Safety of Our Meat Supply: Assessing the Risks and Methods of Control

854 Risk assessment of pre-harvest food safety: a quantitative approach. S.A. McEwen*[1], [1]*Department of Population Medicine, Ontario Veterinary College, University of Guelph*.

This presentation will demonstrate how pre-harvest food safety risk assessment can be used to guide regulatory decision-making, help to establish policies and standards, and explore impacts of different risk-reduction options. The strengths, limitations and demands of risk assessment in the pre-harvest area will be discussed, using actual examples concerning E. coli O157:H7, and antimicrobial resistant bacteria.
We used a quantitative model to assess the benefit of measures implemented in the pre-harvest period that are aimed at reducing the contamination of beef carcasses with E. coli O157. Control measures that were assessed were based on either a reduction in herd prevalence of infection, reduction in opportunity for cross-contamination, reduction of concentration of E. coli O157 in fresh feces (by vaccination or other method), or a reduction in the amount of feces, mud and bedding ("tag") transferred from the hide to the carcass. Risk assessment is also being used in regulation of veterinary drugs, which will be the focus of the second example. FDA scientists have prepared and publicly presented a risk assessment on the human health impact of fluoroquinolone resistant Campylobacter associated with the consumption of chicken. Alternative approaches have been proposed and their stregths and limitations will be dicussed.
Demands to enhance pre-harvest food safety continue to mount as microbial and chemical crises occur with amazing regularity around the world. Those concerned with managing risks at the farm level are often pressed to identify which risks can and should be addressed at that level, and at what cost. Risk assessment is gaining acceptance as a valuable tool because of the difficulty in making sound public health decisions in the face of complexity, uncertainty and varying scientific and public opinion. There is a compelling case for a decision-making process that is open and based on scientific evidence, economic analysis and wide consultation with due consideration of societal values.

Key Words: Risk assessment, Food safety, Pre-harvest

855 Pre-harvest Food Safety. J.E. Marion*, *National Chicken Council, Stuart, VA*..

The importance of food safety considerations prior to the slaughter of food animals has been recognized for centuries. It was first recognized that healthy food animals would yield safe food animal products if proper slaughter and processing techniques were followed. Diseases of animal origin that could be transferred to humans have been largely brought under control by vaccines, management, etc. during the past two centuries. During the mid-20th century, food animals were recognized as potential carriers of chemical residues, and programs are now in place to monitor and reduce such residues. More recently, food borne organisms that affect humans, but not necessarily animals, are being targeted for reduction in numbers and incidence. A most recent foods situation involves bovine encephalopathy (BSE) in European cattle and its' possible relationship to a human form of the disease. All the above situations bring us to a full realization that food safety is a farm-to-table concept that demands programs beyond those for slaughtering and processing. We are compelled to consider all phases from pre-harvest to the consumers plate, and to consider related issues such as environment and waste management. The Hazard Analysis and Critical Control Points (HACCP) approach has been employed by industry and regulatory agencies to accomplish a reduction in food borne pathogens and to model meat and poultry inspection for food safety and wholesomeness aspects. HACCP in poultry plants appears to be successful and will likely be used in broader based programs from the farm to the table. HACCP and other programs will be discussed to illustrate progress in food safety , and to point out areas, especially in preharvest, that need attention. A specific industry program for pathogen intervention will be discussed.

Key Words: Food Safety, Slaughter and Processing Techniques, HACCP

856 Future directions for FSIS and food safety. K. Hulebak*, *USDA Food Safety and Inspection Service, Washington, DC*.

With HACCP now fully implemented nationwide, FSIS is developing a roadmap to enable it to build upon the improvements it has made so far in the safety of meat, poultry, and egg products. Next steps are being considered in many different areas. For example, FSIS has begun to consider and discuss with its stakeholders how the agency's chemical residue program might change as it becomes part of the HACCP approach to ensuring food safety. Through the Workforce for the Future initiative, FSIS plans to implement an ambitious human resource program emphasizing the further development of one of its most valuable resources—the public health professionals who work throughout the agency as inspectors, consumer safety officers, veterinarians, microbiologists, and lawyers, among others. Undertaking reviews of the scientific bases for performance standards will be another important activity within the coming several years. With respect to inspection, FSIS is pursuing a risk-based approach. Education initiatives all along the farm-to-table chain will play a role in FSIS' next steps. And research and risk assessment, the critical underpinnings of all of FSIS' regulatory activities, are receiving ever-increasing emphasis. FSIS is working to enhance its traditional relationship with USDA's Agricultural Research Service, is developing new relationships with USDA's Cooperative State Research, Education, and Extension Service, and is establishing a new Risk Assessment Center to spearhead new risk assessments for Salmonella Enteritidis, Listeria monocytogenes, and E. coli O157:H7. FSIS has initiated a wide-ranging dialogue with stakeholders to explore these next steps.

Soybeans in Monogastric Nutrition

857 Nutrient composition and processing of soybeans impact the nutritional value of resultant soybean meals. C. M. Grieshop* and G. C. Fahey, Jr., *University of Illinois, Urbana, IL/USA*.

It is vital that raw soybeans contain an optimal nutrient profile if the highest quality soybean meal is to be produced. Both soybean composition and processing conditions impact the nutritional quality of soybean meal. In a comparison of soybeans grown in a variety of locations around the world and representing diverse environmental conditions, significant differences in chemical composition (e.g. crude protein, amino acids, and lipid) were noted. These differences could impact the nutritional value of the resultant soybean meals. Little information is available on the impact of processing conditions (e.g. processing time and processing temperature) on the chemical composition and nutritional value of soybean meal. Soybean meals obtained from a large number of U.S. soybean processing plants varied in crude protein, lipid, and amino acid concentrations. Indicators of nutritional value (e.g. protein solubility in potassium hydroxide, urease activity index, and protein dispersibility index) are commonly used to rank soybean meals. United States soybean meals from many processing plants exhibited significant differences in these characteristics. Optimization of both soybean quality and processing conditions is necessary to produce optimal quality soybean meal that will allow for maximal digestibility and growth performance of animals.

Key Words: Soybean, Soybean meal, Nutrient quality

858 Digestibility of amino acids in soybean meal for poultry. C.M. Parsons*, *University of Illinois, Urbana, IL USA*.

The digestibility of amino acids (AA) in well-processed soybean meal (SBM) for poultry is quite high, with mean digestibility coefficients being 90% or higher. Decreased digestibility of AA is usually due to either insufficient or excess heat processing. Inadequate heat processing results in decreased digestibility of all AA, whereas excess heating usually results in decreased digestibility of only Lys primarily. The reduction in Lys digestibility is due both to destruction of the AA and decreased digestibility of the Lys that is not destroyed. The protein efficiency ratio (PER) growth assay, slope-ratio growth assay and digestibility or balance assays such as the precision-fed cecectomized rooster assay or the chick ileal digestibility assay are all sensitive for measuring bioavailability or digestibility of AA in SBM. A great advantage of the digestibility assays is that all analyzable AA can be measured in the same assay.

When considering *in vitro* or laboratory assays for predicting AA digestibility or protein quality of SBM, the urease assay is good for detecting underprocessing and the KOH protein solubility assay is good for detecting overprocessing. A combination of the latter two assays is needed to ensure that SBM has neither been underheated nor overheated. The protein dispersibility index (PDI) assay may be superior to the urease and KOH assays as an indicator of minimum adequate heat processing of SBM. Determining the Lys concentration as a percentage of the CP may be a good initial indicator of possible overprocessing. Recent work indicates that near infrared reflectance spectroscopy (NIRS) and a new immobilized digestive enzyme assay (IDEA) may also be useful assays for predicting in vivo AA digestibility of SBM.

Key Words: Soybean meal, Amino acid digestibility, Poultry

859 Soybean meal quality:swine industry perspective. Keith Haydon*[1], [1]*Heartland Pork Enterprises, Inc.*.

Soybean meal (SBM) in swine nutrition has long been the "gold-standard" protein that all other competitive proteins are measured and priced against. SBM provides an excellent amino acid (AA) profile of high true digestibility relative to the pigs' requirement when balanced with corn in a complete feed. The quantity and availability of energy, essential amino acids (EAA) and phosphorous (P) primarily drive SBM quality in the context of swine nutrition. Since energy is the most costly nutrient in swine feeds, the energy value of SBM is critical in formulating cost efficient diets that provide optimum growth with minimal nutrient excretion and/or energetic losses. Dehulled SBM contains (by difference) approximately 32 to 35% carbohydrates in primarily oligosaccharide forms. Improvement in the digestibility of these components offers tremendous potential in improving the available energy in SBM. Defining the factors that can influence or that can improve the energy value of SBM is paramount to swine nutritionists. Considerable time and effort has been spent over the past 84 years in understanding the impact of required heat treatment of soybeans to neutralize the inherit anti-nutritional factors and their impact on AA availability. The use of protein dispersibility index alone or in conjunction with KOH protein solubility test provides an excellent means to predict adequacy of heat treatment during processing, but are not practical for use in large scale feed mills. Most swine nutritionists surveyed by the author routinely monitor moisture, protein and fiber in SBM. Many have AA analyses performed for quarterly or monthly baselines or predict AA levels from protein levels; however, rarely would they modify their matrix digestibility values based on compositional changes. Increasing the P availability in SBM could decrease diet cost and P excretion and increase dietary energy concentration. Many swine nutritionists consider SBM one of the most consistent quality (nutrient composition and availability) ingredients they use. Areas of concern or opportunity to improve SBM are energy value, consistent processing methodology across the industry and increased P availability.

Key Words: Soybean meal , swine, industry

Twinning Beef Cows

860 Experiences and management of twinner cattle. D. O'Kief*, *O'Kief Ranch, Wood Lake, NE.*

After graduation from the University of Nebraska at Lincoln and before returning to ranching at Wood Lake, NE, Dan O'Kief put his knowledge of reproduction in cattle to work managing Twinner cattle at the United States Meat Animal Research Center at Clay Center, Nebraska. In this symposium on twinning beef cows, Dan will discuss three primary areas related to twinning cow management. These include:
1. The critical period from calving to day three.
2. Improvement of reproductive management of twinning cows.
3. Meeting the mineral and energy demands of twinning cows.

Key Words: Cattle, Twinning, Management

861 Summary of the MARC genetics program to produce twinner cows. R. M. Thallman* and K. E. Gregory, *USDA/ARS, U.S. Meat Animal Research Center, Clay Center, NE.*

The U.S. Meat Animal Research Center (MARC) initiated a program to select cows for increased twinning rate in 1981. Cows that had produced multiple sets of twins were purchased from commercial producers (96 cows) or were transferred from other projects at MARC (211 cows). Semen from 8 Swedish Friesian and 7 Norwegian Red bulls whose daughters twinned more often than normal was imported. Other foundation sires included sons of foundation cows and one Pinzgauer and one Charolais bull whose daughters twinned at high rates in another project at MARC. The herd is 24% Pinzgauer, 18% Simmental, 17% Holstein, 14% Swedish Friesian, 9% Hereford and Angus, 10% Norwegian Red, and 8% other breeds. Current herd size is 300 cows, half calving in spring and half in the fall. Twinning rate (TR) currently averages 50%. Ovulation rate (OR) is used as an indicator trait and is measured by counting corpora lutea via rectal palpation over six to eight estrus cycles prior to breeding heifers for the first time to calve at 30 months of age. The heritabilities of TR and OR are 0.09 and 0.10, respectively, with a genetic correlation of 0.75. Predicted breeding values (PBVs) are computed using a multiple trait, repeated records model for TR and OR. Approximately 10 young bulls are progeny tested per year. Following measurement of their daughters' OR, the best sires are mated to females with the highest PBVs to produce candidates for progeny testing. Response to selection for TR has averaged 2.5% per year. Tissue samples for DNA have been obtained from animals in the herd in 1994 and thereafter. In addition, semen samples were available from most of the sires used prior to 1994. Two quantitative trait loci (QTL) for TR and OR have been identified on chromosome 7 (approximately 60 cM apart) and one on chromosome 5. These three QTL account for about 15% of the genetic variance and are used together with residual polygenic effects in a two-trait model to compute marker adjusted PBVs, which have been used since 1998. Selection for TR has been effective, in spite of low heritability.

Key Words: Twins, Beef, Genetics

862 Reproductive, growth, feedlot, and carcass traits of twin versus single births in cattle. S. E. Echternkamp* and K. E. Gregory, *USDA, ARS, RLH US Meat Animal Research Center.*

The production of fraternal twin calves presents a new paradigm in beef cattle management and production and affords an opportunity to increase both reproductive and economic efficiency. The first prerequisite for fraternal twins is twin ovulations. Breeding value for twinning was predicted by repeated measures of ovulation rate in yearling heifers and of twinning rate in the selected herd at the U. S. Meat Animal Research Center. Twinning rate increased 3% per year to an annual rate of 50 to 55%. Gestation length was shorter (275.6 vs 281.3 d; $P<0.01$) and birth wt was smaller (38.2 vs 47.0 kg; $P<0.01$) for twin vs single calves, respectively, but total birth wt (live) was increased 53.1% for twins. Respective weaning wt (200-d wt) were 231 vs 259 kg ($P<0.01$). Number of calves weaned per cow calving was 0.92 for single vs 1.52 for twin births ($P<0.01$); thus, total weaning wt was increased 47.4% for twins. Single male calves gained 74 g more per d than twin males from birth to 200 d, and 45 g more per d from 200 d to slaughter. Differences in carcass traits between twin and single males were small. Freemartins, 96% of the females born co-twin to a male, did not differ from normal females in growth traits, but freemartins had higher ($P<0.05$) scores for marbling and a higher ($P<0.05$) percentage of carcasses were USDA Choice or higher quality grade. Efficiency constraints to twins were increased ($P<0.01$) incidence of retained placentae (28.0% vs 1.9%), of dystocia (46.9% vs 20.6%) and of perinatal calf mortality (16.5% vs 3.5%); difference in calf survival at 200 d was 14.3%. Dystocia of twins resulted primarily from malpresentation of one or both calves. Fertility was reduced 11.6% ($P<0.01$) after a twin birth and 9.5% ($P=0.06$) after a retained placenta, but the effect of twinning on fertility varied significantly ($P<0.01$) among years and seasons. Collectively, twinning increased productivity at weaning by 54.2 kg or 28.3% per cow exposed at breeding.

Key Words: Twinning, Production, Cattle