

Livestock Update

Beef - Horse - Poultry - Sheep - Swine

August 2014

This LIVESTOCK UPDATE contains timely subject matter on beef cattle, horses, poultry, sheep, swine, and related junior work. Use this material as you see fit for local newspapers, radio programs, newsletters, and for the formulation of recommendations.

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Scott P. Greiner, Extension Project Leader
Department of Animal & Poultry Sciences

Dates to Remember

HORSE

SEPTEMBER

- 11-14 State 4-H Horse Show. Virginia Horse Center. Lexington, VA.
Contact: Celeste Crisman, (540) 231-9162 or email: ccrisman@vt.edu or
Jessica Tussing, (540) 231-6345 or email: jessit07@vt.edu

SHEEP

AUGUST

- 30 Virginia Tech Sheep Center to Host 15th Annual Production Sale. Alphin-Stuart
Livestock Arena. **Contact:** Scott Greiner (540) 231-9159; email: sgreiner@vt.edu

SEPTEMBER

- 19 Small Ruminant Field Day (7:30 am – 3:00 pm). VSU Randolph Farm. Petersburg.
Contact: Dahlia O'Brien, (804) 524-6963; email: dobrien@vsu.edu
- 27 Southwest AREC Education Field Day and Ram Sale. Glade Spring. **Contact:** Lee
Wright, (276) 944-2200; email lrite@vt.edu or Scott Greiner (540) 231-9159; email:
sgreiner@vt.edu

August Herd Management Advisor

Scott P. Greiner & Mark A. McCann
Extension Beef Specialists, Virginia Tech

As the calendar moves into August, weaning time for spring calves and calving season for fall cows are on the horizon. Both groups will respond to high quality forage, so stockpiling to provide high quality pasture at a later date will pay dividends. The current price of calves compared to the cost of corn suggests that creep feeding could be a profitable decision. Typical feed to gain conversions of creep diets usually are around 8 lb feed/lb of gain, so cost of feed and value of added gain need to be compared before committing to this management strategy. Beyond the potential value of additional weight gain, training calves to eat feed pays dividends later if calves are retained and preconditioned at home prior to marketing. After calves begin eating 2-3 lbs/hd/d, intake can be moderated through the inclusion of 2-3% white salt in the creep diet. Remember high levels of creep consumption can increase body condition of the calves to a point where they may be discounted when marketed. Creep feeding is a management practice that needs to be reconsidered each year to determine its economic feasibility.

Spring Calving Herds (January-March)

General

- End breeding season early in month (if not already completed).
- Make plans for marketing of calf crop. Plan early to time weaning, vaccination program, and weaning management in concert with marketing plans. Calculate break-evens on various marketing options and consider risk management strategies.
- Begin planning for winter by evaluating feed and forage supplies and options.

Nutrition and Forages

- Continue to manage first-calf heifers separately; give them best forage
- Continue to feed high Se trace mineral salt. A forage analysis can reveal what other minerals should be supplemented.
- Continue to manage growth of warm season grass pastures by rotational grazing
- Store your high quality hay in the dry.
- Collect and submit forage samples for nutrient analysis
- Reserve high quality hay and a pasture area for calves post-weaning

Herd Health

- Continue parasite and fly control program for herd. Monitor fly numbers to insure tags are still effective.
- Finalize vaccination and preconditioning protocol for calf crop. Administer pre-weaning vaccinations.

Reproduction

- Make plans to pregnancy check heifers as soon as possible after bull removal. This will allow options in marketing open heifers.

- Remove bulls after 60 days for controlled calving season
- Schedule pregnancy check of cow herd with veterinarian

Genetics

- Collect 205-day weights on calf crop at appropriate time (AHIR age range 120-280 days), along with cow weights, hip heights and body condition scores (cow mature size data taken within 45 days of calf weaning measure).

Fall Calving Herds (September-November)

General

- Prepare for calving season by checking inventory and securing necessary supplies (ob equipment, tube feeder, colostrum supplement, ear tags, animal health products, calving book, etc.)
- Begin planning for winter by evaluating feed and forage supplies and options.

Nutrition and Forages

- Continue to feed high Se trace mineral salt.
- Body condition score bred females. Plan nutrition and grazing program based on BCS. This is the most efficient period to put weight and condition on thinner cows prior to calving
- Evaluate growth and development of replacement heifers. Adjust nutrition and management to achieve 65% of mature weight by breeding season. Low levels of protein supplementation can be effective in stimulating performance if forage has become mature.
- Reserve high quality hay and a pasture area for cows post-weaning.
- Manage growth of warm season grass pastures by rotational grazing
- Store your high quality hay in the dry.
- Collect and submit forage samples for nutrient analysis.

Herd Health

- Administer mid-summer deworming on replacement heifers and pregnant heifers
- Continue parasite and fly control program for herd.

Genetics

- Identify replacement heifers. Utilize available tools including genetics, dam performance, individual performance, and phenotype. Restrict replacement heifer pool to those born in defined calving season.
- Evaluate bull battery and begin planning for the breeding season by evaluating herd goals and objectives.

Weaning Nutrition and Management

Dr. Mark A. McCann
Extension Animal Scientist, Virginia Tech

One time-tested method of adding value to a calf-crop is to retain the calves post-weaning at a minimum through a 45-d preconditioning program. The 45-d length is required to participate in many special sales or programs and is viewed as the “gold standard” of having cattle ready for a forage based stockering program or directly into a feedyard. Beyond post-weaning management, many other ingredients are necessary for a successful program which maximizes your potential for added value. The one which takes the greatest planning and most forethought is the genetics of the calf crop. What is the sire’s EPD’s, etc. Repeat customers and premiums frequently are based on the genetic base of the cattle and documented performance. The other key ingredient to reputation cattle is an effective and well documented herd health program. Health and genetics are probably the two greatest determinants of achieving added value through selling preconditioned calves or retaining ownership through the stockering or feedlot phases. During our current period of high prices, pre-conditioned calves are still receiving a premium above bawling calves.

The key to management through this process is a sound approach to calf management and nutrition through the weaning process.

Calf management- The focus of management practices should be to enhance value and decrease stress throughout the weaning process. That means castration and dehorning are done young and health vaccinations administered on time and according to label recommendations. Exposure to creep feed for a few weeks before weaning can decrease the required time post-weaning that it takes for calves to start consuming dry feed. Even low levels (1lb/hd/d) of creep consumption can hasten adaptation to feed post-weaning and minimize weight loss.

Recent attention has also been given to the weaning process with the management strategies of fence-line weaning or two stage weaning (stop nursing, then separate cow and calf). Both strategies have been compared to abrupt calf weaning and removal in research trials including one conducted at the Shenandoah Valley AREC in 2005 and 2006. Calves were assigned to a fence-line group, a nose-clip group where the clip was an anti-suckling device where calves remained with dams or a control group where the cows and calves were abruptly and completely separated. Fence-line weaning provided superior gain results as compared to nose clips or control groups when measured at days 7-14 post-weaning. In a Michigan research trial, the benefits of fence-line or nose clips dissipated by d-42 post-weaning. Both alternative strategies offer some short-term benefit in reducing stress on the calf, but advantages in animal gain tend to be short-lived. These alternative, lower stress management options can become more important as the age at weaning is reduced.

Calf nutrition- During the first week post-weaning, the focus should be on intake, intake and intake. Nutrient density also plays an important role but dry matter intake is generally the most important challenge. Feeds offered should be high quality and palatable. Calves are accustomed to grazing; so long stem hay for the first 3-7 days is a recommendation. This should be high quality, leafy hay. Hand feeding allows you to limit offer the forage to the point where the calves leave a small amount (generally 1-2% of body weight).

- 1) Hand feeding allows a better feel for true feed intake of the calves
- 2) Limit feeding forage lightly pressures calves to consume more dry feed
- 3) Many feeders find that slightly limiting intake and keeping calves somewhat aggressive allows for easier detection and pulling of sick calves.
- 4) Limit feeding allows a better examination of feeding behavior and perhaps allows better general management of the group.

Calves can be successfully started on many different feedstuffs including corn gluten feed, soyhulls, corn silage, etc. The important thing is to allow time for the calves to develop an appetite for new feeds, and the rumen bacteria to adapt to the new feeds. The feed mix should also meet the nutritional requirements of the calves (Table 1).

- Corn gluten feed adds energy and protein without contributing starch. As with many by-products, quality and nutrient content vary with source. Phosphorous and sulfur content is an issue and 1% of body weight is much preferred to ad libitum intake.
- Soyhulls are a very palatable, safe feed to use. They will add fiber, but not roughage. Protein content is 12-14%. Better as a supplement to forage programs and limited to 1% of body weight.
- Whole corn can work as well (or better) as ground corn in a starting ration. If grinding, avoid making the feed too fine and dusty.
- Calves can be started on corn silage, but a 2 week adaptation is best.
- There are excellent commercial pellets available and several formulated for specifically for pre-conditioning. If these are used, our experience at the Virginia Tech Beef Farm would suggest that calves can be quickly transitioned to a by-product feed after a few days of commercial feed.

Table 1. Suggested Nutrient Concentrations for Stressed Calves (dry matter basis)

Nutrient	Unit	Suggested range
Dry matter	%	80-85
Crude Protein	%	12.5-14.5
Total Digestible Nutrients (TDN)	%	60-70
Net energy for maintenance	MCal/lb.	.59-.73
Net energy for gain	MCal/lb.	.36-.41
Calcium	%	.6-.8
Phosphorous	%	.4-.5
Potassium	%	1.2-1.4
Magnesium	%	.2-.3
Sodium	%	.2-.3
Copper	ppm	10-15
Iron	ppm	100-200
Manganese	ppm	40-70
Zinc	ppm	75-100
Cobalt	ppm	.1-.2
Selenium	ppm	.1-.2
Iodine	ppm	.3-.6
Vitamin A	IU/lb	1800-2700
Vitamin E	IU/day	180-230

NRC (1996)

Other notes/ cautions-

- If the calves are not part of a retained ownership program, be cautious of gains exceeding 2 lb/d due to supplementation. Calves can be considered too fleshy and potentially discounted by buyers.
- Purchased, commingled calves should follow the same nutritional program, but the lack of nutritional history and additional stress increase the challenges.
- Growth promoting implants will usually increase daily gain 10% during the preconditioning period and return a profit over your investment
- Newly weaned or received calves should have enough feed bunk space so all the calves can eat at one time (18-24"/hd).
- Non-protein nitrogen sources such as urea or chicken litter should not be introduced until the calves are settled in.

Breeding Season Management: Ewes and Rams

Scott P. Greiner, Ph.D.
Extension Animal Scientist, Sheep
Virginia Tech

Breeding season is a critical time of year, as management decisions and practices greatly influence productivity and profitability of the flock. In addition to key genetic decisions, such as ram selection and replacement ewe lamb selection, several management practices influence success during the breeding season. It is during the breeding season that the number of lambs which potentially can be born during the subsequent lambing season is established. Lambs born per ewe lambing has a very large influence on break-even costs and profitability of the flock. Both the ram and ewe contribute to the potential success or failure during the breeding season, and warrant optimum management and care preceding and during the breeding season.

RAM MANAGEMENT

Breeding Soundness Exam (BSE)- The BSE examines the ram for fertility and includes physical inspection, examination of the reproductive tract, and semen evaluation. The BSE should be conducted on all ram on an annual basis, and performed in advance of the breeding such that it allows time for procurement of replacements should the need be identified. A BSE can be performed by most veterinarian. While the BSE provides evidence the ram should be capable of settling ewes, in most cases it does not include assessment of libido. Therefore, rams need to be observed closely to make sure they are active breeders. A marking harness is an excellent management tool for this purpose.

Nutrition- Often, newly purchased ram lambs are coming off a high plane of nutrition heading into their first breeding season. To prepare ram lambs for the breeding season, rams should be “hardened up” prior to introduction with ewes. This can be accomplished through limit feeding grain while on pasture. The amount of supplementation will vary according to the ram’s body condition and pasture quality, but as a guideline 1-2% of body weight will suffice to achieve a moderate body condition at the start of the breeding season (BCS 3, not excessively fat or thin). Be certain that housing and facilities provides adequate shade and ventilation so that rams can stay cool. These principles also apply to mature rams, which may be new to the flock or been in use for several years. Excessively fat or thin rams are likely to have compromised fertility, so nutrition is critical (and needs to be addressed well in advance of the pending breeding season). When practical, supplementing ram lambs with grain during the breeding season will reduce excessive weight loss (feeding rate of 2% bodyweight daily). It may be advisable to supplement mature rams as well, when practical, particularly if they are expected to service a large number of ewes or the breeding season is long.

Ram:Ewe Ratio- Many factors influence the breeding capacity of rams, including age, breed, nutrition, management, and environment. As a general guideline, ram lambs are capable of breeding 15 to 25 ewes during their first breeding season, and most mature rams can service 50 or more ewes. Ram lambs should not be commingled with older,

mature rams either prior to or during the breeding season. Particular care should be taken if rams from different sources (of similar age) need to be commingled, and all commingling should take place prior to the breeding season. Rams used in multi-sire breeding groups should be of similar size and age due to dominance which generally is associated with mature vs. ram lambs.

EWE MANAGEMENT

Health- Vaccination of the ewe flock for *Campylobacter* (vibrio) and *Chlamydia* are important for abortion disease control. For ewe lambs and ewes not previously vaccinated, these products typically require an initial injection prior to the breeding season followed by a second vaccination during gestation. In subsequent years, a single booster vaccination is required. Follow product label directions when administering any vaccine. A month prior to the breeding season is also an opportune time to trim and inspect feet on the ewe flock, and perform preventative foot care. An effective parasite control program is a must.

Nutrition and Body Condition- Body Condition Scores (BCS) are a practical management tool to be used in conjunction with nutritional and other management strategies to optimize production of the flock. Condition scores are subjective in nature and utilize a five point scoring system (1=very thin, 5=obese) to visually classify sheep according to body fatness. Optimum BCS at breeding is 3. As with rams, adjustments to the nutritional program should take place well in advance of breeding to accomplish needed changes in BCS. Flushing is the practice of increasing energy intake, and therefore body condition, during the 10-14 days prior to breeding. This practice has been shown to be effective in increasing ovulation rates, and thereby increasing lambing percentage by 10-20%. The response to flushing is affected by several factors, including existing BCS of the ewe and time of the breeding season. Ewes that are in poor body condition (3- and lower) will respond most favorably to the increase in energy, whereas fleshier ewes (BCS 4-5) will show little if any response. Flushing can be accomplished by moving ewes to high quality pastures, or through providing .75 to 1.25 lb. corn or barley per head per day from 2 weeks pre-breeding through 4 weeks into the breeding season. A key is that thin ewes are increasing in their BCS during the breeding season and fat ewes are at least maintaining their energy status (not declining). Provide a high-selenium, sheep mineral free choice.

Ewe Lambs- Ewe lambs should be managed to achieve 70% of their mature weight by their first breeding season. As result, they require special attention prior to and during the breeding season which is most effectively accomplished by separate breeding groups from mature ewes. Keeping ewe lambs in a positive energy balance is important. Research has clearly established that ewe lambs which give birth as yearlings are more productive and profitable during their lifetime.

Environment- Like rams, ewes are also prone to heat stress during the breeding seasons. Prolonged exposure to high temperatures can have an effect on ewe fertility and embryo survival. To help reduce these embryo losses and resulting decrease in lamb crop, minimize handling during the heat of the day and allow the flock access to a cool, shaded area.

GENERAL

Seasonality- Both ewes and rams are seasonal in their reproduction. For most breeds utilized in Virginia, fertility is maximized during October and November.

Length of Breeding Season- A concise breeding season (35 days) results in a concise lambing season, which better optimizes labor and management and results in a more uniform lamb crop. Culling open mature ewes and ewe lambs places selection pressure on reproduction in your environment.

Registration Details

A registration fee of \$10.00 per person is required in advance. Registration includes continental breakfast, box lunch, sheep and goat meat and dairy sampling and workshop materials. Space is limited to the first 200 producers. Please complete the registration form contained inside this brochure or on-line at <http://tinyurl.com/2014srfieldday>

Driving Directions

*To Reach VSU's Randolph Farm:
(Take any high way to I-95)*

1. Interstate 95 to Exit 54 (Temple Ave.) in Colonial Heights
2. At end of exit ramp, turn left.
3. Turn left at 2nd traffic signal onto Route 301 (Boulevard).
4. Drive to the 4th traffic signal staying in the right hand lane until reaching traffic signal with WaWa Gas on right. Turn right onto Dupuy Road.
5. Drive for 1 and ¼ mile past VSU to traffic signal.
6. Curve to the right at the yield sign, passing over the railroad bridge, and continue straight for another ¼ mile on River Rd.
7. Slow down, at the first gated entrance to Randolph Farm, turn left, or proceed to the next left at the Pavilion (Randolph Farm Auditorium), which has a large parking area.



Virginia Cooperative Extension programs and employment open to all regardless of race color national origin sex religion age disability status or marital status. Special programs available for women. Services rendered by staff are equal opportunity/affirmative action employees located in buildings or Cooperative Extension units, Virginia Polytechnic Institute and State University, Virginia State University and the U.S. Department of Agriculture cooperating. National 8000 Extension Program, Virginia State University, Virginia Tech, Blacksburg, VA 24061. Operation Administration, 9800 Extension Program, Virginia State, Petersburg.

General Information:

Dr. Dahlia O'Brien, Associate Professor
Small Ruminant Extension Specialist
Virginia Cooperative Extension
Phone: (804) 524-6963
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P. O. Box 9081
Petersburg, VA 23806
<http://www.vsu.edu>

If you are a person with a disability and desire any assistive devices, services or other accommodations to participate in this activity, please notify this office at (804) 524-5960 during the business hours of 8 am and 5 pm at least 5 days prior to the event.

REGISTER TODAY!

Mollie Klein
mklein@vsu.edu
Phone: 804-524-5960

2014

SMALL RUMINANT FIELD DAY

VALUE-ADDED PRODUCTS



Date: September 19, 2014
Time: 7:30 am – 3:00 pm
Place: VSU Randolph Farm



Virginia State University • Virginia Tech

2014 SMALL RUMINANT FIELD DAY

VALUE-ADDED PRODUCTS

The theme of VSU's 2014 Small Ruminant Field day is "Value-added Production". The goal is to assist sheep and goat producers in realizing what other opportunities are available to make their farm more profitable and in the long run contribute to sustainability of the industry.

AGENDA

7:30 – 8:30 am	Registration and continental breakfast
8:30 – 8:45 am	Welcome
8:45 – 12:00 pm	Seminars
12:00 – 1:00 pm	Lunch
12:00 - 3:00 pm	Afternoon session
3:00 pm	Adjourn

Event is also sponsored locally by:

Heretick Feed and Seed Company, 201 Bollingbrook St, Petersburg, VA 23803

Southern States, 1609 W. Washington St, Petersburg, VA 23803



Program Details Value-Added Topics

Dr. Paul Kuber, Associate Professor/Extension Specialist, will speak about: Small Ruminant Meat Production and Processing

Patricia Knight, Owner of Nana's Dream Farm and Apiary, Suffolk, VA will share tips on: Small Ruminant Dairy Production and Processing

Theresa Nartea, Extension Specialist-Marketing & Agribusiness, Virginia Cooperative Extension will explain practical techniques for: Strategic Marketing for Small Ruminant Products

Afternoon Activities

Small ruminant meat and dairy sample tastings

Demonstrations of various management practices

The chance to learn about ongoing research projects by VSU's Small Ruminant faculty!

Paid Registration of \$10.00 per person includes Continental Breakfast & Boxed Lunch in addition to free sample tastings in the afternoon.

Space is limited to first 200 producers.

**If you have any registration questions please contact Mollie Klein at:
Email: mklein@vsu.edu
Phone: 804-524-5960**

Registration fee is \$10.00 per person in advance.

Register on-line at <http://tinyurl.com/2014srfieldday> or mail in with registration fee enclosed

Registration Form

PRE-REGISTRATION DEADLINE: SEPT 12, 2014

Name _____

Address _____

City _____

State _____

Zip Code _____

Phone _____

Email _____

____ Enter TOTAL Number of Attendees
X \$10.00 = \$ ____ Total Amount Enclosed

Please Make Checks Payable to:
Virginia State University (SMALL RUMINANT FIELD DAY 2014)

Mail Form & Check by Sept 12, 2014 to:

Virginia State University
Cooperative Extension
ATTN: Mollie Klein
P.O. Box 9081
Petersburg, VA 23806

Heat Stress and Small-Scale and Niche Market Pork Production in Virginia

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¹Department of Animal and Poultry Sciences and ²Tidewater Agricultural Research and Extension Center, Virginia Tech

INTRODUCTION

The effects of elevated environmental temperatures on pigs may be severe for any operation, but can be particularly detrimental in small-scale or niche market settings. Raising pigs outdoors or in buildings that offer little in the way of environmental control exposes these animals to high temperatures and heat stress. *Heat stress* is the combined effect of all environmental conditions that raise an animal's core body temperature above their upper critical temperature limit, such that behavioral and/or physiological changes are necessary to return the animal to a normal body temperature. *Heat strain*, then, is the animal's behavioral and physiological responses to heat stress. In swine, heat stress can cause reproductive failure in the breeding herd and decreased growth performance in grow-finish hogs, and ultimately decrease profitability through increased production losses and additional expenses. In 2003, production losses and additional expenses due to heat stress cost swine farmers in Virginia over \$1.8 million (St. Pierre et al., 2003). Producers must strive to maintain swine in a comfortable environment that is as close as possible to temperatures within the animal's *thermal comfort zone*. The purpose of this paper is to present current knowledge of swine physiology, management, and technology as it relates specifically to heat stress in small operations, with the goal that small-scale and niche market pork producers may more effectively implement heat abatement strategies that allow high levels of productivity and profitability during the hot summer months.

HEAT STRESS IN SWINE

The symptoms of heat stress in pigs are similar to those in other domesticated species: panting, excessive vocalization, red and blotchy skin (especially on the ears), lethargy, decreased appetite, muscle tremors, increased heart rate, and in extreme cases, death. However, heat stress in pigs can quickly become severe because unlike other animals, pigs lack effective sweat glands and are unable to dissipate heat through sweating. As such, it is not uncommon for pigs, especially market-sized hogs or breeding sows and boars, to begin suffering the effects of heat stress at temperatures that may actually feel comfortable to humans.

Table 1 shows the optimal temperatures for maximizing performance, as well as the thermal comfort zone for swine of various weights and ages. This table serves only as a guide, however, as many factors can and will influence the temperature at which heat stress occurs.

Table 1. Optimum temperature and thermal comfort zone for swine of various ages, sizes and stages of production. (Adapted from Whitney, 2014)

Animal (age, weight, or stage of production)	Optimum Temperature (°F)	Thermal Comfort Zone (°F)
<i>Breeding herd</i>		
Boar	60	50 – 70
Gestating sow	60	50 – 70
Lactating sow	60	50 – 70
<i>Offspring</i>		
Pig, newborn	95	90 – 100
Pig, three weeks old	80	75 – 85
Nursery pig, 12 to 30 lbs. body weight	80	75 – 85
Nursery pig, 30 to 50 lbs. body weight	75	70 – 80
Nursery pigs, 50 to 75 lbs. body weight	65	60 – 70
Grow-finish hog	60	50 – 70

Heat stress in grow-finish hogs

In the grow-finish herd, the most notable impact of heat stress is a diminished appetite, leading to reductions in average daily gain and overall growth performance. For example, Collin et al. (2001) found that increasing temperatures from 73.4 to 91.4° F decreased daily feed intake and growth rates by approximately 30% in pigs in the late-nursery/early-grower phase of production. In that study, pigs were allowed free-choice access to feed and the researchers reported that the reduction in feed intake was due to less time spent at the feeder and not decreases in the total number of meals consumed per day or the rate of feed consumption per meal.

Heat stress in the breeding herd

In late summer, heat stress conditions may compromise reproductive performance in both boars and sows and gilts, a phenomenon referred to as *seasonal infertility*. Changes in photoperiod (daily amount of light) occur concomitantly with elevated temperatures during the summer however its contribution to seasonal infertility has not been resolved.

Boars. Boars subjected to heat stress conditions produce semen that has low sperm concentrations, high percentages of abnormal sperm cells, and decreased percentages of progressively motile sperm cells. Research has indicated that the minimum exposure time and critical air temperature above which production of sperm cells is adversely affected is 72 hours (McNitt and First, 1970) and approximately 85° F (Stone, 1982), respectively.

The negative effects of acute heat stress on semen quality may be somewhat immediate. A “lag” period of approximately 2 weeks, however, is often observed between the initiation of acute heat stress and the first indications of abnormal sperm production. After the cessation of heat stress conditions, a period of 6 to 7 weeks is necessary before fertility returns to normal. That is because heat stress impairs *spermatogenesis*, the process by which new sperm cells are created in the testicles that lasts approximately 6 weeks. Thus, acutely heat stressed boars can have a protracted, negative influence on reproduction in a breeding operation. For example, boars exposed to 95° F temperatures for three consecutive days in late-July may be responsible for suppressed conception rates well into

September, **even in the unlikely situation in which temperatures do not rise above 85° F after the July “heat wave”**.

Researchers at North Carolina State University reported data obtained from seven commercial boar studs in southeastern North Carolina from June through October in a year when average weekly high temperatures at these facilities never exceeded 84° F (Flowers, 1997). Nevertheless, during this period there was a significant increase in the number of ejaculates rejected due to poor quality and a decrease in the number of artificial insemination (AI) doses per ejaculate. The reduction in the number of AI doses per ejaculate began 5 to 6 weeks after the weekly high temperatures had stabilized at approximately 81° F. Thus, boars may also be sensitive to chronic periods of moderately elevated temperatures not recognized as classic “heat stress” conditions.

The effects of elevated environmental temperatures on various characteristics of libido have not been extensively studied. However, during the summer, boars may become lethargic and display a reluctance or refusal to mount a sow in heat.

Producers that utilize boars for natural mating should anticipate a reduction in fertility during the summer. Breeding extra sows and gilts to compensate for the lower conception rates expected during the summer is a common practice, but boars must not be overworked. When boars are used for natural mating during or after periods of heat stress conditions, it is advisable to decrease the number of sows that they service by approximately 30%. It may be necessary to purchase guaranteed quality semen from outside sources for use in artificial insemination, or if possible, use estrus synchronization products to avoid breeding during times of impaired fertility. Perform heat detection and breeding early in the morning or late in the evening when it is cooler.

Sows and gilts. Females bred during heat stress conditions exhibit decreased conception and farrowing rates, and farrow smaller litters. Heat stress conditions during the first few weeks of pregnancy causes high embryonic mortality, and heat stress during the final weeks before farrowing increases the number of stillborns. Heat stress during lactation decreases milk production, largely due to reduced feed intake, and can delay the normal post-weaning return to estrus.

Developing gilts. Christenson (1981) reported that the percentage of gilts displaying estrous cycles by 9 months of age tended to be greater during winter months (October to April) than during summer months (April to October) (81.3 versus 75.2%). Indeed, the environmental and climatic conditions during the season of the year when gilts are approaching sexual maturity have a greater influence on age at puberty than the season of birth. Under Australian conditions, onset of puberty in gilts was delayed in summer (average daytime high temperature of approximately 85° F) compared with winter (Paterson et al., 1991). Flowers et al. (1989) conducted an experiment during which only 20% of gilts housed in heat stress conditions (continuous temperature of approximately 92° F and 35% relative humidity) reached puberty by 230 days of age compared with 90% of gilts housed in control conditions (continuous conditions of approximately 60° F and 35% relative humidity).

Generational Effects of Heat Stress

Recent research conducted in collaboration among Iowa State University, the University of Missouri, and Virginia Tech has shown that piglets exposed to heat stress *in utero* (i.e., fetuses that developed while the pregnant dam was chronically heat stressed) gain more fat tissue at the expense of lean muscle tissue during the early finishing phase of production (Johnson et al., 2014). This means that heat stress can affect the carcass quality of offspring before they are even born, and may impact profit margins for producers who market pork on a carcass-grade basis.

MEASURING HEAT STRESS AND HEAT STRAIN

Heat Stress

When assessing the potential severity of heat stress on the farm, it is important to record the environmental conditions in the pen or pasture where the pigs are actually housed; information from local weather service stations is useful for obtaining the day's forecast, but will not provide a precise indication of the pig's immediate environment. Ambient temperature and relative humidity (the ratio of the partial pressure of water vapor in an air-water mixture to the saturated vapor pressure of water at a prescribed temperature) can be used to calculate the degree of heat stress. The instrumentation necessary to record temperature (**thermometer**) and relative humidity (**hygrometer**) is relatively inexpensive and can be purchased at hardware or farm supply stores.

Once recorded, the temperature and humidity data can then be plotted on a swine-specific temperature and humidity stress index (**THI**), such as the one shown in Figure 1, to determine the severity of heat stress. To use the THI table, locate the ambient temperature and relative humidity values on the appropriate axes then draw lines perpendicular to the axes. The position where the two values intersect informs the producer of the current degree of heat stress.

Another tool that is gaining popularity in agriculture is smartphone apps. These applications incorporate weather data and make recommendations for action based on the calculated degree of heat stress. Many of these applications are free to download.

Heat Strain

The most accurate measure of heat strain, that is, the animal's behavioral and physiological responses to heat stress, is rectal temperature. Normal rectal temperature in healthy swine is approximately 101.0° F – 102.5° F. Rectal temperatures in a healthy animal greater than 103° F constitutes an emergency level of heat strain.

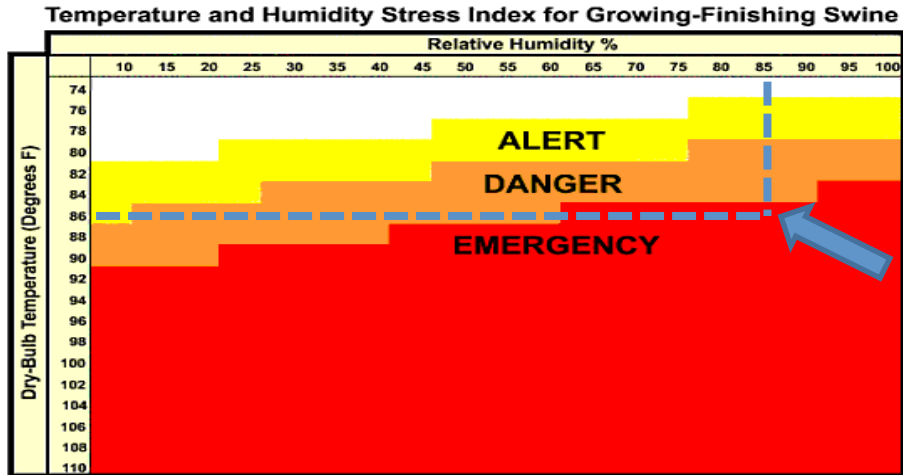


Figure 1: Temperature/humidity stress index for growing-finishing swine (from: Iowa State University Agricultural and Biosystems Engineering, 2002). In this example, temperature is 86° F and relative humidity is 85%. A horizontal line drawn from the vertical axis (temperature) and a vertical line drawn from the horizontal axis (relative humidity) intersect (indicated by the arrow) in a portion of the chart that indicates Emergency conditions.

Determining rectal temperature usually requires that the pig be restrained, which may be difficult in many smaller operations, and moving the pig into a holding pen could further stress the animal and exacerbate the effects of heat stress. Thus, a stress-free visual appraisal system was developed in concert with the THI table to determine the severity of heat strain (Figure 2). This system is based on observations of the pig’s behavior and respiration rate. Respiration rate is defined as the number of breaths taken in one minute (**bpm**). Once the severity of heat-strain has been determined, the appropriate actions for amelioration should be taken immediately.

Behavior	Respiration Rate	Thermo-Neutral
<ul style="list-style-type: none"> No change in behavior 	~25 - 40 bpm	Thermo-Neutral
<ul style="list-style-type: none"> Lethargy Slight drop in feed intake 	~50 - 65 bpm	Alert
<ul style="list-style-type: none"> Little desire to stand or move Severe drop in feed intake Heavy panting Flushed skin appearance 	~70 - 100 bpm	Danger
<ul style="list-style-type: none"> Extreme panting Muscle tremors Off feed Vomiting Blotchy skin Foaming at mouth 	100 bpm +	Emergency

Figure 2: Visual heat strain appraisal system for mature swine.

MANAGING HEAT STRESS

The most effective means of alleviating the symptoms of heat stress is to provide the pigs with unlimited access to clean water. While this may seem obvious to many, it is important to remember that limiting access to water can be just as detrimental as providing no water at all. Nipple waterers and water troughs should be cleaned of any contaminants and checked to ensure proper flow rate and temperature. Minimum nipple waterer flow rates are provided in Table 2.

High pen stocking density will lower the temperature at which heat stress occurs; if possible, reduce pen stocking density to allow the hogs room to dissipate heat more freely. Pens should also be cleaned of manure daily. Dirty conditions will intensify the effects of heat stress and, in extreme cases, can cause an approximately 10% reduction in feed intake and growth (Renaudeau, 2009).

Table 2. Water requirements for the swine herd (Adapted from Whitney, 2014).

Type of swine	Water/head/day, gallons	Swine/Nipple	Minimum Nipple Flow Rate, gallons/min
Gestating sow	6	12 to 15	1.0
Sow with litter	8	---	1.0
Nursery pig, 10 to 45 lbs. body weight	1	10	0.3
Grower pig, 45 to 120 lbs. body weight	3	12 to 15	0.67
Finisher hog, 120 to 250 lbs. body weight	5	12 to 15	1.0

Ideally, pigs housed outdoors should have access to a wallow that allows animals to bathe and promotes evaporative cooling. Unfortunately, given the value of land in Virginia, it is difficult and impractical for small-scale producers to devote a large tract of land for use as a pig wallow. A small wallow can be created by soaking one-quarter to one-half of a small outdoor pen, but in this region, using a combination of shade and water sprinklers is often more practical and can provide similar benefits. Research conducted in Oklahoma and Florida revealed that boars maintained on outside lots with a shade and sprinklers had 20% greater fertility than boars provided shade only. Shade can be naturally provided (trees) or artificially provided (lean-to or awning). Sprinkler systems should not fog the pen as fog droplets drift with air movement. Fogging systems also raise the humidity in the immediate surroundings and cause more harm than good in the long run. Instead, set the sprinkler to sprinkle large water droplets for one minute every half-hour. Adjust the sprinkler settings as needed for maximum benefits.

For maximum cooling, any type of sprinkler system should be combined with air movement. In outdoor systems, house pigs in an area with wind exposure, or provide supplemental fans. Indoors, good ventilation is imperative to cool the pigs, but also to

remove dust and ammonia, which can further complicate the symptoms of heat stress. Guidelines for optimum ventilation speeds during cold, mild, and hot weather conditions are provided in Table 3.

Table 3. Ventilation requirements for the swine herd. (Adapted from Whitney, 2014).

Type of swine	Rate, cubic feet per minute (cfm)/head		
	Cold Weather	Mild Weather	Hot Weather
Boar	14	50	300
Gestating sow	12	40	150
Sow with litter	20	80	500
Nursery pig, 12 to 30 lbs. body weight	2	10	25
Nursery pig 30 to 75 lbs. body weight	3	15	35
Grower pig, 75 to 150 lbs. body weight	7	24	75
Finisher pig, 150 to 220 lbs. body weight	10	35	120








Three systems have been shown to provide cooling benefits for sows with litters in farrowing crates: snout coolers, drip lines, and conductive cooling pads. Snout coolers are simply a hose system positioned at the base of the crate that blows cool air on the snout while the sow lies down. Drip lines hang above the sow and drop water onto the back of the neck and shoulders to promote evaporative cooling; in this system the water should be provided in a slow drip so as not to dampen the area and increase humidity, and the drops should ideally be evaporated before reaching the ground. Dripping water in the ears of swine should be avoided as this can cause inner ear and balance problems. Finally, conductive cooling pads are large squares of coiled copper piping strong enough for the sow to partially lie on. When cold water is pumped through the pad, the outer surface stays cold and cools the sow. Conductive cooling pads have proven to be the most effective in promoting sow thermal comfort (Bull et al., 1997), but drip lines are likely to be the easiest and most inexpensive for a producer to construct.

During mild heat stress, pig movement should be limited, and pigs should only be worked during the cool periods of the day. During severe heat stress, pigs should not be worked. Similarly, trucking pigs during times of heat stress can be dangerous. When temperatures are in the “Alert” zone on the THI table, producers should load 10% fewer hogs than they would under normal conditions. For example, if a trailer normally holds 30 hogs, producers should only load 27 head. Moreover, the delivery should be made before 11:00 a.m. When conditions on the highway reach the “Danger” zone, producers should load 20% fewer hogs and deliver at night. If conditions are in the “Emergency” zone, pigs should not be transported (Grandin, 2002). Many packers in the area will not accept pigs in the afternoons on very hot days in an effort to prevent poor carcass quality and death loss during severe conditions.

Pigs in heat stress conditions often show a tendency to consume most of their feed at night, when temperatures are coolest. If limit-feeding or meal-feeding the herd, producers

should make every effort to feed before 8:00 a.m. or after 8:00 p.m. Likewise, if providing *ad libitum* or free choice access to feed, make sure the feeders are full overnight, so that the pigs may capitalize on cooler nighttime temperatures to compensate for the lost intake during the daytime.

Feeding strategies that can help increase intake and maintain performance during heat stress conditions are:

-  Using only fresh feed
-  Feeding when temperatures are coolest
-  If meal feeding, such as when feeding a sow in the farrowing barn, providing smaller meals at more frequent intervals
-  Adding water to the feed to create a liquid diet that must be consumed fully in a shorter time frame. Alternatively wet/dry feeders can be employed.
-  Using higher levels of fat in the diet (approximately 5% of diet)
-  Decreasing dietary crude protein, but increasing the amount of crystalline lysine
-  Limiting the amount of dietary fiber

CONCLUSION

Heat stress and seasonal infertility decreases profitability for the small-scale and niche market pork producer through decreased performance and additional expenses. However, effectively recognizing heat stress in the herd and implementing heat stress abatement strategies will recover some of the lost performance and keep the farm productive and profitable.

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