

independence of residual feed intake with growth rate, body weight, and other energy depots can be forced, however, genetic associations may remain when phenotypic regression is used. Heritability estimates for phenotypic residual feed intake have been moderate, ranging from 0.26 to 0.43. Genetic correlations of phenotypic residual feed intake with feed intake have been highly positive, suggesting that improvement would produce the correlated response of decreasing feed intake. Residual feed intake estimated by genetic regression results in zero genetic correlation with its predictors thus alleviating concerns over long term antagonistic response in increased mature size and maintenance requirements. The genetic regression approach requires knowledge of genetic covariances of feed intake with growth rate and weight. Cost of individual feed intake measurement on potential replacements will be a consideration for implementation of national cattle evaluations for efficiency of feed utilization. These costs must be compared to expected and, if possible, realized rates of genetic progress and associated reductions in feed input requirements.

**Key Words:** Genetic Evaluation, Beef Cattle, Feed Efficiency

**174 Realities of measuring feed intake on individual pigs to genetically improve feed efficiency.** D. S. Casey\*<sup>1</sup> and P. W. Knap<sup>2</sup>, <sup>1</sup>*Pig Improvement Company, Franklin, KY*, <sup>2</sup>*Pig Improvement Company, Germany*.

Feed efficiency is an important economic trait to the swine industry. Most improvement has been made indirectly by selecting on lean growth rate, but can also be improved by selecting for growth when feed intake is restricted. Neither of these methods involves measuring feed intake on the pig, but if done would result in a direct measurement of feed efficiency. The objective of this review was to discuss issues involved in measuring feed intake on individual pigs. Feed intake can be obtained by penning pigs individually, but pigs in this situation tend to eat more, grow faster, and are fatter than pigs housed in groups. To avoid this genotype x housing system interaction, electronic feeders were developed to measure individual feed intake on group-housed pigs. These feeders are single-spaced and offer some protection from competition, whereas conventional feeders offer no protection. These feeder differences did not affect performance of boars, but gilts on electronic feeders ate less, grew slower, and deposited less backfat and loin muscle area. Data from electronic feeders have also been found to contain substantial amounts of errors that require editing. Different editing methods have been shown to affect the accuracy of feed intake estimates, which in turn affect heritability estimates. Operating these feeders takes time and requires highly trained personnel. They are also costly, which usually limits the number of pigs that can be evaluated. Testing strategies can be adapted to increase the number of pigs measured during a test period with minimal impact on accurately estimating feed intake. This

## Combined Animal, Dairy, and Poultry Extension Workshop

**176 Development of model biosecurity programs.** J. Shutske\*, *University of Minnesota, St. Paul*.

Bio- and agricultural security programs designed to protect animal health and minimize risk often contain components such as facility access control, personal hygiene, sanitation, and animal quarantine/isolation protocols. Biosecurity protocols are often implemented using checklists that guide the user in the process of evaluating current practices and environmental/equipment conditions. These checklists provide a basis for continuous improvement. We have learned in other areas of risk control that the most effective measures to reduce risk/loss involve efforts to eliminate potential hazards through equipment and system-level design rather than heavy reliance on human action and behaviors which can be highly variable and subject to competing motivations. This becomes increasingly important as animal agriculture becomes more reliant on a labor force that may include individuals with limited knowledge of animal production, animal health, or even a basic understanding of personal health behaviors and practices. Workers themselves may, in fact, be the most crucial link within a successful production security program. Being on the front lines of an operation, workers are in the best position to monitor environmental conditions, observe changes in animal health, suggest improvements, and provide an ongoing evaluation of an operation's biosecurity program. Other industries have recognized and embraced the role of the workforce in implementing quality control and improvement. Workers are also the ones who will have the first expo-

sure to hazardous biological and chemical agents that could impact an operation. Thus, an effective biosecurity program should also have some means of monitoring and protecting worker health. Based on the few events in the U.S. where there have been intentional breaches of security within the food system, it is also clear that those in the labor force could also be involved in facilitating (or preventing) an event whether intentionally or otherwise. So, biosecurity programs, educational materials, and checklists created in the future should encourage producers to engineer out potential hazards and should holistically consider the role of workers in implementing and providing continuous evaluation of biosecurity programs.

**Key Words:** Swine, Feed Efficiency, Feed Intake

**175 Methods of editing errors in data from electronic swine feeders impact heritability estimates of average daily feed intake.** D. S. Casey\* and L. Wang, *Pig Improvement Company, Franklin, KY*.

Methods of editing errors in data from electronic swine feeders affect accuracy of estimating average daily feed intake (ADFI), which will impact genetic improvement of feed efficiency. The objective of this study was to measure the effect of two editing methods on heritability estimates of ADFI. FIRE<sup>®</sup> electronic feeders were used to measure feed intake for 7,106 boars from approximately 73 to 163 d of age. Feed intake data were edited using two methods (EM1, EM2). For EM1, errors were identified in daily feed intake (DFI), occupation time per day, and mean DFI for a pen. Corresponding DFI records were replaced with a missing value. Data for a pig were discarded if the percentage of missing DFI was >75. DFI records were regressed on test day for each pig using a 4<sup>th</sup> order polynomial. Estimates of DFI from this model were used to calculate ADFI. Unreasonable values for ADFI from individuals and off-test groups were discarded. For EM2, 16 criteria were used to identify errors in visits. A linear model was used to adjust error-free DFI for the effect of errors. Unreasonable values of DFI were replaced with a missing value. Data for a pig were discarded if the percentage of missing DFI was >85. Adjusted DFI were regressed on test day for pigs in an off-test group using a random regression model that included a 3<sup>rd</sup> order polynomial for the fixed curve for each line (n=10) and a 1<sup>st</sup> order polynomial for the random curve for each pig. Missing values of DFI were replaced with estimates from this model. A sire model was fit to ADFI from the two editing methods. The model included on-test weight x line, herd-line-year-season, and herd-off-test group. After editing there were 6,197 (87.2%) and 6,861 (96.6%) pigs with an estimate of ADFI from EM1 and EM2. Mean ADFI for EM2 was 51 g/d larger and the standard deviation was 29 g/d smaller. Heritability estimates were .18 and .27 for EM1 and EM2 and the phenotypic correlation was .88. Methods of editing errors in data from electronic swine feeders impact estimates of heritability thus affecting genetic improvement of feed efficiency.

**Key Words:** Feed Intake, Editing Methods, Heritability

**177 Catastrophic Composting: Is it safe and effective?** J. M. DeRouchey\*, J. P. Harner, and J. P. Murphy, *Kansas State University, Manhattan*.

**Key Words:** Biosecurity, Engineering, Labor

Composting of animal mortalities has increased in popularity in recent years due to decreased availability and increased costs associated with the traditional animal rendering industry. However, with increasing foreign animal disease and transmission concerns, composting has received considerable more attention as a potential method for mass mortality disposal. Limited research has shown composting can reduce pathogens

and parasites up to 99.99% when heated to 55°C for 3 consecutive days, such as *E. coli* and *Salmonellae*. Also, composting has been shown to effectively eliminate the highly pathogenic avian influenza virus after 10 d of composting and tissues from chickens infected with egg drop syndrome-76 virus after 20 d. However, little other data is available on effectiveness on other animal diseases. A number of challenges are present that operators must overcome properly compost large masses of diseased mortality animals. First, in areas of large animal density, there may be a lack of adequate carbon sources (straw, hay, silage, sawdust, etc.) to adequately cover and compost mortalities. Composting sites need proper drainage and collection areas, security from predators and setback distances to not jeopardize public health if the disease is transferable. Water addition for maintaining the compost with adequate moisture (50-60%) is imperative. For large carcasses turning the piles may be necessary to thoroughly degrade tissue and bones. However, this may expose transmittable pathogens to the air during turning if they had not been properly heated for the desired treatment time. All activities with composting will require human activity, which may have direct health concerns if the disease is highly contagious and proper handling procedures are not followed. Composting mass mortalities may be effective in certain instances. However, numerous challenges will prevent its widespread use in catastrophic mortality events.

**Key Words:** Composting, Mortality, Livestock

**178 What are extension's roles in the early detection of agro-terrorism events?** R. M. Smith\*, *USDA, CSREES, Washington, DC.*

The early detection of an agro-terrorism event is essential to help contain the damage and to decrease any adverse economic impact. Across the United States extension will be expected to play an important role in early detection through the development and implementation of training and educational programs. The dissemination of accurate and timely information by extension agents to people working within the agricultural sector will enhance our nation's ability to rapidly and accurately detect an intentional agro-terrorism event. Extension personnel will be integrated into the National Animal and Plant Diagnostic Laboratory Network system as it matures. Their involvement with these networks will help to ensure a more rapid submission of suspected plant and animal samples to these state and university diagnostic laboratories. This presentation will review a few of the current or proposed national initiatives to support the role of extension personnel in the early detection of agro-terrorism events.

**Key Words:** Extension, Diagnostics, Agro-terrorism

**179 Use of antibiotics and alternatives in the animal industries: What is extension's role?** R. B. Phillips\*, *Animal Health Institute, Washington, DC.*

The use of antibiotics to keep food animals healthy is a continuing source of controversy despite several lines of evidence that producers and the public benefit from the practice and that these benefits outweigh the very small risk of antibiotic resistance transfer via the food chain. Recent reductions in the use of antibiotics can be attributed to several factors, including the observation of judicious use principles and increased management. Confinement and increased biosecurity, while derived by some as factory farming, has several benefits including disease prevention. The search for other alternatives to antibiotics is limited by research funding and a lack of flexibility in the regulatory approval process. Extension can assist producers in evaluating the benefits of antibiotics, the alternatives, and by helping them implement judicious use principles.

**Key Words:** Antibiotics, Judicious Use

**180 Country of origin labeling: update and path forward.** J. D. Lawrence\*, *Iowa State University, Ames.*

Country of Origin Labeling was part of the 2002 Farm Bill and was scheduled to become mandatory September 30, 2004. The House and Senate voted to delay it for 2 years. While debate rages over how it should be implemented by both opponents and proponents, producers, markets, and processors remain confused about what to do and where to start. Parallel to COOL is movement toward a national animal identification system. National ID is not COOL, but it will make COOL

more practical to implement. Extension has a significant role in helping producers understand what is required under both programs, how they differ, and the motivation behind them.

**Key Words:** COOL, National ID, USAIP

**181 Opportunities for extension professionals in international education.** J. P. Blake\*, *Auburn University, Auburn, AL.*

There are numerous opportunities for international colleagues bound by a common thread to share in the exchange of information. Numerous organizations support agricultural based projects overseas, with a major source of funding originating from U.S. Agency for International Development (USAID) via the US Farm Bill. Partner organizations that share in this funding through the Farmer-to-Farmer program include: ACIDI/VOCA (Agricultural Cooperative Development International and Volunteers in Overseas Cooperative Assistance), Citizen's Network for Foreign Affairs, Land O'Lakes, Inc., Partners of the Americas, and Winrock International. These programs rely on the expertise of volunteers from U.S. farms, land grant universities, cooperatives, private agribusiness' and nonprofit farm organizations to provide assistance to individual farm enterprises, cooperatives, farmer's associations, agribusiness', rural credit institutions, universities, and agricultural youth groups overseas. Commodity groups such as the American Soybean Association (ASA) and U.S. Grains Council (USGC) also recruit experts that are involved with technical programs that teach livestock and poultry producers how to use feed grains effectively and manage operations efficiently. The Fulbright Scholar Program administered by the Council for International Exchange of Scholars (CIES) offers opportunities for international educational exchange. Fulbright grants are awarded to U.S. citizens and nationals of other countries for a variety of educational activities which may include, university lecturing, advanced research, graduate study, and teaching in elementary and secondary schools. The primary mission of extension is to "take the university to the people". Whether the scope is local, regional, national, or international, the essence of extension supports key projects, which may include the building of partnerships, improvement of business practices, increasing productivity and profitability, and introducing new technologies. In addition, opportunities for scientific exchange contribute to an increased understanding of history, culture, politics, and social structure.

**Key Words:** International, Extension, Fulbright

**182 Cultural issues in processing plants and on farms.** W. V. Jamison\*, *Dordt College, Sioux Center, IA.*

Latino immigration is prominent in the US poultry industry and carries with it profound cultural manifestations. It is a result of increasing globalization which is defined as the flow of labor and capital across market concentration gradients, e.g. either the money goes to where the poor are or the poor come to where the money is. Anecdotal evidence and LIUNA estimates indicate that over 50% of workers in many plants and 10% of farm labor are now Latino. Immigration will continue to define human resource management in the poultry industry, and the proposed blanket amnesty and worker permit program will exacerbate immigration trends. Also, the influx of Latinos will provide a ready labor supply that both artificially suppresses wages and antagonizes native residents. While Huntington argues that Latinos are poorly assimilated and increasingly strident in rebuffing enculturation in favor of aggressive Latino identity, Brooks argues that assimilation can and will occur as American culture adapts to and compromises with Latino immigrants. However, both views are incomplete. More accurately, Bohon argues that assimilation will be episodic and dependent on ethnicity, regional social factors, and the existence of successful Americanized kinship networks. These findings imply that immigrant labor is successfully suppressing wages while subtly reshaping American culture. In processing plants, cultural, ethnic and religious conflicts between Anglos and Latinos, as well as Latinos and other racial and ethnic groups, will continue to intensify. In poultry processing regions increasing immigration will strain social and economic infrastructures, and the development of a permanent ethnic underclass entrenched in barrios is indicated. Finally, on-farm day labor will pose an increasing biosecurity risk as a

largely invisible labor force transits from farm to farm unrestricted by biosecurity protocol.

**Key Words:** Latino, Immigration, Assimilation

**183 Extension's role in conflict resolution and consumer education.** M. M. Schutz\* and J. S. Ayres, *Purdue University, West Lafayette, IN.*

The role of extension dairy, poultry, and livestock educators is evolving rapidly; and to be relevant, we must continue to provide science-based information to an ever-broadening clientele. Campus-based specialists have remained insulated from this shifting paradigm longer than field-based staff that often facilitate disputes involving agriculture. Examples of conflicts involving animal agriculture include disagreements over manure or odor regulations, animal welfare, animal cloning, and food safety (for example sales of raw milk). The situational framework of Heifetz and Sinder describes three situations that illustrate the shifting paradigm faced by extension specialists. In the first situation, both a problem and a solution are clear, which characterizes the traditional role

of extension specialists as experts in a particular field. The second situation, where a problem is clear but a solution is not; is familiar ground for those of us trained as scientists. But the third situation, where both the problem and solution are unclear, will become more common as we tackle the larger societal issues facing animal agriculture. In 1988, Carpenter and Kennedy put forth the concept of a spiral of unmanaged conflict. Initially, the problem arises, sides form, and positions harden. But as the conflict spirals out of control, communication stops, resources are committed, conflict spills outside the community, perceptions become distorted, and a sense of crisis emerges. As livestock, dairy, or poultry extension specialists, our best opportunity is to be involved and to provide science-based solutions or alternatives before the conflict begins to spiral out of control. Once communication stops, even science-based information may be misinterpreted as advocacy. Unfortunately, in most cases we are not properly trained and do not feel comfortable in dispute resolution; and our reward systems within our universities do not properly recognize efforts in public issues education, conflict resolution, or consumer education.

**Key Words:** Extension, Conflict Resolution, Consumer Education

### Dairy Foods: Perspectives on Raw Milk Cheeses

**184 Survival of *Escherichia coli* in Cheddar and Colby cheese.** D. R. Henning\*, *South Dakota State University, Brookings.*

Trials evaluating survival of *Escherichia coli* in Cheddar cheese provided data indicating this organism will survive 60 days of curing if present in sufficient numbers and cheese composition is favorable for the organisms survival. Cheddar cheese manufacturing and curing were used for two treatments utilizing a cocktail of three strains of *E. coli* O157:H7. The target for treatment one was  $10^3$  colony forming units per mL (cfu/mL) in pasteurized cheese milk; treatment two was 1 cfu/mL of cheese milk. Cheeses were analyzed at 0, 14, 28, 42, 60, and 74 d, and at 28 d intervals thereafter until *E. coli* O157:H7 could no longer be detected in two successive sampling periods. When no cfu/g were detected by plating, 25 g of cheese were enriched to detect viable *E. coli* O157:H7. Treatment one resulted a two log reduction in cfu/g after 60 days of curing with viable *E. coli* O157:H7 being detected in 25 g of cheese after 150 days. Treatment two resulted in reduction of *E. coli* O157:H7 numbers to 1 or <1 cfu/g in 60 days with none detected in 25 g of cheese at 150 days. Both treatments permitted the survival of *E. coli* O157:H7 for more than 60 days of curing. The second study mathematically described the decline of viable biotype 1 *E. coli* during the curing of cheese. Pasteurized milk was inoculated with  $10^2$  to  $10^9$  cfu/ml for making Cheddar and Colby cheeses. Multiple regression was employed to determine the effects of low to high levels of composition and curing temperatures in typical cheese [moisture (34 to 40%), pH (5.0 to 5.6), curing temperature (4 to 13C), and salt level (0.8 to 1.7%)] on survival of *E. coli* during cheese curing. A total of 56 survivor curves representing combinations of the parameters were generated during four-months of curing. The model for surviving biotype 1 *E. coli* can be described as:  $\text{Log}(\text{Days}4\text{D}) = -74.64881 + 28.5745^*P - 0.00098^*M^*T + 2.64579^*P^*P$ , where Days4D = time, in days, needed to reach 99.99% inactivation, P = pH, M = moisture, and T = temperature.  $R^2 = 0.532$ .

**Key Words:** Cheese Curing, *Escherichia coli* Survival, Survival Model

**185 Use of heat-treated cheesemilk to make high quality Cheddar cheese.** B. Luth\*, *Tillamook County Creamery Assn., Tillamook, OR.*

The primary argument in favor of creating cheese from heat-treated milk is to retain the quality and flavor characteristics of the cheese as it ages. This process is used because natural enzymes in the milk, essential for producing quality cheddar cheese, suffer during full pasteurization. One of the distinguishing attributes of Tillamook Cheddar Cheese is the consistent ability to age cheddar cheese for two years or more without the development of bitter or atypical flavors. Studies have been conducted using commercial vats of cheesemilk that have been pasteurized compared to commercial vats of cheesemilk heat-treated at 150° F. These were sampled over time for blind analysis by trained panels. Results show that pasteurized cheese only five months old was determined to be significantly different in flavor and texture when compared to heat-treated control samples made at the same time. The panels noted flavor

attributes of bitter, bland and flat and the texture deficiency of pasty body for the pasteurized product. The process of pasteurization of milk at 161° F for 15 seconds was designed and implemented for the control of pathogenic and spoilage microorganisms. Studies have demonstrated, however, that many organisms are inactivated by heat treatments of 148° F or above for 16.2 seconds and that heat-treatment of cheesemilk is but one of the technologies and practices which contribute to the manufacture of safe cheese. It is recommended that the heat-treatment process be recognized for cheesemaking based on the following parameters: 1. Raw Milk intended for heat-treatment meets the following requirements on a daily average: SPC < 15,000 cfu/ml; SCC < 250,000 cells/ml, indicating that the milk was from healthy animals. 2. Raw milk is heated to 148° F or greater and held for a minimum of 16 seconds. 3. Finished cheese produced under these conditions will be cured at a temperature of greater than 35° F for a period of at least 60 days.

**Key Words:** Cheese, Heat-Treatment, 60 Day Hold

**186 Approaches to ensuring the safety of raw milk cheeses.** C. Donnelly\*, *The University of Vermont, Burlington.*

Although cheeses have been linked with documented outbreaks of foodborne illness, epidemiological evidence collected from around the world confirms that this occurs infrequently. Cheeses can become contaminated with bacterial pathogens as a result of their presence in raw milk used for cheesemaking and subsequent survival during the cheesemaking process. Alternatively, bacterial pathogens can contaminate cheese via post-processing contamination if sanitation and other measures in the processing plant are not sufficient to prevent re-contamination. The characteristics of the specific cheese variety will dictate potential for growth and survival of microbial pathogens, with ripened soft cheeses presenting a higher risk for growth and survival of pathogens in comparison with aged hard cheeses where a combination of factors including pH, salt content and water activity interact to render cheeses microbiologically safe. This presentation will compare and contrast approaches used worldwide to insure the safety of raw milk cheeses. The 1996 European Union Statutory Instruments contain regulations for hygienic production and marketing of milk and milk based products. EU regulations establish limits for pathogens in raw milk cheese, where presence of *S. aureus* and *E. coli* would indicate poor hygiene. The relative merits of such approaches in the context of assuring cheese safety will be reviewed.

**Key Words:** Cheese, Safety, Pasteurization

**187 Survival of a five strain cocktail of *Escherichia coli* O157:H7 during thermalization and the 60 day aging period of hard cheese made from unpasteurized milk.** J. Schlessler\*, *Food and Drug Administration, NCFST, Summit-Argo, IL.*

Cheeses have been cited as vehicles for outbreaks of foodborne illness. The standard of identity for hard cheeses requires pasteurization of the milk or as an alternative treatment, a minimum 60-day aging for cheeses