RESEARCH WATCH OCTOBER 2010

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BEEF CATTLE

"Benchmarking study of current transport practices in the Alberta beef industry"

Alberta Beef, July 2010

EVALUATING INDUSTRY CATTLE TRANSPORT PRACTICES

PROJECT NO.: 0022-002RESEARCH INSTITUTION: Agriculture and Agri-Food Canada (Lethbridge Research Center)LEAD RESEARCHER: Drs. Karen Schwartzkopf-Genswein and Luciano González

Background: Most commercial cattle are hauled at least three times in their lives (home ranch to auction mart, auction mart to feedlot, feedlot to packing plant); many are shipped more often than this (e.g. cows shipped to summer pasture, grass and backgrounding cattle). Livestock transportation is regulated by the Canadian Food Inspection Agency under the federal Health of Animals Act. Although the CFIA is interested in revamping the 30 year old transport regulations, there is very little research indicating that changing current industry practices is necessary, nor what the new standards should be. Relevant industry benchmark practices are needed to measure against before the effects of transportation on cattle welfare can be meaningfully studied, or before new regulations are introduced.

These researchers surveyed loads of cattle hauled by producers and commercial truckers into, out of, or travelling within Alberta. They collected information on driver experience, trailer type, loading density, distance travelled, time in transit, frequency of feed, water and rest breaks, temperature conditions in transit, transportation delays (frequency, length and reason), animal description (type, weight, sex, age, condition), etc. to identify (a) current industry practices, and (b) potential risks that are of particular concern. This project was completed in 2009.

Objectives: The objective of this study was to establish current beef cattle trucking practices in Alberta.

What they did: These researchers designed surveys to collect relevant information during both long (≥ 400 km) and short (< 400 km) haul transport. Surveys were mailed to several truck companies, farms and feedlots located throughout Alberta. Drivers completed one survey following each journey. Over 9,000 loads and close to half a million cattle were surveyed.

What they learned: Driver experience: Equal proportions of long-haul drivers had less than 2 years (31%), 3-10 years (32%) or more than 10 years of experience hauling cattle (35%). More short-haul drivers had longer experience (68% had hauled livestock for more than 10 years).

Cattle class: Across both surveys, the majority of animals were fat cattle (63%); 27% were feeders over 600lbs, 7% were weaned calves, and 3% were market cows.

Distance and time on truck for long-haul trips averaged 16 hours in length. Although one long-haul trip took 45 hours, over 95% of long-haul cattle spent less than 30 hours in transit.

"Over 99.9% of cattle reach their destination injury-

Transport delays due to mandatory paperwork and inspections at the Canada-USA border affected 77% of all long haul journeys. This delay averaged 1.3 hours, and lasted as long as 15 hours. On average, border delays were longer for feeders (nearly 4 hours) than fat cattle (1 hour). Delays due to drivers' rest stops and waiting to unload cattle after arrival to the destination were also important. Interestingly, the unloading delays for Canadian cattle at U.S. packing plants tripled from 38 minutes (before Mandatory Country of Origin Labeling) to an hour and three quarters (after Mandatory Country of Origin Labeling was implemented) in the fall of 2008.

Temperature ranged from -42 to 45°C with an average maximum of 18°C. In spite of some long distances travelled (e.g. Bakersfield, California), fewer than 5% of journeys experienced a temperature fluctuation greater than 26°C.

Loading density was lowest in the nose and doghouse, but densities in the deck and belly generally exceeded Canadian recommendations. Calves and feeders were loaded at the highest density compared to recommendations; fat and cull cattle were loaded near or below recommended loading densities.

Shrink was higher in long-haul feeders (7% of body weight) than in fat cattle and market cows (both at 5%) or calves (2%) after accounting for transport time and temperature. Shrink increased sharply at temperatures over 30°C and increased with time on truck (but leveled off after 30 h).

Factors affecting animal health and welfare: 99.95% of long-haul and 99.98% of short-haul cattle reached their destination injury-free. The risk of injury (lame, downer, or dead) was higher for long-haul than short-haul journeys, and was highest in market cows, intermediate in calves, and lowest in feeder and fat cattle. Injuries were generally more prevalent for less experienced drivers, and increased at high temperatures (in fat cattle), long transit times, high levels of shrink, and loading density.

What it means: Over 90% of Canadians are two or three generations removed from the farm. These people only see cattle on liners. This "first impression" keeps cattle transportation in the public eye, and makes it a common target for animal activist groups. This study should help to inform discussions about how Canada's beef industry raises, manages, handles and transports cattle. It will also help to identify real problems so that industry can develop cost-effective ways to correct any issues that are identified

Dehorning, castration and pain mitigation

By Bovine Veterinarian news staff | Tuesday, August 24, 2010

How "routine husbandry procedures" such as dehorning and castration are being performed on farms are increasingly being scrutinized by the public. The results of a survey of AABP and AVC members conducted by the research group of Hans Coetzee, BVSc, Cert CHP, PhD, Dipl. ACVCP suggest that:

Surgical castration with a scalpel followed by emasculator (>90 kg) or twisting (< 90 kg) is the most common castration method used by practitioners in the United States.
Risk of injury, calf size, handling facilities and experience were the most important considerations in selecting a castration method.
Non-surgical castration is perceived to cause more adverse events than surgical castration.
1 in 5 veterinarians currently report using anesthesia or analgesia at the time of castration.
90% of veterinarians vaccinate and dehorn at the time of castration.
The Barnes dehorning tool appears to be the most common method of dehorning used in the USA. .
The results of studies that use plasma cortisol or weight gain to determine the optimal timing and method of castration in and use of analgesia are often equivocal or conflicting.

The provisional findings of a study using electroencephalography to examine the effect of age at the time of castration on brainwave activity show a more prominent shift toward high-frequency, low-amplitude brain activity in older calves compared with 6-week-old calves
Meloxicam tablets administered orally at 1 mg/kg may provide a convenient and cost-effective means of providing analgesia in cattle
In recent studies we found that meloxicam administered prior to dehorning at 0.5 mg/kg IV significantly increased average daily weight gain in calves after dehorning
A second study found that calves receiving oral meloxicam 24 hours prior to surgical castration tended to have a lower incidence of bovine respiratory disease
Follow-up studies with meloxicam are planned and participation from qualifying feeder operations that castrate large numbers of bulls on arrival is currently being sought. For more information please contact Dr. Hans Coetzee at jcoetzee@vet.ksu.edu

The use of local anaesthetics in routine castrations of older beef animals

FARMSENSE BC SPCA Farm Animal Welfare News
August 2010
by Doug Fenton, Owner/Operator of Celista Springs Ranch, Celista, B.C.

We run a small operation that supports beef, pigs, sheep, and seasonal poultry on a quarter-section in the southern interior. My goal today is to share some of our insights gained on the journey to regular use of local anaesthetic for the purpose of castration of the older beef animals, and now other species, within our animal health programs.

To give you some history, our beef program is grass-based and does not include the use of hormones, appetite stimulants, or grains. To effectively and naturally grow/yield the most beef possible we considered leaving our bull calves intact until 6-7 months to allow the natural hormones to add a little extra weight at harvest time. Not to mention bull calves with potential to become herd sires require that you leave them intact well beyond the criteria laid out in the SPCA Certified standards. While these standards are under review this year, they currently state that pain control must be given if animals are castrated past 7 days of age. To comply, one of our options involved a vet plus all associated travel, service, and drug costs making it cost prohibitive.

When we initially became SPCA Certified we had just finished researching the best method of castration for our older beef animals, including literature, our vet's advice and insights, and a close review of the tools available to us. The goal was to find the easiest tool/procedure for us to use, the least pain/ discomfort for the animal, and, when used properly, the fewest potential complications. This led to the purchase of a Calibrate Bander; we subsequently submitted this to the program's Review Panel for consideration.

In 2007, the SPCA Certified program came out with a factsheet on castration and for those who sought certification within the beef program, the factsheet provided official

direction on this matter. As a small producer I was at odds with the existing standard so I considered this an improvement, but it still forced us into more steps, procedures, and costs associated with each animal.

After reading the literature provided by the BC SPCA and further consultation with our vet, we consciously weighed the merits of staying in the SPCA Certified program and amending our ways to meet these guidelines. In the end, we decided on the latter and developed a protocol for castration of older beef cattle that incorporated our current tool of choice (banding), with the addition of a local anaesthetic. The outcome was good, and in retrospect, we feel that exercise has led to an improved process overall.

Key Elements

- Band per normal procedure;

- Lidocaine is administered into each testicle using a 22 gauge needle prior to banding;

- While you inject Lidocaine you have time to re-inspect your work: 2 testicles, band placement and tightness, and a well-sealed clamp.

Our experience pre-Lidocaine use

- Several animals would jump with initial banding but settle within seconds;

- Usually 1 animal annually would lie down post-banding (within 10-15 minutes) for a period of 15-20 minutes;

- A few would wander for a while, stop and turn and kick their hind legs in an attempt to remove the irritant;

"One of those key players is our vet and we applaud him and his team for being there to assist us in finding a balance betweeen a practical and safe approach and the economics associated with these new animal management guidelines."

- A vast majority of animals showed little concern and would wander for a few minutes and then start feeding or go for a drink.

Our experience with the use of Lidocaine

- We have no animals lay down;

- Only 1 or 2 of one breed (Galloway) fussed post-banding, but settled within 5-10 minutes;

- Almost all would be back eating within minutes of being released;

- During the 45-90 minute window identified by Stafford and Mellor (2005) as the period of acute pain post banding there have been no animals who present with overt signs of distress.

Advantages with this new protocol

- You are forced into a second close inspection of the banded scrotum, there is no more second guessing myself about proper placement and clamping after animals are let out;

- Less discomfort for the animal with the majority of animals appearing to be in no distress post-banding.

Disadvantages

- Additional time is required at the time of banding;

- Additional cost for Lidocaine, syringe, and needles (Lidocaine is relatively inexpensive at about $7.50/250 ml multi-dose bottle).

We are now using local anaesthetic when we castrate our piglets with very good results -- much less stressful on both animal and farmer. This year, we will implement a similar protocol with our lambs with hopes of similar results.

Upon reflection, one might say why do we go through all of this? In my opinion, for the same reason that we voluntarily registered in the SPCA Certified program to begin with; we care dearly about our farm animals, and, at the end of the day, we want to ensure that we are making our best effort to do things properly. To meet the challenges associated with ever-changing expectations and practices, we have found ourselves enlisting numerous members on our team to help us become comfortable with the requisite knowledge, skills, and approach that best fit our situation or circumstance.

One of those key players is our vet and we applaud him and his team for being there to assist us in finding the balance between a practical and safe approach, and the economics associated with these new animal management guidelines. Second, is the SPCA Certified program itself: we have taken a very up-front approach with this program and its people. I would like to commend them all for taking a proactive approach, working towards evidence-based standards, providing an ear when needed, and making changes to narrow the gap between standards and the realities of our specific farming situation.

Calf welfare and weaning

Drovers
By Geni Wren (5/27/2010)

Weaning represents the single greatest stressor we impose on calves, says Joe Stookey, MSc, PhD, Western College of Veterinary Medicine, Saskatoon, Canada. For about three to five days they can be immunocompromised, have psychological stress and a setback in gain, he said at the 2nd International Symposium on Beef Cattle Welfare was held May 19-21 at Kansas State University.

Potential stressors associated with traditional weaning include:

Managed weaning age is younger than the natural age at weaning
Calves are in a new social environment
There is an absence of adults
There is a mixing of unfamiliar animals
There is a formation of a new social hierarchy
There is a physical separation of mother and calf
There is a premature end of lactation
Stookey discussed several research projects involving different types of weaning. “Could the stress of weaning be reduced in the presence of adults?” he asked. “Calves are born in a matriarchal system were cows set the pace. Calves follow that. Cows are teachers, calves are pupils. Some people wean in fall, preg test, then put some cull cows in with weaned calves to calm them down.”

With that in mind, research has been done with “trainer cows” to see if they help the weaning process and help teach newly weaned calves how to eat at the feed bunk, etc. However, Stookey noted, they found no advantages and some disadvantages of using trainer cows. “Some cows would be dominant and not let calves up to the bunk. It sounds good but didn’t work. Calves also don’t know this cow and she doesn’t know them.” Stookey said a study looked at calves weaned in the presence of familiar adults didn’t help because a cow would not let a calf nurse her that wasn’t hers, and the calves won’t approach a cow that is not their mother. “A calf wants his own mother and a cow wants her own calf.”

They also studied cow and calf behavior at weaning. They observed cows and calves for two days, then weaned on Day 3. Cows are relatively quiet on a normal day, but after weaning, cows are calling to calves. “If vocalization equals fear and mishandling, what does it mean at weaning? Big stress,” noted Stookey. “Cows figure out soon that the calf is gone. It takes the calves a couple of days before they start calling.” In that same study, they found that eating time drops after weaning and walking increases.

Fenceline weaning is another strategy that holds better promise for reduced stress. Stookey says a 1985 study in horses using fenceline weaning with foals on one side and the mares on the other showed less nickering and walking. It was also demonstrated in domestic elk herds in 1997. “Cattle studies show fenceline weaning reduces calling. Traditionally weaned calves called 50% more than fenceline-weaned calves. Calves were calmer than if they were completely separated. It also reduced walking and increased lying time. Fenceline weaning is superior to pasture-separated and or feedlot weaning.”

“Two-stage weaning” was also studied to determine if at weaning the calf was missing the milk or missing its mother. Plastic clips were placed in the calves’ noses that allowed them to eat grass, but not nurse, and calves were left with their mothers. Stookey says calves stayed closer to the cows for the first few days (within 10 meters of their dam), and there was an increase in grooming.

The second step was to then separate cows and calves. When separated, there no real response either. “They don’t complain when milk turns off or when mom disappears,” Stookey says. “They are already weaned. They spent four days getting weaned before separation.”

There’s a limit to how long you should leave the nose-clips in. If you leave them in too long, they depress performance compared to control calves. After about 14 days you get more “cheaters” that figure out how to flip the tags around and nurse. Stookey suggests that 3-7 days of the nose clips will get you the results you need.

If you were to rank the weaning systems, Stookey says the worst on calf stress is abrupt separation, fenceline weaning is better, and two-stage weaning is the best.

Reducing calf stress at weaning

Boehringer Ingelheim Vetmedica | Tuesday, September 28, 2010

Cattle experience a variety of stressors throughout their life that can hinder their overall productivity. Combining good management practices with a solid vaccination program creates a preconditioning plan designed to help calves perform at the best possible levels.

“Cattle producers should have a desire to produce quality calves that perform well in the feed yard and beyond, giving the cattle industry a positive image and producers a marketing advantage,” says Travis Van Anne, DVM Boehringer Ingelheim Vetmedica Inc.

Preconditioning calves can optimize their immune system and nutritional status while minimizing stress. Several factors can contribute stress on cattle and weaning is one of the most stressful. Castration, transportation, disease challenges, social mixing, inadequate diets, and dietary changes can cause reduced performance, increased morbidity and even death. It’s important that producers do everything they can to reduce the stress on calves at weaning.

A sound vaccination program can protect calves from potentially devastating diseases or pests. Van Anne recommends a clostridial product be administered at birth or turnout, followed up by a second dose during preconditioning, three weeks prior to weaning. A five-way modified live viral with pasteurella should also be given at turnout and a booster given at preconditioning. A good deworming product is invaluable to reducing calf stress at weaning and beyond. By controlling parasites, calves will better utilize feed and respond more completely to vaccinations.

In addition to a strong herd health program, producers should look at the age of calves at weaning to reduce stress and optimize performance. Van Anne says producers should consider weaning at times when the calf’s age and the weather are more consistent with good health. He explains that calves that are weaned at a younger age, less than four months, can get along well at the feed yard because they still have colostral protection. In addition, when weaning occurs earlier in the year, the weather is consistent. “Although it may be a hot time of year, the weather is consistently hot,” says Van Anne. “So temperature swings that can compromise a calf’s immune system are reduced.”

Van Anne adds that waiting until calves are approximately seven months of age to wean allows their immune system to further develop, assuming they are vaccinated correctly. At this time, the calf has started the weaning process naturally because the cows are reducing milk output. This increases a calf's ability to handle comingling, feed changes and other potential stressors.

Training calves to eat from a feed bunk and drink from a water trough, as well as exposing them to people and machinery are critical experiences to their success in the feed yard. Van Anne adds, "Supplementing calves at the ranch, on or off the cow, gives producers the chance to have contact with animals frequently, ultimately familiarizing them with people, machinery and feed." This familiarity will improve their overall disposition and relationship with people, ultimately reducing stress.

Van Anne recommends that cattle producers work with their local veterinarian to formulate a preconditioning program that works for their operation, environmental conditions, and management needs.

Cattle producer's role in animal welfare

09/17/2010 The Cattle Network
Source: Jane Parish – Extension Beef Cattle Specialist, Mississippi State University

Animal welfare is the basis of sound animal husbandry. Beef cattle ranchers should consider themselves stewards of a valuable resource that provides high quality protein products to many people throughout the world. By engaging in beef cattle production, the producer agrees to an unwritten set of guidelines for ensuring that they provide the basic requirements to the cattle they own or manage. These basic requirements include: allowing daily access to ample feed and clean water, providing appropriate health care for preventing and/or treating disease or injury, and handling cattle in a manner that does not exert undue stress or hardship.

Offer cattle adequate space for comfort, socialization, and environmental management. Maintain pens appropriately, including harvesting manure, to improve pen conditions. Monitor mud accumulation on cattle as a measure of pen condition and cattle care in relation to weather conditions. Use dust reduction measures where needed to improve animal performance. Properly design and drain floors in animal housing facilities. Provide traction in barns and handling alleys to prevent injuries to animals and handlers. Keep handling alleys and housing pens free of sharp edges and protrusions to prevent injuries to animals and handlers.

Design and operate cattle handling facilities including alleys and gates to avoid obstructing cattle movement. Look for ways to reduce excessive noise when handling cattle to lessen any distress to them. Adjust restraining chutes and alleys to the appropriate size of cattle to be handled. Regularly clean and maintain handling and housing facilities to ensure proper function and safety for cattle and handlers.

The majority of cattle are transported during some point in their lives, and hauling is an integral part of most operations. Much of this transportation occurs as part of the marketing process or among pastures or other operational locations. Ensuring that proper transportation practices are used can reduce stress and prevent injury to the cattle. The Master Cattle Transporter Guide is an excellent reference on this topic and is available as part of the National Beef Quality Assurance Master Cattle Transporter training program.

Stress compromises cattle health and makes cattle handling more difficult. There are many potential sources of cattle stress including climate extremes, climate changes, disease, parasites, injuries, mud, noise, predators, poor nutrition, handling, calving, weaning, castration, dehorning, hauling, commingling, and isolation. Some of these factors are difficult to control or avoid, whereas others can largely be controlled by management. Minimize cattle stress with advance planning to best manage stress sources.

Examine cows with mild lameness, early eye problems, mastitis, or loss of body condition to determine well-being and any need for prompt marketing. Castrate and dehorn calves early in life. Vaccinate against respiratory diseases prior to weaning and based upon veterinary advice. Provide proper pre-weaning nutrition. Use low-stress weaning methods such as fenceline weaning.

Ensure that diets for all classes of beef cattle meet the National Research Council (NRC) recommendations and/or those of a qualified nutritional consultant. Provide cattle with access to adequate water and feed supplies, and avoid feed and water interruption longer than 24 hours. Make sure that feedstuffs are of satisfactory quality to meet nutritional needs. Use only feed products and additives that are USDA, FDA, and EPA approved for use in cattle. Use these products in accordance with the approved product use guidelines.

Euthanasia is humane death occurring without pain and suffering. Consider the animal's welfare in making euthanasia decisions. Reasons for euthanasia include: severe emaciation, weak cattle that are non-ambulatory or at risk of becoming downers; downer cattle that will not sit up, refuse to eat or drink, have not responded to therapy, and have been down for 24 hours or more; rapid deterioration of a medical condition for which therapies have been unsuccessful; severe, debilitating pain; compound (open) fracture; spinal injury; central nervous system disease; and multiple joint infections with chronic weight loss.

"Downer" cattle are non-ambulatory (unable to walk or move normally). Diagnose this condition promptly to make the best decisions on whether the animal should be humanely euthanized or receive additional care. Humanely euthanize cattle unable to sit up on their own and which refuse to eat or drink within 24 to 36 hours of initial onset. Do not send downer cattle to a livestock market or to a processing facility, even when signs of a more favorable prognosis may be present. Market cattle promptly before this issue occurs. This helps promote both a better quality of life for the animal and an economic benefit for the operation. For downers that are treated, be sure to provide adequate feed and water to non-ambulatory cattle at least once daily. Move downer animals very carefully to avoid compromising animal welfare using a sled, low-boy trailer, or in the bucket of a loader. Dragging cattle, lifting them with chains, or scooping them into loader buckets are all unacceptable.

Beef cattle producers are responsible for providing proper care to cattle. Beef Quality Assurance training is highly encouraged for all producers and industry participants as it is a combination of technology, common sense, a concern for animal well-being, and a consumer oriented production system. It reflects a positive public image and instills consumer confidence in the beef industry in a time of increased public attention on animal welfare. The Beef Quality Assurance Code of Cattle Care includes general recommendations for care and handling of cattle. All cattle handlers and caregivers should follow the Producer Code of Cattle Care as outlined in The Cattle Industry's Guidelines for the Care and Handling of Cattle.

• "Provide necessary food, water, and care to protect the health and well-being of animals.
• Provide disease prevention practices to protect herd health, including access to veterinary care.
• Provide facilities that allow safe, humane, and efficient movement and/or restraint of cattle.
• Use appropriate methods to humanely euthanize terminally sick or injured livestock and dispose of them properly.
• Provide personnel with training/experience to properly handle and care for cattle.
• Make timely observations of cattle to ensure basic needs are being met.
• Minimize stress when transporting cattle.
• Keep updated on advancements and changes in the industry to make decisions based upon sound production practices and consideration for animal well-being.
• Persons who willfully mistreat animals will not be tolerated."

Assess management practices daily to ensure that animal welfare is not compromised. Conduct self reviews periodically that include all persons involved with cattle handling and care. Ensure that employees and all others involved in the cattle operation receive proper instruction, training, and oversight.

Implement management programs built on science and common sense. Sound animal husbandry practices are based on decades of research and practical experience. They impact the well-being, health, and productivity of cattle. It makes both economic and moral sense to use these sound practices throughout the beef cattle industry. By following these very basic, yet extremely important, guiding principles (as outlined in the National and Mississippi Beef Quality Assurance Programs), reasonable

production levels can be maintained and the public perception of beef cattle production should remain favorable.

Cattlemen can help prevent dark cutters

Highplains Journal
August 31, 2010

In most situations, things go better when everyone remains calm. That's true for cattle, too, including those about to enter the food chain. Excited cattle can become "dark cutters," lowering profit potential and causing beef demand challenges, says David O'Diam, brand extension manager for Certified Angus Beef LLC. As an animal is harvested, its body draws on stored reserves of energy (sugar) to create lactic acid in the muscles, he explains. That slight decline in alkalinity (decrease in pH) sets up the meat to react with oxygen to show the bright, cherry-red color beef consumers are accustomed to.

But stress prior to harvest depletes the energy reserve. Without time to recharge, meat from the animal will be unable to form enough lactic acid to decrease the pH level. The sustained higher pH level allows meat to hold more water, O'Diam says. "It's like cardboard," he says. "As it gets wet it turns a different, darker color." Hence, it becomes a dark cutter.

The causes of a dark cutter depend as much on the animal as on the conditions surrounding it. "Different people react to different things, and it's the same with cattle," O'Diam says. "Animals that are timid or afraid tend to stress more easily," says Jeff Savell, animal scientist at Texas A&M University.

Incidence of dark cutters only average about one percent, so it can be difficult to make measurable change as an industry, O'Diam says. However, producers can employ strategies to lower the risk, especially if their cattle have greater than average issues.

Animals should be healthy, well cared for and handled as calmly as possible, says Phil Bass, a meat scientist and executive account manager for CAB. "Make sure they have plenty of feed and water a couple of days before they are shipped to increase the sugar stores in their muscles," he says. "You can take preventive measures and select for calmer animals, too." The Angus breed offers a selection tool in the form of an expected-progeny difference rating for docility. Including that EPD in selection can help reduce the incidence of dark cutters, Bass says.

Data from the Iowa Tri-County Steer Carcass Futurity indicate that calm cattle returned $39.01 more per head than aggressive herd mates. The rate of CAB brand acceptance more than doubled for the docile group, earning them more carcass premiums. On the other hand, discounts for dark cutting carcasses can amount to $30 per hundredweight because consumers are unwilling to purchase the off-color meat. Stores rarely even place it on the counter, O'Diam says.

Produces can influence handling, feeding and breeding, but there is at least one stressor they have no control over. "Weather changes can frequently account for increases in dark cutters," Savell says. "In Texas, we see more dark cutters in October because of the weather."

Dark cutters are hard to avoid altogether, he says: "There is no sure-fire method for preventing them." Still, it makes sense to focus on what can be controlled. "As producers work to improve on this, the same management should help ensure higher quality grades and a better end product," Savell concludes. That leads to improved consumer demand, something worth getting excited about.

Communicating with frightened cattle in transport accidents

Drovers Magazine
By Geni Wren (5/26/2010)

Cattle that have been involved in a livestock hauling accident can have some of the same issues as humans in that situation – fright, confusion and disorientation. Cattle handling expert Tom Noffsginger,

DVM, Benkelman, Neb., says the first order of business is to step back and take care of the people who might be involved in the accident. Noffsinger spoke last week at an emergency preparedness seminar preceding the 2nd International Symposium on Beef Cattle Welfare at Kansas State University.

Next, Noffsinger gave some tips on dealing with loose and frightened cattle in a situation of a livestock trailer accident:

Have one person approach the cattle vs. many. “Cattle have a hard time processing all of that. If you have a team, stand closer together as you approach.”

The herd mentality is that there is safety in numbers. Let them congregate together and don’t try to separate them.
Confinement is threatening. “If you can give them a little freedom to flee and don’t just try to box them in, they will just stay at a certain distance from you,” he notes.

Respect what cattle can see. A bovine’s field of vision goes just about completely around them, but they have little depth perception. “Never stand still in front of a group of cattle,” says Noffsinger. “They can’t see you. Use motion so they know where you are.”

Cattle can’t look up well. To do so they must lift their chin which stops their front feet from moving.

Take their focus away from the noise, stress and confusion during an accident by letting them focus on a handler.

Always walk in straight lines when handling cattle. “Wolves circle,” Noffsinger says. “Try not to act like a predator.”
Pressuring the animals in the back to force the animals in the front to move isn’t fair, Noffsinger says. “You need to encourage the lead animals to move and the others will follow.”

To regulate the speed of cattle, walk beside them slow them down. To speed them, walk parallel to them in the opposite direction.
Cattle are not verbally based, so yelling can create fear. “Take the human voice out of it,” Noffsinger adds. He encourages first responders to eliminate yelling and whistling.

“Cattle need to see what is pressuring them and where they need to go,” Noffsinger states.
“Communicate by observing, be visible to them and don’t yell in these and other handling situations.”

DAIRY AND VEAL

Cow comfort and stall maintenance

UBC Dairy Education & Research Centre
Faculty of Land and Food Systems

In previous Research Reports, we have reported how stalls can be built or modified to improve comfort. However, regardless of how well your stalls are designed and built, comfort will be limited by how well stalls are maintained.
There are many advantages to using wellbedded freestalls. Cows choose these stalls over bare surfaces or those covered with a thin layer of bedding, even when stalls also contain a thick mat or mattress. Cows housed with wellbedded stalls spend more time lying down, are less likely to become lame and fewer have hock injuries.

Unfortunately, maintaining bedding in stalls can be a challenge. Soon after filling stalls with fresh bedding, cows move the bedding to the outer edges of the stall and into the alley. The resulting changes to the depth and shape of the bedding may make the stalls less attractive for cows. To make better decisions

about how often to add bedding to stalls, we studied how sand bedding depth declines with time after fresh bedding is added, and how these changes in bedding level affect cow comfort.

Our ‘head-to-head’ stalls had a total bed length of 8' and were 4' wide between Artex Y2K dividers. Bedding was river sand, sieved over a 2-mm screen and washed with water to remove silt. We measured changes in 24 stalls (housing 24 lactating dairy cows), from the day they were filled with sand (to the height of the rear curb) and over the next 9 days. Sand bedding depth declined rapidly with time and stall surface became increasingly concave or bathtub' shaped. Greater sand loss in the centre of the stalls creates a bath-tub like shape. The most sand was lost during the first day after the stalls were filled but sand levels continued to decline over the following 9 days. Also, those stalls that were in the locations preferred by cows tended to lose sand more rapidly than stalls that were used less.

To determine how these changes in bedding depth and shape affect cow use of stalls, we experimentally imposed treatments by digging out stalls to match these conditions. In this way we determined how cows respond to stalls representing different amounts of stall maintenance. In the first experiment we tested stalls filled to the level of the curb (like a well maintained stall), and what they looked like 3, 6 and 9 days with no maintenance (having lost up to 6 cm of sand at the deepest point).

In a second experiment we imposed levels like those seen in the stalls that lost the most bedding over the same period. In this case stalls varied from bedding level with the curb to losing as much as 14 cm of sand. To measure the effects of these conditions on lying time we again used 24 cows, and monitored behaviour using electronic sensors attached to the cows’ hind legs. These sensors automatically recorded whether the cows were lying or standing every 30 seconds.

Cows spent less time lying down in stalls that contained less sand. On average, lying time declined by about 11 minutes per day for every 1 cm decline in bedding. In the stalls with the least bedding, cows spent 2.3 hours less time lying down each day. These differences in lying time were due to cows lying down for shorter periods each time they lay down, suggesting that the reduced bedding depths made the stall less comfortable to be lying in.

These differences in lying time associated with decreased bedding levels are as large or larger than any other stall feature we have tested in previous research on cow comfort. Thus any improvements in cow comfort associated with building or renovating freestall barns can be completely undone by poor stall maintenance.

This research demonstrates that comfort is improved by frequent stall maintenance, such as daily raking when cows are moved to the milking parlour. In addition to improved cow comfort, better stall maintenance will help keep cows cleaner, reducing the risk of environmental mastitis.

This research was part of a project designed by visiting researcher Marek Gaworski and research assistant Michelle Drissler. Cassandra Tucker is currently a scientist at AgResearch in New Zealand and Dan Weary is a professor in the UBC Animal Welfare Program. This research was made possible through funding by the Dairy Farmers of Canada, NSERC, and many other donors listed on our web site at www.agsci.ubc.ca/animalwelfare.

Give limit-fed heifers plenty of bunk space

Dairy Herd Management
October 11, 2010
Source: Dairy Calf and Heifer Association

Limit-fed heifers still fight over their feed, even if given excess feed bunk space or some straw to munch on, according to a Canadian study.

Researchers at the University of Guelph in Ontario fed 13-month-old Holstein heifers a TMR at a restricted level of 1.9 percent of body weight. They gave heifers either 27 inches or 13.5 inches of feed

bunk space. All heifers could eat simultaneously. A third treatment group received about 4 pounds of straw per animal per day, in addition to a limit-fed TMR fed at the lower level of bunk space.

The researchers recorded dry matter intake, feeding behavior and displacements from the feed bunk.

They found that neither excess feed bunk space or the addition of straw reduced competition among limit-fed heifers. In fact, the frequency of displacements from the feed bunk was similar across all three treatments during the first 90 minutes after feed delivery.

Meanwhile, the straw-fed heifers displaced each other another 8.7 times during the rest of the day, which might be because they were competing for the straw that they had largely ignored following feed delivery. Overall, this actually resulted in more competition in this group compared to the other treatments. And, even though straw was available in this treatment, heifers still ate their TMR just as quickly as the other two treatments.

“These results suggest that heifers strongly compete for a limit-fed TMR, thus reinforcing the need for sufficient bunk space for all heifers to feed simultaneously,” says Trevor DeVries, assistant professor of animal science at the University of Guelph’s Kemptville campus in Ontario.

Evaluate your calf raising strategies

Calf & Heifer Advisor
October 11, 2010-10-13
Source: William H. Miner Institute

A new tool to assess the critical points of management and their impacts on the welfare of calves and heifers was recently developed by researchers at Laval University, Agriculture and Agri-Food Canada, and Valacta.

The development and implementation of these types of assessment tools are a critical counter-balance to the legislation approach to animal welfare that groups such as the Humane Society of the U.S. employed recently in California and Ohio, says Peter Krawczel, Ph.D. student at the Miner Institute in Chazy, N.Y.

In setting minimum standards or banning certain practices, legislative approaches do not allow for the flexibility to solve specific welfare problems at the farm level, notes Krawczel. A better approach, and the one used by the aforementioned researchers, relies on the assessment of critical points of the management. This allows consultants, auditors, or producers to identify the main risk to welfare on each farm and formulate a specific plan to solve the area in which management is found to be insufficient.

The initial and critical step to this type of approach is the identification of critical points and appropriate targets for each (i.e., not so high that they were impossible for any farm to achieve and not so low that problem areas were not detected).

This new advisory tool was first drafted using the available scientific literature and then a draft of critical areas, the goals for each, and the specific components of the assessment that would be used for data collection on farm were reviewed by a panel of dairy experts, including an agronomist, a dairy farmer, a veterinarian, a technical advisor, and two researchers. All material related to the advisory tool was revised until a consensus was achieved.

The advisory tool contains the following critical areas and targets:

- Calving management, including regular observation of calving area, use of calving pen, separation of sick animals, sanitation of calving area and cow comfort within calving area.
- Care of newborn calves and pain abatement, including disinfection of navel immediately following birth, clear identification of calf and management of painful procedures, standard operation procedures for dehorning including timing and use of analgesic.
- Colostrum management, including colostrum offered within four hours of birth, monitoring amounts of colostrum consumed during first feeding, assessment of colostrum quality, minimum IgG concentration of colostrum offered, feeding limited amounts of colostrum only when excellent quality was

offered or difficulty in feeding encountered, adequate stock of frozen colostrum maintained and regular verification of the success of the transfer of passive immunity.

- Calf nutrition, including a milk-feeding plan for calves written and followed, delivery of more than two gallons of milk per calf per day, appropriate feeding schedule followed, milk offered in container using a nipple, waste milk not used, unrestricted access to clean water at two days of age, a written plan for solid feed in place and followed, and unrestricted access to concentrate in clean, functional feeders.
- Weaning, including waiting until appropriate age and concentrate intake and use of a progressive weaning method.
- Housing of calves, including clean and comfortable housing with sufficient bedding provided.
- Heifer feeding, including unrestricted access to clean, functional waterers, nutrition plan in place and followed, and unrestricted access to forage in clean, functional feeders.
- Heifer housing, including clean, comfortable housing with sufficient bedding provided and access to pasture (when weather-appropriate).
- Monitoring protocol, including records of mortality and sickness, recording of growth rates and evaluation of hoof health.

Access the complete advisory tool.

Moving the neck rail may help lame cows

The dairysite
July 28, 2010

A recent research report by the University of British Columbia, Dairy Education and Research Centre has showed how lame cows recover rapidly when provided access to pasture.

Just two weeks on pasture led to improvements in gait of lame dairy cows. Cows that stayed in a free stall barn showed no improvement. Of course pasture access is not always possible, for example during the wet winter months.

The next question raised by researchers Dan Weary and Marina von Keyserling was whether indoor housing could be modified to allow similar benefits? Specifically, can changes to freestall barns provide similar benefits for lame cows?

Standing outside of the stall (typically on wet concrete) increases the risk of lamness. One aspect of the stall that especially affects where cows stand is the position of the neck rail. If stalls could be custom fitted for each cow, the neck rail would be positioned so that each cow could lie down and stand up comfortably in the stall, but while standing she would be 'indexed' so that her urine and feces fall in the alley outside of the stall. Unfortunately, cows come in a wide range of sizes, and this 'fit' is hard to get just right.

Both the height of the neck rail and its distance from the curb affect standing behaviour; more restrictive neck-rail placements (lower and closer to the rear of the stall) prevent cows from standing fully in the stall. Preventing the cow from standing in the stall is one way to keep stalls clean, but has the unfortunate effect of forcing the cows back onto the wet concrete outside of the stall.

In a recent study, the researchers showed how neck rail placement affects the cows' ability to stand in the stall. Cows were tested with neck rails positioned over the range of values

found on commercial farms; ranging from a restrictive placement of 130 cm from the rear curb, to a much more generous 190 cm from the curb.

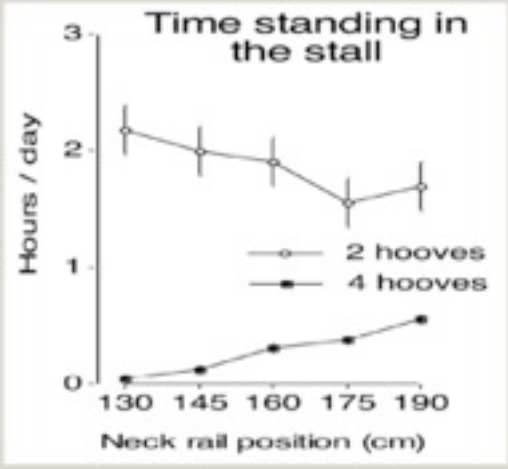

Figure 1. Moving the neck rail away from the curb allowed cows to spend more time standing in the stall and reduced the time they spent perching standing with the front two hooves in the stall. This study included five pens with six cows per pen and each pen was tested with each of the five neck rail positions.

As can be seen in Figure 1, the more time the cow spent perching (standing with the front hooves in the stall) and the less time she was able to stand fully in the stall. This clear result gave usMr Weary and Ms Keyserling an idea. They knew that standing outside of the stall increases the risk of lameness, and now they also saw how a simple aspect of stall design can change where the cows stand. Could an environment be created that would help lame cows recover simply by moving the neck rail?

Lameness takes weeks to develop and weeks more for cows to recover, so in our next experiment we tested cows for 10 weeks. This time just the two extreme positions from the previous study were tested, 130 and 190 cm from the rear curb. Cows were housed in pens with the neck rail in one position or the other for the first five weeks. Treatments were then switched ('crossed over') and the cows were observed for another five weeks. Every week cows were gait scored using the UBC scoring system; cows with perfect gait are scored 1, and severely lame cows are scored 5. Scores of 3 or greater are considered clinically lame.

Again, the results were clear. When provided stalls with the more generous neck rail placement (190 cm from the rear curb), the cows spent more time standing with all 4 hooves in the stall and less time 'perching' with just the front two hooves in the stall. As expected, this change in behaviour resulted in a change in lameness. Figure 2 shows how gait changed over the 5 weeks tested with each position. When cows were housed with the neck rails positioned permissively at 190 cm gait improved, and gait worsened when kept in pens with the neck rail at 130 cm.

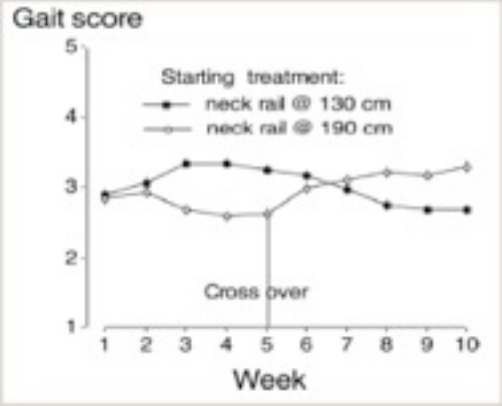

Figure 2. Changes in gait score when cows were housed in pens with neck rails positioned at 130 cm from the rear curb or 190 cm from the curb. Cows were assigned to one treatment for the first five weeks, and then tested on the alternative treatment for the next five weeks. Gait improved (i.e., gait scores declined) when cows were housed in stalls with the neck rail at 190 cm, but worsened when treatments were switched and the neck rail was made more restrictive. Cows started on the 130-cm treatment showed the opposite pattern (i.e., increased gait scores followed by declines after the cross over in treatments.

13 new cases of lameness were recorded over the experiment, but only two of these occurred while cows were in pens with the neck rail at 190 cm. Also as expected, stalls in these pens were more likely to become contaminated with feces and urine; however, we saw no increase in the number of clinical or sub-clinical intra-mammary infections.

This study provides the first experimental evidence that changes in stall design can reduce the risk of lameness. The results also illustrate how changes in design that result in improvements in cow comfort and lameness can come at the expense of cow and stall cleanliness.

From the researchers perspective the benefits exceed the costs associated stall maintenance. However, a better option would be housing that keeps cows clean and reduces the risk of lameness. Well managed pasture can do just this, but most dairy producers also require indoor housing. Their aim now is to develop housing systems that provide both a suitable environment for the cow to stand (thus reducing the risk of lameness), and a clean, dry lying surface that promotes cow comfort and udder health (thus reducing the risk of mastitis).

Colostrum may boost immune function after exercise

By Stephen Daniells, 09-Jul-2010
Source: British Journal of Nutrition
Volume 103, Pages 1425–1432 doi:10.1017/S0007114509993503
“Bovine colostrum supplementation attenuates the decrease of salivary lysozyme and enhances the recovery of neutrophil function after prolonged exercise”
Authors: G. Davison, B.C. Diment

Supplements of colostrum from cows may counter the drop in immune function following exercise, says a new study from Wales.

Four weeks of supplementation with bovine colostrum reversed the decreases in the function of immune cells that accompanied intense exercise, according to findings published in the British Journal of Nutrition.

“The main findings of the present study are that 4 weeks of bovine COL supplementation improved the speed of recovery of neutrophil function after exercise-induced immunodepression and reduced exercise-induced alterations in salivary lysozyme concentration and secretion rate,” wrote Glen Davison and Bethany Diment from the Department of Sport and Exercise Science, Aberystwyth University.

“This is the first study to demonstrate that COL supplementation enhances these innate immune parameters in the recovery period after prolonged endurance exercise that causes acute immunodepression.”

Colostrum is obtained from the first milk produced by a mammal after giving birth. It is considered to be a special boost to health thanks to its high level of immune globulin (IgG), a substance that helps build up the immune system of a newborn mammal.

The colostrum used in this study was provided by Neovite UK, which sources the ingredient from Fonterra, a major supplier of colostrum.

Study details

Davison and Diment recruited 12 healthy, active men and randomly assigned them to receive either placebo or a daily bovine colostrum supplement for four weeks. After this time, all the participants cycled for two hours at 64 percent of their maximal oxygen uptake.

Results showed that there were no differences between the groups for levels of circulating immune cells (neutrophils), and the ratio of neutrophils to lymphocytes. However, significant differences were observed between the groups for the function of the neutrophils, and for levels of lysozymes in the saliva. Lysozymes are enzymes that are part of the immune system and a natural form of protection against a range of pathogenic bacteria.

“Bovine colostrum supplementation either speeded the recovery (neutrophil function) or prevented the decrease (salivary lysozyme) in these measures of innate immunity,” stated the researchers.

Commenting on the potential mechanism, the Aberystwyth researchers noted that previous findings only provide speculative evidence and that “further research is required to determine whether this is the mechanism by which oral supplementation with bovine colostrum enhances innate immunity after physical stress in human subjects.

“It is also worthy of note that, in the present study, we only assessed one aspect of neutrophil function. In order to determine the mechanisms of action, future studies should also examine other aspects of neutrophil function, such as chemotactic, phagocytic and oxidative burst responses for example,” they added.

Overstocking: At the stall and the feed bunk

The Dairysite

August 20, 2010

Overstocking typically occurs in two areas of the barn: at the freestall and at the feed bunk. Producers overstock dairy cattle to save building costs, or because herds grow before barns can be expanded to accommodate more cows, say experts from the Dairy and Research Centre from the University of British Columbia.

Overstocking can also occur unintentionally; even when each cow has access to a freestall (i.e. one-to-one, or 100 per cent stocking rate, for cows-to-stalls). Overstocking typically occurs in two areas of the barn: at the freestall and at the feed bunk. Producers overstock dairy cattle to save building costs, or because herds grow before barns can be expanded to

accommodate more cows. Overstocking can also occur unintentionally; even when each cow has access to a freestall (i.e. one-to-one, or 100 per cent stocking rate, for cows-to-stalls). Differences in barn layout can mean that cows have adequate feeding space in barns with two rows of freestalls but too little feeding space in barns with three rows of stalls in each pen. This is because two-row pens have to be longer in order to house the same number of cows as a three-row pen, providing approximately 50 per cent more bunk space per cow.

Researchers at UBC have completed a series of studies designed to provide producers with science- based recommendations for stocking rates. These studies have addressed overstocking at both the stall and the feed bunk. To assess the effects of overstocking stalls, 48 Holstein cows were housed in pens containing one stall for every cow (i.e. 100 per cent stocking rate), or overstocked at 109, 120, 133, and 150 per cent (Figure 1). Cows were tested in groups of 12, and each group of cows was exposed to each stocking density treatment. Video was used to record the amount of time cows spent lying in the stalls and standing in the alley as well as latency to lie down after returning from milking. Additionally, aggressive interactions or "displacements" between cows were recorded to identify whether aggression would increase when cows were forced to compete for lying space.

Cows spent less time lying down and more time standing outside the stall when overstocked. For example, cows housed at 100 per cent stocking density averaged 13 h/d lying in the stall, but lying time decreased to just 11h/d when cows were housed at a stocking density of 150 per cent. Cows compensated for reduced lying time by spending more time standing in the alley. The effects of overstocking were greatest during the period of the day when most cows were lying down, such as in the early morning between 2 and 5 am (Figure 2).

Fresh feed is often delivered to the pens when cows are away for milking. The delivery of fresh feed is known to motivate cows to spend time feeding after milking, and allow time for the teat ends to close before they lie down in the stalls. Overstocking interferes with this response as overstocked cows often chose to lie down when they returned from the parlour instead of eating fresh feed. This result tells us that cows are highly motivated to lie down and will forgo eating time to ensure that they secure a freestall. This decline in the time cows remain standing after milking may also increase the risk of environmental mastitis. For some cows, overstocking may not be a problem; they can simply make another cow get up and then take her stall. These displacements are much more common at higher stocking densities, and may help explain why submissive cows, or those that are displaced frequently, are at a higher risk of becoming lame than more dominant cows.

Other research has also shown how overstocking at the feed bunk increases competition among cows. Competition at the feed bunk increases the time cows spend standing in the feed alley, presumably waiting to obtain access to feed. Transition cows may be especially susceptible to negative consequences of competition with decreased feed intake and high standing times increasing the risk of postpartum disease and lameness.

Stocking Density (per cent)	Ratio of Cows : Stalls
100	12 : 12
109	12 : 12
120	12 : 10
133	12 : 9
150	12 : 8

Figure 1. *Stocking density expressed as a percentage with the corresponding ratio of cows to stalls*

A recent UBC study assessed the effects of overstocking at the feed bunk on transition cows. Cows were assigned to either an individual electronic feed bin or had to share access to their feed bin with a second cow. These treatments provided cows with the equivalent of 0.3 and 0.6 m of linear feed space per cow; the recommended amount of bunk space is between 0.6 and 0.8 m per cow, but 0.3 m per cow is not uncommon on commercial farms.

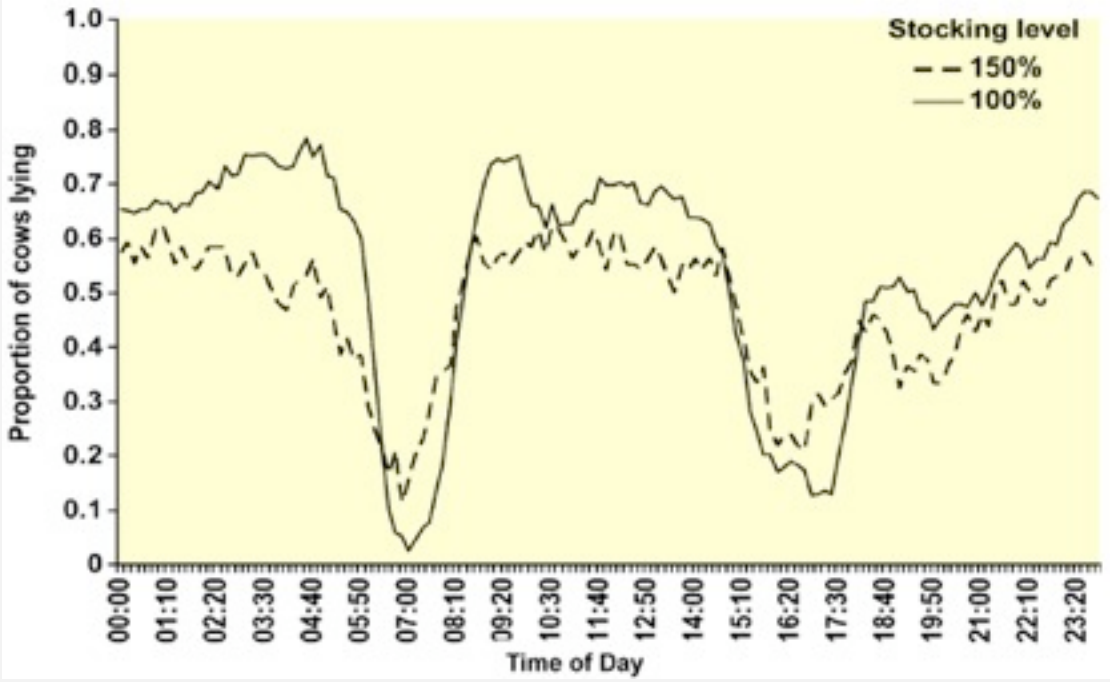

Figure 2. Proportion of cows lying down over a 24-hour period shown for cows housed at 100 per cent (12 cows: 12 stalls) versus 150 per cent (12 cows: 8stalls) stocking density. Cows on the overstocked treatment could not synchronize behaviour and lie down at the same time as much ascows that were not overstocked.

Over 100 cows were tested in this trial. All were assigned to treatments approximately 18 days before calving and remained in the experiment until 18 days after calving. Feed intake and feeding rate, displacements between cows at the feed bins and the amount of time cows spent standing were recorded in the periods before and after calving. First lactation (primiparous) and older (multiparous) cows were housed within the same pens.

Overstocking at the feed bunk decreased feed intake before calving for multiparous cows, and increased the number of displacements for both multiparous and primiparous cows. We saw the greatest increase in feeding rate of submissive cows (displaced more often from the feed bunk) compared to more dominant cows.

Another consequence of overstocking at the feed bunk was that multiparous cows increased the time they spent standing (but not eating) during the week after calving. This increase in time spent standing was most likely driven by cows waiting for access to the feed bunk, and is a known risk factor for lameness.

In summary, these studies illustrate the effects of overstocking at the freestalls and the feed bunk; overstocking reduced the time cows (especially subordinate animals) can access the resource (i.e. lying space or feed), and increases unwanted behaviours (i.e. standing and competition for feed). Transition cows are more vulnerable to these effects, especially in

terms of reductions in feed intake (that increase the risk of transition diseases) and increased standing time (that increase the risk of lameness). The effects of overstocking at both the freestalls and the feed bunk on displacements are also more harmful for submissive cows. Submissive cows may be especially at risk for disease during the transition period because they show reduced intakes, stand more and lie down less. Whether these cows are submissive by nature, or temporarily submissive due to their ill health, is not known and is a focus of future research.

These results provide a scientific basis for the recommendations in Canada's new Recommended Code of Practice for the Care and Handling of Dairy Cattle. Specifically, the code recommends that producers provide each cow with one lying stall and one feeding position (typically 60 cm of bunk face). The code emphasises this space allotment is most important during transition. Adopting these practices can improve cow comfort and cow health.

Somatic cell counts: Friends or foes

September 2010
Written by Charlotte Johnston, TheCattleSite junior editor.
Speaking at a recent Pfizer press briefing on somatic cell counts (SCC), Dr Ynte Hein Schukken from Cornell University said that somatic cells are a crucial part of the normal function of a healthy cow.

What is a somatic cell count?
SCC is the number of cell in milk. It is expressed as cell per milliliter of milk and is used worldwide as a criteria to determine the quality of milk.

Table 1 shows that in normal milk there are less than 100,000 cells/ml, however in mastitis milk this can increase to anything over 250,000 cells/ml.

Cells in Milk
Cell type Normal milk Mastitis milk
Total cells <100,000 >>250,000
White blood cells >85% >99%
Of which: - -
Macrophages >35% -
Neutrophils >25% >99-100%
Lymphocytes >25% -
Epithelial cells <15% <1%

Friends or foes

Macrophages steer the immune response in the mammary gland. When bacteria enter, macrophages attack them and send out messages, which causes neutrophil cells from the blood stream to enter the mammary gland.

Hence when a cow has mastitis, the amount of neutrophils in the milk rise, increasing the cell count.

The neutrophils engulf the bacteria and break it up.

"Therefore are cells not friends, as they fight the bacteria?" asks Mr Schukken. Without cells in the milk, cows wouldn't be healthy. Which is why it is important not to simply reduce SCC levels are far as possible, he said.

“Cows cannot live without somatic cells. A fully healthy cow will have approximately 50,000 cells per milliliter of milk and this number varies between 5,000 and 200,000 in fully healthy and normal cows.”

However, there are cows who constantly return high SCCs. These are cases where the bacteria has survived in the neutrophils, and these cows are those with chronic mastitis. The management of these cows is critical for herd health.

When cell counts are persistently high, producers must intervene, either by culling, treating or segregating the infected animal.

SCC depends on stage of lactation and age of cow

Figure 1 is data taken from a study on healthy cows (SCC<200/ml) in the Netherlands. It shows that the number of cells changes during different stages of lactation and increases as the cow gets older.

Cows in their first lactation are more likely to have higher SCCs in the first few days after calving, but after the first 50 days in milk, their SCC will drop to below 100 SCC/ml.

This shows that half way through lactation, SCCs in older cows increases.

Management

Milk with high cell counts isn't unsafe to drink, however the consumer doesn't want to drink it - which is why it is important to identify cows with high cell counts and separate the milk.

Bulk tank somatic cell count testing is now available to EU dairy farmers universally and many also have access to SCC data at an individual cow or quarter level – but are they making the most of the data that is available?

"Short term increases in SCC are completely normal, however the milk must be separated," Mr Schukken said.

"The key is to use the data available and identify cows who are making SCCs increase in the long-run and effectively manage these animals."

Effects of feed composition and management

The DairySite
July 2010

In a total mixed ration (TMR) feeding system, forage and concentrate feed components are combined into a single feed mixture. The objective of this feeding method is to deliver, to each cow, a well-balanced ration that is formulated to maintain health and maximise milk production, say researchers at the University of British Columbia.

However, despite our best efforts in formulating and delivering the ration to cows there are indications that the composition of what an individual cow consumes is not the same as what was initially delivered. Dairy cows have been shown to preferentially sort for the smaller grain particles and discriminate against longer forage components. This type of feeding behaviour can lead to cows consuming less fibre and more concentrate than expected. As result, these cows experience lower rumen pH, putting them at greater risk for sub acute ruminal acidosis (SARA).

One of the most critical time periods during which dairy cattle experience SARA is in early lactation, in the weeks following calving. During this time cows experience a dramatic change in ration as they are switched from a high forage close-up ration fed before calving

to a much lower forage lactation ration after calving. Until recently, we did not know what effect this dietary change had on the feed sorting behaviour by cows.

We therefore set out to determine whether the forage concentration of a ration influences feed sorting by cows and whether the extent of this sorting changes as the cows adapt to a new ration.

In our study six lactating Holstein cows, individually fed once per day, were provided each of two rations in a crossover design: 1) higher forage ration (62 per cent forage), and 2) lower forage ration (51 per cent forage) on a dry matter basis. Dry matter intake, feeding and sorting behaviour were monitored for the first 7 days each cow was on each treatment. Sorting was determined by sampling the offered feed and refusals daily for each cow and undertaking particle size analyses using a Penn State Particle Separator. The particle size separator contained two screens (18 and 9 mm) and a bottom pan resulting in three fractions (long, medium and short). Sorting was calculated as the actual intake of each particle size fraction expressed as a percentage of the predicted intake of that fraction.

We found that cows rapidly adjusted their sorting behaviour within one day when their ration was changed. Cows sorted for the shorter concentrate particles and sorted against the longer forage particles to a greater extent when fed the lower forage ration. We also found that when cows were provided a lower forage ration they increased their dry matter intake (22.2 vs. 19.9 kg/d), decreased feeding time (193.3 vs 220.5 min/d), and increased feeding rate (0.15 vs. 0.11 kg/min), particularly during the time period following feed delivery. These findings are of interest as they provide evidence that feeding a lower forage ration may increase the risk of cows succumbing to SARA, particularly during early lactation when dry matter intake is rapidly increasing.

Another major concern with feed sorting is its varied effect in group-fed cows. When cows engage in sorting, the nutritive value of TMR remaining in the feed bunk changes for those cows which eat hours after feed delivery. Our work has shown that subordinate cows do not have primary access to feed when it is delivered. It is likely that these cows end up consuming a ration that is very different than what was originally formulated. In an extreme case cows may consume insufficient nutrients to maintain high milk production.

To test this prediction we completed a study to investigate how feed sorting is affected by competition for feed bunk access. Thirty-six dry Holstein cows, consuming a close-up TMR (31 per cent corn silage, 40 per cent alfalfa hay, 29 per cent concentrate), were assigned to one of two treatments: 1) noncompetitive (1 cow/feed bin) or 2) competitive (2 cows/feed bin). Feeding behaviour, dry matter intake, and sorting behaviour were monitored on four separate days during weeks 2 and 3 before the cows' expected calving dates.

As seen in the previous study, regardless of treatment, cows sorted against longer forage particles and for the shorter concentrate particles. Interestingly, competition at the feed bunk dramatically increased the feeding rate of cows throughout the day (Figure 2a). Even though time spent feeding was similar (195 min/d), the competitively-fed cows had fewer meals per day, and tended to have larger and longer meals than the non-competitively fed cows. Competition also changed the distribution of DMI over the course of the day (Figure 2b), resulting in higher intakes during the later hours after feed delivery after much of the feed sorting had already occurred.

These results suggest that increased competition at the feed bunk promotes feeding behaviour patterns that will likely increase the between-cow variation in composition of TMR consumed. In other words, the subordinate cow likely is even more vulnerable in

competitive situations and may end up consuming a ration very different than what was initially formulated.

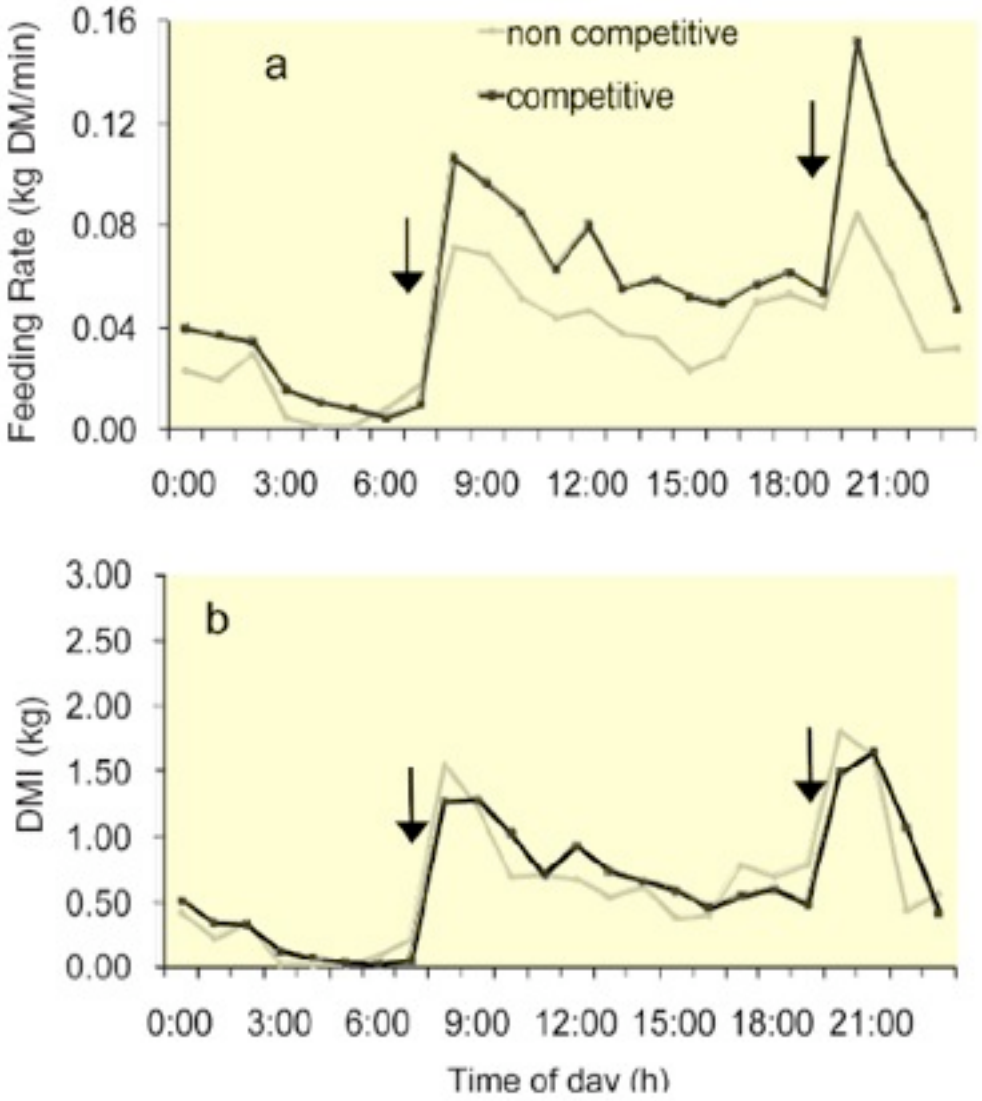

Figure 2. Hourly averages for a) feeding rate (kg DMI/min of feeding time) and b) DMI for cows fed competitively or noncompetitively. Arrows indicate fresh feed delivery times.

Overall, it is recommended that producers pay attention to what their cows are eating. Using a forage particle separator to compare the feed offered with what is left at the end of the day can provide an indication of what they are eating. If producers find evidence of feed sorting, they can manage it and its effects by changing dietary composition (increasing ration forage content) and by decreasing feed bunk competition by providing more bunk space.

This report is a summary of two studies published in the Journal of Dairy Science (Hosseinkhani et al. 2008. J. Dairy Sci. 91:1115- 1121and DeVries et al. 2007. J. Dairy Sci. 90:5572-5579). Dr. Trevor DeVries completed his Ph.D. in UBC's Animal Welfare Program and is now an Assistant Professor with the Department of Animal and Poultry Science, University of Guelph, Kemptville Campus. Dr. Marina (Nina) von Keyserlingk is an Associate Professor in the UBC Animal Welfare Program located in the Faculty of Land and Food

Systems. We thank UBC's Dairy Education and Research Centre. In particular we thank Karen Beauchemin, Doug Veira, Katy Proudfoot, and Ali Hosseinkhani for their participation in these studies. The project was funded by the Westgen Endowment Fund and Investment Agriculture Foundation of British Columbia and through contributions from many other donors: http://www.landfood.ubc.ca/animalwelfare.

Feed delivery impacts behavior

Dairy Herd Management
August 9, 2010
Source: Journal of Dairy Science

A new study published in the August Journal of Dairy Science looked at how different feeding methods may affect the learning of feeding and competitive behavior of growing dairy heifers.

Researchers hypothesized that heifers previously fed a total mixed ration (TMR) would distribute their feeding time more evenly throughout the day, compete less for feed, maintain a more solid fecal consistency, and continue to grow rapidly compared with heifers previously fed a top-dressed ration (TDR).

Thirty-two Holstein heifers were divided into eight groups of four and were exposed to one of two treatments for 13 weeks: 1) TMR or 2) TDR. Each treatment contained 65 percent grass/alfalfa haylage and 35 percent textured concentrate on a dry matter (DM) basis.

Following this feeding period, all heifers were switched to an unfamiliar TMR containing 56.1 percent grass/alfalfa haylage, 21.0 percent corn silage, 21.0 percent high-moisture corn, and 1.9 percent mineral supplement (DM basis). Heifers remained on the new treatment for an additional seven weeks.

Group DM intakes were recorded daily throughout the experiment. Feeding behavior, recorded using time-lapse video, and sorting behavior were measured for seven days during weeks one, four, and seven after the dietary change. Feeding competition was measured on days two, four, and six of each recording week. Sorting activity was determined through particle size analysis of the fresh feed and orts. The particle size separator separated feed into four fractions (long, medium, short, and fine). Sorting of each fraction was calculated as the actual intake expressed as a percentage of the predicted intake. Animals were scored for fecal consistency twice weekly, using a scale from one (liquid) to four (solid). Heifers were weighed every two weeks.

Neither DM intake nor average daily gain differed between treatments. Sorting also did not differ between treatments. Heifers tended to spend more time feeding if they had previously been fed a TDR, largely due to the increase in time spent feeding in the two hours following feed delivery. As they had done before the dietary change, heifers previously fed the TDR spent more time at the bunk in the two hours following feed delivery. Heifers previously fed the TDR were displaced from the feed bunk more frequently than heifers previously fed the TMR, particularly during the two hour period following feed delivery. Fecal scores were lower (more fluid in consistency) for heifers originally fed the TDR.

The continued difference in feed bunk competition suggests that heifers previously fed the TDR had learned these patterns when fed the TDR, retaining them even when switched to an unfamiliar ration. Furthermore, lower fecal scores for heifers previously fed the TDR suggest altered rumen fermentation, possibly because of altered daily consumption patterns. These results show that feeding a TMR to replacement dairy heifers from a young age promotes a more even daily feeding pattern, minimizes feed bunk competition, and promotes a more solid fecal consistency.

Picky eaters: ensuring dairy cows eat what is provided for them

FARMSENSE BC SPCA Farm Animal Welfare News
August 2010

by Dr. Trevor DeVries, Assistant Professor in the Department of Animal and Poultry Science at the University of Guelph, Kemptville Campus.

Total mixed ration (TMR) feeding systems, where forage and concentrate feed components are combined into a single feed mixture, have become widely recognized as the optimal way to provide the consistent balance of nutrients that dairy cattle need. These rations are designed so that producers may be confident that they are providing their dairy cattle a well-balanced diet that is consumed as formulated. Despite these best efforts in formulating and delivering the ration to cows, there are indications that the composition of what an individual cow consumes is not always the same as what was initially delivered.

Dairy cows have been shown to preferentially consume (sort) for the smaller grain particles and discriminate against longer forage components of their TMR. This type of feeding fibre and more grain concentrate than expected. Not only can such sorting result in cows consuming an inconsistent ration, these cowsmay experience lower rumen pH, putting them at greater risk for sub-acute ruminal acidosis. This is particularly troublesome for early lactation cows, where greater sorting of a higher concentrate, lower fiber diet, coupled with rapidly increasing dry matter intake (DMI), will exacerbate the intake of highly fermentable carbohydrates and refusal of physically effective fiber, thus increasing the risk of sub-acute ruminal acidosis. This in turn may contribute to inconsistent feed intake, poor feed efficiency, low milk fat, and increased laminitis.

Alternatively, sorting of the TMR can reduce the nutritive value of the TMR remaining in the feed bunk, particularly in the later hours past the time of feed delivery. For group-fed cows, this may be detrimental for those cows that do not have access to feed, at the time when it is delivered, for example when there is high competition at the feed bunk. In such cases, these cows may not be able to maintain adequate nutrient intake to maintain high levels of milk production. It follows, therefore, that providing adequate feeding space so that all cows can feed at once will help reduce the variation, both within and between cows, in nutrient intake.

A large proportion of research on feed sorting in dairy cattle has focused on changing the composition of the TMR, particularly the forage components. Research has shown that inclusion of a greater proportion of hay in the ration, as percentage of the total forage in the ration, will increase the amount of sorting against longer, fibrous particles. Further, researchers have shown that increasing particle size of forages, including alfalfa, hay and corn silage results in increased sorting against long forage particles in the TMR. There is also data to suggest that feeding processed corn silage, as compared to unprocessed, will decrease sorting against longer particles, largely due to reduction in overall particle size in the TMR. Finally, increasing the concentrate to forage ratio in a TMR has also been shown to increase the amount of sorting against long particles, and for shorter particles.

Beyond changing forage characteristics or content, sorting can be influenced by other dietary factors. It is commonly believed that adding water to a dry TMR will help bind particles together and make it harder for dairy cattle to sort out smaller particles. Research has shown that the amount of feed sorting (against long particles) can be reduced when water is added to a dry TMR, containing a high proportion of dry forage. Alternatively, more recent research has shown that adding water to a wetter TMR, containing no dry forage, actually increased the amount of sorting. It can be concluded that the effect water addition may have on reducing feed sorting may hinge on the original dry matter content of the ration, and whether or not dry forage was included in that ration. It would be recommended that in situations where sorting is evident, producers try adding water to their TMR; however, be careful to monitor the effects that this may have. In cases where sorting increases with additional water, it would be recommended to stop this practice.

Beyond dietary factors, there are feed management practices which may influence the level of feed sorting. Increasing the frequency of TMR delivery from once per day to twice per day has been shown to reduce the feed sorting. Given this, and that more frequent feeding (more than once per day!) also promotes more equal access to freshly delivered feed and a more even distribution of feeding time over the course of the day, feeding cows more often has the potential to reduce the variation in composition of ration consumed.

We typically discuss feed sorting as a bad thing. There is evidence to suggest, however, that observation of feed sorting may not always be a bad thing. Researchers have shown that dairy cows experiencing a bout of ruminal acidosis will, at times, alter their sorting behavior to select in favor of long forage particles, rather than against these particles as they typically would. This alteration in behavior may indicate that the cows are selecting for those feed components that may assist in the alleviation of the effects of acidosis, that is, to make themselves feel better. It stands to suggest, therefore, that obvious changes in the diet selection patterns of cows within a herd may indicate that they are experiencing some level of ruminal acidosis.

It is recommended that dairy producers pay close attention to what their cows are eating. A simple way to do this is to compare, using a forage particle separator, the feed offered to the cows to that which they leave at the end of the day or prior to the subsequent feed delivery. Only then will producers know if their cows are eating what they are supposed to be eating. Any evidence of feed sorting should be dealt with, thereafter, by making changes in dietary composition, feed components and feeding management.

"Any evidence of feed sorting should be dealt with, thereafter, by making changes in dietary composition, feed components and feeding management."

Quick facts on feed sorting

Research shows that dairy cows sort through their total mixed ration (TMR) selecting for the small grain particles and discriminating against the longer forage components.

Feed sorting can result in cows consuming an inconsistent ration and increased cases of sub-acute ruminal acidosis, a digestive disorder which can reduce milk production, milk fat, and feed efficiency, and increase the risk of laminitis (a painful hoof condition associated with lameness), thus compromising animal welfare.

What to do:

1) Watch what your cows eat by comparing the feed offered to the cows to the feed that remains at the end of the day. Evidence of feed sorting should be addressed promptly – consult with specialists on changes that may be necessary.

2) Consider increasing feeding frequency to at least twice a day. This can reduce the amount of TMR sorting and allow subordinate cows to access feed more frequently.

3) Provide adequate feeding space (the Dairy Code recommends at least 24 in. per cow) so that all cows can feed at once, without competition.

4) Add water to dry TMR – this helps bind particles together making it harder for the cows to sort. Note that adding water to a wetter TMR, containing no dry forage, may increase sorting.

Steel troughs and chlorine effective against Johne's disease

FoodQuality.com
August 12, 2010

New Safety Approach for Dairy Cattle
Adding chlorine to trough water effectively reduces survival of the bacterium that causes Johne's disease among dairy cattle—especially if the trough is made of stainless steel, according to a new study.

"Chlorine is a cost-effective, readily available disinfectant, and trough chlorination should be easy to implement in an agricultural environment," said Kimberly Cook, PhD, a microbiologist at the U.S. Department of Agriculture (USDA) Agricultural Research Service, Animal Waste Management Research

Unit, in Bowling Green, Ky. Dr. Cook was first author of a paper describing the study (Cook KL, Britt JS, Bolster CH. Vet Microbiol. 2010;141(1-2):103-109).

Dr. Cook and colleagues evaluated the hidden sources of contamination where animals may be exposed to Mycobacterium avium subspecies paratuberculosis (Map), the agent that causes Johne's disease. Trough basins are not only a moist and nutrient-rich environment for the bacterium, but they also provide a surface for biofilm formation, she said in an e-mail to Food Quality.

The researchers evaluated Map's ability to form biofilms on four watering trough materials: concrete, plastic, stainless steel, and galvanized steel. The study also looked at the bacterium's ability to persist in the microbial flora within the trough water and to become part of the biofilm on the trough.

"Our research findings suggest that trough materials provide a ready source for biofilm formation," she said. "Biofilms rapidly formed (within three days) and persisted for over 300 days, suggesting that M. paratuberculosis [Map] attaches to trough sides where nutrients are readily available and where it is protected from other microorganisms and from washout."

Stainless steel troughs had the lowest concentration of Map survival, followed by plastic, galvanized steel, and concrete.

The weekly addition of two parts per million of chlorine to the trough water reduced survival of Map on stainless and galvanized steel troughs but not on the plastic or concrete troughs. "Regardless of trough material, the best advice would be to clean troughs routinely to minimize sediment and biofilm formation and improve chlorine effectiveness," Dr. Cook said.

Ketosis in dairy cattle

Ralph Bruno, DVM, MPVM, Texas AgriLife Extension Service (8/12/2010)

The postpartum period is a critical stage of lactation for a high producing dairy cow. This period is characterized by drastic metabolic changes, immunosuppression, negative energy balance (NEB) and elevated levels of stress, which can lead to increased incidence of diseases and decreased animal efficiency. Ketosis is one metabolic disease, frequently observed in high producing herds. Ketosis usually occurs within a few days to a few weeks after calving. It is characterized by low blood glucose, excess ketone bodies in blood and urine, lack of appetite, either lethargy or excitability, weight loss, depressed milk production and occasionally, in cases of severe ketosis, incoordination and neurologic signs. Based on various reports, the incidence of clinical ketosis can range from 2 to 15% and subclinical ketosis from 9 to 34%.

Any factor resulting in a reduction of dry matter intake (DMI) increases the risk for ketosis. Around calving, lactating dairy cows naturally decrease DMI due to the advanced stage of gestation, as well as metabolic changes which occur in this period. This decrease in DMI typically leads to NEB. During the last week of fetal development, the fetus uses approximately 46% of maternal glucose. The onset of milk production makes this energy shortage even more remarkable. When lactation starts, the mammary gland requires a large amount of glucose for lactose milk synthesis. It is estimated that the mammary gland consumes 60 to 70% of the whole body glucose, mainly for lactose synthesis. In this case, a cow producing 66 pounds of milk per day uses at least 3.3 pounds of blood glucose to synthesize milk lactose. The high energy demand during this period of glucose shortage triggers a compensatory process of nutrient partitioning and fat mobilization. During this period of glucose shortage, fat is mobilized as an alternative source of energy. It is used as a fuel for basic cell functions in addition to providing energy to maintain milk production.

In the process, ketone bodies are produced and the excess are eliminated in the urine and milk. Several studies have described deleterious effects of ketosis on animal health and reproduction. Clinical ketosis is associated with an increase of 2 to 3 days to first service and a 4 to 10% reduction in pregnancies per AI at first service. Other researchers have identified an association between ketosis and an increased

incidence of ovarian cysts. Body condition score (BCS) has been linked to metabolic changes during the postpartum period. An elevated BCS at calving is a major risk factor for ketosis.

Cows with elevated BCS at calving (BCS ≥ 4.0) had elevated levels of circulating ketone bodies in plasma. They were at the highest risk of developing clinical and subclinical ketosis compared to cows classified as either a moderate or thin BCS prior to calving. Ketosis is an undesirable disease with a severe impact on animal performance and consequently on the economic wellbeing of dairies. Prevention usually is less costly than treatment associated with production losses.

Due to the increased energy demand required before calving, strategies to prevent metabolic diseases must focus on the nutritional management of the dry and transition cow. The goals of these diets are to provide all required nutrients and to adapt the rumen for future diet changes as cows advance through these lactation stages. To prevent metabolic disorders, diets must be properly formulated to accomplish this goal and to minimize DMI reduction.

Managing BCS towards the end of the previous lactation is an important management practice to minimize ketosis and other postpartum metabolic diseases.

“Few disadvantages' to large herds, say Government welfare advisors

Farmers Guardian
17 August 2010 | By Alistair Driver

THE Government’s farm animal welfare advisers have concluded that there are ‘few disadvantages’ to cows being housed in large herds.

In newly published advice to UK Ministers, the Farm Animal Welfare Council (FAWC) says cows kept in large, permanently housed herds can enjoy a ‘satisfactory standard of welfare’, defined as, ‘at the very least, a life worth living’.

However, it says this is entirely dependent on the quality of stockmanship and certain provisions being met to alleviate the ‘great stress’ these cows are under.

FAWC chairman Professor Christopher Wathes says there are ‘both advantages and disadvantages’ from permanent housing in terms of animal welfare.

Advantages include greater ability to control feed composition and target diets according to need, reduced risk of parasitic infection and summer mastitis, protection from adverse weather and reduced exposure to diseases transmitted by air and wildlife.

But he also identifies a number of disadvantages that he says pose a risk to the fourth of FAWC’s ‘five freedoms’ – the ability of animals to express ‘normal behaviour’.

These include the inability of cows to carry out natural foraging behaviour, the reduced space they have to move in and ‘less environmental choice’. The absence of pasture as a ‘soft, non-slip surface’, and increased risk of physical injury, lameness and some types of environmental mastitis are also labelled as disadvantages.

Prof Wathes calls for further research on how all-year housing affects the ability of dairy cows to express normal behaviour and the extent to which their welfare is affected.

He tells Ministers: “If a dairy cow is to be housed all year round with little or no access to grazing, it is particularly important that housing and general facilities are appropriate such that the cow remains healthy and has the opportunity for good welfare whilst providing the desired milk yield.

“In addition to the provision of resources, good management, highly skilled veterinary care, and adequate numbers of stockmen, stockmanship of the highest standard is essential.

“Provided that these conditions are met and pending the new evidence about the Fourth Freedom, FAWC’s advice is that a cow housed all the year round with little or no access to grazing can have a satisfactory standard of welfare.”

Moving on to herd size, he concludes that there are ‘few disadvantages’ to herds of over 1,000 cows and again states that these animals can have a ‘satisfactory standard of welfare’. This is conditional, however, on the herd being divided into appropriate groups, with each managed according to nutritional and other needs, and stockmanship being ‘of the highest standard’.

“Paradoxically, very large herds have the potential to benefit the individual’s welfare,” he says.

For example, large herds enable a team of ‘experts’, including nutritionists and vets, to be employed on health management and disease prevention, while they are nearly always established on new sites, with modern buildings and equipment and good biosecurity.

However, Prof Wathes ends with a warning about consumer perceptions of large units. “It is our view that their objections to highly intensive farming practices will continue unless significant steps are taken to ensure that consumers become adequately and appropriately ‘informed’ about animal welfare issues,” he says.

Mitigating mastitis pain

By Bovine Veterinarian news staff | Thursday, July 01, 2010
Source: NMC’s April 2010 The UdderQuarter

At the 49th NMC Annual Meeting, Ken Leslie, DVM, MSc, University of Guelph, Ontario, Canada, discussed pain management and mastitis. Leslie looked at both veterinarian attitudes about pain associated with mastitis as well as studies evaluating the use of non-steroidal anti-inflammatory drugs (NSAIDS) for pain mitigation.

A 2006 survey in the United Kingdom asked veterinarians to rate severity of pain associated with mastitis on a scale of 1 to 10. Respondents rated severe mastitis at a pain level of 7, comparable to a fracture or foot abscess. Mild clinical mastitis was only rated a 3, which was similar to ratings given for hair loss on the hock. Women veterinarians in the survey did rate bovine mastitis as more painful than did men.

Researchers have looked for measurable changes in cattle behavior to indicate pain associated with mastitis including respiratory rate, rectal temperature, heart rate, stimulus pressure applied to rear legs and so forth.

A British study found that cows affected with mastitis exhibited greater sensitivity to pressure stimulus applied to the leg nearest the infection. Determining whether treatment with NSAIDS would offer benefit has been more difficult, especially in mild to moderate cases.

Several studies have investigated the affect of using NSAIDS in treatment of mastitis. While results remain unclear, several conclusions have emerged:

NSAID therapy has shown benefits in the treatment of endotoxin-induced mastitis including reduced rectal temperature and heart rate as well as decreased signs of inflammation. In experimental-challenge mastitis studies, cows that received NSAID therapy returned to a normal physiological state more quickly, had faster reduction of inflammation and decreased rectal temperature. There was no change seen in milk production loss.

On-farm results have been difficult to obtain due to the lack of research into naturally occurring mastitis. However, similarities between experimental challenges and natural occurrences of mastitis do exist. Since communication with cattle isn’t an option, researchers will continue to look for new and better ways to answer these questions. However, it’s clear that animal welfare concerns will only continue to grow,

and as an industry, we must continue to strive to provide cows treatment for disease as well as the pain associated with it.

Fighting the effects of dystocia

Bovine Veterinarian
By Geni Wren | Saturday, May 01, 2010

The immediate survival of a calf experiencing a dystocia birth is critical, but the effects of dystocia can put the calf at a higher risk of death or illness in the first four months of life. The USDA NAHMS Dairy 2007 report says that calves experiencing a dystocia have a higher risk of being stillborn. In dairy cattle, stillborn is usually defined as death at or within 24 to 48 hours of delivery. 2002 data from Meyer et al. showed the reported stillbirth rate for dairy calves based on 666,341 calving records was 7%, and a 2007 study by Lombard et al. of three Colorado dairies reported a stillbirth rate of 8.2%.

What dystocia does

Calves experiencing a prolonged dystocia are likely to have low levels of oxygen in their blood (hypoxia), and their blood pH is frequently acidic (acidosis) instead of neutral. These impairments lead to a cascade of events, such as decreased ability to nurse, decreased absorption of IgG, and poor temperature regulation.

Calf problems associated with dystocia are most profound in the time immediately after birth. Dystocia is the major cause of stillbirth and approximately half of the calf losses from birth to weaning occur in the first day of life.

Most deaths that are directly related to dystocia occur within hours after birth and are attributable to physical trauma and to physiological problems associated with prolonged birth asphyxia, explains Frank Garry, DVM, MS, Colorado State University. These include poor cardiac and respiratory function, poor blood oxygenation, poor blood circulation, and resultant poor metabolic function. Dystocia increases the amount of physiologic derangement of newborn calves and decreases the calf's ability to correct these physiological problems.

"Residual physiological problems attributable to dystocia can still kill calves throughout the first two to three days after delivery," Garry says. Problems after that time are typically associated with the common infectious conditions of newborn calves. "Higher death rates in dystocia affected calves after the first two days of life a greater susceptibility to infection because the calf got off to a poor start. I do not believe that a specific cellular mechanism for this susceptibility has been identified."

Calves that experience prolonged hypoxia and survive are often weak and slow to stand and suckle which affects absorption of colostral immunoglobulins and also impairs temperature regulation, notes Jason Lombard, DVM, MS, USDA:APHIS:VS:CEAH, Fort Collins, Colo.

From 2 to 14 days of age calf death is usually attributable to infectious gastrointestinal problems. "Dystocia calves seem to be less capable of dealing with these infectious diseases and therefore have a higher mortality rate when they occur," Garry says. "Most calf deaths from 1 to 4 months of age are attributable to infectious respiratory disease. While dystocia calves are more prone to these problems, this impact is less profound than the tendency to do poorly in the first hours, to days, to two weeks."

Immediate care of dystocia calves

Dystocia calves suffer a greater than normal degree of birth asphyxia and will have both respiratory and metabolic acidosis, will be weak, and will be less responsive than normal calves. Typically the calf will not breathe as well as a normal calf, so it will not take in as much oxygen nor eliminate as much CO2. "This means the calf will have less ability to correct these physiological derangements," Garry says. "In turn, the calf will not rise as quickly and will not use as much muscle activity and will not generate as much body heat." The quickest and easiest thing to do is to provide oxygen through a tube to the nasal passage.

Sam Leadley, PhD, Attica Veterinary Associates, P.C., Attica, N.Y., says a common error is that the farm does not have oxygen on hand to provide supplemental oxygen to the newborn calf when needed. “Another common error is to hold a calf upside down for more than just a few seconds,” he explains. “The mistaken thought is that this position will help drain fluids out of the mouth and nasal passages. It might do that in the first few seconds, but after that time there is a good chance the liquid is coming out of the esophagus, thus the fluids can be aspirated and calf health compromised.”

Leadley says as soon as the calf’s chest is out of the dam, it is not too soon to start oxygen supplementation. Oxygen supplementation may be continued after the calf is on the ground, too. The oxygen flow rate should be about 5 to 10 liters/minute as measured by the flow meter on the oxygen tank or a gentle breeze on your face. Measure the tube from the tip of the nose to the corner of the eye. Do not insert the tube past this measured point. Leadley says the nasal tube not only provides oxygen but it also may irritate the calf enough to cause a sneeze response which will help clear any fluid from the upper airways.

Calf stimulation as soon as the calf is out of the dam is vital to survival. Use a clean bath towel to rub the calf “fluff dry.” “Concentrate efforts especially around the neck and shoulders,” Leadley recommends. “Those areas best stimulate strong breathing responses.”

The calf should be dried so it does not lose as much body heat from a wet hair coat. Even in very modest temperature environments the calf will lose heat because it has a wet hair coat. The act of drying will help stimulate the calf so that it becomes more active. Additional heat can be provided by heating lamp, and Lombard suggests administering warmed colostrum to assist in warming the calf. The simplest measurement that can be done is a rectal temperature, which can be measured at half-hour intervals until the calf is active, alert, strong, and suckling well, Garry suggests.

Leadley adds that the body temperature should be 1-2 degrees above the dam’s rectal temperature immediately after birth. It will then drop to about 102° F within 15-30 minutes and should maintain that temperature. “A typical sign of poor adaptation is a falling body temperature,” he says. “Calves that are very cold may not shiver.”

Respiratory acidosis will be resolved by improved breathing function. In severe cases the calf’s ventilation can be assisted through a tracheal tube, but this is not practical in most farm settings. Making the calf move and sit in sternal recumbency will promote better breathing.

Metabolic acidosis will usually resolve if there is good circulating blood volume. Usually this is provided by promptly giving colostrum to the calf which increases blood volume as fluid is absorbed from the colostrum. In more severe cases, IV fluids can be administered. Only the most severe cases need additional bicarbonate.

Research has shown that calves with respiratory acidosis or low blood oxygen absorb immunoglobulins less effectively. Low oxygen and high CO2 contribute to poor cellular respiratory function in all tissues that have high metabolic rates. “Plausibly, this should have an adverse effect on many cellular functions of the newborn calf,” Garry says. “It is worth noting that just like other problems in dystocia calves, decreased immunoglobulin absorption is not uniform across all affected individuals. Some calves administered normal amounts of colostrum will still show good immunoglobulin transfer, while other affected calves will perform poorly.”

Lombard adds that it appears that 10-20% of non-dystocia calves will not have adequate passive transfer even when given adequate colostrum and “we don’t have a good explanation for failures in these calves, either.”

Garry recommends that dystocia calves are given colostrum for both the first and the second day of life, amounting to four quarts in the first day and four quarts the second day.

Urge clients to be proactive

Garry says the most common mistake in handling a dystocia calf is making the assumption that it is normal until it proves otherwise. “This wait-and-see attitude usually means the calf got off to a poor start and continued to do poorly until a problem was observed. Many calves after dystocia still look pretty normal for the first 15 minutes to half an hour while they have high circulating catecholamine levels. Then they get quiet, depressed and weak rather than looking stronger and standing and moving around.” Therefore the best approach is to assume the calf needs help, dry it promptly, put it under a heat lamp, and make sure it is making vigorous attempts to stand and move and breathe.

Many of these calves are probably tubed with colostrum soon after birth and not monitored for an extended period of time, Lombard says. “So no one observes the calf crashing.”

It’s best to assume a dystocia calf needs help, even in the absence of specific measurements. Garry believes all dystocia calves should be treated and monitored more closely to see that they are dried promptly, kept warm, stimulated to move, provided supplemental oxygen, and promptly given colostrum. “The required treatments are basically supportive care, and will do no harm in the case where the calf does not need them.”

Although it makes sense that a mild dystocia calf will be mildly affected and a severe dystocia calf will be severely affected, in reality the correlation is not that close, Garry explains. “Some calves with mild dystocia will have very significant problems. Many calves that suffer severe dystocia will actually survive quite well. This explains in part why many producers are not as proactive as they should be in treating dystocia calves. When they have seen calves affected by severe dystocia perform reasonably well, it removes some of the urgency of the need to do something special.”

Lombard agrees. “Although almost half of calves with severe dystocia will die before weaning, if the death occurs a period of time from the dystocia event, the producer does not link the dystocia and the death.”

Records should be kept of all deliveries so calf performance can be later analyzed to see if dystocia calves are performing adequately. On average, dystocia calves will have higher levels of sickness and death which should prompt closer attention to the calf immediately after delivery. Leadley tries to keep track of the calves that had a hard time coming into the world. An old cow tag clipped to the top front of their hutches can flag them for special attention. “In addition to being badly stressed, a fair proportion of these calves can have broken ribs,” he says. “Some TLC is called for when handling the calves even when getting them into their hutches.”

Leadley tries to be more lenient with leaving dystocia calves on a bottle longer than other calves. “At risk of over-treating calves I probably started treatment for pneumonia symptoms for these calves a little sooner than for ‘un-assisted delivery’ calves as well.”

“If calves right after birth are being assisted and cared for most of the residual problems will be greatly diminished,” Garry says. “Anything you are going to do to improve the performance of dystocia calves needs to be done within the first minutes to hours after delivery. Just like administering colostrum, care of the newborn calf needs to be done right after delivery, otherwise it is too late.”

Play behaviour in dairy calves

The Dairysite
August 13, 2010
Charlotte Johnston, TheCattleSite junior editor reports.

Speaking at the Boehringer Animal Well-Being conference held in Barcelona, Margit Bak Jensen from the University of Aarhus, Denmark looks at play behaviour as an indicator of welfare in dairy calves.

What is play behaviour?
Play behaviour in young animals includes elements of their functional needs, such as flight, fight, sexual and predatory behaviour.

It allows the development of skeletal muscles, modifications of skeletal muscles and the brain, self-assessment of physical and social abilities and training of flexible responses to unexpected events.

Play behaviour in calves may be seen among suckled calves on pasture as they spontaneously start galloping around as a group. Housed in pens calves often buck as a response to provision of fresh straw bedding, or after released from their pens into a novel and large area.

Calf play behaviour includes fast galloping, interrupted by sudden change of direction, bucking, hind leg kicking, body rotations and twists.

This behaviour includes elements of defence and fight, but during play behaviour these elements are exaggerated, repeated and more variable.

Social play includes postures and interactions seen during aggressive interactions, but play does not result in flight or submission.

How can it be used to measure welfare?
Juveniles are motivated to play when their primary needs are met and when they feel no serious threats or challenges. Moreover, the performance of play behaviour is believed to induce positive emotions. Thus play behaviour relates to animal welfare in two ways; by indicating the absence of poor welfare and the existence of good welfare.

How is play behaviour motivated?
Ms Jensen said that previous research looking at the quantity of milk fed to dairy calves showed that dairy calves on an ad libitum diet played more than their peers, on limited amount of milk.

She highlighted that research has shown weaning off milk results in a drop in play behaviour, however only for 24 hours.

The effect of illness on play behaviour has not been fully investigated, however Ms Jensen noted that castration eliminated play behaviour in lambs.

Play behaviour as an indicator of welfare.
Ms Jensen's research reached the following hypothesis:
The absence of motivation to play indicated a state of poor welfare.

The presence of motivation to play indicates a state of good welfare.
Ms Jensen warned that although presence of motivation to play may indicate that the primary needs of an animal are met, only the performance of play behaviour may be taken as indicative of a positive emotion.

How does the physical environment affect play behaviour

There are two ways that physical behaviour may affect play behaviour. Firstly environmental constraints such as lack of sufficient space, lack of play partners or lack of suitable objects to play with may prevent play behaviour.

Secondly, stimuli in the environment may reduce or increase stimulation to play.

Ms Jensen said that the housing of calves in small individual pens does not allow full social contact and thus prevents the performance of social play.

Her research has shown that space dictates the performance of locomotor play behaviour, as an animal can only move in the space provided. Studies show that small individual pens limit locomotor play behaviour, whilst group housing will generally give animals more shared space to play. Increasing the space allowance for group housing doesn't only increase locomotor play but also the general occurrence of play behaviour.

Early on in life, social interaction is much more important for calves, Ms Jensen said. As they grow, space becomes increasingly important to stimulate play.

Developing play behaviour
Ms Jensen questioned whether play behaviour was always a positive welfare indicator? Play is, by definition, without the function of the original behaviour, however in some reports social play in piglets has ended in fight. In cattle, the tendency for social play to develop into real fights increases as the animals reach maturity, and here it is important to realise at which stage the behaviour may develop into serious interaction.

The future
Ms Jensen says that is may be possible to record play behaviour automatically in the future. An accelerometer attached to the leg of the calf could distinguish between walking, trotting and galloping, as well as counting the number of steps taken in each category.

There is much more scope for the benefits of play behaviour. Little research has been done to see how play behaviour is affected by environmental conditions, such as lighting and temperatures. Further more there is the scope to see what the economic benefits of play behaviour are, including long term research into weight gains, fertility and milk yields.

Ms Jensen's and others research suggests that play behaviour in juveniles is a indicator of good welfare. Ms Jensen concluded by saying that focus on validation of play behaviour as an indicator of positive emotions in dairy calves, identifying 'play markers' and developing techniques to automatically record play behaviour will allow the industry to relate play behaviour to various housing and management conditions, as well as to health status's on commercial farms.

Transition cow management

By Bovine Veterinarian news staff
(8/24/2010)

There are a variety of factors involved in the health and productivity of transition dairy cows. Speaking at the 2010 AABP-AVC meeting, Ken Nordlund, DVM, Dipl. ACVP-Dairy, University of Wisconsin, outlined some of the most critical areas for success. Field studies of transition cow management using Transition Cow Index as the outcome variable have shown that housing constraints are the major risk factors for fresh cow health in freestall dairies today.

Bunk space
Sufficient space at the feeding fence for all transition cows to eat simultaneously appears to be the most important determinant of transition cow performance in our current industry. Nordlund recommends a minimum of 30 in. of bunk space per Holstein cow in pre-fresh and post-fresh pens for a 90-minute period after fresh feed is delivered and after every milking.

Video studies suggest that lactating Holstein cows will voluntarily fill a bunk at a spacing of one cow per 30 inches. It is likely that pregnant prepartum cows would take even more space than lactating cows.

Nordlund prefers to build special needs pens to accommodate the surges in numbers of special needs cows. He recommends sizing close-up and fresh pens for 140% of the average number of calvings, which will mean that these pens are overstocked less than 10% of the time. Each stall and headlock in a prefresh pen has an impact on the start of somewhere between 10 to 15 lactations each year. Because of the multiplier effect on the start of the lactation of so many cows, it is critical that these facilities are excellent and available to all cows.

Pen moves and social stress
Each pen move requires that a cow familiarize herself with the surroundings, as well movement into a new social group also creates stress as the cow establishes rank within the group. Work with mid-lactation cows has shown reduced time spent eating, increased feed evictions, and reduced milk yield

following a pen move. Minimizing the number of regroupings through the transition period is consistent with successful transition programs.

In pens where cows enter at intermittent intervals, like a week or more, extended stays in such pens are considered more desirable than in pens with entries and departures every day. Isolation from the herd creates stress for a cow and separating a single cow into a separate calving pen for more than a couple of days appears to be a practice with high risks for fresh cow health.

Dry and close-up pens
The traditional close-up pen is based upon cows entering the pen approximately 3 weeks prior to due date.

Generally, movement of single animals should be avoided as it is believed that familiarity and social bonds among 3 to 5 to five moved animals may reduce the social stress of integrating within a larger group.

Nordlund says the optimal transition cow pens would be based upon an all-in pen where a cohort of cows due to calve within a short period of time, such as a 7 to 14-day day window, are assembled with no further additions through the calving process. The usual policy would be to periodically move entire pens of cohorts intact into the next pen to keep the cows near due date in a location proximal to the calf delivery facilities. Advantages include establishing group stability, eliminating the need to lockup dry cows and remove close ups and more meaningful monitoring of dry matter intakes.

Calving pens
If the calving pen has a stable social structure (no additions), extended stays are fine. If new cows are continually being added, Nordlund recommends that the duration of stay be limited to 48 hours maximum. Field data shows dramatic increases in ketosis and displaced abomasums and early lactation culling of cows that stay 3-10 days in daily-entry group calving pens.

Moving cows to calving pens once calving has begun effectively minimizes the time in high turmoil pens, but requires round-the-clock labor to check and move cows. Freestall pens can be designed to facilitate this practice with the construction of two-row head-to-tail arrangements of the stall rows. With the tails of all cows visible from the central feed alley, the observer can monitor each cow without disruption. Workers should not move cows into calving pens too early. One report showed that moving cows when in labor but with only mucus showing had 2.5 times the rate of stillbirths as cows that were moved when the calf's feet or head were showing. If cows are moved to individual box stalls for calving, the duration of stay should be limited to a matter of a few hours.

Surface cushion
A loose, deeply bedded surface has emerged as a major factor for improving fresh cow TCI scores. In freestall herds, sand-based stalls were associated with more than a 1,000-pound TCI advantage over herds with mattress freestalls. Similarly, depth of loose bedding under shades emerged as a risk factor affecting herd average TCI scores in open lot dairies.

Studies of sand and mattress freestalls show that cows with elevated locomotion scores change their behavior on mattress stalls, but not on sand, and may explain the substantial improvement in fresh cow performance on sand surfaces.

Amply-sized housing
A deeply bedded pack is the probably the preferred housing for close-up cows in confinement housing. The guideline of 100 sq. ft. of space/cow includes the bedded area only and assumes that cows have access to an external feeding alley or outside lot. If the feeding area is continuous with the bedded pack, the space should provide a minimum of 120 sq. ft./cow with good bedding covering most of the area.

Stalls for prepartum Holsteins and Jerseys should be at least 50 and 45 in. wide, respectively. Length is the distance between the outer corner of the rear curb to the point where the stall surface touches the brisket locator. If there is no brisket locator, the total stall length is the stall resting length. This distance should be greater than 70 and 63 inches for Holstein and Jersey cows, respectively.

For a stall to be considered low-risk for Holstein cows, the total stall length should be at least 9 feet long with no obstructions to forward lunge and bob. If the stall is less than 9 feet, but the lower side rail is 11 inches above the stall bed or less, it should allow side lunging and is considered an average risk for transition cows. If the stall is less than 8 feet and has obstructions to side lunging, such as lower divider rails greater than 13 inches above the stall bed, the stalls present major risks to successful transition performance. Finally, the neck rail should be approximately 48-50 inches above the stall surface.

In open lot dairies, transition cow facilities should provide at least 45 square feet of shade per cow with loose bedding at least 3 inches deep below the shade.

Screening program
The practices of the herdspersons of the elite transition programs in Nordlund's study were remarkably similar: delivery of fresh TMR while fresh cows were being milked, palpation of udders for fullness while being milked, observation of cow demeanor as the cows returned to the pen, i.e., does she go to feedbunk or does she lie down, and an assessment of appetite and attitude. Herdspersons in the elite herds knew and cared about the fresh cows under their watch.

Cows that do not lock-up, or cows that lock-up with suppressed appetite or signs of depression were examined. Other examination procedures including rectal temperature, observations for vaginal discharge, ketosis, displaced abomasum, lung sounds, etc., were conducted when primary assessments indicated further evaluation.

Formal screening procedures that lock cows up for a period of 1 hour or less per day are considered optimal. Cows are capable of compensating for a 1-2 hour change in routine; if lock-up is prolonged and in association with other stressors, the ability of the cow to compensate and catch-up on lying time may be exceeded. Extended lockup time adds substantially to the stresses of transition.

Location also has impact. If the cows have access to feed while being examined, feeding and the screening can proceed almost simultaneously. Screening time at a palpation rail, for example, must be weighted as riskier than equivalent time in lockups over feed.

Calf pen moves are making me dizzy

By Dairy Herd news source | Tuesday, June 01, 2010
Source: Dairy Calf and Heifer Association

Most dairy research scientists as well as dairy operators agree that calves that are weaned and moved from individual pens to group pens experience stress that makes the calf more likely to become ill than it would if those stresses did not exist.

One of the practices that is generally followed is to move calves from individual pens to groups of four to eight calves, then move them to somewhat larger groups, and perhaps move them to still larger groups as they age. This practice is based on the belief that the calf will suffer less stress with the step-wise increase in group size than it would suffer if it is put in a large group pen directly out of the individual hutch or crate. However, these assumptions may not be correct.

Extensive and numerous research efforts have shown that many biochemical changes occur in the body of a calf that is subjected to any type of stress. Typically, these stress-induced changes cause the calf to be more likely to develop some type of disease. Events and conditions such as weaning, transportation, being moved to a new pen, being grouped with calves with which it has had no previous contact, a change in feed and new objects in its environment can all cause stress. Research has also found that the stress of the event lasts for one to two weeks, and, during this time, the calf's immune system is compromised, making it more likely that the calf will get sick. Biochemical and immunopathology research has shown that the mucus lining of the respiratory system - the body's first defense against respiratory disease - undergoes significant changes in response to stress, which may help explain why calves are so likely to get respiratory disease.

Thus, each time we move the calf to a new pen, we subject the calf to a period of one to two weeks in which its ability to resist disease is weakened, while at the same time it may be subjected to disease organisms to which it has not previously been exposed. If we move the calf three times, then each time we move the calf the same increased susceptibility to disease occurs. If the calf stays in the same physical pen, and unfamiliar calves are moved into the pen, a less severe stress response occurs.

Repeatedly regrouping calves is not only labor-intensive, but you may not be improving your chances of having disease-free calves: (a) you are repeatedly stressing your calves, and (b) if you have a disease in one pen, by regrouping you may move the disease to another, larger, group of calves.

HOGS

Effects of transport conditions and vehicle design on the welfare and meat quality of pigs in Canada

Prairie Swine Centre Annual Report 2009.
When transporting hogs to market, pigs in the bottom front compartment had the highest heart rate measures at unloading, and also produced the highest incidence of DFD pork, according to J. Brown, T. Crowe, S. Torrey, R. Bergeron, T. Widowski, J. Correa, L. Faucitano and H. Gonyou in the Prairie Swine Centre Annual Report 2009.

Summary
This study examined transport conditions and behavioural and physiological responses of pigs transported in summer and winter, in both Eastern and Western Canada. Data were collected during all stages of transport, including loading, transport, unloading and lairage (waiting) at the abattoir. Measures included truck temperature, pig behaviour, core body temperature, heart rate, blood measures of stress and meat quality.

The presence of steep internal ramps in pot-belly trailers had a significant impact on the handling behaviour and heart rate of pigs at loading and unloading. Significant variation in temperatures was found between compartments within pot-belly trailers during transport, both in summer and winter.

The combination of handling conditions and truck temperatures had a significant impact on pork quality. In the winter trials, a higher incidence of dark firm and dry (DFD) or moderate DFD pork was found, especially in the west where pigs experienced longer transport times. In the summer trials, a higher incidence of pale, soft and exudative (PSE) or moderate PSE pork was found.

Introduction
Transport conditions (including loading and unloading procedures), and the design of transport vehicles can have a significant effect on the welfare of pigs, and on the economics of pork production. A recent Ontario survey found that death losses during transport were 0.17 per cent. The mortality rate across Canada has been estimated at 0.10 per cent, and corresponds to approximately 1,400 tonnes of pork lost per year.

Most research on the effects of transport conditions on pigs has been done in European countries where moderate temperatures and shorter transport distances prevail. In comparison, swine transport in Canada is highly variable in terms of the types of vehicles used, distance of transport, and seasonal changes in temperature.

The objective of this study was to examine the influence of transport conditions on the behaviour, physiology and welfare of pigs in eastern and western Canada, in both summer and winter. Our goals were to evaluate differences between truck types, truck compartments and seasons in each region, and to use this information to identify problem areas and potential solutions.

Experimental Procedures

Trials were conducted both in summer and winter, with six trials per season in the east (Quebec) and west (Saskatchewan and Manitoba). Animals transported were market weight pigs, including both males and females, averaging approximately 115kg liveweight. A total of 24 truck-loads (total of 3,756 animals) were transported in the east, and 12 truck-loads (total of 2,145 animals) were transported in the west

In western trials, a dual-purpose (cattle and pig) dual-axle pot-belly (PB) truck was used to transport pigs, containing 5 internal ramps to move pigs to different levels within the truck. In eastern trials, two types of trucks were used: a double deck 10 wheel truck (10W) and a tri-axle pot-belly trailer (PB, Figure 1). The 10W truck had no internal ramps, and the PB truck used two internal ramps to move pigs onto the upper and lower decks. Loading density on all trucks was 0.41 m2/pig. The western pot belly truck carried 195 pigs per load, while the easter pot belly truck carried 228 and the 10W truck 85 pigs per load.

Temperatures on trucks were monitored, as was the behaviour of pigs during loading, transport, unloading and lairage. Behaviour during transport was recorded on all trucks using still image digital cameras to determine the percentage of animals standing, sitting or lying during transit. During the lairage period, behaviour was recorded using video cameras to determine the number of pigs lying.

Physiological measures, including core body temperature, heart rate, and blood indicators of stress (lactate and CPK), were collected on a total of 504 animals in the east, and 330 in the west.

Carcass and meat quality data were collected on 792 pigs in the east and 495 pigs in the west. Skin damage was assessed as a measure of aggression. Pork quality was assessed in loin and ham muscles, including pH measured at six hours and 24 hours, light reflectance and drip loss.

Data from the western and eastern trials were analysed separately. Statistical analysis was used to determine differences between seasons and truck compartments, as well as between truck types in the eastern trails.

Results and Discussion
The comparison of truck types in the eastern trials indicated that, overall, transporting pigs on the 10W truck provided superior results in terms of reduced death losses and improved welfare. Compared to the PB truck, pigs took less time to load and unload on the 10W truck, and showed fewer incidents of slipping, falling, backing and balking during loading and unloading. The 10W truck provided more consistent internal temperatures, whereas temperatures within PB trucks varied significantly.

Measures of CPK and lactate were also lower in the 10W truck. Differences between HR and core body temperatures on the two trucks are less clear in terms of their effects on welfare. Pigs on the 10W truck had lower core body temperatures at the farm, but higher temperatures and HR during transport. These differences are likely due to the study protocol, as the 10W truck was always loaded last, giving pigs on the 10W less time to acclimatise before transport. Thus pigs on the 10W truck experienced the additive effects of loading and transport.

On PB trucks, significant variation was found within the truck, both in terms of truck microclimate and the response of pigs. In both eastern and western trials, compartments that required negotiation of ramps and turns had the greatest impact on physiological measures in pigs. In the western PB truck, the bottom front compartment (or 'nose') was accessed by two ramps, and was also the warmest area on the truck.

Pigs in the bottom front compartment had the highest HR measures at unloading, and also produced the highest incidence of DFD pork. Pigs in the upper-level compartments had higher HR and core body temperatures during loading and waiting on the farm. The upper compartments were also cooler during the transport period, and this may benefit pigs in summer but be detrimental in winter. It should be noted that pigs in this study were transported in early morning, and different results may have been found if pigs were transported in midday. Pigs loaded on the middle deck of PB trucks did not have to negotiate any internal ramps, and these animals also showed lower HR during transport, and lower CPK and lactate levels at slaughter.

The effect of season was significant but the effects varied between eastern and western trials. In western trials, higher HR and core body temperatures were found in winter, and CPK and lactate levels were also

higher in winter. Whereas in the eastern trials, HR and core body temperature were higher in summer, as were blood lactate levels. Pigs in the west experienced a much longer transport time (roughly eight hours versus two hours in the east) and colder winter temperatures, and thus winter transport may pose a greater challenge in these conditions. In contrast, pigs in the east had a short transport time, and experienced higher summer temperatures and increased death losses in summer (Table 1), suggesting that summer transport may be a greater challenge under these conditions.

Table 1. Incidence of death losses and compromised animals at unloading in Eastern and Western trials

Region	Western trials		Eastern trials			
Truck type	Pot belly		10 Wheel		Pot belly	
Season	Summer	Winter	Summer	Winter	Summer	Winter
N	1167	953	510	512	1368	1367
NANI* (n)	0	0	1	0	7	1
NAI* (n)	0	2	0	0	2	1
Death loss (n)	1	0	1	0	6	1
Rectal prolapse (n)	4	2	1	2	2	13

* NANI: Non-ambulatory, non-injured. NAI: Non-ambulatory, injured

Implications
Transporting pigs on trucks such as the 10W truck, which do not require the use of internal ramps, provides benefits in terms of improved welfare and ease of loading. Unfortunately, these trucks are less economical as they have much reduced capacity compared to PB trucks. In the long run, alternative designs should be sought, such as trucks including hydraulic lifts and/or minimal ramps, to minimize handling stress at loading and unloading.

On the PB trucks, compartments involving ramps and turns had the greatest impact on pig welfare in terms of HR and core body temperature.

Further studies will examine the effects of ramp angle and alternative ramp configurations on the stress response of pigs. The PB trucks also showed significant variability in temperature between different compartments.

Further research should be done to assess ways of controlling truck conditions to retain heat in winter, while exhausting moisture, and to increase cooling in summer. Potential solutions include adjusting panelling/vent configurations to optimise air flow, addition of insulation, use of fans, adjusting pig density, or sprinkling pigs in hot weather to increase evaporative cooling.

Due to the different results observed in eastern and western trials, future studies in the east will focus on ways of cooling pigs in summer, while studies in the west will focus on the effect of transport time on the welfare and meat quality of pigs.

Acknowledgements
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Heat treatment improves piglet growth and health status

PigProgress
06 Oct 2010

Recent research indicated that using gelatinisation during cereal product production for piglets results in a rapid reduction in viscosity and optimal nutrient intake in the small intestine. All these positive effects lead to faster growth and a better health status for the piglets.

The trials were carried out by cereal and animal nutrition company Meneba, headquartered in Rotterdam, the Netherlands. The company had research conducted into an intensive heat treatment, used during the production of its puffed cereal product range Presco.

Starch utilisation
The company writes: "For better starch utilisation, the starch needs to be mechanically or thermally gelatinised. The thermal treatment also affects the viscosity of the mass in the stomach and the intestine and therefore nutrient intake.

"For thermal gelatinisation of starch in cereals, Meneba has developed the Presco process. This process has positive benefits over other techniques such as steam flaking, micronising, expanding and extruding. In vitro tests, performed at the independent research centre Schothorst Feed Research, clearly showed these positive benefits."

Process
The Presco process produces starch gelatinisation. Cereals are treated under high pressure (20-25 bar) with overheated steam for 15 to 30 seconds. By suddenly reducing the pressure, the grains expand rapidly and destroy the crystal structure of the starch entirely.

Both ileal digestibility and faecal digestibility of the starch and organic matter were proven to be better than other gelatinisation techniques, in in vitro-tests at the independent research centre Schothorst Feed Research, the Netherlands.

This is caused by microbial fermentation in the large intestine: anything that remains undigested in the piglets' small intestine ferments in the large intestine. Too much fermentation in the large intestine is harmful.

Viscosity
Because of their high degree of gelatinisation, the products Presco maize and Presco wheat remain in the stomach for longer. This enables the piglet’s protein-splitting enzymes to digest the protein in the feed more effectively. This results in higher ileal amino acid digestion.

Improving design of trucks used to move swine

The PigSite
July 29, 2010

CANADA - Research conducted by the Saskatoon based Prairie Swine Centre suggests changing the design of vehicles used to transport swine to reduce stress and cut losses during transport and improve meat quality, writes Bruce Cochrane.

Researchers with the Prairie Swine Centre have completed a study which looked at the effects of transport conditions and vehicle design on the welfare and meat quality of pigs in Western and Eastern Canada.

A typical pot bellied truck used for transporting pigs to market has ten compartments on three levels.

Dr Harold Gonyou, a research scientist in animal behavior, says there is considerable variation in the amount of effort it takes for a pig to get to the different compartments.

“Some compartments they simply walk straight on, other compartments they have to go up a ramp, in some compartments they have to go down a ramp on the truck and in fact there are some that are configured so that they have to go both up and down a ramp to get to the compartment when they are

loaded and of course the reverse happens when they come off so the amount of effort getting to a compartment differs.

We fund that there are a couple of compartments that were more stressful.

In general anytime a pig has to go up or down a ramp it causes more stress and so we would see a higher heart rate on those pigs, we'd see a higher body temperature on those pigs when the truck initially started out and also when they unloaded at the plant you'd see animals that were a bit more stressed because they had to do this extra climbing getting in and out of the truck.

That had an effect on meat quality.

Some of the animals in each of those compartments showed meat quality issues related to stress.

So we saw differences in compartments.

We also saw differences in terms of the stressfulness of the transport in eastern Canada, when we did it in Quebec versus Western Canada and interplaying on the seasons as well. “

Dr Gonyou recommends changing the design of these trucks to reduce the numbers of ramps the pigs have to encounter and making improvements to the ventilation of these trucks.

Group size and alley width affect the movement of market pigs

Prairie Swine Centre 2009 Annual Report.
September 2010

When handling near-market weight hogs, group sizes of four or eight pigs are preferable for minimising stress based on handling and behavioural measures, according to L. Kavanagh, S. Goumon and H.W. Gonyou in the Prairie Swine Centre Annual Report.

The objective of this study was to examine the interaction between group size and alley width on the ease and speed of movement of near-market pigs. Pigs were moved in different group sizes through a three-sided simulated handling course, in which alley width could be changed. Data were collected on heart rate, duration, handling and behavioural measures.

Moving a group of four or eight animals is preferred for minimising stress and alley width of 0.9 metres appears to be most conducive to easy handling.

Introduction
Current recommendations advise that pigs should be moved on farm in small groups of five or six. However, packing plants routinely move groups of 25 to 50 pigs with ease from lairage pens to the squeeze tub. One difference is in facility design. On farms, the alley is generally limited to the width of two pigs (approximately 0.6 metres), whereas in plants the alleys may be tow to three metres wide. Therefore, handling challenges and stress related to larger group sizes on farms may be due, in part, to crowding resulting from space limitations. As farms increase the number of pigs handled and loaded each week, specialised handling and loading facilities may be warranted in order to minimise stress, speed the process and reduce labour costs. In this perspective, the Prairie Swine Research Centre group examined the interaction between the group size and the alley width on the ease and speed of movement of near-market pigs.

Experimental Procedure
This study was undertaken at the Prairie Swine Centre. Forty-four finishing pigs within three weeks of market, weighing between 100 to 115kg, were used each day during this trial. A randomised block design was used with treatments in a 4×4 factorial arrangement: 1) alley width (0.6, 0.9, 1.2 or 2.4 metres), and 2) group size (four, eight, 12 or 20 pigs). Alley width sizes were based on the shoulder widths of pigs

(approximately 30cm) and included two, three, four and eight body widths (0.60, 0.9, 1.2 and 2.4 metres). Five replicates of each alley width, group size combination was undertaken.

Pigs were moved through a three-sided simulated handling course (Figure 1). One handler was used, moving the pigs with paddle and board only. Once the animals were moved from the holding pen to the starting pen, they were left for five minutes to rest and to acclimatise to the pen and unfamiliar pigs. After the run of the course, pigs were held in the end pen for five minutes before being returned to their respective holding pens.

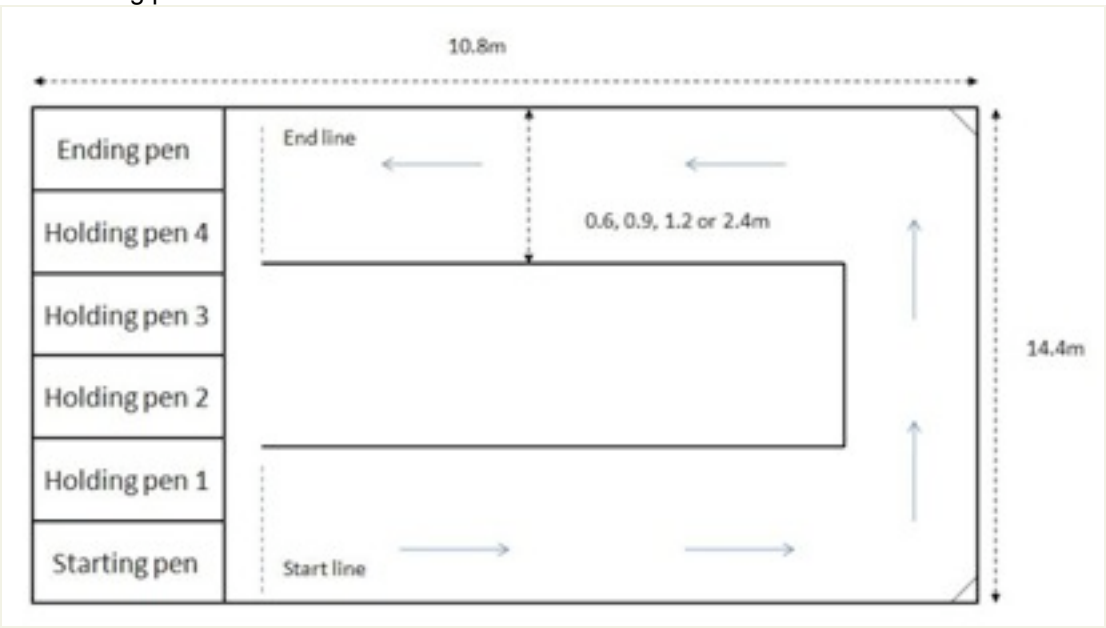

Figure 1. Handling Course

Heart rate data were collected from five minutes prior to running the course, while pigs where in the starting pen, and until five minutes after the end of the run while pigs waited in the end pen. Each run of the course included two pigs wearing a heart monitor. Pigs were also scored for vocalisations (squeals), turn-backs, piling, slipping and falling events. The time to complete the course was measured. The number of touches and slaps given by the handler to move pigs through the course were recorded. At the end of each run, the handler also provided a subjective rating of handling ease or difficulty using a visual analogue scale where 'minimal difficulty' was labelled at one end, 'average difficulty' in the centre of the scale, and 'maximum difficulty' at the end of the scale.

Results and Discussion

Pigs moved in groups of 12 or 20 emitted more squeals than those moved in groups of four or eight (figure 2). They took significantly more time to complete the course (figure 3) than smaller groups (four or eight animals).

In addition a significantly higher number of turn-backs were also recorded when pigs were moved in groups of 12 or 20 (compared to four or eight), and in group size eight compared to four (figure 4).

This highlights the challenge of moving animals in larger group sizes, which results in a stressful situation. The handling measures (figure 5) showed that handling became more challenging as group size increased. This matches the results found for the behavioural measures in that group size of four was rated as easier to manage by the handler than larger group sizes and group sizes of four and eight required less handler intervention than group sizes 12 and 20.

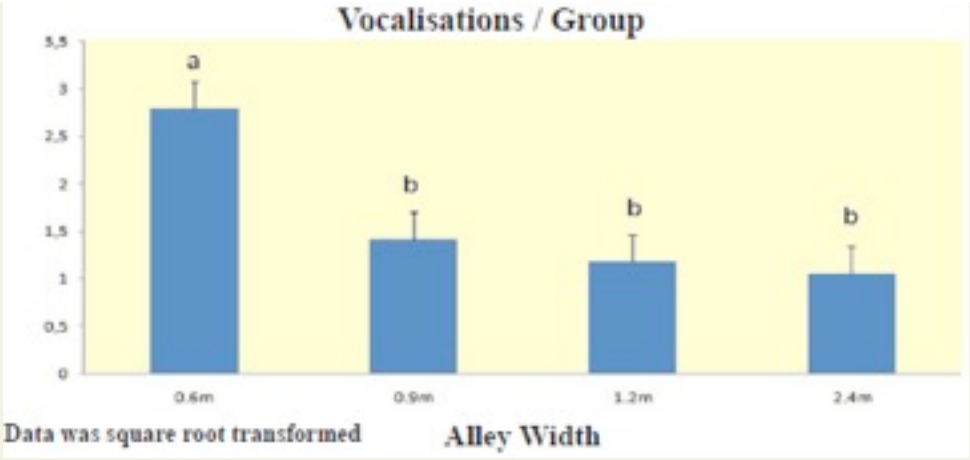

Figure 2. Number of vocalizations for each alley width

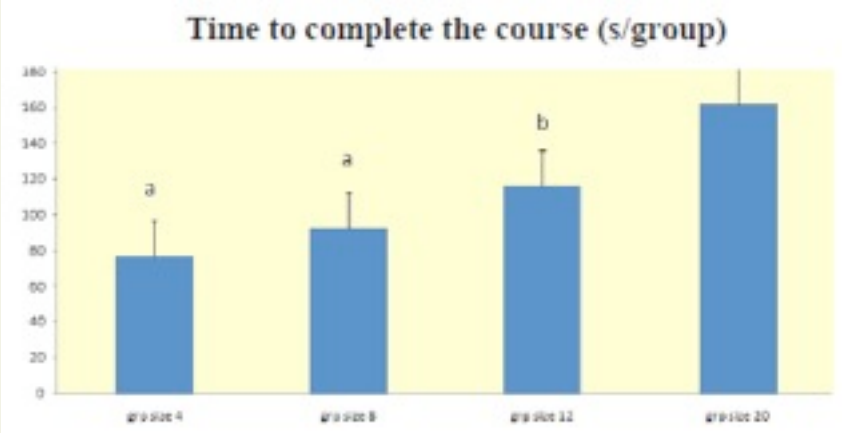

Figure 3. Time to complete the handling course for each group size

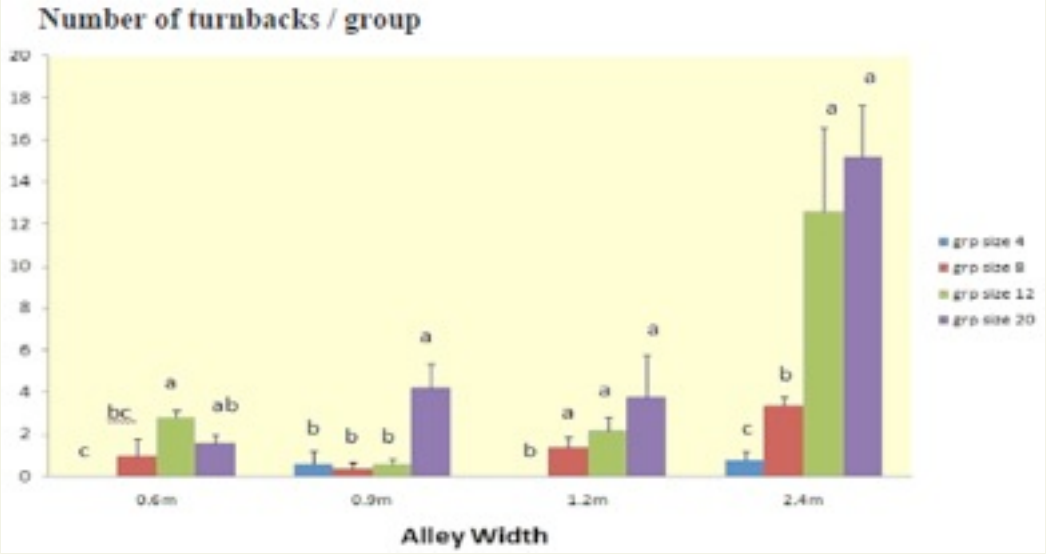

Figure 4. Interaction between group size and alley width

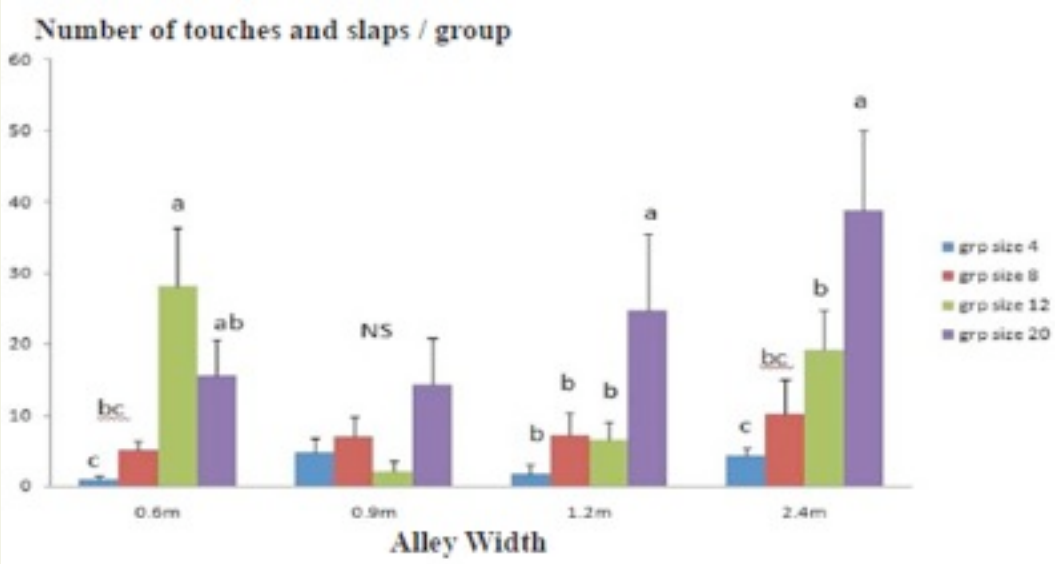

Figure 5. Interaction between group size and alley width effects on the number of touches or slaps given by the handler

Overall, the results from the behavioural and handling measures indicate that group size of four is preferred, based on the number of turn-backs and the subjective handling scored, or that group sizes of four and eight are equally superior to the larger group sizes, based on measures of vocalizations and handling (touches and slaps).

The number of touches and slaps administered by the handler (figure 5) suggest that the middle alley widths of 0.9 metres and 1.2 metres are most conducive to easy handling.

However, an interaction between group size and alley width for the handling intervention measure of touches and slaps was found and suggests the alley width of 0.9 metres is preferable as there was no significant difference found between group sizes on this measure. In addition, the number of touches and slaps given were relatively low compared to those given in group size 20 in the wider widths of 1.2 metres and 2.4 metres. The higher number of squeals emitted by pigs when moved in alley width of 0.6 metres (figure 2) compared to the wider widths was a reflection of the tight space causing pigs to bump into other pigs and/or bunch up.

The increased difficulty in managing pigs in a wide alley width was the reason for more turn-backs in the 2.4 metres alley width compared to the smaller widths. Moving pigs in groups of 12 and 20 resulted in many more turn-backs (figure 4) in the alley width size 2.4 metres compared to 0.9 metres, for example, where the number of turn backs is uniformly low in group sizes of four, eight 12.

An interaction between group size and alley width was found for turn-backs and confirms this as the difference in the number of turn backs between group sizes increased dramatically when the alley width was set at 2.4 metres.

A higher average heart rate was measured in group size 20 compared to group sizes of four and eight animals during the pre- and post-periods (table 1). This difference was likely a result of stress from mixing with unfamiliar pigs. Pigs sometimes fought during these periods. Thus, when released from the start pen to run the course, heart rates may have lessened for the pigs experiencing higher stress as a result of mixing as they were given the opportunity to escape a conflict situation.

Furthermore, although the researchers found higher maximum record heart rates in group size 20 compared to groups of four or eight pigs during the run, the physical activity of the run may have confounded the accuracy of heart rate measures.

Table 1. Heart rate data

	Group Size			
	4	8	12	20
Pre HR Average*	11.22^{bc}	11.16^{b}	11.64^{ac}	11.92^{a}
Run HR Maximum	175.1^{b}	175.9^{b}	186.6^{ab}	192.5^{a}
Post HR average	133.2^{bc}	129.6^{c}	141.1^{ab}	146.8^{a}

* transformed data; Means with different letters in the same row are significantly different ($P<0.01$).

Implications
Maximising the ease with which animals are moved and handled requires taking into account a variety of factors. The results support the current recommendations and suggest that moving pigs in group sizes that are appropriate for the alley width used can reduce handling time and contribute to improved welfare.

This study could be extended in order to assess the effect of ramp widths on pig's movement during loading and unloading.

Acknowledgement
Strategic programme funding provided by Alberta Livestock Meat Agency. Project funding provided by Sask Pork, Alberta Pork, Manitoba Pork Council & Saskatchewan Agriculture Development Fund.

Free space utilisation by sows in free access stalls

Prairie Swine Centre Annual Report 2009.
Sows housed in the pens arranged in a T-shape used the free-space area significantly more than the sows housed in pens arranged in an I-shape, according to F.C. Lang, S.M. Hayne, V. Heron and H.W. Gonyou in the Prairie Swine Centre Annual Report 2009.

Summary
With announcements by the largest producer/packers in the USA and Canada that they will transition all of their production facilities to group housing for sows over the next ten years, North American producers are anticipating change.

The objectives of this study were to compare two pen configurations fitted with walk-in/lock-in stalls and determine the number, size and parity of sows that use the free space. One pen configuration, referred to as the 'I-pen', consisted of an alley with slatted flooring running between two rows of stalls. The other configuration is referred to as the 'T-pen' as it was similar to the previous configuration with an additional solid floor loafing area at one end. Pigs were individually marked and photographs taken every two minutes for 24 hours once a week, for 11 weeks through gestation.

The majority of sows did use the free space although not regularly or for extended periods. Older, heavier sows used the free space area significantly more than younger, smaller sows. Although many sows did use the free space, it was at a much lower level than expected. This could be due to lower ranking animals feeling threatened by higher ranking animals.

Introduction
With announcements by the largest producer/packers in both the USA and Canada that they will transition all of their production facilities to group housing for sows over the next ten years, all North American producers are anticipating a change to group housing. This can be a challenging step for producers, and it is made more difficult by the lack of scientific information currently available on the implementation and design of alternative systems. Group housing systems can be complex to initiate and require greater input

from stockmen, however when done correctly, can produce sows that are able to socially interact with one another and have the freedom to move. Sows currently housed in gestation stalls have almost no opportunity to exercise and perform natural behaviours, leading to a possible decline in well-being.

It has previously been suggested that exercise is required to maintain bone composition and strength, and when exercise is insufficient, calcium will be mobilized from the bone itself (Lanyon, 1984 and 1987). Exercise is important to allow the development of bone and muscle to their maximum potential. Decreased muscular strength (which is commonly observed in confined sows) can contribute towards difficulty in lying and standing, and higher susceptibility to lameness due to increased slipping. Lack of exercise in confined housing has also been shown to cause bone weakness in other species. For example, confined laying hens have significantly weaker humeri and tibiae than birds housed in non restrictive environments (Knowles and Broom, 1990).

One possible alternative to gestation crates are free-access or walk-in/lock-in stalls. This system provides sows with opportunities to interact as a group in a communal area, or remain alone in a free access stall.

There is some concern regarding the degree to which sows use free space group areas, and how to avoid aggression, particularly when new sows are mixed into a group. This study investigates the implementation of walk-in/lock-in stalls for group housed sows. More specifically, the objectives of this study were to compare two different pen configurations by determining the proportion and type (size/ parity) of sows that are using the free space areas of the walk-in/lock-in stalls, and also how sows utilise the free space areas.

Experimental Procedures
Eight groups of 25 sows (± 3; mean ± SD) were used in the study, and were housed in walk-in/lock-in stall gestation pens at the Prairie Swine Centre, Saskatoon. Groups were selected according to how many individuals were confirmed pregnant in a batch of animals within a two-week breeding date window, therefore group size was not always the same.

Each of the groups were exposed to one of two configurations of free space areas. The first is referred to as the I-pen as it consisted of an alley (10 feet × 35 feet) with slatted flooring running between two rows of 16 stalls on each side. Any additional stalls, surplus to the group number, were locked off for the purpose of the trial. The second pen configuration is referred to as the T-pen as it consisted of an identical alley with an additional solid floor loafing area at one end (12 feet × 23 feet). Sows were weighed when moved from their breeding stall to the gestation pen, and individually marked with livestock paint.

Photographs were taken from mounted cameras at two-minute intervals over a 24-hour period, once a week, for 11 weeks throughout gestation. Two cameras were set up in the I-pen, one at each end of the pen. Four cameras were used in the T-pen in order to also observe the free space area. The pens were divided into three areas (I-pen) and nine areas (T-pen) (see Figure 1). The individual sow and location was recorded numerically by a trained observer. Measurements recorded from the photographs include the percentage of time spent out of the stall over 24 hours, and also the location and position of sows in the free-space areas.

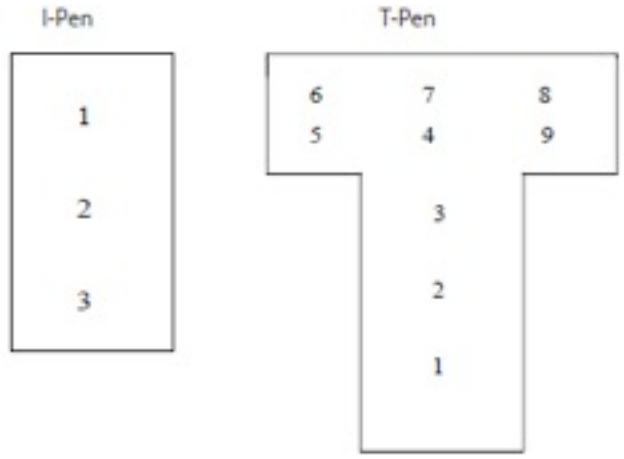

Figure 1. Location of free space areas used for space utilisation

Results and Discussion

The majority of sows did use the free space areas (more than 95 per cent of sows) although not on a regular basis or for extended periods of time. The average usage for the I- and T-pens were both relatively low, however, the sows housed in the T-pens used the free space area significantly more than the sows housed in the I-pens ($P<0.001$). More than half the animals in the study spent less than five per cent of their time in the free space area, however the average usage was about 18 per cent (with considerable individual variation).

Heavier sows appeared to use the free-space area significantly more than lighter sows ($P<0.0001$), and older (higher parity) sows also used the free-space significantly more ($P<0.001$) (Figure 2). Figures 3 and 4 illustrate the preferred lying areas of the sows. In the I-pens, the far end of the pens was the most preferred place to lie, with the highest recorded usage in Area 3 with 8.9 per cent of the average total usage. Similarly, with the T-pens, the most preferred place to lie was also in the corners (Areas 5, 6, 8 and 9).

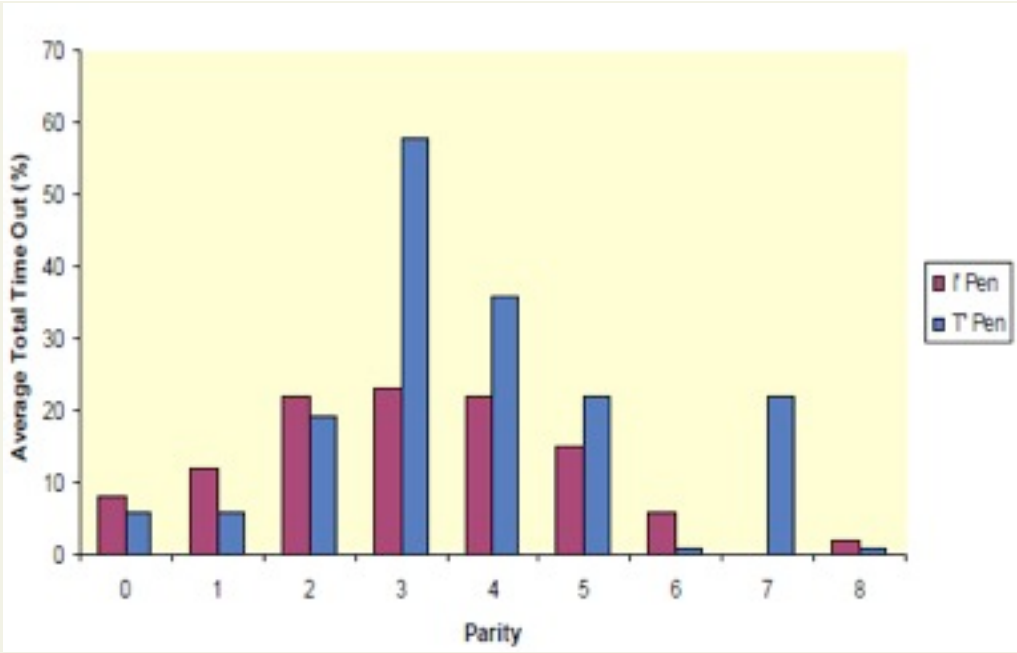

Figure 2. Average total time that sows of varying parities spend in the free access areas

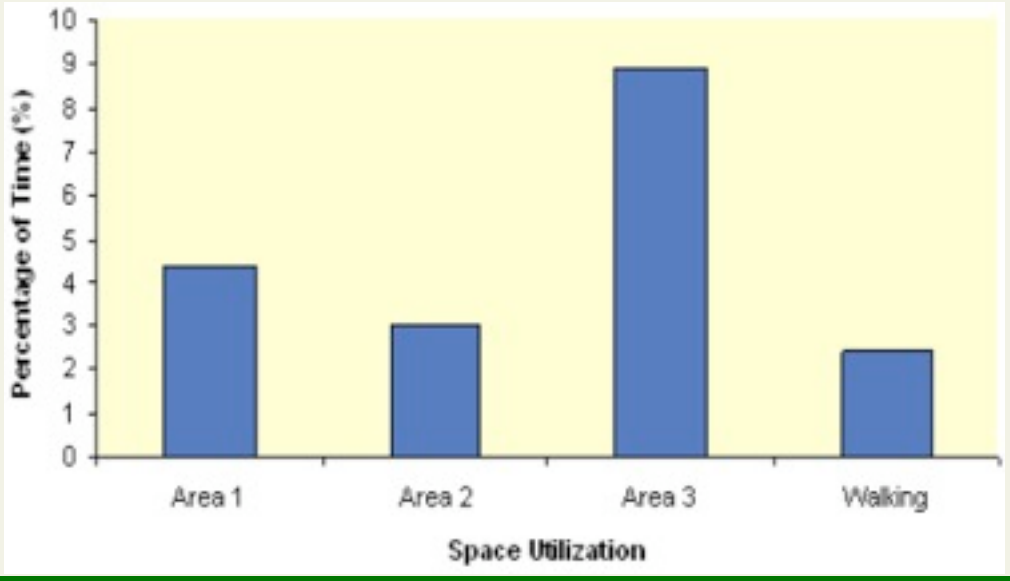

Figure 3. Percentage of time that sows spend in each location during utilization of the free space areas, I-pen data

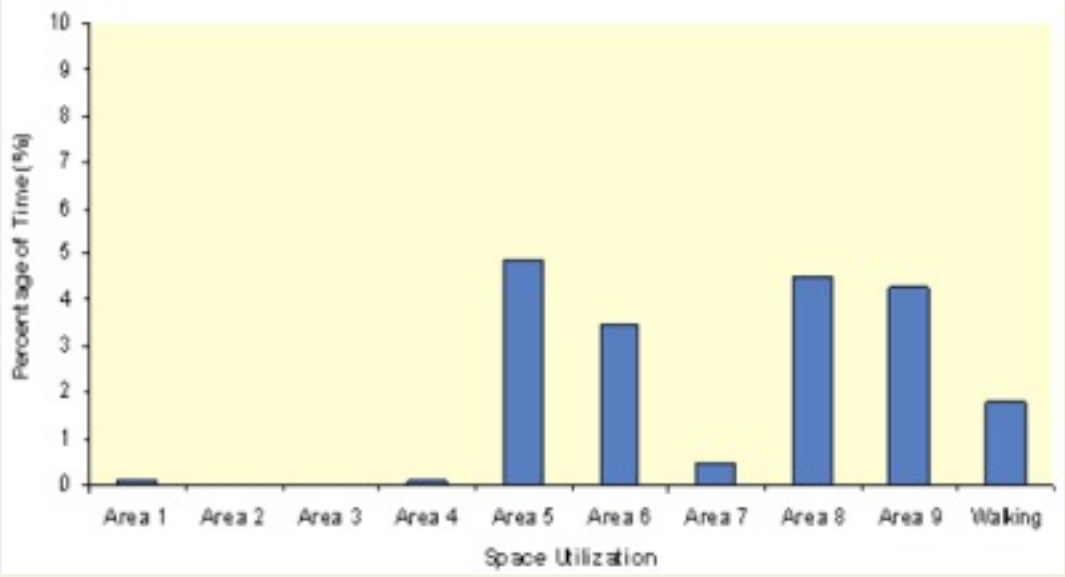

Figure 4. Percentage of time that sows spend in each location during utilization of the free space areas, T-pen data

Although many sows did use the free space, it was at a much lower level than expected. This could be due to several possibilities, such as lower ranking animals feeling threatened by higher ranking sows, or larger sows utilising the free space due to crowding in the stalls.

It has been suggested that due to the rigorous selection for improved meat production, the body shape of modern domestic pigs has been changed (Whittemore, 1994). Selection has resulted in larger pigs which can have difficulty lying and standing, and may not fit comfortably into conventional stalls. The areas where sows have shown a preference to lie down all have more walls than the other available areas, which can act as support. This finding is in agreement with previous studies (mostly in the farrowing environment) where sows also show preference to use support when lying down. Marchant et al., (2001) reported that 89 per cent of lying down events were carried out using either a sloping wall, or a wall fitted with a piglet protection rail.

Pigs using the T-pen free space area

Looking down onto the I-pen

With the transition towards group sow housing, it is important that scientific research is used to design the optimum housing system which can facilitate social interactions and minimise aggression and competition.

Future research resulting from this study will focus on methods for encouraging the sows to utilise the free-space areas. This will include improving the comfort of the free space area with rubber mats, providing environmental enrichment, or possibly allowing sows access to the free area in different social groups (alternate groups) i.e. gilts and sows.
Implications
Group housing of sows is recognised as an alternative system for improving animal comfort and well-being. However, the researchers found that not all sows used the free-space areas on a regular basis, or for extended periods of time. It is apparent that the older, heavier sows are utilising the space the most, therefore further research in this area will involve reducing social stress perceived by younger animals, and making the free space area more comfortable.
The complete 52 page report can be found on the Prairie Swine Centre's website under publications.

Acknowledgements
Specific project funding was also provided by the Saskatchewan Department of Agriculture and Food. Strategic programme funding provided by Sask Pork, Alberta Pork, Manitoba Pork Council and the Saskatchewan Agricultural Development Fund.

Light levels in the farrowing house

The PigSite
August 16, 2010

We know that temperature requirements for piglets and sows are quite different in the farrowing house but what about the different light requirements of stockpeople and sows? The new Knowledge Transfer bulletin from BPEX provides the answers.

We know that temperature requirements for piglets and sows are quite different in the farrowing house but what about the different light requirements of stockpeople and sows?

Defra states that pigs in buildings with no natural light should have at least 40 lux of supplementary light for at least eight hours per day. However 40 lux does not provide adequate lighting for stock people to be able to observe pigs in detail and manage a farrowing house to an excellent standard. So what level of lighting is needed to enable staff to work effectively and what does the sow need, and can it make a difference to the productivity of your unit?

What Does the Sow Need?
Studies carried out in this area showed that very bright levels of light, 400 – 500 lux, for 16 hours a day (with eight hours of dark) produced heavier weaners than those housed in less bright light as a result of increased suckling frequency and a higher milk yield. Increasing light levels in diary cows has similar effects on their milk yield.

In addition, work looking at dry and farrowing sows comparing a long day (eight hours light at 250 lux, 16 hours dark) and short day (16 hours light at 250 lux, eight hours dark) showed that sows kept in the short-day systems had higher levels of cortisol circulating in their bodies, which is an indicator of stress.

However, the natural behaviour of a loose-housed sow around farrowing is to seek dark areas to nest and give birth. Therefore, it may be necessary to consider increasing light levels and the length of light a couple of days after the whole room has farrowed. After this period, the research shows that good levels of light for longer lengths of time improve weaning weights through better suckling and milk yields.

What Does the Stockperson Need?
The level of light (lux) required by stockpeople varies depending on what tasks are being performed and the level of detail required, along with the individual site's hazards and risks. General recommendations are for a minimum light intensity of 200 lux and an average of 250 to 450 lux. The higher the level of detail required the higher the light intensity (lux) needed.

Assess your light intensity (lux) and timings today to improve productivity.

General Tips for Lighting
Fit timers: they save energy and cut out a job to remember each day
Investigate the bulbs you use and see where you can save energy without scrimping on resource
White wash walls to improve reflection of light

Managing Boar Taint: Focus on genetic markers

ThePigSite
October 11, 2010
E.J. Squires and F.S. Schenkel of the University of Guelph explain that significant progress has been made towards a genetic solution to boar taint in a paper presented at the London Swine Conference 2010.

Abstract
Male pigs are normally castrated to prevent boar taint, but this reduces feed efficiency, lean gain and has a negative impact on animal welfare. Alternatives to surgical castration are immunocastration and the development of genetic markers that can be used in a marker assisted selection breeding programme to produce pigs that are free of boar taint.

Our approach is to identify single nucleotide polymorphisms (SNPs) in candidate genes that encode the enzymes involved in the synthesis and degradation of the boar taint compounds, androstenone and skatole. We used a sample set of about 1,300 animals representing eight different lines, comprising six breeds, for the discovery and validation of SNP markers. So far, about 80 effective SNPs in 28 candidate genes have been validated.

The SNPs that were associated with fat skatole and androstenone and the strength of the associations varied among the eight lines of pigs, although some SNPs were effective in several lines.

Application of the markers to produce pigs that were homozygous for the favourable alleles would decrease average fat skatole levels from 20 to 54 per cent and fat androstenone from 26 to 61 per cent, depending on the line.

The authors also determined that none of these markers were associated with negative effects on production traits.

A genetic solution for boar taint will eliminate the need for castration of male piglets. This will dramatically improve the profitability and decrease the environmental impact of pork production, as well as address the increasingly important animal welfare concerns about castration.

Introduction
Why castrate?
Young male piglets are castrated to prevent off-odours and off-flavours (boar taint) in the meat at slaughter weight. Castration prevents boar taint but intact boars have improved feed efficiency, nitrogen retention and lean gain compared to castrates, which could result in significant economic gains to producers. The use of entire male pigs for pork production will improve pork production efficiency but this brings with it also concerns about pork with boar taint and husbandry of entire males pigs which are more aggressive than castrates (Lundström et al., 2009).

A major driving force for using entire males is the growing animal welfare concerns against castration. Several EU countries will ban surgical castration in the next few years (even with anaesthetic) and some major grocery stores in the Netherlands have now decided not to sell pork from castrates.

Controlling boar taint without surgical castration would, therefore, have dramatic benefits for production and consumer acceptance of pork products.

What causes boar taint?
Boar taint is caused by the accumulation of two compounds – androstenone and skatole, in the fat. Androstenone is a steroid produced in the testis as the boar nears puberty, and it acts as a sex pheromone to regulate reproductive development in gilts and induce a mating stance in sows.

Skatole is produced as a bacterial breakdown product of the amino acid tryptophan in the gut. It is produced in equivalent amounts in the gut of both males and female pigs, but it is poorly metabolized and eliminated by males, so it accumulates in fat.

Boar taint from skatole is affected by diet and environment (management). The main source of the tryptophan for skatole production comes from the turnover of cells lining the gut, and this can be reduced by including sources of fermentable carbohydrates in the diet. Skatole can also be absorbed from the manure, so dirty pigs of any sex can accumulate high skatole levels in fat.

Androstenone production is controlled by the sexual maturity of the boar, so diet does not have much of an effect on boar taint from androstenone. Androstenone levels could be decreased by slaughter at lighter weights before puberty begins but this is not economical.

Options for Control of Taint

Two promising alternatives to deal with boar taint are the use of genetic markers to select pigs that have reduced propensity to produce boar taint (Zamaratskaia and Squires, 2009) and the use of an

immunocastration vaccine (Improvac, developed by Pfizer; Dunshea et al., 2001; Moore et al., 2009; Pauly et al., 2009).

Immunocastration
A promising method for controlling boar taint is by immunocastration, instead of surgical castration. Immunocastration works by injecting a vaccine which stimulates the production of antibodies against gonadotropin releasing hormone (GnRH). GnRH is produced by the hypothalamus in the brain to drive the release of luteinising hormone and follicle-stimulating hormone by the pituitary gland, which stimulate the development of the testis. The antibodies inactivate GnRH to shut down testicular development to the same extent as surgical castration. However, since the vaccine is given to pigs near slaughter, they grow as normal boars for most of their life and retain the performance advantages of intact boars.

Genetic selection
Genetics can affect both the production and metabolism of boar taint compounds, and these effects can be found both within breeds and among different breeds. For example, levels of androstenone are much higher in Durocs than in the white pig breeds. There is also a wide variability in the amount of boar taint that individual pigs have within a breed. The heritability of both androstenone and skatole is moderate to high but previous attempts to select for pigs with low boar taint have resulted in reproductive problems (reviewed in Zamaratskaia and Squires, 2009). The development of specific genetic markers for boar taint would minimize these negative effects on reproduction.

The use of genetic markers to produce lines of pigs that are free of boar taint but otherwise grow as normal boars is a long-term solution to raising entire male pigs for pork production. A number of studies have shown differences in expression of candidate genes encoding enzymes involved in the metabolism of boar taint compounds between high- and low-boar taint pigs and between different pig breeds. However, only a few studies have reported SNPs in these genes that are correlated with levels of boar taint. A recent report from Norway (Moe et al., 2009) is the first association study to compare a large number of SNPs to boar taint in Duroc and Norwegian Landrace breeds. They found significant marker effects for fat androstenone in Duroc but not in Landrace, and significant marker effects for fat skatole in both breeds. Individual markers explained from 2.5 to 16.3 per cent of the total variation in the traits.

At the University of Guelph, the researchers have developed genetic markers for boar taint based on candidate genes that encode the enzymes involved in the synthesis and degradation of the boar taint compounds, androstenone and skatole. They have a database of about 1,300 animals representing eight different lines, comprising six breeds (Duroc, Hampshire, Landrace, Large White, Pietrain and Yorkshire), that we have used for the discovery and validation of genetic markers, mostly single nucleotide polymorphisms (SNPs) in the DNA. They compared the sequences of candidate genes from pools of DNA obtained from animals from the extremes of the boar taint phenotypes in each line for SNP discovery. They then genotyped all the animals in the database for each SNP and conducted association analysis for each SNP with the boar taint phenotypes, i.e. androstenone and skatole.

So far, we have about 80 effective SNPs in 28 candidate genes for boar taint. The strength of the associations of the SNPs with skatole and androstenone levels in fat varied among the different lines. The SNPs that were associated with fat skatole and androstenone varied among the eight lines of pigs although some SNPs were effective in several lines. The number of significant SNPs across lines varied from five to 17 and from three to 16 for skatole and androstenone, respectively.

A large proportion of effective SNPs were associated with both skatole and androstenone (65 per cent) across lines, which corroborates with the reported moderate positive genetic correlation between these two boar taint compounds (e.g. Tajet et al., 2006). Application of the markers to produce pigs that were homozygous for the favourable alleles would decrease average fat skatole levels from 20 to 53 per cent and fat androstenone from 26 to 61 per cent, depending on the line. The researchers also determined that none of these markers was associated with negative effects on production traits. They are now working with a commercial company (JSR Genetics) to validate these SNPs in their lines. The ultimate goal is to identify the causative mutations in the handful of most important genes, and then use these markers in breeding programs to develop lines of pigs that are free of boar taint but otherwise grow as normal boars.

These findings represent significant progress towards a genetic solution to boar taint. Work is continuing to characterise additional SNPs for boar taint and to validate these markers in commercial swine populations. The control of boar taint by marker assisted selection will eliminate the need for castration. This will significantly improve the profitability of pork production and address animal welfare concerns about castration that are now a hot topic in several EU countries.

Conclusions
Castration to prevent boar taint limits productivity and increases animal welfare concerns of commercial pork production, so alternative strategies for controlling taint are needed.

Immunocastration effectively controls boar taint but the development of low boar taint lines of pigs by marker assisted selection would provide a long term solution to the problem. This will improve pork quality and consistency, profitability, environmental impact and animal welfare in pork production by eliminating the need for castration of male piglets.

In terms of production efficiencies, it is anticipated that the use of entire male pigs will improve profits per pig by more than $5, which is based on analyses that were conducted previously by de Lange and Squires (1995) and adjusted to 2010 economic conditions. Intact males also produce less manure and thus excrete less nitrogen and phosphorous in the manure than castrates, thereby decreasing the environmental impact of pig production.

Acknowledgements
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Castration in the swine industry and the impact on growth performance – physical versus vaccination

The PigSite
September 27, 2010
Frank Dunshea of the University of Melbourne, Australia, gave a thorough review of the impacts of castration (both physical and by vaccination) on the performance of male pigs at the London Swine Conference 2010. He also covered the important practical aspects of both managing and feeding

vaccinated boars.

Abstract
In most parts of the world, male pigs that are destined for the market are physically castrated very soon after birth in order to reduce the risk of boar taint. However, entire male pigs are more efficient and deposit less fat than barrows, particularly at high slaughter weights. Also, animal welfare activists are lobbying for a cessation of physical castration in many parts of the world, particularly the EU, with a high likelihood that this could lead to inferior pork and processed products.

A welfare-friendly alternative is vaccination against gonadotrophin releasing factor (GnRF) which allows producers to capitalise on the superior natural growth and carcass characteristics of intact boars without the risk of boar taint. Vaccination against GnRF results in superior feed efficiency and carcass lean yield over physical castration, while maintaining pork eating quality.

There have been very few studies that have compared the lysine requirements of boars and barrows, and none with contemporary genotypes. Recent data suggests that the lysine requirement of boars is slightly higher (ca. 0.6 to 0.9g/kg) than for gilts and barrows. Given that the penalty in growth performance for having inadequate dietary lysine is greater in boars than in gilts or barrows, it is important to ensure that dietary lysine requirements are met to obtain the maximum benefits of boar production coupled with vaccination against GnRF.

Introduction
The castration of male domestic animals of most species, with the exception of breeding stock, has been practised for centuries. Traditionally, the major reasons for castration were to control the reproductive state of contemporary females (as often male and female animals were grazed or housed together), to take advantage of the propensity for castrate animals to fatten (fat is/was highly valued in some cultures) and to reduce the incidence of rutting and aggressive behaviours often observed in entire animals.

Another issue, which is particularly pertinent to pork production, is that non-castrated male pigs (boars) may exhibit flavours and odours, collectively called boar taint, that are offensive to many consumers. During sexual development and when mature, boars accumulate substances, predominantly androstenone and skatole, in their fatty tissue that are regarded as the main contributors to this boar taint in pork (Bonneau, 1982).

To avoid tainting of the meat, boars destined for fresh meat consumption in Australia, New Zealand, the UK and South Africa have, until recent years, been slaughtered before full sexual maturity. For example, in the UK, it is stipulated that weight of carcasses utilised for fresh pork production must be less than 85kg (MLC, 2003). In other countries (Asia, North America, much of the EU) taint has been overcome by physical castration of the boar before weaning. For example, in the EU approximately 100 million male pigs are physically castrated every year, representing 80 per cent of the male population (EFSA 2004).

However, physical castration results in significant reductions in growth performance and excess deposition of fat (Campbell and Taverner, 1988; Dunshea et al. 1993; 1998; 2001, Suster et al., 2006). In many markets there is a penalty for having over fat pigs as consumers and processors alike are demanding leaner and generally heavier pigs. For example, over recent years, the average weight of pigs at slaughter in most countries has increased, driven by the efficiencies associated with the slaughter of heavier pigs (MLC, 2003).

While genetic selection has meant that carcass fatness is continually being reduced, the upward pressure on slaughter weights has placed a conflicting pressure on carcass fatness. This is particularly so for physically castrated male pigs (barrows) that have a declining rate of lean tissue deposition during the late finishing phase (Suster et al., 2006).

Incentives for Utilising Boars in a Pork Production System
The potential lean tissue growth and efficiency of weight and lean tissue gain are greater in boars than in barrows, prompting the cessation of castration 30 years ago in some markets, particularly those that are focused on lean meat production.

Some of these differences in tissue nutrient partitioning rates were elegantly demonstrated in a recent study designed to investigate the interactions between housing and sex in contemporary genotypes (Suster et al., 2006). Suster et al. (2006) found that under group-housed conditions there was very little difference between boars and barrows in daily gain and lean tissue content until 122 d of age (ca. 77kg). Beyond 17 weeks of age, the barrows grew faster than the boars but deposited less lean tissue and more fat. Thus, at 154 days of age, the boars weighed 5kg less than the barrows (103 vs. 108kg) but contained 3kg more lean tissue (69.1 vs 66.2kg), almost 6kg less fat (18.2 vs 23.8kg) and 2mm less P2 back fat (15.1 vs 17.1mm).

In pigs raised in ideal conditions, including individual penning, the differences were even more profound in favour of boars (112 vs 113kg liveweight; 73.1 vs 66.8kg lean tissue; 20.6 vs 27.1kg fat; 15.9 vs 20.6mm P2 back fat). Also, over the finisher phase the feed conversion ratio (FCR) was 13 per cent higher in barrows than in boars (3.50 v. 3.10).

These data for efficiency and P2 back-fat were very similar to that observed elsewhere (Dunshea et al., 1993; 2001). Indeed, a meta-analyses of up to 10 studies conducted with group-housed pigs shows that physical castration increases feed intake (+467g/day; P<0.001), FCR (+0.48; P<0.001) and backfat (+4.9mm; P<0.001) with modest increases in growth rate (+31g/d; P=0.011) and carcass weight (+2.1kg; P<0.001) over the finisher phase compared to entire boars (Table 1). While the differences in feed efficiency have been extensively chronicled during the finishing phase where they are most pronounced because of the decline in lean tissue deposition in the barrows, boars are actually more feed efficient and leaner than barrows throughout the entire post-weaning growth phase (Campbell and Taverner, 1988; Hennessy et al., 2009).

Table 1. Average fixed effects of physical castration (barrows – boars) from meta-analyses of data from studies with group-housed pigs[a]

	Effect	sed	95 per cent CI	P-value	No. of studies
ADG (g/day)	-31	15.5	(-61.4, -0.6)	0.011	8
ADFI (g/day)	-467	30.9	(-531, -40)	<0.001	7
FCR	-0.48	0.030	(-0.54, -0.42)	<0.001	7
Carcass weight (kg)	-2.14	0.656	(3.43, -0.86)	<0.001	10
Backfat (mm)	-4.9	0.29	(-5.1, -3.9)	<0.001	10

a Analyses only included data from studies where data were collected over a nominal finisher phase

The relative efficiencies associated with boar and barrow production systems have been well summarised by the MLC in the UK (MLC, 2003). In this work, the MLC commissioned a desktop study to investigate the efficiencies associated with producing heavier pigs and found that 10 per cent increase in slaughter weight would reduce the cost of production by €0.05 per kg. Based on slaughter weights of 108 and 130kg for boars and barrows, respectively, it was estimated that the cost of production of boars was €0.05 greater per kg carcass weight but €0.17 less per kg of lean tissue. However, in this model the slaughter weight of the boars was limited to 108kg to ensure that all carcasses were below 85kg and so could enter the fresh pork market.

Commercial pork producers should consider increasing pig slaughter weights as a means of lowering unit costs during both production and processing stages (King et al., 2000) but obviously cannot if legislation does not allow it or if meat quality is likely to be compromised. If the carcasses could be guaranteed to be free of boar taint, using a technology such as vaccination against GnRF, allowing boars to be safely slaughtered at 130kg, then the cost of production of boars would be less than barrows on both a carcass weight and lean tissue basis.

Constraints to Utilising Boars in a Pork Production System

The major reason why male pigs are still castrated in much of the world is because of the issue of boar taint. The principal compounds contributing to taint in boars are androstenone and skatole, which are

found at much higher levels in the carcasses from boars than from either gilts or barrows.

As mentioned above, one approach to reduce boar taint, apart from physical castration, is to slaughter boars at light weights, before they have reached sexual maturity. However, this runs counter to the desire to increase slaughter weights as a means of lowering unit costs during both production and processing stages. In the UK, it is stipulated that weight of carcasses utilised for fresh pork production must be less than 85kg (MLC, 2003).

The European Community legislation (Directive 64/433/ EEC) decrees that carcasses from boars that are over 80kg may only be allowed to be used for human consumption provided they are processed (used in small goods) or tested for taint.

However, processing does not necessarily eliminate boar taint (McCauley et al., 1997). Pigs with the steroidogenic capacity to produce high concentrations of testosterone also have the potential to produce androstenone, and hence to have detectable levels of taint in the carcass. A survey of Australian and New Zealand boars revealed high concentrations of both androstenone and skatole in boars as light as 85kg live-weight (Hennessy et al., 1997). Therefore, although slaughtering boars at lower weights may reduce the incidence of boar taint, it will not guarantee meat free from boar taint. Thus, boar taint remains the major impediment to the utilisation of boars in a pork production system.

While it is accepted that boars are leaner and more efficient than barrows, the growth performance of boars in groups under commercial conditions is generally less than that of individually housed boars (McCauley et al., 2000; Suster et al., 2006), suggesting that the putative benefits may not be as marked as assumed when pigs are housed under commercial conditions. Furthermore, during the late finishing phase, group-housed entire males often grow at a similar or slower rate than barrows (De Haer and de Vries, 1993; Dunshea et al., 2001; Suster et al., 2006), possibly because of increased sexual and aggressive activities between entire males.

From the peri-pubertal period onwards, boars exhibit negative aggressive and sexual behaviours that can detract from feeding (Cronin et al., 2003). For example, Cronin et al. (2003) found that at 21 weeks of age, boars had more aggressive behaviours (27.9 vs 9.5 bouts per pig per day) and sexual activity (7.2 vs 0.1 mounts per pig per day) than barrows resulting in less time spent eating (5.3 vs 7.2 per cent of time) and lower feed intake (2.69 vs 2.90kg per day). These negative behaviours and reduced feed intake are major reasons why boars do not perform as close to their potential as barrows do when housed under commercial conditions (Suster et al., 2006). Also, the negative behaviours that occur with mixing of boars around slaughter causes carcass damage and reduced meat quality (Dunshea et al., 2009; Lealiifano et al., 2009).

The alternative to physical castration: Vaccination against Gonadotrophin-Releasing Factor (GnRF)

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Growth and behavioural responses
An alternative method of inhibiting sexual development and aggressive behaviours and reducing the accumulation of boar taint compounds in carcass fat is immunisation against GnRF, resulting in a reduction in plasma gonadotrophins and testosterone (Bonneau et al., 1994; Dunshea et al., 2001; McCauley et al., 2003; Oliver et al., 2003; Nghia et al., 2008).

Recently, a vaccine containing a modified form of GnRF in a low-reactogenic adjuvant system has been developed to reduce the production and accumulation of both androstenone and skatole in pig carcasses (Dunshea et al., 2001). The vaccine formulation and dosage regimen allows pigs to be immunised relatively close to slaughter. Any taint substances already present are progressively metabolized, allowing the entire boar to be slaughtered at a higher liveweight without taint, having earlier benefited from the effects of its own testicular steroids on growth and carcass composition (Dunshea et al., 2001). The decrease in testosterone appears to also have some additional effects on sexual, aggressive and feeding activity (Cronin et al., 2003) with resultant positive effects on growth performance. Thus, vaccinated boars

grow faster than non-vaccinated boars and at a similar rate to the barrows but with a similar FCR as the boars. Backfat depth was intermediate between the boars and the barrows.

Table 2. Behavioural traits of boars, barrows and boars vaccinated against GnRF at 21 weeks of age (data are from Cronin et al., 2003 and McCauley et al., 2001)

	Boar (B)	Barrow (Ba)	Vaccinate (V)	Difference B vs V	Difference Ba vs V
Aggressive bouts per pig per day	27.9	9.5	9.5	18.4	0.0
Mounts per pig per day	7.2	0.1	0.6	6.6	-0.5
Time feeding per cent	5.3	7.2	7.7	-2.4	-0.5
Feed intake [a] kg per day	2.69	2.9	3.32	-0.6	-0.4
Fighting lesion scores[b]	1.01	0.26	0.30	0.7	0.0

a Determined over the last 4 weeks prior to slaughter.
b Fighting lesion scores on a 4-point scale from 0 to 3 with 0 having no lesions and 3 severe number of lesions with carcass condemnation.

The reduction in testosterone as a result of vaccination against GnRF has a profound effect upon behaviour. Cronin et al., (2003) found that there was a reduction in both aggressive and sexual activities in vaccinated boars who exhibited similar activities as barrows (Table 2). As a consequence the vaccinated pigs increased the amount of time they spent eating and their feed intake. Another indicator of reduced negative activities was the reduction in lesion scores in vaccinated pigs observed upon mixing in lairage (McCauley et al., 2001; Table 2).

While comparison with individually housed contemporary boars clearly showed that the growth performance of the group-housed boars was well below their potential during the finisher phase, vaccination against GnRF provided a means of ameliorating this reduction in performance (Dunshea et al., 2000). Indeed, the growth rate of group-housed vaccinated boars and individually housed entire boars were identical over the five-week period after secondary vaccination (1090 vs 1099g per day), being approximately 20 and 15 per cent higher than the group-housed entire boars and barrows, respectively. Importantly, the variation in growth performance was also less, which makes nutritional and sales management easier (Dunshea et al., 2009).

There are now a number of studies conducted with anti-GnRF vaccination across the globe and these have been incorporated into a series of meta-analyses. These analyses of up to 16 studies show that vaccination against GnRF increases feed intake (+512g per day; P<0.001), ADG (+149g per day; P<0.001) and carcass weight (+1.5kg; P<0.001) over that of boars, with only small increases in FCR (+0.07, P<0.001) and back fat (+1.2 mm, P<0.001) (Table 3). The small increases in FCR appear to occur in smaller group sizes where negative activities may not be as great as in larger groups. Therefore, the increased growth rate and carcass weight of boars vaccinated against GnRF, combined with assurances of high quality pork free of boar taint, provide real incentives in markets where physical castration is not normally practiced. This becomes even more appealing in countries were metabolic modifiers such as porcine somatotropin (pST) or ractopamine are approved to ensure that additional feed consumed in the late finishing period is converted into lean meat.

Table 3. Average fixed effects of vaccination against GnRF (vaccinates – boars) from meta-analyses of data from studies with group-housed pigs[a]

	Effect	sed	95 per cent CI	P-value	No. of studies
ADG (g/day)	149	18.4	(113, 179)	<0.001	14
ADFI (g/day)	512	30.9	(469, 565)	<0.001	10
FCR	0.07	0.054	(-0.04, 0.18)	<0.001	10
Carcass weight (kg)	1.48	0.412	(0.67, 2.29)	<0.001	16
Backfat (mm)	1.2	0.17	(0.9, 1.6)	<0.001	16

a Analyses only included data from studies where animals slaughtered between 4 and 5 weeks after the secondary vaccination.
b Determined over the period between the secondary vaccination and slaughter.

The incentives for vaccinating against GnRF in markets where physical castration is practised are even more compelling. There are now a number of studies comparing the finishing performance and carcass quality of vaccinated boars and barrows and these have been incorporated into a series of meta-analyses. These analyses of up to 11 studies show that vaccination against GnRF increased ADG (+173g per day; P<0.001) and reduced FCR (-0.33; P<0.001) and backfat (-3.4mm; P<0.001) with a small increase in ADFI (+115g per day; P=0.004) and a small decrease in carcass weight (-1.16kg; P=0.015) (Table 4). The large decrease in backfat combined with only a small decrease in carcass weight indicate a substantial increase in lean meat yield in the vaccinated pigs.

Table 4. Average fixed effects of vaccination against GnRF (vaccinates – barrows) from meta-analyses of data from studies with group-housed pigs[a]

	Effect	sed	95 per cent CI	P-value	No. of studies
ADG (g/day)	173	15.6	(142, 204)	<0.001	8
ADFI (g/day)	115	46.9	(23, 209)	0.004	5
FCR	-0.33	0.030	(-0.39, -0.27)	<0.001	8
Carcass weight (kg)	-1.16	0.616	(-2.37, 0.05)	0.015	11
Backfat (mm)	-4.9	0.29	(-5.1, -3.9)	<0.001	10

a Analyses only included data from studies where animals slaughtered between 4 and 5 weeks after the secondary vaccination
b Determined over the period between the secondary vaccination and slaughter

McKeith et al. (2009) summarized 30 studies (internally and externally sponsored) and found that the average un-weighted carcass back fat, loin eye area and lean tissue in were -10.2, +1.7 and +4.6 per cent. Also, it should be borne in mind that the improvements in FCR are cumulative across the entire grower-finisher period (Hennessy et al., 2009; Hanchun et al., 2009). For example, Hanchun et al. (2009) found that feed efficiency was improved by 6.5 per cent from weaning to slaughter in vaccinated pigs compared to barrows.

Antibody, endocrinal and metabolic responses

Antibody titres to GnRF peak a week after vaccination and gradually decline over the next eight weeks (Claus et al., 2007; Bauer et al., 2008; Dunshea et al., 2008). The intensive bleeding studies of Claus et al. (2007) and Bauer et al. (2008) show that plasma androstenone, testosterone and LH had all reached a nadir six to 10 days after the second vaccination.

Plasma urea nitrogen (PUN) – an accurate proxy for excess amino acid catabolism (Dunshea, 2002) – was found to be increased at 14 and 28 days after vaccination against GnRF (McCauley et al., 2003) as a result of either increased protein intake, decreased lean tissue deposition or both. Temporal studies (Claus et al., 2007; Bauer et al., 2008) indicate that PUN begins to increase within the first few days after vaccination, certainly before any increase in feed intake, suggesting that changes in protein metabolism occur very quickly. Indeed, when feed intake was restricted to either 2 or 3kg, there was a rapid increase in PUN between 8 and 10 days after the second vaccination (Bauer et al., 2008).

Plasma IGF-I, which has been shown to be positively related to previous growth rate, decreased more gradually and did not reach a plateau until beyond 14 days after the second vaccination (Claus et al., 2007; Bauer et al., 2008).

Plasma leptin concentrations were increased at 14 and 28 days after vaccination against GnRF (McCauley et al., 2003), possibly in response to increased feed intake and fat deposition that occurs around this time. However, there are no data investigating the temporal pattern of plasma leptin in the immediate period after vaccination.

These data suggest that boars that are vaccinated against GnRF have reduced steroidigenic capacity very soon after the second vaccination with the accompanying effects on muscle and fat metabolism and feed intake occurring very soon after. The effects on steroidigenic capacity seem to be still at least eight weeks after secondary vaccination even though antibody titres decrease by six to eight weeks post-vaccination (Dunshea et al., 2008).

Androstenone and skatole are both fat-soluble and highly labile and freely exchange between adipose tissue and plasma. Therefore, reductions in plasma androstenone and skatole should theoretically precede reductions in the concentrations of these compounds in adipose tissue.

Dunshea et al. (2008) found that vaccination decreased adipose tissue androstenone over the first two weeks (0.40 versus 0.17µg per g; $P<0.01$) after the second vaccination and it remained lower until at least eight weeks (1.12 versus 0.14 µg per g; $P<0.01$). On the other hand, adipose tissue skatole was not decreased at two weeks after the second vaccination but was at four, six and eight weeks ($P<0.05$) (Dunshea et al., 2008).

In another study, Dunshea et al. (2009) found that adipose tissue skatole concentrations were decreased by 17 days after the secondary vaccination and continued to decline until at least 28 days after the vaccination. Also, Lealiifano et al. (2009) found that adipose tissue androstenone was decreased at two weeks after secondary vaccination and remained low until at least six weeks after injection. Adipose skatole was very low in the control boars and so there was no significant difference between samples taken at 0, two, three, four and six weeks after secondary vaccination. However, the pooled adipose tissue skatole concentrations from two, three, four and six weeks after secondary vaccination were lower ($P<0.05$) than those obtained from pigs that did not receive a secondary vaccination.

Thus, it appears that vaccination against GnRF decreases boar taint compounds and improves carcass weight for between four and at least eight weeks after the secondary vaccination. If the major source of boar taint is androstenone then pigs may be slaughtered as early as two weeks after the secondary vaccination. However, in markets where skatole is an issue, further work is required to describe the temporal pattern of adipose tissue skatole.

Managing Vaccinated Boars

Despite the rapid antibody, endocrinal and metabolic responses to vaccination against GnRF, the effects on feed intake, growth and body composition do not become apparent until beyond two weeks after the secondary vaccination (McCauley et al., 2003; Oliver et al., 2003; Claus et al., 2007; Lealiifano et al., 2009).

As adipose tissue androstenone is decreased by two weeks after the secondary vaccination, it should be possible to slaughter vaccinated boars at two week post secondary vaccination without any increase in back fat over that of the boars and with the surety that the boars taint compounds have been cleared from the carcass fat (Dunshea et al., 2008; Lealiifano et al., 2009). However, in practice, most producers slaughter at four to six weeks after the secondary vaccination to be certain that all boar taint compounds have been cleared although this may be associated with some small increases in carcass fatness.

In many markets, the increase in fatness is not an issue and may really be desirable especially since it may be associated with an increase in intramuscular fat (D'Souza et al., 2000). These markets will be also those that can make use of the increase in carcass weight and indeed may wish to extend the slaughter age out to eight weeks after vaccination to maximise carcass weight without compromising boar

taint compounds (Dunshea et al., 2008).

There needs to be research aimed at investigating the way in which the additional energy consumed by vaccinated boars can be converted to carcass and/or carcass lean to maximise the profitability in various markets. These strategies will clearly not be the same in all markets.

In an attempt to reduce the effect of the increase in feed intake on backfat after vaccination against GnRF, recent studies were conducted to investigate the interactions between vaccination against GnRF and ractopamine (Rikard-Bell et al., 2009; Moore et al., 2009). Ractopamine is currently registered in the USA and many other countries but not the EU for use as an in-feed metabolic modifier. Dietary ractopamine increased lean tissue and decreased fat mass, particularly in vaccinated boars (Rikard-Bell et al., 2009; Moore et al., 2009a). Therefore, dietary ractopamine may be a means of ensuring that the increased feed intake observed in vaccinated boars is directed towards lean tissue rather than fat over the last few weeks before slaughter. Similar synergies have been seen between vaccination against GnRF and pST treatment (McCauley et al., 2003; Oliver et al., 2003) although pST is unavailable in many markets.

Nutrition of Boars and Vaccinated Boars
In any production system, it is important to pay attention to nutrition, particularly dietary protein and lysine. In order to model and estimate nutrient requirements in response to any management strategy, it is necessary to have accurate data on tissue deposition rates, maintenance requirements and feed intake (Schinckel and de Lange, 1996) and it is known that vaccination against GnRF has the potential to impact on all of these parameters.

To date, there have been no published studies conducted to investigate the effect of vaccination against GnRF on lysine requirements although it is realistic to assume that up until at least two weeks after the secondary vaccination, their nutrient requirements should be similar to that of the boar since both lean tissue gain and feed intake are similar until two weeks after vaccination (Dunshea et al., 2008). Indeed, the rate of lean tissue deposition of vaccinated boars appears to be maintained (Oliver et al., 2003; Dunshea et al., 2008; Moore et al., 2009) or decreased only slightly (McCauley et al., 2003; Rikard-Bell et al., 2009) compared to that of entire boars until approximately four weeks after the secondary vaccinations. This would suggest a similar requirement for total available lysine intake, although it should be noted that feed intake is universally increased beyond two weeks after secondary vaccination and therefore the lysine content of the diet could likely be reduced beyond this point.

Also, the PUN responses suggest that there is excess protein (lysine) by two weeks after the secondary vaccine (McCauley et al., 2003; Claus et al., 2007; Bauer et al., 2008), which indicates that lean tissue deposition is reduced relative to boars at this time. While there are no tissue deposition rate data beyond four weeks after secondary vaccination, it is likely that lean tissue would decrease and fat deposition increase relative to boars.

It is important that the temporal pattern of tissue deposition rates and feed intake be further explored to be incorporated into models to predict nutrient requirements over this period of rapidly changing metabolism.

There are also very few data comparing the lysine requirements of boars and barrows, particularly in contemporary improved genotypes. Given that the lysine requirements of gilts are generally considered to be similar or slightly higher to that of barrows (NRC, 1998) and that there have been a number of studies comparing the lysine requirement of boars and gilts, it is realistic to use the gilt requirements as a reference point.

During the early 1980s, a number of studies were conducted that suggested that the protein deposition potential and lysine requirements of grower boars (up to 60kg) was slightly higher than that of gilts (Batterham et al., 1985; Giles et al., 1986). However, more recent studies suggest that, although the protein deposition and growth potential of boars is greater than that of gilts, there is little difference in the lysine requirements of grower and finisher boars and gilts (King et al., 2000; O'Connell et al., 2005;2006). For example, King et al. (2000) found that there was no difference in the lysine requirement to maximise protein deposition and feed efficiency in heavy (80 to 120kg) finisher boars and gilts. O'Connell et al. (2005) found that, in three studies in grower boars and gilts (20 to 68 kg), there were no differences in the

lysine requirements to maximise growth and feed efficiency. In heavier pigs (60 to 100kg), these authors found lysine requirements were slightly higher in boars than in gilts in one study but not in two others (O'Connell et al., 2006).

In the most recent study conducted with high-performing grower pigs, it was found that the lysine requirement of boars was higher than that of gilts (Moore et al., 2009b). The studies that have shown no difference in lysine requirement have often been conducted with individually penned pigs where the full feed intake potential can be expressed and often in these cases, boars consume more feed than gilts (Dunshea et al., 1998; King et al., 2004). However, in commercial conditions, ad libitum feed intake of boars is well below (ca. 70 per cent) that which is seen under ideal conditions (Dunshea et al., 2000) and slightly less than gilts (Dunshea, 2005) and this may be where the differences in lysine requirement between boars and gilts may be exhibited.

Therefore, it appears that despite large differences in protein deposition rates between the sexes, boars have similar, or slightly higher, dietary lysine requirements, suggesting that boars use dietary lysine more efficiently than do gilts and barrows.

Very recently, Quiniou et al. (2010) characterised the growth performance and feed intake patterns of gilts, boars and barrows and, according to simulations performed with the InraPorc software, the digestible lysine requirement was on average 0.1 g/MJ net energy higher for boars than for gilts and barrows.

In an effort to clarify the situation, the published data where lysine requirements of boars and gilts have simultaneously been determined were subject to a meta-analyses and the overall effect was that boars require a slightly (ca. +6 per cent) higher dietary lysine content than gilts (10.9 versus 10.3g lysine per kg; $P<0.001$).

A multi-regression analysis of lysine requirement indicates that lysine requirement decreases with live weight (-0.076g lysine per kg), is greater for boars than for gilts (+0.88g lysine per kg), and has increased over time (0.16g per kg per year).

It should also be noted that since the slopes of the lysine dose response curves are greater in boars than in gilts, the penalty in growth performance for having inadequate dietary lysine will be greater in the former. Also, the requirements of both boars and gilts estimated in this manner are greater at any live weight than those suggested by the NRC (1998). In part, this may reflect the fact that much of the data used to generate the NRC (1998) requirements were obtained some time ago and there has been steady improvement in lean tissue potential.

An additional consideration when estimating lysine requirements of vaccinated is that because feed intake increases markedly over the period beyond two weeks after the secondary immunisation, it may be possible to decrease both the lysine and energy contents of the diets or restrict feed beyond this point. Alternatively, growth modifiers such as ractopamine (Rikard-Bell et al., 2009; Moore et al., 2009a) or pST (McCauley et al., 2003; Oliver et al., 2003) may be used in some markets.

In many production systems, the ability to change diets at this point is limited. However, another strategy may be to have a diet change and introduce a metabolic modifier for the final two to three weeks before slaughter.

Conclusions

Boars are more efficient and deposit less fat than barrows, particularly at high slaughter weights. However, the risk of boar taint in peri-pubertal boars has resulted in legislation or recommendations in some countries that boars are slaughtered before they reach 85kg carcass weight.

Animal welfare activists are lobbying for a cessation of castration in many parts of the world, particularly the EU. However, this could result in inferior pork products being placed in the market.

A welfare-friendly alternative is vaccination against GnRF, which allows producers to capitalise on the superior natural growth and carcass characteristics of intact male pigs without the risk of boar taint.

Recent data suggests that the lysine requirement of boars is slightly higher (ca. 0.6 to 0.9g per kg) than for gilts but it is important that this is verified and quantified.

Given that the penalty in growth performance for having inadequate dietary lysine is greater in boars than in gilts, it is important to ensure that dietary lysine requirements are met to obtain the maximum benefits of boar production, coupled with vaccination against GnRF.

Also, it is important that the temporal pattern of tissue deposition rates and feed intake be further explored to be incorporated into models to predict nutrient requirements over this period of rapidly changing metabolism. This will be important to ensure that the benefits of vaccination against GnRF can be optimised in all the markets where it will be available.

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Research shows some sows prefer stalls

ThePigSite News Desk
August 06, 2010

CANADA - Research conducted by the Saskatoon based Prairie Swine Centre shows, given the choice, not all sows will choose to leave their stalls, writes Bruce Cochrane.

Several packers and producers have indicated a desire to transition from stall housing to group housing over the next decade.

The Prairie Swine Centre has completed a study which examined free space utilisation by sows in free access stalls to determine the number, size and parity of sows that use the free space.

Dr Harold Gonyou, a research scientist in animal behavior, explains researchers tracked the amount of time sows spent inside their stalls and in the free access area.

“We found that the sows did spend a fair amount of time within the stalls, that they would eat and then many of them would lie down within the stalls.

We found that 95 per cent of the sows at some point would leave their stall during their gestation.

We know that they did that because we found them in different stalls the next day.

But when we were looking at them over a 24 hour period we found that we'd have 40 per cent of the sows or so that spent less than two percent of the time outside the stalls throughout the day but we also had some that would spend 80 or 90 percent out.

So what we saw was about 20 percent of the sows outside of the stalls at any time during the day but we found it very skewed in terms of who was outside and who was inside the stalls.

We found that the sows that were outside are the larger sows and the older sows and this raises two questions in our mind.

Are the younger sows staying in the stall and not using the free access space because they want to avoid these other larger sows, so it's the dominance or social management question.

And the other one is, maybe the stalls that we were using which were 26 inches wide are not adequate to provide a comfortable lying space for the older sows and so they felt that they had to get out and lie somewhere else. “

Dr Gonyou says further research is needed to identify the issue and to come up with ways to even out the use of the free access space.

Prenatal stress leads to stress-prone piglets

The Pigsite
Friday, October 08, 2010

SCOTLAND, UK - Stress in pregnant pigs results in their offspring being 'stress-programmed' for life, research by at the Scottish Agricultural Colleges (SAC) has revealed.

The findings of the five-year study have implications for pig welfare and production and may also add weight to the theory that stress experienced by pregnant women can impact negatively on their babies' development.

Researchers at SAC's Sustainable Livestock Systems Research Group studied the impact of pregnant sows' exposure to social stress, which may happen routinely on pig farms when unfamiliar pigs are mixed into new social groups or when competition between sows occurs when they are fed together. The offspring from stressed mothers were found to be more fearful and to react more strongly to stressful situations than those born to pigs which had not experienced prenatal stress.

The study, funded by the Biotechnology and Biological Sciences Research Council and the Scottish Government, also found evidence that the piglets' immune systems were affected, potentially making them more susceptible to disease; that they had a substantially slower rate of growth after being weaned; and that they showed poorer quality maternal behaviour with their own piglets, including a greater tendency to attack their young.

The researchers believe that these problems are caused by stress hormones in the pregnant animal crossing the placenta and affecting the brain development of the foetus, particularly during the second third of pregnancy. The study focused on piglets of first time mothers, known as gilts, which are often more likely to experience stress during pregnancy.

Dr Kenny Rutherford of SAC's Sustainable Livestock Systems Research Group, which led the study, said: "Our findings showed that factors such as social stress on pigs during pregnancy had clear, negative effects on the way their offspring deal with stress, their growth and their behaviour.

"The impact of maternal stress on the offspring's later health and welfare may currently be overlooked within some farming environments but our study found that changing certain conditions that pregnant pigs experience could lead to a win-win situation of improved welfare both for the mothers and their offspring, as well as increased farm productivity and efficiency.

"Our findings could also be relevant to theories about the impact of stress on pregnant women because brain development in foetal pigs and humans is similar and at birth, human infant and piglets' brains are at an equivalent developmental stage."

Dr Rutherford will share his findings with representatives of the UK pig industry, pig researchers and policy makers at SAC's Pig Research Knowledge Exchange event in Edinburgh later this month.

SAC has received funding from DEFRA to build on the research by examining how the experiences of pregnant farm animals (pigs, sheep, cattle, poultry and farmed fish) might have a negative effect on their developing offspring and to measure how common these are in normal commercial conditions. The three-year study will result in recommendations on the best methods of managing pregnant animals for the sake of their own welfare and that of their developing offspring.

Foetal programming – Can it impact pork production housing?

PigSite
August 2,2010

The type of housing a female is penned in during gestation may cause foetal programming, according to Ronald O. Bates, state swine specialist at Michigan State University, writing in MSU *Quarterly Pork Quarterly*. In other words, pregnancy housing type can affect the performance of the sow's subsequent litter.

Introduction

There is an on-going discussion regarding how the care and treatment of female mammals during pregnancy may impact the subsequent performance of their offspring. In those cases where differences in care among pregnant females do alter subsequent progeny performance, this is called foetal programming. In essence, the care during gestation 'programmes' the developing foetus in such a way that after birth, it grows and develops differently than what may be expected. This interest in possible alterations in animal performance due to gestation management is being studied in pigs as well. It is generally regarded that if pregnant gilts or sows are provided adequate feed, water, space and an appropriate thermal environment (cooling in the summer, warmth in the winter) that gestation environment does not influence subsequent offspring performance.

However, this may not always be the case. As Michigan producers start to consider how compliance with recent legislation (P.A. 117) may alter how they manage gestating sows, it is relevant to consider how group housing gestating sows may influence the performance of their subsequent offspring.

A recent paper studied the subsequence performance of offspring from gilts housed in different types of housing during gestationa. This study reported that Yorkshire-Landrace F1 gilts were mated and housed in either 1) gestation stalls, 2) gestation pens or 3) stalls for the first 30 days of gestation and then gestation pens. Gestation stalls were 2‵ × 7‵, while gilts housed in pens were allocated 25.5 to 30.5 square feet per animal. Gilts were fed 6lb per day of gestation feed that met or exceeded NRC (1998) requirements. At 110 days of gestation, gilts were placed into standard farrowing stalls and remained there through lactation. Pigs were weaned at approximately 24 days of age. At weaning, gilts were placed into nursery pens by weight and these groups of gilts remained intact through the end of the finishing phase. Gilts were placed on self-feeders and fed rations that met or exceeded NRC requirements for each of the nursery and grow-finish phases. At approximately 240lb, gilts were removed from finishing and were limit-fed 5lb of feed per day and exposed daily to mature boars to detect oestrus.

Results

The results from this study can be viewed as two different parts. The first part is how gilts housed differently during gestation performed during lactation, while the second part regards differences in performance of offspring from gilts housed differently during gestation.

The farrowing performance of gilts which had gestated in one of these three housing systems could be considered a possible preview to how first litter performance for gilts gestated in groups may differ from a farm's previous experience of gestating gilts in stalls.

Gilts that gestated exclusively in stalls were similar in weight at mating and at farrowing (Table 1) compared to gilts in the other two gestation housing treatments. However, during lactation gilts that gestated in stalls exclusively, lost less weight and backfat thickness during their first lactation than females that had gestated in either group housing treatment. Gilts that had gestated in stalls exclusively or in stalls for 30 days and grouped into pens had similar number born alive, compared to each other but was greater than gilts that had gestated in groups throughout gestation (Table 1.). However after cross-fostering across treatment groups, all females regardless of gestation housing treatment had similar number of pigs weaned per litter and similar pig weaning weights.

Table 1. Lactation Performance of Gilts Housed in Different Gestation Housing Types[a].

Item	Stalls	Pens	Stalls/Pens
Weight at Mating, lb	442.0	429.0	420.0
Weight at Farrowing, lb	543.0	546.0	541.0
Lactation Weight change, lb	-6.6[b]	-22.9[c]	-48.7c
Lactation Backfat change, mm	-2.3[b]	-4.2[b]	-5.4c
Lactation Average Daily Feed Intake, lb	15.6[b]	14.6[b]	12.3b
Number born alive	12.1[d]	9.1[e]	11.3d
Number weaned	9.6	9.8	9.6
Avg. pig birth weight, lb	3.5	3.5	3.7
Avg. pig wean weight, lb	19.4	19.4	18.7

[a]Adapted from Estienne and Harper, 2010.
[b,c]Means with differing superscripts differ (P=0.06).
[d,e]Means with differing superscripts differ (P=0.07).

Gilt offspring, regardless of dam gestation treatment had similar grow-finish average daily gain (Table 2; average = 2.17lb per day). However, gilt offspring whose dams gestated in stalls exclusively or had gestated in stalls for 30 days and then grouped into pens had better feed efficiency than gilt offspring whose dams gestated in pens exclusively (Table 2). Gilt offspring whose dams had gestated in stalls exclusively were leaner at 240lb than gilt offspring whose dams had gestated in either group housing treatment. Furthermore, fewer gilt offspring whose dams had been housed exclusively in stalls throughout gestation expressed their pubertal oestrus by 165 days of age compared to gilt offspring whose dams gestated in either group housing treatment (Table 2). However, though not shown, by 210 days of age, there was no difference in the occurrence of puberty of gilt offspring regardless of dam gestation housing type.

Table 2. Subsequent Gilt Performance from Dams Gestating in Different Housing Types[a].

Item	Stalls	Pens	Stalls/Pens
Grow-finish ADG, lb/day	2.23	2.14	2.14
Grow-finish Feed/Gran, lb feed/lb gain	2.60[b]	2.72[c]	2.61[b]
Off-test backfat thickness, mm	10.9[d]	12.5[e]	12.1 [d,e]
Percent reaching puberty @ 165 days of age	13[b]	48[c]	40[c]

[a]Adapted from Estienne and Harper, 2010.
[b,c]Means with differing superscripts differ (P<0.05).
[d,e]Means with differing superscripts differ (P<0.09).

This study does demonstrate that the type of gestation housing a female is penned in during gestation may cause foetal programming. That is, subsequent offspring from dams gestated in different types of gestation housing can perform differently. This provides some insight to how pig performance may change after switching gestation penning. Dependent on the type of group housing system chosen for gestating gilts, producers who switch from stalls to group housing may see subsequent offspring be slightly fatter and feed efficiency could worsen. However, if farms maintain an internal gilt multiplication programme, gilts from dams gestated in group housing may achieve puberty at a younger age and therefore have experienced more estrous cycles before mated for their first litter, if mated at a constant age.

Conclusion

Gilts housed in different gestation housing types did have gilt offspring perform differently. This suggests that gestation housing system could cause foetal programming. Producers should take note that growing pig performance could differ from previous experience due to a change in gestation housing systems. However, further research is needed to determine how prevalent this effect may be on barrow progeny grow-finish performance as well as determine if replacement gilt farrowing and lactation performance is impacted by the type of gestation housing in which their dams were penned.

Reference

Estienne, M.J. and A.F. Harper. 2010. Type of accommodation during gestation affects growth performance and reproductive characteristics of gilt offspring. J. Anim. Sci. 88:400-407.

Advances in sow and gilt management

The Pigsite
September 22, 2010-09-22
Rudolf Wiedmann of the Centre for Education and Knowledge in Boxberg, Germany, describes the changes that can be made in feeding and husbandry to improve sow and gilt welfare and to reduce losses in a paper presented at this year's London Swine Conference.

Abstract
In highly prolific sow units you have to keep a special eye on dry sows. To reduce the increasing overall losses of dead sows it is necessary in the first place to optimize the feeding management. Three main suppositions have to be fulfilled: individual, undisturbed and simultaneous. Self-locking stalls enable the sows to eat their individual quantity of concentrate in a private atmosphere.

In respect to husbandry, there are three aspects to consider as well. First, you have to do everything for a quick and stable social hierarchy. Second, each sow has to fill her stomach completely at least once a day. And third, the lying comfort has to be adequate to the very different situations in respect to weather and individual body condition. In this respect you need, in each pen, at least two floors with different insulation properties.

Introduction: Sow Losses Are Too High

Low hog prices have driven successful pig producers to focus a great deal on cost control. While not one of the major cost centres in swine production, replacement rate of gilts has reached a level that is too high, with more than 50 per cent in many units. In addition, the performance and particularly health status of such herds is suppressed. Therefore we have to ask the question: How should we manage the modern highly prolific sow to lower the risk for a too early loss? What are the risk factors in respect of feeding and husbandry?

The Fachhochschule Soest in Germany investigated, in 46 piglet producer units, the background for sow losses. In many cases, there is a combination of several reasons which lead to the culling decision. Therefore the scientists identified both main reasons and secondary reasons. Most of the sows were culled due to age and fertility. But how old is an old sow? On some farms, the 'age' already begins after the fourth litter (Figure 1).

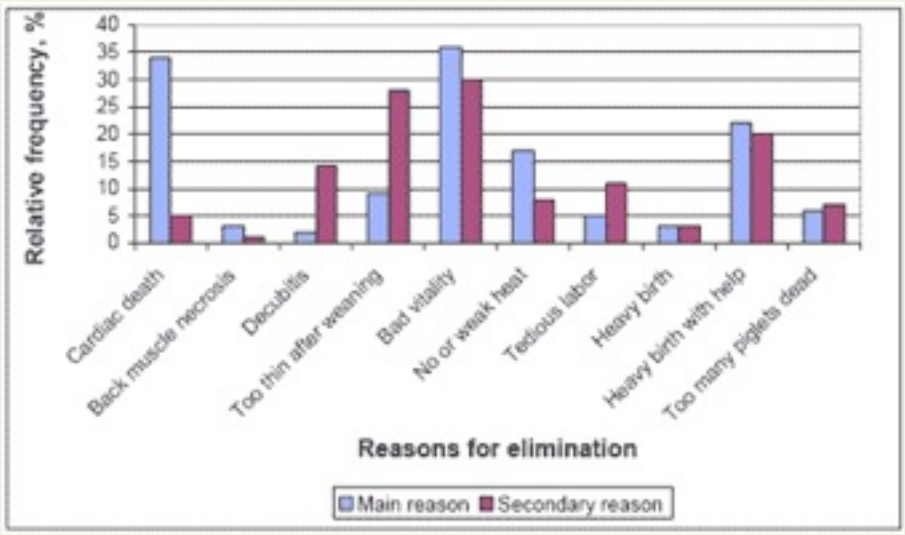

Figure 1. Reasons for culling sows in German sow units.
(Freitag and Wittmann, 2008)

In many cases you cannot detect the real culling reason. In a German field study from November 2004 to November 2005, dead and culled sows from four sow herds were brought to a pathology institute and a post mortem investigation was performed. Results showed that 47 per cent of the post mortems were not because of infectious disease: 33 per cent were from infections and 20 per cent were due to ruptures and accidents (Figure 2).

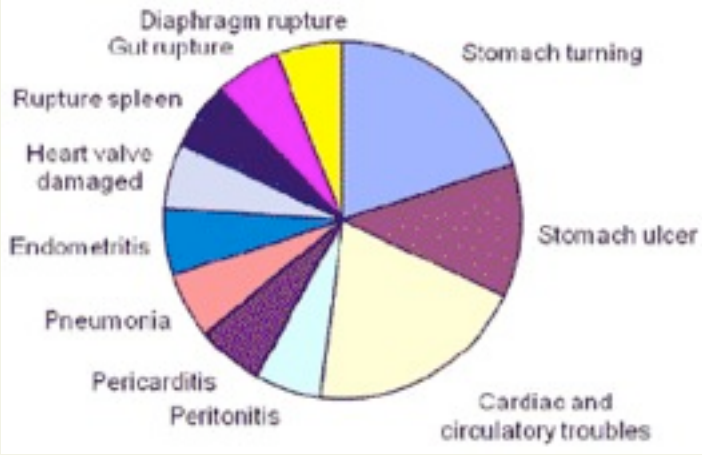

Figure 2. Pathological-anatomical diagnostic findings
(Nienhoff, 2007)

We know that there are not only big differences between different farms but also between different countries. In Germany, we have a culling rate of five to seven per cent; in the Netherlands, only five per cent but in Denmark, 15 per cent on average. A certain percentage in Denmark is due to mercy killing of sows with shoulder lesions but the overall percentage is still much too high.

Strategic Management Measures in Feeding

To simplify the actual problems it is useful to restrict our efforts only to the pregnant sow. Furthermore we have to differ from reasons by feeding or by husbandry. Settling new housing, firstly you should be concerned with feeding. After determining the feeding system, then it is time to decide the housing system.

In Europe, sows have to be kept in groups from week 5 of gestation until one week before farrowing (EU guideline 2001/88/EG). The hierarchy, which is among sows, can be a

problem when feeding them in groups. Alpha sows – those at the top of the ranking system – can tend to dominate feeder entrances. This intimidates more timid sows, who may not be able to easily access their feed.

There are three principal goals of a feeding system:

1. Each sow has to be fed each day individually. Otherwise, you risk undesired growth.
2. Each sow has to be undisturbed during feeding. Concentrate mixture for pregnant sows is strongly rationed and there are more than 100 per cent differences in eating speed.
3. All sows of one compartment should eat together. No electronic feeding machines without simultaneous feeding cannot overcome this great disadvantage.

Feeding Stalls are First Class

It is not surprising that only feeding stalls with self-locking or manual-locking doors fulfill the demands of the sows as well as the claims of managers and staff. The self-catch system has many advantages. It enables sows to have contact with other animals whenever they want, but have more privacy when eating.

First of all, the system is quiet and animal friendly. Also, pregnancy scanning is easier as sows can be fixed with little effort. Often, the bile is empty before they start eating again and go into their stalls, so the diagnosis is generally accurate. Sows are very calm during feeding in their stalls.

Feeding stalls are very common in the Netherlands and uncommon in Denmark, which is one reason for the big differences in sow losses. Feeding stalls are well suited for little as well as for very big units. People use them in conventional and organic farms. Staff with lower training can work more easily than with electronic feeding systems (Table 1).

Feeding system	Individual	Undisturbed	Synchronal	Behaviour	Evaluation as a whole
Slowfeeder	No	Yes/No	Yes	All right	
Quickfeeder	No	No	Yes	Too quick	
Liquid feeding without stalls	No	No	Yes	Too quick	
Electronic feeding	Yes	Yes/No	No	Not species-appropriate	
Feeding stalls	Yes	Yes	Yes	Species-appropriate	

Table 1. Qualification of five feeding systems for highly prolific sows.

Strategic Management Measures in Husbandry

In respect of housing conditions, three aspects are very important for health, performance and sustainability. These are stable social hierarchy, gut fill and lying comfort.

Stable social hierarchy

Sow aggression is a heritable trait and it may be possible to select against it. But the environment and management still play an important role in how sows behave. When mixing sows, a new social hierarchy has to be found. To prevent negative influence on claws, it is favourable to give during the first two days of mixing enough space (5 square metres = 55 square feet) and a solid floor with deep straw.

After staying in such an 'area', the sows have built up their hierarchy. To stabilise this

hierarchy, it is necessary to offer suitable conditions in their pens in respect to feeding system, gut fill and adequate lying comfort.

Gut fill: 'a full sow is a peaceful sow'

Highly prolific sows are able to eat daily during lactation more than 8kg (16lb) of concentrate. Therefore you can imagine, that dry sows cannot reduce this quantity to 2.5kg (5lb) without any problems. With single housing there was no great problem to handle permanent hungry sows.

But it is very different in group housing. To keep sows peaceful, they have to be full. Otherwise, there will be problems like restlessness, injuries of skin, vulva, claws, fertility and so on.

Adequate lying comfort

Most of the time, sows are resting. Therefore you have to offer adequate facilities to keep them warm in cold weather, i.e. insulation and/or heating of building or floor in lying area. During hot weather, sows need appropriate cooling. Therefore, it is for highly prolific sows performance-suppressing to lie only on slats. The resting area has to be at least solid and insulated, i.e. in housing with cold climate. Much better is sufficient and dry bedding material.

Location of the test point	Temperature °C	Temperature °F
6 ft above slatted floor	20	68
Near slatted floor	18	65
Slatted floor with thin sow	17	63
Slatted floor with normal sow	19	66
Slatted floor with thick sow	24	75
Insulated or littered floor with thin, normal and thick sows	28	82
Skin of sows	28	82

Table 2. Floor temperatures in the sow lying area with regard to body condition score

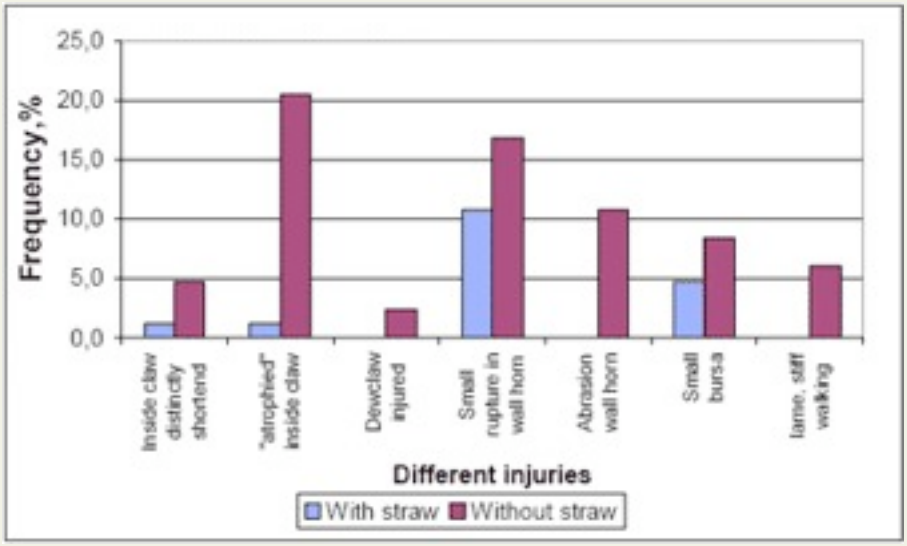

Figure 3. Comparison of pens with or without straw in the lying area in respect ot different parameters of claws. (Hahn, Boxberg, 2009)

Since the skin temperature of sows is about 28°C (82°F) – like in human beings – all lying materials have to make sure, that those skin temperatures can be maintained easily. Table 2 shows the problem, that thin sows are not able to heat slats to the necessary 82°F. Such sows are more exposed to risks like colds, cystitis and so on. Furthermore, they lie more on their stomach and are not able to sleep in relaxed lateral position. Lying on the stomach is a leading cause of leg and claw injuries. Dry straw in the lying area is a very good method to keep claw injuries at a low level. (Figure 3).

Figure 4. Structured housing for pregnant sows in a double-row with different insulated areas.

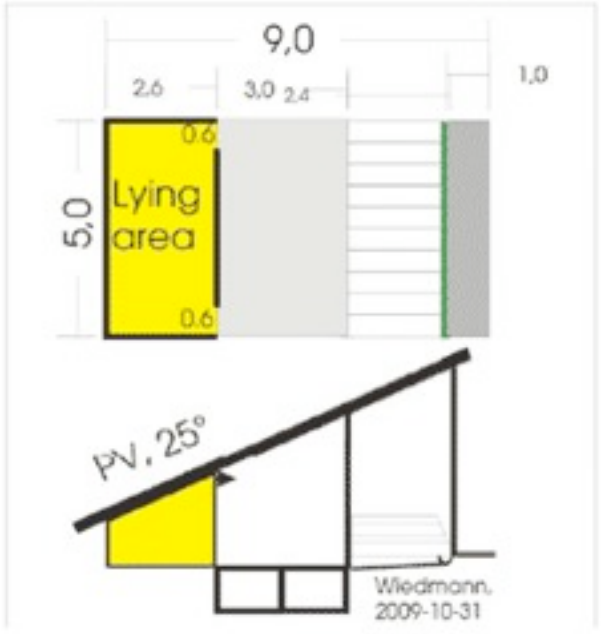

Figure 5. Structured housing for pregnant sows in a single row with photo-voltaic roof to the south
(measurements in metres)

In Figures 4 and 5, you can see examples for pregnant sows with different areas for lying, feeding and dunging. Floor and walls of the lying area are insulated.

Some Aspects to Gilt Management

First of all: gilts are the 'crown jewels' of each unit. Therefore, do not house them like finishers.

A great deal of problems with today's sow herds are the results of not respecting the needs of the gilts in the past.

Guidelines for Gilts

- Gilts should be kept in little groups of about six to 10 animals
- Offer them much space (at least 3 square metres = 30 square feet per gilt) for their own fitness training (heart, muscles and fibers, immunity)
- Give them each day a lot of employment, a full gut and fresh air
- Lying areas must have different insulation (straw area and concrete area)
- Look for claw abrasion and strong, clean legs
- Keep gilts separate but not too far away from your unit
- Emphasise a firm human-animal-relation and talk to them each day
- Serve them not before they are eight months old
- Adapt them to feeding stalls
- Give them contact with boars
- Put them to the sows after first litter at the earliest – or even better after second litter

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Milk immunoglobulins important for piglet growth

Pig Progress Aug 3/10
02 Aug 2010

Author: Ioannis Mavromichalis

We all know quite well that sow's milk is an ideal source of nutrients for newborn piglets. Not only milk, and especially colostrum, is rich in nutrients like protein, lipids, and lactose, but these very nutrients are extremely digestible. What is less known is the fact that sow's milk and colostrum are also an essential source of functional compounds, mostly proteins that play an important role in piglet growth, development, and overall health.

Very recently, a team of researchers from China* and the USA investigated the expression of such functional proteins in sow's milk and colostrum in relationship to mammary gland position. This study was done to better understand why piglets on anterior and middle mammary glands grow faster than piglets obtaining milk from posterior mammary glands.

Although a number of theories exist to explain this phenomenon, none has provided a complete picture so far, perhaps because it is a combination of factors leading to it. In the above study, just published in the Journal of Animal Science (2010, 80:2657-2664), it was demonstrated that milk and colostrum from the anterior (and to a lesser degree middle) glands were richer in functional proteins such as immunoglobulins, lactoferrin, lactadherin, and haptaglobin than milk and colostrum obtained from posterior glands.

It is important here to mention that all of the above compounds contribute significantly to piglet passive immunity and gastrointestinal health and integrity. This clearly supports the notion that piglets receive and require more than just nutrients to live and thrive. It also supports the favourable results obtained in other trials where piglets were supplemented with such functional proteins as immunoglobulins and lactoferrin. Although the latter is currently commercially unavailable, immunoglobulins are used quite extensively through animal plasma and hyper-immunized egg powder.

To this end, we could question the adequacy of simple diets for young pigs, especially after weaning, when milk supply is abruptly terminated. Most such formulas contain all required nutrients, such as protein, carbohydrates, lipids, minerals, and vitamins, but they are rather deficient in functional proteins. Only the presence of milk products provides a rather weak supply of such components, but in low-quality diets, milk products are used sparingly. If we account for the rather poor (cheap) quality of such milk products (quite often over-heated), then we can discount the presence of functional proteins (heatsensitive) altogether!

Perhaps, the presence of immunoglobulins in high quality diets (through high levels of whey, plasma, and egg immunoglobulins) can explain the better performance and higher health supported by such diets. Of course, we still don't know how much is required of this 'novel nutrient', but immunoglobulins are today

recognised as almost essential in piglet nutrition, although most recognise as such their sources. This is of course the case with animal plasma, where considerable confusion exists.

In conclusion, I believe there is increasing evidence supporting the need for accounting for functional compounds in milk when formulating piglet diets. In my opinion, the most important functional protein is the group of immunoglobulins. Thus, when you next find yourself buying a piglet diet you may want to ask your supplier about the type, quality, and source of the immunoglobulins used!

* Many thanks to Dr. J.J. Wang from China Agricultural University (Beijing).

Enrichment makes pigs happy

The PigSite
Aug 3, 2010

UK - Researchers at Newcastle University have developed a method to tell whether a pig is happy. Babe may be the most famous sensitive pig in the world but new research from Newcastle University suggests he is by no means the only one. Experts from the university's School of Agriculture, Food and Rural Development have shown for the first time that a pig's mood mirrors how content he is, highlighting that pigs are capable of complex emotions which are directly influenced by the environment in which they live. Led by Dr Catherine Douglas, the team has employed a technique to 'ask' pigs if they are feeling optimistic or pessimistic about life as a result of the way in which they live.

In an experiment reminiscent of Pavlov's dogs, the Newcastle team taught the pigs to associate a note on a glockenspiel with a treat – an apple – and a dog training 'clicker' with something unpleasant – in this case rustling a plastic bag. The next step was to place half the pigs in an enriched environment – more space, freedom to roam in straw and play with 'pig' toys – while the other half were placed in a smaller, boring environment without straw and with only one non-interactive toy. The team then played an ambiguous noise – a squeak – and studied how the pigs responded. Dr Douglas said the results were compelling. She said: "We found that almost without exception, the pigs in the enriched environment were optimistic about what this new noise could mean and approached expecting to get the treat. In contrast, the pigs in the boring environment were pessimistic about this new strange noise and, fearing it might be the mildly unpleasant plastic bag, did not approach for a treat. "It's a response we see all the time in humans where how we are feeling affects our judgement of ambiguous events. For example, if you're having a bad day – feeling stressed and low – and you're presented with an ambiguous cue such as your boss calling you into their office, the first thing that goes through your head is what have I done wrong? We call this a negative cognitive bias. But on a good day you greet the same ambiguous event far more positively, you might strut in expecting a slap on the back and a pay rise.

"This 'glass half empty versus glass half full' interpretation of life reflects our complex emotional states, and our study shows that we can get the same information from pigs. We can use this technique to finally answer important questions about animal welfare in relation to a range of farm environments, for pigs and potentially other farm animals." The research, funded by Universities Federation for Animal Welfare (UFAW) was presented at the organisation's annual conference in York. Quality of life of our farm animals is becoming increasingly important to consumers, scientists and government and the study is part of ongoing research at Newcastle to further our understanding of animal welfare and improve the lives of farmed stock. Sandra Edwards, professor of agriculture at Newcastle University and one of the UK's leading experts in pig welfare, said the next step would be to refine and further validate the methodology so it could be used to help scientists determine what is really important to the pig for its well-being. She explained: "Historically, animal welfare research looked only at alleviating suffering. Now the UK industry itself is going beyond a minimum standard and funding research to explore measuring, and then promoting, quality of life.

"Although techniques exist to measure stress, in the past we haven't been able to directly ask a pig if it is happy or not. Instead we have assessed production systems based purely on human perceptions and our best interpretations of behaviour. "Our research, for the first time, provides an insight into pigs' subjective emotional state and this will help scientists and farmers to continue to improve the lives of their pigs in the

future." Dr Douglas said that in their experiments they deliberately used only environments that could be easily and sustainably introduced in commercial systems. She added: "UK farmers have some very difficult decisions to make in order to compete in the global market and to suggest that we make all pig farms free-range is simply not practical, possible or necessarily desirable. Unfortunately, consumers buying cheap imports have the biggest impact on animal welfare and this puts pressure on UK farmers who, as a rule, do their utmost to ensure good welfare of the UK pig herd. "In our experiments, the enriched environment was also a widespread commercial housing system, so a 'happy pigs' system already exists on many farms across the UK."

Tryptophan-enriched diet reduces pig aggression

Pigsite September 6 2010

Supplementing the diet of young gilts with amino acid, tryptophan, made them less aggressive and easier to manage, according to new research from the USDA Agricultural Research Service (ARS).

When pigs are subjected to the aggressive behaviour of other pigs, they become chronically stressed, which interferes with their ability to fight off disease and maintain typical growth levels.

Now scientists have found that feeding the amino acid tryptophan to young female pigs as part of their regular diet makes them less aggressive and easier to manage. Tryptophan, which is only acquired through diet, is the precursor for serotonin, which is a cerebral neurotransmitter that helps to control emotion and aggression.

In the study, a diet with 2.5 times the normal amount of tryptophan was fed for one week to three-month-old grower pigs and six-month-old finisher pigs. Another group of pigs received a normal diet.

Behavioural activity and aggressiveness were measured before and after the seven days of diet supplementation.

The supplemented diet raised blood concentrations of tryptophan in three-month-old females by 180 per cent and by 85 per cent in six-month-old females and reduced aggression and overall behavioural activity among the younger female pigs.

The research was carried out by Jeremy Marchant-Forde and Heng-Wei Cheng, USDA-ARS Livestock Behavior Research Unit, West Lafayette, Indiana.

More feeding during early gestation is feasible

Pigs Progress 06 Sep 2010

The Dutch Product Board for Livestock, Meat and Eggs, De Heus Voeders and Varkens KI Netherlands commissioned Wageningen University to study certain feeding measures during early gestation of young sows.

The researchers examined if feeding 30% extra feed (3.25 kg v.s. 2.5 kg) or feeding a feed with 30% extra protein during the first four week of gestation, day 2-32 after insemination, influenced reproduction results and weight, back fat and muscle development. In addition, this study examined if weaning at three weeks positively influenced reproduction results in subsequent parity.

Experimental design
After insemination, 146 1st and 51 2nd parity sows were allocated to one of four treatments. Sows in the 4th treatment group were allocated to this group at farrowing. The four treatment group that were compared in this study were:

1. Control group: Sows in the Control group were fed 2.5 kg of a standard gestational feed during the first four weeks of gestation.
2. Plus Feed group: Sows in the Plus Feed group were fed 3.25 kg of a standard gestational feed during the first four weeks of gestation.
3. Plus Protein group: Sows in the Plus Protein group were fed 2.5 kg of a gestational feed containing 30% extra protein during the first four weeks of gestation.
4. Three Weeks group: Sows in the Three Weeks group were weaned at three weeks and were fed 2.5 kg of a standard gestational feed during the first four weeks of gestation.

During lactation sows were housed in farrowing crates, during the weaning to insemination interval and the first four weeks of gestation in individual crates and the remaining gestation in groups.

Main results and conclusions
The Plus Feed group gave significantly larger litters from 1st insemination (15.1 piglets) compared with the Control group (13.1 piglets). The Plus Feed group seemed to give more repeat breeders from 1st insemination (23%) compared with the Control group (10% repeat breeders), however this difference was not significant and can still be due to coincidence. Litter size and percentage of repeat breeders from 1st insemination of the Plus Protein (13.7 piglets and 10% repeat breeders) and Three Weeks group (13.3 piglets, 8% repeat breeders) were not significantly different from the Control group. The Plus Feed group shows a lower percentage of litters with ten or less piglets and a higher percentage of litters with 17 or more piglets from 1st insemination compared with the Control group.

Average piglet birth weight and piglets lost in the first three days after farrowing was not different between treatments. Sows in the Plus Feed group gained significantly more compared with other treatment groups (24 vs. 16 kg). The extra feed cost for the Plus Feed group was € 4.29 per sow per four weeks. The extra feed costs for the Plus Protein group was € 0.94 per sow per four weeks. The financial revenue of the increased litter size in the Plus Feed group compared with the Control group, taking the extra cost for the repeat breeders into account, is €66.88 on a yearly basis. However, we did not account for extra cost of a possible higher culling rate because of a higher number of repeat breeders.

Contradicting results
Feeding 30% extra protein during the first four weeks of gestation or weaning at three weeks showed no effects on reproduction in subsequent parity. Feeding 30% extra feed during the first 28 days of gestation, however, showed contradicting results. Litter size from 1st insemination was positively influenced without decreasing piglet birth weight, whilst the percentage of repeat breeders was increased. Perhaps the percentage of repeat breeders can be lowered by starting the high feeding level later after insemination. Literature shows, that a high feeding level starting right after insemination decreased embryonic survival in gilts. Placental development might be improved by the high feeding level level, causing piglet birth weight not to decrease, despite the higher litter size in the Plus Feed group.

More feed is financially feasible
Despite the higher percentage of repeat breeders, feeding extra feed during the first four weeks of gestation is financially feasible. If the percentage of repeat breeder can be lowered by finding an explanation for the higher percentage of repeat breeders, the feeding strategy will be even more feasible.

Clostridium difficile shedding in piglets investigated

PigProgress.net 26 Aug 2010
[Source: Weese JS, Wakeford T, Reid-Smith R, Rousseau J, Friendship R, Longitudinal investigation of Clostridium difficile shedding in piglets, Anaerobe 2010 Aug 12]

A longitudinal study of Clostridium difficile colonization in piglets was performed on a conventional swine farm in Ontario, Canada. Fecal samples were collected from 10 sows prior to their expected farrowing date, and then from all their piglets on days 2, 7, 30, 44 and 62 of life. C. difficile was isolated from 4/10 (40%) of sows prior to farrowing, 90/121 (74%) piglets on day 2, 66/117 (56%) on day 7, 45/113 (40%) on day 30, 23/101 (23%) on day 44 and 2/54 (3.7%) on day 62.

There was a significant decrease in colonization over time (P < 0.0001). Overall, C. difficile was isolated from one or more samples from 116/121 (96%) piglets. There was an inverse association between sow colonization and piglet colonization on day 2 (P < 0.0001) and a positive association on day 7 (P = 0.001). Ribotype 078/toxinotype V predominated, accounting for 213/234 (91%) isolates. A toxinotype XIV strain that has been previously found in humans in the province was the 2nd most common, but was mainly found in sows, not piglets.

Overall, 227/234 (97%) of isolates were from types that have been isolated from humans in the province. Intermittent colonization was detected in 11 (9.6%) piglets. The decline in C. difficile colonization over the first 2 months of life was remarkable. The variation in colonization over a relatively short period of time has important implications for the design and interpretation of studies evaluating C. difficile colonization in pigs, since relatively small differences in age may have a major confounding effect on the prevalence of colonization.

The decline in prevalence over time may also have implications on public health concerns, since colonization rates of animals at the time of slaughter are presumably more relevant than those earlier in life.

POULTRY

Evaluation of alternative methods of euthanasia for cull turkeys

Canadian Poultry Research Council
Tina Widowski, University of Guelph
Sept 2010
PWB020

Funding: $75,579 (CPRC $25,193, NSERC/AAFC $50,386)
Start date: April 2007
Expected end: October 2009
Interim report received: August 2008
Final report received: January 2010
Status: complete

Background:
Over 20 million turkeys are produced annually in Canada. As with other types of animal production, it is sometimes necessary to follow culling or depopulation protocols that are designed to reduce animal suffering. The turkey's large size makes some methods that are routine in smaller species difficult to perform effectively. In Canada, recommended euthanasia methods for turkeys on farms, as outlined in the current Codes of Practice for Care and Handling of Farm Animals, include blunt force trauma and manual or mechanical cervical dislocation. The American Veterinary Medical Association considers manual cervical dislocation to be an acceptable method for small birds, and the Canadian Council on Animal Care considers mechanical cervical dislocation to be an acceptable method for large birds. Until now, no scientific studies have been conducted to determine which method is the most effective for rapidly rendering turkeys insensible. "Insensibility" is the point at which an animal can no longer feel pain. It can be measured by looking at the nictitating membrane reflex (this membrane is the clear "third eyelid" birds use to moisten or otherwise protect the eye while maintaining vision) and pupil constriction. Rapidly rendering an animal insensible is critical to any euthanasia protocol.

Research Progress:
Dr. Tina Widowski and graduate student Marisa Erasmus at the University of Guelph looked at the effectiveness of a device known as a Zephyr Stun Gun for euthanizing turkeys. This air-powered device has been used successfully to euthanize pigs by driving a non-penetrating captive bolt that impacts its

target. The researchers compared the Zephyr to other physical methods in terms of time to insensibility and the degree of resulting brain lesions.

Small pilot trials were first performed on carcasses to determine appropriate pressure settings for and placement of the device to make it most effective. Based on the results of these trials, the Zephyr was modified such that is could inflict sufficient brain trauma on large (over 10 kg) turkeys.

Using the methods and settings developed during the pilot studies, a number of trials were performed using the modified Zephyr on live birds (that were destined for culling) on commercial farms. The researchers looked at time to insensibility and time to death of different weight birds and compared the Zephyr to other euthanasia methods (manual cervical dislocation, mechanical cervical dislocation and blunt force trauma). Brain damage was assessed using macro and micro observation, histology, and CT scans.

In the first trial, mature breeder hens (11 kg) were euthanized using the Zephyr or by mechanical cervical dislocation. In the second trial, toms ranging from 17-19 kg from two farms were euthanized by Zephyr or blunt force. In the third trial, broilers were euthanized by Zephyr (4.6 kg), manual cervical dislocation (1.6 kg) or blunt force (5 kg).

Results from all trials indicate that the Zephyr is as effective as blunt force trauma at quickly rendering turkeys insensible. Time to insensibility and time to death were both longer using cervical dislocation (manual or mechanical).

This study concludes that the Zephyr is a highly repeatable and effective method for euthanasia of birds in all of the weight classes tested. The results also suggest that the methods used for cervical dislocation in large birds, particularly by mechanical means, do not render birds unconscious immediately. Any recommendations for their use need to be reconsidered.

Dr. Widowski's team is planning work to improve the practicality of the Zephyr for on-farm use and will be looking into avenues by which to make the device commercially available to producers.

Publications:
Erasmus MA, Lawlis P, Duncan IJ, Widowski TM. 2010. Using time to insensibility and estimated time of death to evaluate a nonpenetrating captive bolt, cervical dislocation, and blunt trauma for on-farm killing of turkeys. Poult Sci. 89:1345-54.

UK: Egg production drops in welfare-friendly poultry

18.Aug.10
Octagon Services

In various parts of the world, an increasing number of egg-production drops due to Brachyspira infections are being reported. This infectious bacterial disease seems to thrive particularly in outdoor, "welfare-friendly" free-range poultry flocks.
Normal poultry droppings consist of dry faeces and white urates. Yellow frothy droppings are suspicious of Brachyspira bacteria, causing Avian Intestinal Spirochaetosis (AIS).

The major recognised pathogenic Brachyspira are B. intermedia, B. pilosicoli and B. alvinipulli in caged systems. However, B. murdochii and B. innocens, although considered non-pathogenic in caged birds, have been associated with depressed egg production in free-range systems. Brachyspira hyodysenteriae, the main pig Brachyspira, has also been isolated in hens, closely associated with pig farms.
In a survey in the UK of 222 commercial layer, pullet and breeder farms 74% of the flocks were positive and 25% were associated with the pathogenic strains. When this was broken down by type of farm a different picture arose (Figure 1). Breeder layer flocks could be infected, but it was not found in in-rear pullet flocks up to 15 weeks of age. The organism is spread by the faecal-oral route and there is a natural break as it dies out on the egg surface during hatching.

Free-range and free-range organic flocks were heavily infected (approx. 90%) and less so in caged flocks (76%). Barn flocks were all infected. Brachyspira infection began at a much earlier stage in free-range flocks, by 22 weeks of age, soon after the birds were allowed to go outside (Figure 2). By comparison, caged flocks took longer for the infection to spread, but the majority of flocks were positive by 36 weeks of age. This explains the high level of infection in the US survey in 2009 with 86% of flocks infected as they were over 40 weeks of age. There were not many barn flocks tested, but the younger ones of 31-34 weeks of age were all positive.

Interestingly, there did not appear to be any difference in age of infection between caged flocks using deep pits for waste disposal or belt cleaning. This was considered surprising as the number of flies in deep-pit systems is usually much higher. It is also thought that flies are important, mechanical carriers of Brachyspira from faeces to feed and thereby complete the infection cycle.
A survey in Sweden identified rodents, particularly rats, as major carriers of Brachyspira on poultry farms (Table 2). Wild birds are also potential carriers of Brachyspira.

With the dramatic changes that occurring in layer production at present the widespread phasing out of cages - productivity is going to be a key issue. Cages have generally separated hens from their faecal waste and as a result have a significantly better performance than free-range hens. Barns are somewhere in between. Enriched colony cages will still be able to maintain this separation, however, there is already a major move to barns in some countries and certainly towards free-range flocks in the UK, and therefore likely that we will be facing more concerns regarding Brachyspira infections in commercial laying flocks.

Salmonella thrives in cage housing

Source: World Poultry Vol. 25 No. 10, 2009
20 May 2010

The poultry industry is permanently fighting the battle against Salmonella. That is certainly not without reason, as Salmonella is an important cause of gastrointestinal disease in humans throughout the world. It is likely that the type of housing that layer hens are kept in influences the occurrence of infection. This appears to be in the advantage of flocks that are reared in alternative housing systems in comparison to cage systems.
By Prof. Dr. Jeroen Dewulf, Faculty of Veterinary Medicine, Ghent University, Merelbeke, Belgium

As of January 2012, housing of laying hens in battery cages will be forbidden in the EU and only alternative housing such as enriched cages and non-cage systems (barn, free-range and free-range organic) will be allowed. This ban on battery cages aims to improve the welfare of laying hens, yet it has also initiated the question whether there aren't any adverse consequences of this decision on the spread and/or persistence of infectious (zoonotic) diseases in a poultry flock. This fear is based on the opinion that a big advantage of conventional battery cages is that, because hens are separated from their faeces, the risk of disease transmission through the faeces can be minimised. It was argued that the increased exposure of layers to environmental contaminations in non-cage systems can increase the risk of Salmonella infections.

Salmonella remains an important cause of gastrointestinal disease in humans worldwide. In Europe, S. Enteritidis (predominantly originating from poultry) and S. Typhimurium (predominantly originating from swine) are the most commonly isolated serotypes in human cases of salmonellosis. Contaminated eggs still remain the most important source of infection of S. Enteritidis for humans.

Effect of the housing system

A number of field studies, varying from small to very large, have evaluated the effect of the housing system on the occurrence of Salmonella. As often is the case, these studies have variable results going from a reduced risk of Salmonella contamination in cage systems, to no influence of the housing system, to an increased risk.

Two studies (one in laying hens and one in pullets) have found a lower level of Salmonella infection in laying hens housed in cage systems in comparison to deep litter systems. Meanwhile, four studies have found no significant effect of the housing system on the occurrence of Salmonella. However, six studies found an increases risk of Salmonella infection in laying hens housed in cage systems in comparison to the alternative housing systems.

Of course, it is difficult to summarise all these results into one single conclusion concerning the effect of the type of housing as a result of both the variable study design and the variable outcome. Nevertheless, the majority of the studies clearly indicate that a cage housing system has an increased risk of being Salmonella-positive in comparison to non-cage housing systems.

Although the majority of the studies indicate that cage systems have an increased risk of testing positive for Salmonella, this does not necessarily mean that there is a causal relationship between the housing type and infection. On the contrary, it is more likely that the effect attributed to the housing system is in reality influenced by several other production characteristics, such as magnitude of the flock or the herd, age of the building, probability of previous Salmonella infections on the farm, etc. The most important production characteristics that are most likely to be related to the housing system and the probability of a Salmonella infection are discussed below.

Herd and flock size

In general, cage flocks are larger than alternative flocks. They do not only have more birds per flock, but often also more flocks per herd. It has been shown in several studies that both the number of flocks, and thus the number of hens in a herd, as well as the number of hens in a flock are, independently from the production type, significant risk factors for Salmonella. The presence of multiple flocks in one herd may enhance the risk of cross-contamination of infection from one flock to another, especially since in multi-house systems there are often open pathways between houses to give way to conveyor belts, feed pipes, passageways, etc. This close association of houses makes it easy for infections to be transferred from one flock to the other, particularly by rodents. This risk is even further increased if the flocks present are in different stages of production.

Related to both production type and flock size is stocking density. For many infectious diseases in production animals it has been demonstrated that an increased stocking density also increases the prevalence of disease and the ease of spread.

Stress factors

Stressors such as re-housing, thermal extremes, transport, initiation of egg lay and molting have all been shown to exacerbate infection problems in poultry. Additionally, the housing conditions may influence the stress level in the animal and as a result influence Salmonella prevalence. In the effect of housing systems on the stress levels in animals, literature presents some conflicting results. Some suggest that birds have less stress in cage systems, whereas others found that hens housed in non-cage environments experience less stress. As a result it is difficult to conclude which of the systems induces the highest stress in the birds.

Age of the building

Salmonella is a micro-organism that can survive for a very long time (up to one year). As a result, after having experienced a Salmonella infection in a flock, it is not easy to fully get rid of this infection, even with cleaning and disinfection. This is why carry-over of infection from one production cycle to the next occurs very frequently. Therefore, the older a system is, the greater the chance that there is some historical infection that may be carried over.

In general, conventional battery cages are older than alternative production systems, such as floor raised or free-range systems. Older systems, independently of the type, may also be more difficult to thoroughly clean and disinfect.

Rats and mice

It has been suggested that cage houses present a more attractive environment to pests such as rats and mice compared to free-range systems since birds are restrained in cages and do not interfere with their movements. It has also been shown that these rodents are capable of spreading Salmonella.

Protective vaccination

The use of vaccination against Salmonella has a clear protective influence on the shedding of Salmonella. It is interesting to note that studies have reported the disappearance of Salmonella after vaccination in free-range flocks, but not in cage flocks. This may again be an indication of the lower challenge of birds in free-range conditions.

Exotic Salmonella species

Because S. Typhymurium is much more common in wildlife, pigs and cattle, it has been postulated that free-range laying flocks will be at greater risk of becoming infected with S. Typhimurium than other production types. It has also been suggested that production systems where hens have access to outdoor facilities are more likely to become infected with less frequently (other than S. Enteritidis and S. Typhimurium) encountered Salmonella serovars. Yet, this cannot be confirmed based on the studies currently available.

Conclusions

Based on epidemiological data provided above it can be stated that it is highly unlikely that a move from conventional battery cage systems to alternative cage systems and non-cage housing systems for laying hens will result in an increases in Salmonella infection and shedding. Rather, the opposite is expected. The true underlying mechanism that causes the prevalence of Salmonella to be generally lower in alternative housing systems in comparison to cage systems has not been identified as yet. It is likely to be a combination of factors influencing the infection pressure in the herd.

Impact of layer housing system on egg safety, quality still unclear, says PSA

The PoultrySite
October 7, 2010

US - Based on a recently published White Paper, the Poultry Science Association (PSA) reports that the scientific jury is still out on how different laying hen housing systems impact egg safety and quality.

In the face of current pressures on the egg industry to shift from conventional to non-cage housing systems for layers, it is important to recognise that there is currently no scientific basis for believing that such a move would improve either egg safety or quality. And, given the conflicting nature of the findings of a number of recent studies on the issue in both the US and the European Union, such a move could conceivably have the opposite effect, according to the Poultry Science Association (PSA).

PSA based its comments on a White Paper to be published in early 2011 in the journal, Poultry Science (Holt, P.S. et al. The Impact of Different Housing Systems on Egg Safety and Quality doi:10.3382/ps. 2010-00794; see link below) that provides a comprehensive summary of research on various layer housing systems and their effects on egg safety and quality. The authors of the paper conclude that "[a] move from conventional cages to either an enriched cage or a non-cage system may affect the safety or quality, or both, of the eggs laid by hens raised in this new environment...An understanding of these [various systems'] different effects is prudent before any large-scale move to an alternative housing system is undertaken."

PSA president, Dr Michael S. Lilburn concurred, noting: "Housing is an emotional issue, and the question of which is preferable – conventional versus non-cage – clearly hinges on a wide variety of important issues. But given that the very reason for the existence of layer housing systems is the production of safe and high quality eggs for human consumption, it is PSA's view that any decisions involving changes that

might impact these parameters of egg production should be objective and science-based. Unfortunately, there is currently no consensus in the scientific community as to which side the weight of the evidence favors, so further work needs to be done before there is any move to follow the EU's ban of conventional cages here in the US."

The EU voted to ban traditional cage systems in 1999 and is scheduled to have completed the transition to non-cage housing by the start of 2012.

Safety Issues

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"Data on the prevalence of Salmonella in cage versus non-cage housing systems is often contradictory."

The key safety issues regarding eggs meant for human consumption relate to the possibility of microbiological and chemical contamination. The overriding microbiological concern, according to the authors of the White Paper, involves minimizing the potential for possible human infection by Salmonella, which can cause severe gastrointestinal distress or, in extreme cases, death. While thorough heating through cooking destroys Salmonella, good protocol calls for taking steps to minimise the presence of the bacterium throughout the egg-to-table production process.

Unfortunately, data on the prevalence of Salmonella in cage versus non-cage housing systems is often contradictory. For example, a number of recent studies out of the EU show a higher incidence rate in traditional housing systems. However, one EU study showed a higher incidence rate in free-range systems, while a second showed no difference.

By contrast, a study in California showed a much higher incidence rate of Salmonella enteritidis (SE)-contaminated eggs among free-range birds than birds raised in traditional cage systems. A nationwide study conducted by the USDA showed that pullets (pre-lay hens) that were raised on the floor of a housing facility had a five-fold higher incidence rate of SE than cage-raised pullets.

The authors of the White Paper concluded that '[m]any factors affect the prevalence of Salmonella enteritidis (SE) within a flock...[and] the superiority of one housing method over another remains to be determined'. They also note that, while many similarities exist between EU and US egg production systems, there are also significant differences. Care must therefore be exercised when applying results from one system to another.

Chemical contamination and contamination by pesticides are also possible egg safety factors that may be impacted by the choice of housing system. The authors of the White Paper cite multiple studies in the EU showing that, for example, free-range eggs have a higher incidence of PCBs (polychlorinated biphenyls or dioxins) and heavy metals than conventional cage hens. They also cite one study in Brazil which showed an incidence rate of the now-banned pesticide DDT in free-range eggs that was 1000x that of caged hens, even though DDT had not been used at the location of the free-range site in the last nine years, pointing to the environmental persistence of some chemicals and, say the authors, the need for great care to be taken when considering land to be used for free-range housing.

Quality Issues

The quality of eggs produced under different housing systems might also vary, though again, the evidence is conflicting. Egg quality is measured along a number of parameters including size, functional and nutritional quality, and the integrity of an egg's shell, yolk and albumen.

According to the White Paper's authors, one study showed fewer cracked eggs in free-range than conventional housing, while a separate study yielded precisely the opposite conclusion. A different study concluded that free-range eggs have higher levels of vitamin E and omega-3 fatty acids than conventional eggs, while yet another concluded that there were no differences between conventional cage, free-range

or floor-raised eggs. Even studies originating from the same laboratory yielded contradictory results when investigating internal quality issues.

USDA researcher Dr Peter Holt, the lead author of the White Paper, noted in a presentation on the authors' findings that: "Many factors besides housing type affect the safety and quality of eggs. As a result, the effect of housing type on egg safety and quality is not clear cut. These [effects] need to be taken into account before hard conclusions can be made [regarding the efficacy of different housing systems vis-àvis egg safety and quality]."

Aerial perches improve free-range layer welfare

ThePoultrySite.
October 1, 2010
Source: Session on Welfare and Behaviour at the WPSA UK Branch Annual Meeting 2010.

Providing access to aerial perches in free-range houses improved welfare in the first half of the laying cycle, according to research presented by Dr Caroline Nicholson1 of Queen's University in Belfast. She explained that this was evident from an apparent reduction of fearfulness towards humans and a tendency to show less aggressive social behaviour.

Dr Nicholson explained that the European Directive on layer welfare requires the provision of 15cm perch space per bird but that the Member States have put somewhat different interpretations on the nature and positioning of the perches. Furthermore, no research had been carried out on the welfare implications of aerial perches in a commercial setting, so she and colleagues recorded and assessed hen behaviour in four commercial houses that had been divided into two sections, one with and one without aerial perches.

Dr Nicholson reported that providing access to aerial perches significantly reduced the flight distances of the birds and the tendency towards less feather-pulling behaviour. No differences were observed between the groups in terms of aggressive behaviour, feather picking or feather pecking, however.

Dr Nicholson concluded: "Perches aid welfare because the birds were less fearful of visitors and they had a reduced tendency to harmful behaviour.

Mating behaviour and fertility of broiler breeder males

WorldPoultryNet
12 Oct 2010

One of the more difficult tasks when raising broiler breeder cockerels is controlling weight gain in the rearing house without inflicting excess stress.
This is a period of time for the young male when many portions of their reproductive system are in the formative stages and, if neglected, can have life long effect on their reproductive performance.

The objective of this study was to raise males under feed management programmes which produced the recommended target body weight of 3.060 Kg for males at 12, 15, 18, 21 and 24 weeks of age.

Males were placed at three week intervals so that all males were light stimulated at the same time but at different ages with the same body weight. All males were reared in the same light controlled house at the University of Arkansas Research Farm.

Males were light stimulated and testes development, complete semen analysis, fertility and mating activity and behaviour being recorded for each group of males. Results for mating behaviour showed that younger males at the time of lighting were less successful at completing matings, crowed less often, as well as showed less wing flapping and neck flaring than older males.

Males that were older at the time of lighting had higher fertility than younger males. Males that were 24 weeks old at the time of lighting had an overall fertility of 94.5%, compared to 91.8%, 91.6%, 79.2%, and 87.3% for the other ages respectively. This study found that males that were exposed to light at ages of less than 18 weeks old showed lower fertility than older males. Younger males also exhibited less overall mating activity than older males.

Source: J. R. Moyle and co workers, University of Arkansas, Fayetteville, USA; proceedings of the 2010 IPSF, Atlanta, GA, USA

Seeking the best water provision for ducks

ThePoultrySite.
October 1, 2010
Source: Session on Welfare and Behaviour at the WPSA UK Branch Annual Meeting 2010.

Overall, the provision of water in a trough or bath seemed to be the best in terms of duck welfare, as well as resulting in increased liveweight, according to Professor Donald Broom2 of the University of Cambridge in the UK.

Dr Broom presented data from two studies carried out with K. O'Driscoll, both using Pekin ducks starting at 21 days of age and housed in pens of straw litter on a solid concrete floor. The area under the drinkers was slatted in each case.

In the first study, the ducks were provided with water either from nipple drinkers or from a wide-brimmed bell drinker. Type of water source did not affect final liveweight, feather hygiene score or foot pad dermatitis score. However, those with the bell drinkers had a significantly worse gait score although the researchers were unable to identify any cause of this from the bedding. There was no effect of the water provision on the frequency of blocked nostrils.

The second study was similar to the first but it compared a narrow bell-drinker, a trough and a bath as the water sources. At the end of the experiment, the birds with the trough were heavier than those with the bell-drinker, with the bath being intermediate. Dirty and blocked nostrils were more often observed for the birds with the narrow bell-drinker than with the trough or the bath.

None of the treatments resulted in eye health problems in these studies.

Professor Broom concluded that the trough or bath offered better welfare conditions for the ducks but providing these facilities in practice requires further work.

Broiler breeders fail the food test

ThePoultrySite.
October 1, 2010
Source: Session on Welfare and Behaviour at the WPSA UK Branch Annual Meeting 2010.

Feed restriction appears to affect negatively the ability of broiler breeders to learn a feed quantity discrimination task, according to research presented in Belfast by Louise Buckley3 of Scottish Agricultural College. The experiment was part of her PhD study. However, she went on to suggest that Y-maze tasks are not suitable for determining the food preferences for hungry broiler breeders because 80 per cent of the birds fed almost ad libitum failed to learn the task.

Ms Buckley explained that hunger is a welfare issue for feed-restricted broiler breeders, and that preference tests have been proposed as a tool to identify whether quantitative or qualitative feed restriction would be better for the birds from the welfare point of view. The aim of this study was investigated the effect of the degree of feed restriction on a broiler breeder's ability to learn a Y-maze feed quantity discrimination task.

Ms Buckley concluded that feed restriction appears to reduce the birds' cognitive capacities.

References
All papers were presented at the World's Poultry Science Association (UK Branch) Annual Meeting in Belfast in April 2010.
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2. O'Driscoll K.,and D.M. Broom. 2010. The effect of water resource type on measures of duck (Anas platyrhynchos) health and other aspects of welfare.
3. Buckley L.A, I.M. McMillan, V.S. Sandilands, B.J. Tolkamp, P.M. Hocking and R.B. D'Eath, 2010. Too hungry to learn? Hungry broiler breeders fail to learn a food quantity T-maze discrimination task.

PSA Emerging Issues Symposium: Social sustainability of egg production papers

Posted September 21, 2010

The following papers, presented during the Emerging Issues Symposium "Social Sustainability of Egg Production" at the 2010 Poultry Science Association Annual Meeting, have been peer-reviewed and accepted for publication in Poultry Science®. Due to the nature of the information in these papers and their relevance to the egg recall, the Poultry Science Association has posted these in-press papers online in advance of publication in a journal issue. In lieu of volume and page, papers can be cited by the doi (digital object identifier), found below the key words on the first page of the article.

The impact of different housing systems on egg safety and quality, P. S. Holt et al. (*Poultry Science* doi:10.3382/ps.2010-00794)

Environmental impacts and sustainability of egg production systems, H. Xin et al. (*Poultry Science* doi:10.3382/ps.2010-00877)

Hen welfare in different housing systems, D. C. Lay et al. (*Poultry Science* doi:10.3382/ps.2010-00962)

Economic and market issues on the sustainability of egg production in the United States: Analysis of alternative production systems, D. A. Sumner et al. (*Poultry Science* doi:10.3382/ps.2010-00822)

Design defines response of selenium

Poultry World
13 Aug 2010

For centuries, selenium was considered a toxic element. In recent decades, however, its advantages have also been discovered. Selenium is a useful element in animal nutrition, such as for poultry, but proper use is essential.
By Dr. Frank Edens , Department of Poultry Science, NC State University, Raleigh, NC, USA, and Dr. Ted Sefton , Alltech, Guelph, ON, Canada

As with so many things in the world, the better the design of a specific item to meet a specific need, the better the response will be. We see this typically in race cars, sailing boats and nearly all aspects of performance. It is no surprise, then, that the design for the form of selenium illustrates the same issue when considered in animal production. Understanding the development of our knowledge on selenium is very important if we are to appreciate our position today, and what the future holds for this essential trace element.In about 1295, Marco Polo described a disease syndrome encountered during his travels to China when the hooves dropped off his horses after the animals ate seleniferous plants. Reports continued on the toxic effects of selenium and hair loss in humans in Columbia in 1560. Swedish scientist J.J.

Berzelius named selenium in 1818 after identifying it in sulfuric acid preparations from mining residue.In America, it has been speculated that General George A. Custer's defeat by the Sioux Indians in 1876 at the Battle of the Little Big Horn may be, in part, attributed to selenium toxicity. This region of Montana contains forages with toxic levels of selenium. The Calvary was delayed because the horses, as the commanding officer reported, had developed a peculiar illness. Could it be true that selenium was responsible for the famous or infamous (depending on your view) defeat of the US Army.

Useful element

It was not until 1957 that the rest of the story began to emerge; selenium could be a useful element. Selenium was found to prevent exudative diathesis in chicks, and liver necrosis in swine. This was quickly followed by the finding that selenium could be a preventative measure of muscular dystrophy in calves and lambs. Research into the interaction of selenium and Vitamin E became a rewarding area of research. This led to selenium supplementation in animal feeds being allowed in many countries, including the US in the early 1970s. However, not all countries allowed supplementation, and in countries where it was allowed, the level was often limited. In the US, for example, supplementation was limited to sodium selenate and/or sodium selenite, only up to 0.3 ppm. Because of the toxic effect that selenium could have on premix plant workers, Japan and Finland did not allow supplementation. Livestock and poultry producers in those countries had to deal with feed with selenium deficiencies until 1993 when Alltech developed Sel-Plex, a yeast-derived selenium supplement based on Saccharomyces cerevisiae CNCMI-3060. This could be 'the rest of the story'. In 2000, regulatory approval was granted in the US. Approval within the EU followed in 2006.

Safety has always been a concern. Marco Polo reported toxicity before Berzelius had named selenium. Sodium selenite and sodium selenate LD50 dose is 5-50 mg/kg body weight. For Sel-Plex, Power (2005) reports the LD50 dose is greater than 2,000 mg/kg of body weight. Under the Global Harmonised System for classification and labelling of chemicals based on oral toxicity, sodium selenite and sodium selenate require labelling indicating 'Danger - Fatal if Swallowed'; Sel-Plex requires no such labelling. Thus, the form of selenium determines function.

Egg selenium levels

Work reported by Leeson and co-workers in Poultry Science in 2008 showed that eggs from breeders fed Se yeast or another source (two sources reported as being sources of organic selenium) had greater egg selenium levels than those fed sodium selenite. Furthermore, the albumen from breeders fed Se yeast had the greatest selenium concentration, while those fed the second Se product had more selenium in the yolk.

The forms of selenium had different modes of action. The greater selenium level in the egg albumen from breeders fed Se yeast would reflect that the yeast incorporates selenium in selenoprotein, which would be absorbed by the breeder as an amino acid and so incorporated as protein in the egg. This also explains why the selenium content of the breast muscle and liver of hens fed Sel-Plex was greater than the other two selenium sources. The production methodof the other Se is not given, but obviously it is not in a selenoprotein form as the deposition differs from the selenium in Sel-Plex; accumulating in yolk, fat, not in albumen, protein. Similar work with Sel-Plex and sodium selenite also show that sodium selenite transferred proportionately more into the yolk. Again, the form of the selenium will determine the animal response.

Greater fertility

Further research by Renema and co-workers (2003) has shown that hens fed Sel-Plex and then inseminated with sperm from males fed sodium selenite supplemented rations have greater fertility than hens fed sodium selenite. This can be attributed to the antioxidative influence on the sperm in the sperm storage glands of the hen. Further, in their trials, the Alberta workers found that there was no negative effect on hatch of fertile eggs, nor was there such a trend in other studies. Edens and co-workers (2002) have demonstrated greater numbers of normal sperm from males supplemented with Sel-Plex. The design or form of selenium makes a great difference to the bioavailability of selenium in feedstuffs. Cantor (1997) shows that plant feedstuffs have higher bioavailability than animal feedstuffs. A total of 50% of the selenium in cereal grains is in the form of selenomethionine (Olsen and Palmer, 1976). Se-methyl-selenomethione, selenocysteine and Se-methyl-selenocysteine are the other seleno-compounds in plants (Brody, 1994). Yeast is part of the plant kingdom so this greater bioavailability will be attributed to Sel-Plex

and the assay of forms of selenium is similar to that of other plants. Thus, selenium for Sel-Plex will be digested similarly to other plant selenium, as selenoproteins, not as fat soluble compounds.

Evaluating the response of broilers in incubation systems of a commercial hatchery

Project No. F002
August 2010

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"Comparison of Single and Multi-stage Incubation for Broilers"

The available incubational management practices are changing and an examination of these practices are needed to evaluate how they perform in a commercial broiler setting. The practices to be examined include a comparison of single stage incubation versus multistage incubation and their impact on viability of the embryos, chick quality and broiler performance. Â Â A second objective was to evaluate the injection of carbon dioxide into single stage machines during the initial incubation period and measure its impact using the same criteria. The third objective was to evaluate the effects of reduced ventilation in multi-staged incubators by controlling ventilation based on humidity or carbon dioxide levels as opposed to the normal damper control based on temperature.

All trials were conducted in a commercial broiler hatchery which used both Chick Master multi-stage incubators and Chick Master single stage incubators. Comparisons were made in all three of the above objectives by equally dividing eggs from breeder flocks at time of set between both treatments of a particular objective. At hatch, chicks from the same breeder flocks were evaluated for weight of chick, weight of residual yolk sac and moisture content of both. Breakout of residue was evaluated for each of three breeder flocks in each incubation treatment. Each farm in the test was comprised of 4 houses where 2 houses each housed the chicks of each incubation treatment except for the reduced ventilation tests in multi-stage incubation where only one house per treatment could be used because of hatch numbers available. Broiler weights were obtained at 1 and 8 weeks of age. Additionally at the 8 week weighing the broilers were evaluated for leg health parameters. Processing plant data were collected when available,

Results: Single stage incubation, when compared to multi-stage incubation, gave the most significant and consistent positive results in improved broiler performance. Hatchability improvements were not consistently observed but there were improvements in hatchling quality parameters, market body weight, feed conversion and leg health issues. The other two objectives comparing ventilation rates in multi-stage incubation and the injection of CO2 into single stage incubation during the early period resulted in inconsistent results that were regarded to be non significant differences between the two systems regarding the broiler performance parameters evaluated.

Expected Impact: The benefits of single stage incubation included improved feed conversion, body weight gain in most of the trials and consistent improvement with regards to leg health issues. The use of carbon dioxide injection during the first 6-8 days of single stage incubation did not prove to be beneficial in our experiments. The use of reduced ventilation in multi-staged machines did not yield benefits in increased performance although energy savings could be realized because of reduced ventilation requirements in the setters.

Funded by U.S. Poultry & Egg Association

The reproductive and physiological development of young broiler breeder males raised on shortened growth cycles

August 2010
Project #F021

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“Reproduction Fitness of Males Programmed to Mature at Early Ages”
One of the difficult tasks of raising broiler breeder males is controlling weight gain in the rearing house without inflicting excess stress.Â During this time, many portions of the male’s reproductive system are developing and, if neglected, can have lifelong effects on their reproductive performance. The current male rearing programs of feed restriction and light stimulation at 21 weeks of age were implemented years ago.Â Current rearing programs inflict increased stress on the developing male, as they are genetically superior to anything broiler breeder producers have previously managed.Â Feed restriction is one area receiving animal welfare attention.Â Therefore, in this study males were raised under various management programs which produced a target body weight (3060g) at 24 (T1), 21 (T2), 18 (T3), 15 (T4) and 12 (T5) weeks of age.Â This study investigated both short term and long-term effects of early semen production and its effects on reproductive characteristics through the normal life of a broiler breeder male.Â Reproductive characteristics that were measured included, testis size and growth, semen volume, and sperm count.Â Mating behavior was also observed to determine if early lighting had any negative effects.

Testicular development occurred more rapidly in the older males (T1 and T2) than the younger males.Â However by four weeks post lighting younger males had achieved the same level of testicular development with the exception of T4 males.

Semen collection began at four weeks post lighting and continued for 41 weeks.Â Males in the T3 group had significantly higher sperm volume than the other treatments, with T5 males having the lowest semen volume. T3 males also had the highest concentration of sperm followed by T2, T1, T4, and T5 males, respectively. The concentration of sperm was significantly higher from males in the T3 and T2 groups than the T4 and T5 groups.

Overall mating behavior followed a similar pattern for all groups as the males aged with the highest mating activity accruing between 28 and 32 weeks of age.Â T4 males had significantly less successful matings than T1 and T3, and younger males crowed, wing flapped and flared their necks less than did the older males.

Life of flock fertility was highest in the in T1 (93.3%) males followed by T2 (91.4%), T3 (90.7%), T5 (86.9%), and T4 (77.9%), with T4 males having significantly lower fertility.

Results indicate that lighting males early at 18 weeks of age may help lower the stress of rearing without negative effects on reproduction. Â Lighting males early will lower feed costs and reduce the time to sexual maturity.

Funded by U.S. Poultry & Egg Association

New research into feed additives to control Necrotic Enteritis

Vetsweb.com

30 September, 2010

Recent experiments show that poultry feeds containing organic acids and medium-chain fatty acids can have anti-clostridium effects in broiler chickens, which may help to control Necrotic Enterisis.
Necrotic enteritis (NE) in broiler chickens is caused by Clostridium perfringens. This disease has a large negative impact on the health of broilers and therefore on the profitability of commercial broiler operations. After the ban on antimicrobial growth promoters (AGPs), it is expected that incidence of NE will increase.

Organic acids (OA) have been used for decades due to their preservative (flora modulating) effects in feed and subsequently in the first parts of the gastro-intestinal tract. Medium-chain fatty acids (MCFA) have recently caught scientific interest due to their antibacterial effects.

In this research a product combining organic acids (formic, acetic, propionic, and sorbic acid) and medium-chain fatty acids (caprylic, and capric acid) was tested. In vitro research had already indicated a strong anti-clostridium effect from this product. The next step was to test the effect of this product in vivo. The research team used an experimental model with a two-step infection, first with Eimeria challenge and then with Clostridium perfringens. The animal performance and intestinal NE lesion score were measured. The hypothesis was that the experimental product would improve these parameters compared to an infected control group without additives. A medicated group with 50 g/ton of growth promoter Bacitracin Methylene Disalicylate (BMD) was also tested.

Materials and Methods

Five experimental treatments were tested (*Table 1*).
A non-medicated corn/soy commercial-type chicken starter ration was formulated. This ration (in mash form) was fed ad libitum from the date of chick arrival until day 28 of the experiment. Experimental treatment feeds were prepared from this basal starter feed. Treatment feeds were mixed at SPR to assure a uniform distribution of the test article. The product was tested in two quantities: 2 and 5 kg/ton of feed.

Table 1 – Experimental treatments

Table 1 – Experimental treatments

Treatment		*Eimeria* challenge	*Clostridium* challenge
T1	Control, No *Clostridium* challenge	Day 14	No
T2	Control, *Clostridium* challenge	Day 14	Days 19, 20 and 21
T3	As T2, + OA/MCFA product, 2 kg/ton	Day 14	Days 19, 20 and 21
T4	As T2, + OA/MCFA product, 5 kg/ton	Day 14	Days 19, 20 and 21
T5	As T2, + BMD 50 g/t	Day 14	Days 19, 20 and 21

One-day-old male Cobb X Cobb broiler chicks were used. At the hatchery, the birds were sexed and received routine vaccinations. Only healthy appearing chicks were used. Upon arrival, chicks were raised in Petersime battery cages. At placement the birds were fed the treatment feeds. Assignment of treatments to cages was performed by SPR. Cages were blocked by location in the battery with block size equal to treatments.

Three control groups were used: a non-infected non-medicated group; an infected non-medicated group; and an infected medicated group (50 g/ton BMD).The study began when the test birds were placed (‘day 0’) at which time they were allocated to the experimental cages. No birds were replaced during the course of the study.

Feed and water were available ad libitum throughout the trial. On day 14, all birds were orally inoculated with a mixed coccidial inoculum containing approximately 25,000 oocysts of E. acervulina per bird and 5,000 oocysts of E. maxima per bird. This was done to sensibilise the birds for the subsequent Clostridium perfringens inoculation, which started on day 19. They were administered a fresh broth culture (108 cfu/ml) once daily for 3 days (on days 19, 20, and 21).

All birds were weighed by cage on days 0, 14, and 28. Feed was weighed in on day 0 and remaining feed was weighed on days 14 and 28. The trial was terminated on day 28.

On day 22, five birds from each cage were selected, sacrificed, weighed, and examined for the degree of presence of Necrotic Enteritis lesions. The scoring was based on a 0 to 3 score, with 0 being normal and 3 being the most severe. Data were analysed by t-test (2 tails) analysis of pairwise comparison. *Table 2* shows zootechnical performance, and Table 3 shows NE lesion score as well as the mortality caused by NE.

Table 2 – Zootechnical performance

Table 2 – Zootechnical performance

Treatment	Feed Conversion	Weight Gain (kg)	Feed Conversion	Wt. Gain kg
	Day 0-28	Day 0-28	Day 14-28	Day 14-28
T1	1.674	0.961	1.600	0.748
T2	2.043	0.576	2.336	0.335
T3	1.871	0.742	1.965	0.504
T4	1.900	0.752	2.051	0.509
T5	1.761	0.836	1.787	0.591

Table 3 – NE lesion scores and mortality rates

Table 3 – NE lesion scores and mortality rates

Treatment	Avg. NE Lesion Score day 22	Total NE Mortality	% NE Mortality (Total/ 10 initial birds) *100
T1	0.0	0	0.0
T2	1.6	14	17.5
T3	1.3	8	10.0
T4	1.2	8	10.0
T5	0.8	3	3.8

Results and Discussion

Clostridium challenge induced a severe NE infection (compare T2 with T1), with strong deterioration of weight gain and feed conversion. The average NE lesion score was 1.6 and the mortality was high (17.5%). Adding 2 kg/ton of OA/MCFA product improved weight gain and feed conversion (0-28 days) by 29% and 8% respectively. NE lesion score (day 22) was decreased by 22% and mortality tended to be decreased by 45%. A dosage of 5 kg/ton of OA/MCFA product did not further improve NE status and bird performance. BMD at 50 g/ton as positive control group, showed the strongest improvement with all parameters tested.

The improvements, as induced by the OA/MCFA product, were roughly equal for weight gain, feed conversion and mortality, when expressed as percentage of the NE infection effect (= difference between non-infected and infected negative control). Adding 2 and 5 kg/ton of OA/MCFA product compensated for about 45% of the negative impact of NE infection, and BMD compensated for about 75%.

The results of the OA/MCFA product are in line with previous in vitro work. MCFA inhibit gram positive bacteria by the so-called uncoupler effect, in contrast to organic acids which have their biggest effect in gram-negative bacteria. Therefore, it is hypothesised that the MCFA fraction in the tested product is mainly responsible for the observed effects on gram-positive Clostridium perfringens. Previous trials have shown that neither OA nor MCFA have any inhibitory effect on Eimeria infection, which rules out the possibility of an indirect effect of the product via the reduction of Eimeria lesions.

It seems that the proven preservative effects of OA and MCFA can be carried over to the intestinal tract flora. This opens opportunities for control of Clostridium-related enteritis problems in the field, especially

in the light of a ban on AMGP and prudent us of feed medication. Still, it is clear that the effect of antibiotics cannot be mimicked to the same extent by natural substances like OA and MCFA; it is not clear in either case by what mode of action the anti-clostridium effects were obtained. It is therefore recommended to base NE control on multi-hurdle techniques including strict hygiene, proper coccidiosis control and optimisation of feed formula, of which the tested OA/MCFA product can be a part.

The trial shows that the tested OA/MCFA product shows mild anti-clostridium effects in vivo and fits well in a total approach to control NE. The recommended dosage is 2 kg/ton, because a higher dosage of 5 kg/ton did not provide additional benefits in terms of lesion scores or broiler performance.

Enriching the range to reduce feather pecking

World Poultry Net
01 Sep 2010
Source: Poultry CRC

Greater provision of pasture, shaded areas and shelter belts will attract birds into the free range, according to recommendations from a Poultry CRC project that explored enrichment strategies under Australian free range conditions. The use of repellents to suppress sporadic feather pecking was also explored.
The CRC project revealed that only 9% of birds on free range farms use the range area. Factors which influence use of the range include weather (temperature, wind and rain), season, age, flock size, time of day, shade and variety of overhead structures. European research has already suggested that feather pecking in free range flocks was greatest when a low percentage of the flock used the outside range. Therefore, decreasing the stocking density within the house should be beneficial.

The Poultry CRC project involved researchers at the South Australian Research & Development Institute (SARDI), the University of New England (UNE) and Queensland Primary Industries (DEEDI), and focused on alternatives to beak trimming. Trials under free range conditions were conducted in South Australia, Queensland and New South Wales.

Project Leader, SARDI's Dr Phil Glatz, explained that the main benefit of enrichment is that it gets the birds out of the shed to engage in a wide range of natural behaviours. Trials at SARDI examined the role of shaded areas, the role of forage and the influence of shelter belts in the range. One trial suggested that forage availability has an impact on the percentage of birds using the range during the day.

"There is a perception that birds on free range farms in Australia are free to range but hardly ever go outside," said Dr Glatz. "This work has shown that birds will utilise the free range when the environment is enriched and, hence, their behavioural repertoire is enhanced. From an industry point of view, however, the health risks to birds increase when they make greater use of the range, due to increased exposure to wild birds, et cetera."

The Queensland trials, conducted by DEEDI's Poultry Extension Officer, Ms Tanya Nagle, showed that on commercial free range farms, the addition of shadecloth shelters, shelterbelts and forage to the range area did attract more hens to utilise this area.

Trials at UNE conducted by Associate Professor Geoff Hinch suggest that initial exposure of chicks to repellents may be associated with a reduced incidence of cannibalism and could provide another option in a multiple strategy approach to reducing potential cannibalism in layers.

OTHER

Stress: Compromising animal health

The Beefsite

August 11, 2010

Researchers in the Livestock Behaviour Research Unit in West Lafayette, Indiana, report their studies on stress in poultry, pigs and cattle in the latest issue of Agricultural Research.

Donald C. Lay is in the USDA-ARS Livestock Behavior Research Unit, 125 S. Russell Street, West Lafayette, IN 47907; (765) 494- 4604, don.lay@ars.usda.gov.

Whenever we feel stress—like falling off a ladder—our bodies react in predictable ways—increased heart rate, rapid and shallow breathing, and an adrenaline rush. Animals feel stress too, and it can compromise their health and ability to thrive. That, in turn, can cost producers money.

Vitamin C and beta-glucan supplements can help piglets gain weight after weaning.Researchers in the Livestock Behavior Research Unit in West Lafayette, Indiana, study stress in poultry, swine, and cattle.

In one study, research leader Donald C. Lay, Jr., used animal restraint and stress-inducing hormone injections of sows as stressors. He found that prenatal stress, the stress imposed on a pregnant animal, resulted in widespread effects on the offspring.

“Prenatal stress has been shown to have effects on the behavior and physiology of many species, including monkeys, rats, guinea pigs, goats, humans, and swine,” says Mr Lay. “Research in our lab has shown that prenatal stress, from restraint and stress hormone injection of sows, caused offspring to have increased plasma cortisol levels in response to stress and less ability to heal a wound when subjected to stress.”

Cortisol is a glucocorticoid—a class of steroid hormones that suppress the immune system. Cortisol can also raise blood pressure and blood sugar levels.

“Prenatal stress has been shown to cause an increase in fetal cortisol, which may in turn impair immune function and increase the maximum binding capacity of glucocorticoid receptors in the central nervous system immediately after birth.”

Pigs in social groups are known to form hierarchies. Sows at the bottom of the hierarchy may produce litters of prenatally stressed piglets. Mr Lay and his colleagues have shown that the effects associated with prenatal stress in swine, however, are not caused by cortisol alone. They are continuing research to identify the other factors involved.

Treating Farm Animal Stress from the Inside Out
Animal well-being can be improved and stress counteracted in farm animals by enhancing their enteric health and immunity through dietary supplements. In studies to reduce the negative health effects of a known stressor—such as animal transport and handling—animal physiologist Susan Eicher has shown that betaglucan (a yeast cell-wall product) and vitamin C supplements, fed together, can improve piglet health by enhancing the animals’ growth and immune function after transport.

In Ms Eicher’s studies, piglets received diets supplemented with beta-glucan alone, vitamin C alone, or both beta-glucan and vitamin C. An unsupplemented diet was fed to piglets as a control.

“Piglets receiving both vitamin C and beta-glucan had a greater weight gain after weaning,” says Ms Eicher. “We also detected changes in the expression of immune-system communication molecules called ‘cytokines’ in intestinal and liver tissues.” Other animal species may also benefit from this combination diet during stressful times, such as transport.

This ARS nutritional supplemental combination was patented in 2005 and is licensed. The marketed product is presently used by calf producers in Idaho, and they report a lower incidence of respiratory problems.

Reducing Stress—and Pain—of Birds’ Beak Trimming

Beak trimming is a routine husbandry procedure used in the commercial poultry industry—particularly in broiler breeders and laying hens—to reduce injuries during confinement.

During conventional beak trimming, one-third to one-half of the beak is removed. A hot blade is normally used to cut and cauterize the beaks of chicks. But the process can be painful to the birds, so alternative methods are needed.

Biologist Heng Wei Cheng has identified a better technique— infrared laser—that can reduce pain and tissue damage.

“Infrared lasers have been widely used for noninvasive surgical procedures in human medicine and their results are reliable, predictable, and reproducible,” says Mr Cheng. “Infrared lasers have recently been designed with the purpose of providing a less painful, more precise beak-trimming method compared with conventional beak trimming.”

Infrared laser was compared to conventional beak trimming, and the results are promising. “Our results indicate that while there was no statistical difference in egg production or bird body weight between the two beak-trim treatments, those birds treated with the infrared method displayed superior feather condition and reduced aggression, even though they had less of the beak removed,” says Mr Cheng. “The data show that infrared beak treatment may reduce the damage done by feather pecking and provides a better alternative to conventional beak trimming. Indeed, infrared trimming may provide a less invasive alternative to conventional beak trimming without compromising productivity.”

These research efforts are just some of many projects of the Livestock Behaviour Research Unit that are aimed at improving existing practices and inventing new practices that enhance animal well-being and increase animal productivity. - By Sharon Durham, ARS.

This research is part of Food Animal Production (#101) and Animal Health (#103), two ARS national programs described at www.nps.ars.usda.gov.

Needle-Free injection technology research expected to stimulate adoption

PigProgress
August 5, 2010-09-27

A Manitoba-based mass vaccination injector manufacturer is confident research into the use of needle-free injectors will help potential customers decide whether or not to invest in the technology.

Needle-free injectors use a high speed blast of gas to propel veterinary compounds through the skin, replacing the need for needles.

Researchers with the University of Manitoba in partnership with AcuShot Inc. are using high-speed photography to track the dispersion of liquids injected into different mediums, including ballistic gels and commercial foams, to assess the technology.

AcuShot regional marketing and technical support manager Mike Agar says over the next three to four months researchers will be assessing the consistency of delivery under a range of pressures.

The key benefits to needle-free injection are first and foremost the removal of needles.
Needles have environmental factors for disposal, biohazard risks, those can be eliminated, landfill issues for true proper disposal of sharps would be eliminated, personal injury issues, damage or trimmage to the carcasses or the animals that it's being administered to because typically they're food grade animals and needles or needle fragments could be left in them which is eliminated through needle-free technology plus the removal of cross contamination that could come from the repeated use of needles which is quite common.
Needle-free technology doesn't transfer disease.

Agar says having an independent third party proof the consistency of the equipment will help open doors in the industry and encourage uptake of the technology.

He notes global uptake of needle-free injection technology is currently less than one percent so the market offers tremendous opportunity.

UoG launches online tool about horse joints

Horsetalk
October 8, 2010

A Canadian university has developed an online tool to provide horse people with an interactive journey from a healthy equine joint to an inflamed, arthritic joint.

Equine Guelph offers a new online resource to take horse people on a journey inside a healthy joint to an arthritic joint. Equine Guelph, part of the University of Guelph in Ontario, developed the online tool, called Journey through the Joints, with support from Pfizer Animal Health. The tool aims to educate horse people about the different stages of joint degeneration, explain the definition of arthritis and provide information about prevention and care.

It also challenges participants' knowledge with user-friendly activities on the anatomy of a joint. It also provides a 360-degree tour of an actual horse joint.
"We think it's really important to teach horse people about the basics on joints," says Dr Cathy Rae, manager of equine technical services for Pfizer Animal Health.

"It is critical to have a basic knowledge of joints before grasping an understanding of causes and care of lameness." Arthritis is one of the biggest health challenges facing both horses and humans. Currently, there is no effective long-term treatment to repair a cartilage injury in the joint. This is one of the leading causes of early retirement in horses.

Tissue from cartilage heals extremely slowly. Damaged or missing tissue is often irreplaceable, usually leading to osteoarthritis. It has been discovered that a staggering 60 per cent of lameness problems in horses are caused by osteoarthritis.

UK centre aims to improve animal lives across the globe

Stackyard
2010-08-09

Improving the well-being of animals worldwide and challenging what is currently acceptable in the way animals are used and treated will be the focus of a new Centre of Excellence.

The Centre will create a focal point for Animal Welfare Education across the globe.

It will establish new veterinary courses, collaborating with international partners to improve the understanding of animal welfare issues.

The Centre which is being set up with a £2 million donation from the Marchig Animal Welfare Trust, will be a key resource of expertise for animal welfare education. It will engage with politicians and governments with the aim of improving animal welfare and seeking alternatives to the use of animals in research.

The Royal (Dick) School of Veterinary Studies will offer a certificate, diploma and masters degree courses in animal behaviour and welfare through full time and on-line learning working with partner organisations particularly in developing countries. It will also strengthen the current provision of animal welfare and ethics in veterinary education.

Professor Elaine Watson, Head of the Royal (Dick) School of Veterinary Studies, said: "Improving animal welfare should be one of the main goals of the veterinary profession. The objective of the Centre is to make determined progress towards a situation where all animals are free from distress, suffering and hunger through instruction and training at all levels.

"The new Centre will also provide a platform for debating the important ethical issues which practitioners are faced with every day in veterinary practice and research.

We are delighted that we have been given the opportunity to set up this important new Centre and about the role it will play in raising awareness of animal welfare globally."

The centre, which will be run by a newly created post of centre director, will be based on the first floor of a new £42 million teaching building for the Royal (Dick) School of Veterinary Studies, due to open next year.

Madame Jeanne Marchig, who established the Marchig Animal Welfare Trust in 1989, said: "The centre will provide an important role in education to strive towards improving the quality of life for animals. We know that by debating the issues, raising awareness of concerns and pushing the boundaries of what is considered acceptable across different borders we can make a positive impact for animal welfare today and in the future both within and outside of the veterinary profession."

The new veterinary teaching building is one of more than 30 projects of the Edinburgh Campaign, which aims to raise £350 million for initiatives across the University. This includes creating new hubs of learning, conserving iconic University buildings and increasing the number of scholarships and bursaries available for students.