to some extent for missing plants.

Skips can reduce yield in fields where the intended population is at or below the optimum, while doubles increase yield when populations are less than optimum. Reduced plant stands will yield better if plants are spaced uniformly than if there are large gaps in the row. As a "rule of thumb", yields are reduced an additional 5 percent if there are gaps of 4 to 6 feet in the row and an additional 2 percent for gaps of 1 to 3 feet.

Uneven corn emergence generally has a greater impact on grain yield than uneven plant spacing. Uneven emergence affects corn performance because competition from larger, early-emerging plants decreases the yield from smaller, later-emerging plants. If the delay in emergence is less than two weeks, replanting increases yields less than 5 percent, regardless of the pattern of unevenness. However, if one-

half or more of the plants in the stand emerge three weeks late or later, then replanting may increase yields up to 10 percent.

Emergence delays of 10 days or more usually translate to growth stage differences of two leaves or more. When two plants differ by two leaves or more, the younger, smaller plant is more likely to be barren or produce nubbin ears. Weeds also tend to be a greater problem in those areas of a field characterized by skips and gaps in the corn rows, and slow, erratic corn emergence.

Corn sometimes emerges unevenly because of environmental conditions beyond the control of growers. However, timely planter servicing and adjustment, as well as appropriate management practices, can help prevent many stand uniformity problems. The following are some tips for improving the uniformity of seed placement during planting.

- Keep the planting speed within the range specified in the planter's manual.
- Match the seed grade with the planter plate.
- Check planters with finger pickups for wear on the back plate and brush (use a feeler gauge to check tension on the fingers, then tighten them correctly).
- Check for wear on double-disc

openers and seed tubes.

- Make sure the sprocket settings on the planter transmission are correct.
- Check for worn chains, stiff chain links, and improper tire pressure.
- Make sure seed drop tubes are clean and clear of any obstructions.
- Clean seed tube sensors if a planter monitor is being used.
- Make sure coulters and disc openers are aligned.
- Match the air pressure to the weight of the seed being planted.
- Make planter adjustments and follow lubricant recommendations when using seed-applied insecticides.

Corn growers should make planter adjustments and follow lubricant recommendations when using these seed-applied insecticides. Unless these precautions are followed, the extra chemical loading on the seed may adversely affect the metering devices. Vacuum planters may under seed and finger pickup planters may over seed. To improve planter accuracy, talc or graphite should be used according to the planter manufacturer's recommendations. With vacuum planters, it will probably be necessary to raise the vacuum to achieve more accurate seed drop.

(R. Grisso)

More Planter Tips: <http://www.ext.vt.edu/pubs/bse/442-457/442-457.pdf>

Avoid Sidewall Compaction During Planting

A properly adjusted planter will close the seed-vee and provide good soil-to-seed contact. Standard closing wheel systems should be set to close the seed-vee and provide seed-to-soil contact without over-packing the seed-vee. Sidewall compaction is caused when the closing wheels over-pack the seed-vee in wet conditions.



The seed furrow opener may smear the soil in wet planting conditions, but the closing devices should fracture the sidewall when closing the seed-vee. If not, the smeared soil may harden when it dries, making root penetration difficult.

Consider spoked closing wheels on the planter, or one spoked wheel and one standard wheel (note picture), to till in the seed-vee in wet conditions, reducing the chances of the seed-vee opening back up as the soil dries. However, this tillage tends to dry the soil while closing seed-vee and some spoked wheels may not provide good seed-to-soil contact. If the closing wheels can be staggered, one in front of the other, doing so will help close the seed-vee in heavier soils.

Tips to reduce sidewall compaction:

1. If possible, wait for drier soil conditions before planting.
2. Reduce downpressure in wet conditions to avoid compaction.
3. Plant corn at least 2 inches deep and fracture

- the sidewall while closing the seed-vee.
4. Evaluate seed-to-soil contact at seeding depth. Resist the temptation to increase downpressure to close the seed-vee.
5. Leave residue over the row to

- reduce the seed zone from drying out and the soil from shrinking.
6. Build soil structure using no-till, manure or cover crops. Soil with good aggregation is less likely to smear or compact.
7. Level the planter front-to-rear, or even operate it slightly tail down, to improve seed-to-soil contact and closing the seed-vee.
8. Use an attachment to till and loosen some soil for closing the seed-vee.
9. Till in the sidewall with spoked closing wheels (need seed firmers for seed-to-soil contact).
10. Use one spoked closing wheel and one standard wheel to close the seed-vee and firm the soil.
11. If possible, stagger the angled closing wheels, one in front of the other, to reduce the seed-vee from opening back up as the soil dries. (If using one spoked wheel, place it in front.)



This planter uses one spoked wheel on each row to close the soil around the seed and one standard press wheel to firm the soil while providing depth control. This reduces the aggressiveness of spoked closing wheels to reduce over-drying of the seed zone.

More Planter Tips: <http://www.ext.vt.edu/pubs/bse/442-457/442-457.pdf>

Reduce Waste of Expensive Hay

Feed makes up 60 to 70% of the cost of running a cow-calf operation. Beef producer's hay and winter forage accounts for about 60% of the cow's annual feed costs.

Big bale feeders are one of the worst culprits when it comes time to point fingers at waste factors. Low quality hay ranks as a close second as far as waste is concerned. Research shows that bale feeder design is a factor in waste.

The most saving design is the cone shaped feeder these modifications do come with a higher price tag. The higher price is justified when feeding high quality-high priced hay. The higher price of that feeder also pencils out favorably when you compare less than 10 percent waste to in excess of 30 percent lost feed.



The latter waste amount is seen with worn out poorly designed

bale rings that stay in one place all season long.

There are advantages - manure distribution and animal sanitation -- to unrolling big bales. But this method of feeding does require some extra equipment for some farms. However, proper management can make this a good alternative to bale feeders.

Research also shows that hay waste is reduced by limiting a cow's access time to big bale feeders. In an university study, when hay was in the feeder free choice, 13.4 pounds of waste occurred per cow per day. In contrast if the cows were given access only nine hours per day they wasted only 9.2 pounds of hay. When access time was cut back to six hours, their waste fell to 5.7 pounds per day. Body condition and weight gains were comparable for the three treatments.

Hay is too expensive to waste, so as cattlemen try to minimize costs in this belt-tightening time this hay feeding season is an important time to observe feeding practices closely.

No matter how hay is packaged, if you waste it, you lose money. Below are some general rules that can help minimize waste during feeding.

- **Feed hay in small amounts or in a feeder to minimize waste.** When fed a limited amount of hay at a time, cattle have less opportunity to trample and soil the hay. Feeding hay in a rack or a "hay ring" also limits the opportunity that animals have to trample or soil hay, and will reduce waste substantially if you intend to provide more than a day's worth of hay at one time.
- **Feed hay in well-drained areas.** If you intend to feed hay in a single location all winter, then providing a footing such as crushed gravel or even concrete can help minimize problems with mud. Perhaps more cost effective is to move hay-feeding areas around the farm to minimize the damage to any one area of the pasture.
- **Feed hay stored outside before hay stored inside.** Hay stored outside usually has more spoilage during storage and lower palatability than hay stored inside. Cattle will waste a greater percentage of poor-quality hay than they will of good-quality hay. Animals fed high-quality hay early in the season will often refuse poor-quality hay when it is offered later.

(R. Grisso)

<http://extension.missouri.edu/explore/agguides/crops/g04570.htm>

How Hay Preservatives Can Help

When baling hay, moisture content can influence yield, quality and storability. If the hay is too dry, leaves will fall off, reducing both quality and yield, but if it's too wet, it can get moldy or overheat and catch fire. There is a narrow moisture range that results in good hay that keeps well.

Hay can be baled a bit wetter if a preservative like propionic acid is applied as it's baled. To get good results from preservatives, though, it helps to know how it works and what it can and can not do.

Baled hay naturally contains

millions of bacteria and mold fungi. As they consume hay nutrients, these microbes produce heat. The duration and intensity of this heat determines the amount of damage.

This heat also forces moisture out of the bale, something called "going through a sweat." Usually, hay gets dry enough that the microbes die or go dormant, but when there's too much moisture, it can mold or overheat.

Preservatives will kill many of the microbes so less heat is produced, giving hay time to dry naturally, without the

"sweat." As it dries, the preservative also vaporizes and disappears. If bales are staked tightly into storage soon after baling or fail to allow for natural drying, the remaining microbes eventually will produce mold and heat. Also, if rain, high humidity, or other sources moisten the hay later, microbial activity can redevelop since the protection from preservatives lasts only a short time.

Preservatives can help make good hay at higher moisture levels, but correct management is needed to keep that hay in good condition.

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>

Arthritis Booklet Available on the Web

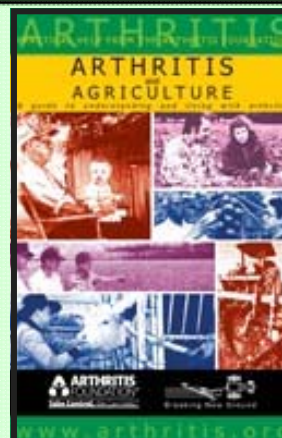
Arthritis and Agriculture: A Guide to Understanding and Living with Arthritis is now available in PDF format at: http://cobweb.ecn.purdue.edu/~agenhtml/ABE/Extension/BNG/Resource%20Center/arth_and_ag.pdf (size 909 kb).

This 23-page brochure focused on agricultural workers that discusses such topics as: common types of ar-

thritis, managing arthritis, unproven arthritis remedies, and sources of assistance. Since this publication is designed specifically for agricultural workers, it gives advice on methods of modifying farm and ranch tasks to provide added protection to joints.

The publication also emphasizes proper diagnosis, exercise, medication, stress management, and working with a team of professionals to

cope with arthritis. A variety of organizations are listed for those wanting further assistance with arthritis or disability-related issues.



Spring Lawn Mower Tune Up

Experience proves that a well-maintained mower reduces emissions up to 50%, reduces fuel consumption up to 30% and restores horsepower up to 7.5%. A typical engine tune-up includes changing the oil, spark plugs and air filter.

Why Tune Up? There are a number of benefits, for you and the environment, including: extending the life of your equipment, reducing fuel consumption up to 30%, conserving natural resources, reducing emissions up to 50%, which protects the environment, restores your horsepower by 7.5%, and improves the startability of your engine.

Changing Your Oil

For optimum performance, you should change the oil in your small engine at least once per season, or every 25 hours of use.

Most small engine manufacturers provide maintenance kits that come with the correct oil and volume for your engine. You can also purchase oil separately through our online store or through participating dealers and retailers.

Step 1: Getting Started. Start the engine and run it until it is warm. Stop the engine. **WARNING:** Be sure to disconnect the

spark plug wire, and secure it away from the spark plug to prevent accidental starting.

Clean around the oil fill and drain plug area to prevent dirt and debris from falling into the crankcase. Remove the dipstick, if equipped.

Step 2: Draining the old oil.

Tilt the mower deck with the air filter or spark plug side up, and position some newspaper and an oil pan or jug beneath the mower. Use a socket wrench to turn the plug counter clockwise, allowing the old oil to drain.

If the plug also serves as a fill cap, it may have two prongs so you can loosen it by hand or with a screwdriver or hex key for additional torque.

Replace the drain plug by twisting clockwise and tightening with a box wrench or adjustable wrench.

Step 3: Engines with Oil Filter.

If your engine does not have an oil filter, skip this step. If your engine has an oil filter, replace it

at least once per season. You replace the oil filter by twisting counterclockwise on the body, using a filter wrench or pipe wrench. Examine the sealing surface on the oil filter adapter for debris or gasket material. Clean if necessary.

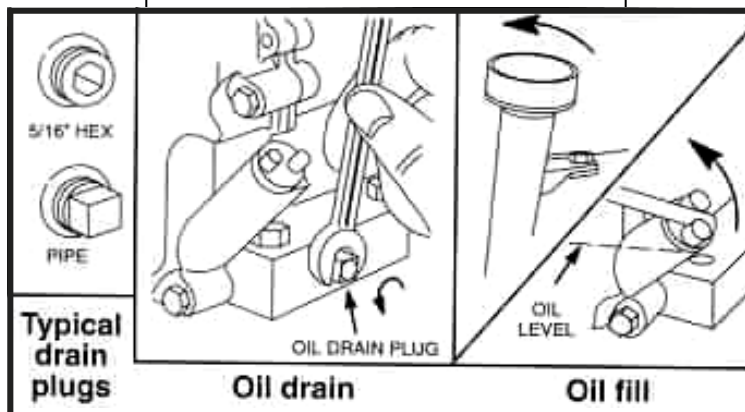
Lightly oil the filter gasket with clean engine oil. Install a new filter, screwing in by hand until the gasket contacts the filter adapter. Tighten the filter an additional 1/2 to 3/4 turn.

Step 4: Fill with New Oil. Pour in the correct amount of oil for your engine, based on this oil capacity chart, or your owner's manual. **NOTE:** Oil capacity on most small engines is 20 oz (0.6 L), which may be LESS than the total amount of oil you have purchased. Overfilling of oil is very common, and is easily avoided.

Dispose of the oil and soiled rags in accordance with local statutes. Run the engine at idle and check for leaks.

Changing Spark Plugs

Changing your spark plug is one of the easiest ways to ensure accurate and easy starting for your engine. This should be done every season.



Spring Lawn Mower Tune Up

(Continued from page 14)

Some spark plugs are pre-gapped, so all you need to do is remove the old spark plug and replace it with the new one. If not, gap the plug according to manufacturer's specifications.

Step 1. Be sure engine is stopped. Disconnect the spark plug wire, and clean the area around the spark plug to avoid getting debris in the combustion chamber when you remove the plug.

Step 2. Remove the spark plug using a spark plug socket and/or socket wrench.

Step 3. Install the new spark plug finger tight. Then tighten 1/4 to 1/3 turn more with the socket wrench.

Air Filter Replacement

Air filters should be replaced every 3 months or after 25 hours of use, whichever occurs first, more often under dusty conditions. Small engines use one of three types of air filters; foam, paper, and a combination of foam and paper.

How To Change a Paper Air Filter

A paper air filter element works by causing any air that is intended to enter the combustion chamber of the engine to pass

through a filtering device made with microscopic holes in it. The paper element traps the dirt particles on the outside of the element.

1. Loosen cover screw.
2. Tilt cover down.
3. Carefully remove and discard paper cartridge.
4. Install new cartridge with paper pleat out.
5. Close cover.
6. Tighten screw securely.

How To Change a Foam Air Filter

The "foam only" style air filter system works by trapping dirt and debris through the use of motor oil spread throughout the oil foam holding medium. A dry or non-oiled oil foam filter will trap only the largest particles. If the air filter element is foam only, it **MUST** be oiled and serviced regularly.

1. Remove air filter screw.
2. Carefully remove air filter assembly and discard foam.
3. Clean all metal air filter assembly parts.
4. Saturate new foam filter with fresh engine oil. Wrap foam in clean cloth and squeeze to remove excess oil.
5. Assemble foam filter so lip extends over edge of air filter body.
6. Reinstall air filter assembly carburetor.

How to Change Dual Element Air Cleaners

Combination filters provide the highest degree of air filtering in the industry. The foam portion is used as a pre-cleaner for the paper element. Pre-cleaning the air increases the life of the more expensive paper element. Air passes through 2 types of filtering mediums providing clean air for the engine.

If you have a combination air filter with pre-cleaner replace pre-cleaner every 25 hours or every season, and replace cartridge every 100 hours or every season.

If you do not have a pre-cleaner replace cartridge, change the filter every 25 hours or every season, more often under dusty conditions.

1. Remove knob(s) and cover.
2. Carefully remove foam pre-cleaner, when so equipped.
3. Reinstall cartridge, nut(s), pre-cleaner and cover.
4. Retighten knob(s) securely.
5. Replace if very dirty, damaged, or doesn't fit properly.

Time spent on maintenance reduces down time on the job, reduces the amount you spend on fuel, and reduces the number of mowers you need to purchase by extending the life of your mower.

(R. Grisso)

New Extension Publication: Small Scale Biodiesel Production

An extension publication (VCE 442-885) on biodiesel will be published soon by Zhiyou Wen, Steve Bantz, Christopher Bachmann, Christie-Joy Brodrick, and Lisa Schweitzer. A previous VCE publication (442-880) discusses the basics of biodiesel fuel including terminology, engine compatibility, engine warranty, biodiesel storage, fuel performance, cold temperature concerns, and emissions.

The publication addresses producing one's own biodiesel fuel from waste oil, fats, and oilseed crops. Currently, there are many small-scale biodiesel producers (ranging in size from several gallons to several hundred of gallons per batch). There are significant safety considerations when operating small-scale processors. In addition, the fuel quality and the byproduct disposal need to be closely monitored to assure en-

gines are not damaged and regulations are met. The purpose of this document is to address safety, fuel quality, and waste disposal related to small-scale production.

A general discussion of these issues based on a case study of four small-scale biodiesel processors conducted cooperatively by James Madison University (JMU), Virginia Tech (VT), the Virginia Clean Cities Coalition, and Blue Ridge Clean Fuels Inc. (Z. Wen)

Identifying Farmers' Interest in Growing Switchgrass

Bioenergy has been getting a lot of attention recently among farmers and the general public. Nationwide, there have been several pilot-scale plants demonstrating production of ethanol from various cellulosic biomass; however, there is no such plant in Virginia.

Switchgrass is a warm-season, perennial grass native to Virginia. Its high cellulosic content makes switchgrass a candidate for ethanol production. In 2007, Virginia Cooperative Extension conducted a farmer survey to gauge farmer interest in growing switchgrass for bioenergy purposes. Over 10,000 surveys were sent via the U.S. Postal Service to farmers throughout southern Virginia.

Two months later the 618 returned surveys were analyzed by Virginia Cooperative Extension.

This represented a 5.8% response rate. The survey results were entered into a geodatabase within ArcGIS 9.1, where the information was further analyzed to the county level. The descriptive statistics included in this report summarize item-by-item responses to the mail survey.

Based upon the results, 43% of surveyed farmers would be interested in cultivating switchgrass if it was shown to be profitable. Twenty-eight percent of farmers indicated they would not be interested in cultivating switchgrass even if it was a profitable venture. A quarter of the respondents were undecided as to whether or not they might grow switchgrass, and 4% provided no response to this question.

Thirty-two percent of respondents generated at least 60% of their 2006 household income through farming. On average

these farmers had 30 years of experience farming.

The successful establishment of a biorefinery facility will depend on adequate infrastructure - good roads, rail lines, adequate water supplies, etc. A reliable, continuous supply of feedstock for the facility is an absolute requirement as well. That requirement clearly will be met only if a sufficient number of farmers within a suitable radius from the putative facility would be willing to dedicate their land to production of feedstock. Toward this goal, the project team is hopeful that the geodatabase created from this survey work can serve as a starting point for mapping the social dimensions of feedstock cultivation and aid in adequately placing a biorefinery in Virginia.

(Report Authors: Wen, Ignosh, Parrish, Stowe and Jones)

EDEN Animal Agrosecurity and Emergency Management Course

This course will be available to the primary audience of Extension educators/agents, as they strive to improve preparedness for animal issues in disasters or potential disasters in their communities. But it is also available to anyone interested in animal biosecurity and emergency management.

The EDEN Animal Agrosecurity and Emergency Management Course will prepare you with the knowledge and skills necessary to

teach others in your community how to:

- * apply emergency management principles to animal emergencies
- * recognize threats, identify vulnerabilities, and establish an action plan for animal disasters
- * partner with interagency representatives in an interdisciplinary effort to address animal emergency issues.

Materials provided with this EDEN course are available for

use at workshops and/or community awareness presentations.

They include:

- * ready-to-use presentations
- * applied activity guidelines including scenario-based exercises
- * printable documents suitable for handouts

The EDEN Animal Agrosecurity and Emergency Management Course is available online on the EDEN website at <http://www.EDEN.lsu.edu/LearningOps/>

(R. Grisso)

NRAES publication—Raspberry and Blackberry Production

Raspberry and Blackberry Production Guide provides information on all aspects of raspberry and blackberry culture from site selection and preparation, trellising and pruning, to nutrient management, to harvesting and marketing. It is the only comprehensive resource for both novice and experienced growers as well as crop advisors and educators.

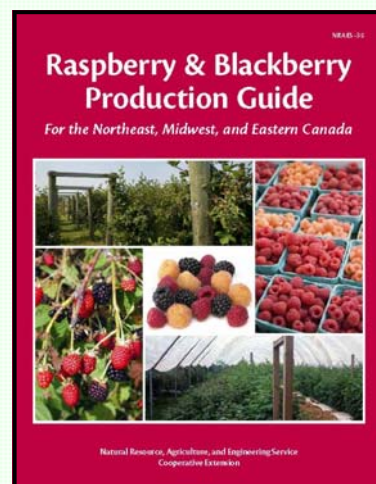
There are descriptions of more than 70 cultivars including summer-fruiting red, black, and purple raspberries; fall-fruiting red and yellow raspberries; thornless, thorny, and fall-fruiting blackberries, and hybrid berries. Field production, high tunnel production, and greenhouse production are reviewed.

- The book is 156 pages and has 14 chapters, 134 color photos, 36 line drawings, 30 tables, 18 side bars, a glossary, and suggestion for further reading.
- The book was edited by Lori Bushway and Marvin Pritts from Cornell University and David Handley from the University of Maine.

Expected Outcomes:

- Increased capacity for growers to reliably produce and market raspberries and blackberries.
- More farms diversifying their business with raspberry and blackberry production.
- Increased demand for supplies and services from support industries.
- More fruit available for a longer period each year result-

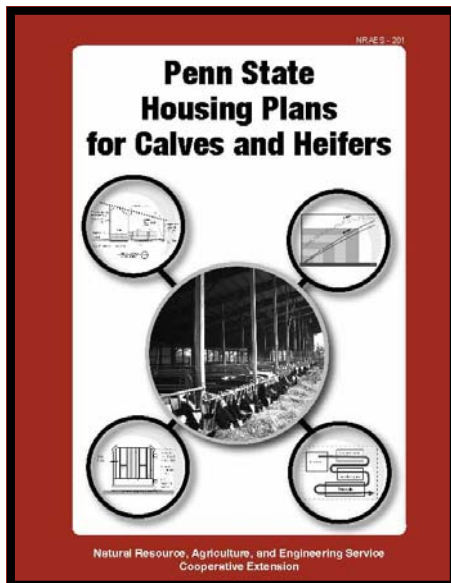
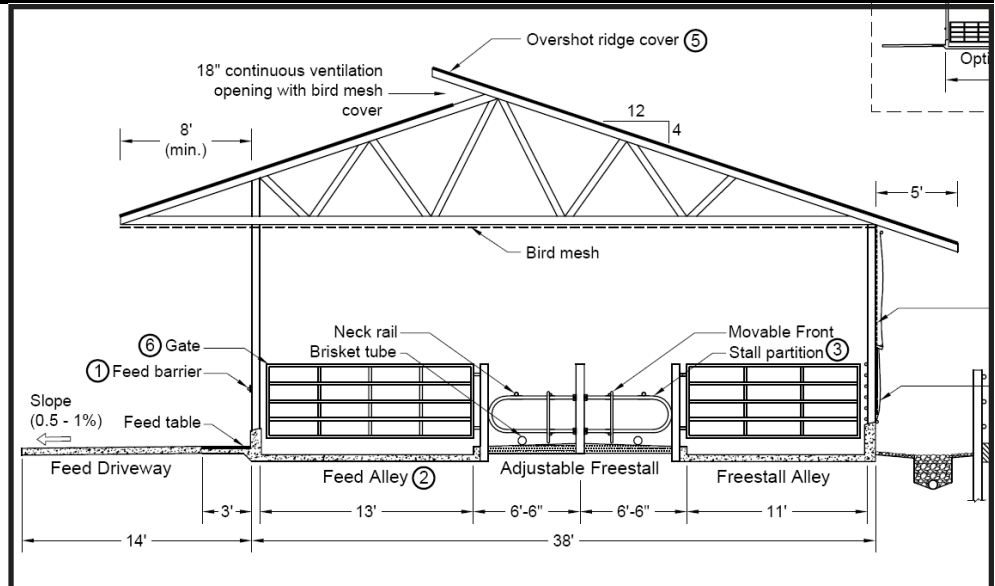
- ing in increased consumption.
- Resources (water, fertilizer, pesticides) used more optimally with less environmental impact and lower cost.
- Production efficiency will improve resulting in more stable businesses and more flexibility for growers to expand or diversify.
- Opportunity for farms to diversify and stabilize income.



<http://www.nraes.org>

NRAES-201—Penn State Housing Plans for Calves and Heifers

Penn State Housing Plans for Calves and Heifers is coil bound, 274 pages, and includes 74 idea plans (NRAES-201). The plans were developed based on research and field experience with the aim of increasing the comfort, productivity, and longevity of dairy cattle. While drawn for specific number of animals, most plans provide guidelines to fit the actual number of calves and heifers.



The plans provide for individual housing for the baby calf with liquid feed, solid feed, and water usually delivered to the pen twice a day. When calves successfully consume sufficient solid feed, plans provide for transferring them to group housing beginning with a small weaned calf group and graduating up through a variety of group housing situations

based on their size and the number of animals kept in a group. The plans provide for a clean dry living environment that accommodates health and management needs and convenience of moving the animal from one age or size group to the next.

The book includes 55 housing plans for calf pens and shelters, bedded pack heifer shelters, freestall heifer housing, drive through systems, and heifer self cleaning shelters. Four plans show how housing needs from birth to breeding-age can be met in one housing system. There are four plans for utility rooms and buildings. Ten additional plans show details for typical sidewalls (including curtains), ridge openings, freestalls, fenceline feed barriers, water stations, freestall crossovers and floor surface, gates and pen work, freestalls, and more. The book also includes growth charts and space requirements for Jerseys and Holsteins from birth to

pre fresh.

Housing plans show a variety of complete layouts and dimensions for calf, heifer, and worker friendly housing. One four-page plan for a heifer freestall shelter shows freestall alley, feed alley, and feed driveway dimensions and slopes. Two groups of 30 freestalls are included, one for heifers 500-700 pounds and one for 700-900 pound heifers. The location of walkways, cross alleys, gates, and waterers are shown. For more information, the plan refers to construction detail plans for feed barriers, crossovers, freestalls, sidewalls, ridge openings, and gates. Recommendations for building materials and management are included (see a plan above). Everything needed for a complete building is shown except the dimensions of load bearing members such as poles and trusses. These must be sized by an engineer based on local conditions.

Check with Jim Riddell about reduced cost for VCE.

<http://www.nraes.org>



Recognizing and Reporting Potential Terrorist Activities



Virginia Fusion Center & the Virginia Department of Agriculture & Consumer Services

The Virginia Fusion Center, created to improve the Commonwealth's preparedness against terrorist attacks, analyzes and shares homeland security information with federal, state and local partners in the public and private sectors. The Virginia Fusion Center and Virginia Department of Agriculture and Consumer Services encourage agriculture producers, veterinarians, food processors and food retailers to report information that may help prevent terrorism and identify potential terrorists and criminals.

7 Signs of Terrorism

Certain activities at or near agriculture and food facilities may indicate terrorist planning efforts. Suspicious activities that should be reported to law enforcement, commonly referred to as the 7 signs of terrorism include:

• **SURVEILLANCE**

May include drawing diagrams, note taking, or vision-enhancing devices to monitor or record facilities and activities.

• **ELICITATION**

Attempts to obtain information on the people, procedures, or security of a facility.

• **TESTS OF SECURITY**

Attempts to breach security measures or assess response times.

• **ACQUIRING SUPPLIES**

Gathering harmful chemicals, infected materials or other supplies for attacks.

• **SUSPICIOUS PERSONS**

Person(s) who do not appear to belong in a given setting due to unusual behavior.

• **DRY / TRIAL RUNS**

Preparatory behaviors, such as practice runs or route mapping.

• **DEPLOYING ASSETS**

Placing people and supplies into place to commit the attack.

Reporting Tips

CALL 911

if immediate police response is needed
and

Notify the Virginia Fusion Center

as soon as possible by phone or online:

804-674-2196

1-877-4VA-TIPS

vfc@vsp.virginia.gov

www.vsp.state.va.us/FusionCenter/index.shtm

Reporting Potential Foreign or Emerging Animal Disease State Veterinarian's Office
804-692-0601

USDA, APHIS, Vet. Services
804-343-2560

After-Hours, Weekends & Holidays

VA Emergency Operations Center
804-674-2400

Reporting Suspicious Activity

Prompt and detailed reporting of suspicious activities may prevent a terrorist attack.

When reporting suspicious activity, provide:

- Brief description of the activity
- Physical description of the person(s) and vehicle(s) involved
- Current location or direction of travel of those involved
- Your name and contact information (optional) - anonymous reporting accepted

Virginia Terrorism Hotline 1-877-4VA-TIPS (toll free - 24/7)

Disaster Protection and Recovery Plan

By resolving to put a disaster protection and recovery plan in place, business owners stand a much better chance of achieving their other areas of resolve, such as improving financial performance.

According to the Institute for Business & Home Safety (IBHS), one of every four businesses forced to close following a disaster never re-opens. And those disasters don't have to be caused by catastrophe-level events. Widespread power outages, water main breaks and fires also can effectively shut down a company for a long period, sometimes months, costing it millions of dollars in lost business, some or all of it never to return.

That's why IBHS encourages business owners to resolve to be better prepared in 2008 by putting together a disaster plan and offers a free copy of its Open for Business® toolkit to kick start the process. The toolkit provides the framework to help prioritize critical business functions and organize infor-

mation needed to continue operating -- even from a remote location.

Contingency planning is a core part of running any successful business. Failing to plan is placing an unnecessary bet on the survival of your business and your employees' livelihoods.

Fortunately, business owners and senior managers can greatly tilt the odds in their favor, even in the face of disaster. Open for Business includes some fairly simple, low-cost steps that can help - saving jobs and allowing the company to continue being there for customers and suppliers.

These are the top five business continuity planning steps offered by IBHS:

- Make two copies of important documents and store them in separate locations. These should include lease papers, photographs of property and lists of inventory.

- Update contact information for employees, the building manager or owner, key suppliers and customers, and local utilities.
- Consider an alternate location from which to do business if a disaster were to force you to relocate.
- Review plans with employees and make sure they know how to reach their immediate supervisor in an emergency.
- Assess current insurance needs with your agent and update their contact information, including emergency hotlines.

Download a copy of the Open for Business® toolkit from <http://www.DisasterSafety.org>



(R. Grisso)

Visit our website:
<http://www.bse.vt.edu>

