by a number of factors such as sex, weight, grade, breed, lot size, location and health. A multiple regression analysis was conducted on data gathered from eight WV sale barns during the fall of 2000 to 2004 for special graded sales. The base calf for the analysis was a black, medium frame (M), No.1 muscle, steer calf weighing 550 lbs..The following table quantifies the average value of the factors influencing price. WVU Extension developed a feeder calf marketing program that specialized in the development and sales of Quality Assurance(QA) Cattle. The program was developed to pool and sell load lots of source and health process verfied calves under Beef Quality Assurance standards. An economic analysis was conducted to compare the QA and graded sales(GS) in 2001-2004. The comparison was made between the QA calves and the M1 & L1 Black & BWF calves in the graded sales. The QA calves had a market advantage in increased value of $61,$54,$66 and $61/hd in 2001 to 2004 respectively. The QA calves were heavier than the GS calves (P<.01) with average increase in weight ranging from 40 to 76 lbs/hd and an average value per head due to weight of $36 to $90. Historically, the pooled calves have sold for 12% more than comparable barn cattle.

Factors Influencing Calf Values

Year	<2000>	<2001>	<2002>	<2003>	<2004>
Avg. Base Value	483.55	464.37	417.83	516.99	592.48
Heifer	-51.68	-55.02	-47.05	-45.31	-46.54
Bulls	-29.41	-31.00	-37.97	-29.52	0.00
L1	-6.82	-9.62	-7.98	-6.31	-9.16
S1	-62.57	-70.12	-65.28	-72.04	-73.04
LM2	-42.72	-35.46	-30.06	-29.95	-41.96
No Grade	-65.33	-39.94	-53.95	-45.76	-56.44
BWF	2.97	-2.53	-0.49	6.30	7.24
CHARX	-15.40	-14.25	-15.62	-11.80	-12.61
REDX	-20.07	-23.49	-17.93	-20.03	-18.05
HERE	-45.53	-44.36	-38.86	-44.60	-59.97
LOT SIZE	0.41	0.56	0.61	0.50	0.71
WEIGHT	0.51	0.53	0.50	0.69	0.75

Key Words: Feeder Cattle, Value Added, Graded Sales

479 Beef artificial insemination economics. W. Ellis*, *Southeast Missouri State University*, *Cape Girardeau.*

The objective of the study was to compare gross sale income between calves sired by artificial insemination (AI) or a clean-up bull. One hundred and twenty animals were enrolled in the study (12 heifers, 108 cows). A 30-day CIDR-based AI protocol was used to synchronize estrus and computerized Heat Watch technology was used to detect estrus in heifers. Cows were Fixed-time AI following a CIDR-based protocol that included GnRH. One AI sire was used for all AI services. Cows were randomly assigned to one of two experienced AI technicians, stratified by age of cow, days postpartum, and body condition score. Clean-up bulls were introduced 14 days after fixed-time AI. Pregnancy diagnosis was determined by ultrasonography. First AI service pregnancy rate following estrus synchronization was 70/120 (58%) and pregnancy rate after the breeding season (AI and clean-up) was 113/120 (94%). There were 66 AI and 42 cleanup calves conceived. Calves were marketed as weaned calves (n=25, 5 AI), bred heifers (n=37, 23 AI) or harvest weight steers on a grid system (n=46, 38 AI). Overall, gross income per calf from AI and clean-up sires averaged $1169.97 ± 33.76 and $952.15 ± 60.76, respectively. Gross income per calf was significantly different between sire groups for weaned calves (p<0.05) and harvest weight steers (p<0.05) but not bred heifers (p>0.5). Bred heifer buyers were knowledgeable of their mode of conception. Weaned calves from clean up bulls were fed 119 days longer post weaning than their AI counterparts and had a higher gross sale value (+$220/calf). Gross income per bred heifer averaged $34 higher for AI over clean up bulls while gross income per harvest weight steer averaged $131 higher for AI. The cost of synchronization and AI was $31.29 per female and $56.89 per AI calf. The cost of synchronization and AI was recovered through higher sale income per AI calf in harvest weight steers but not in weaned calves or bred heifers.

Key Words: Beef, Artifical Insemination, Economics

FASS Symposium on Toxic Levels of Minerals

480 Sources and bioavailabilities of toxic levels of minerals. J. W. Spears*[1] and J. P. Goff[2], [1]*North Carolina State University*, *Raleigh*, [2]*USDA, National Animal Disease Center*, *Ames, IA*.

Most minerals, whether essential or nonessential, can produce negative effects on production and/or health of animals when consumed orally at high concentrations. This presentation will focus on potential sources and bioavailability of minerals most likely to present toxicosis in animals. For the essential trace minerals copper and selenium, oversupplementation or errors in formulation of mineral supplements are frequent causes of toxicosis. Depending on the mineral in question, other potential sources that may lead to toxicosis include: 1) feedstuffs, 2) water, 3) minerals present as contaminants of certain mineral ingredients, 4) consumption of animal waste or by-products, 5) soil ingestion, and 6) exposure to industrial products (batteries, paint, etc.). High concentrations of a mineral in feedstuffs can result from high soil mineral levels due to soil type, use of sewage or industrial sludge, or industrial pollution. In animals ingesting high concentrations of a mineral, bioavailability of the mineral from the source of exposure is a major factor determining whether toxicosis will occur. Chemical form of the mineral present in a given source and the presence of antagonists in the diet are primary factors that affect bioavailability

Key Words: Minerals, Toxicity, Bioavailability

481 Toxic levels of minerals in the diets of animals. J. Goff*[1] and J. Spears[2], [1]*National Animal Disease Center, USDA-ARS*, *Ames, IA*, [2]*North Carolina State University*, *Raleigh*.

Ingestion of any mineral at a high enough level can have detrimental effects on the health and productivity of animals. This presentation will provide examples of the maximal tolerable levels of a number of minerals commonly causing problems in food and companion animals. These maximal tolerable levels are, for most minerals, also dependent on the length of time they are fed. For most minerals a maximal tolerable level is noted for a single oral dose; an acute dose, at which problems would not be expected if feeding the mineral at this level for less than10 days; and a chronic dose, at which problems would not be expected if feeding the mineral at this level for more than 30 days. In general the maximal tolerable level implies no effect on productivity of the animal. For some minerals such as sulfur in ruminants, sudden death due to polioencephalomalacia may be one of the first indicators of decreased performance of the animal when the mineral is fed beyond the maximal tolerable level. In the case of minerals such as calcium, intolerable levels may be defined as levels interfering with feed intake or utilization of other minerals, rather than induction of pathological changes. The presentation will briefly review the new recommendations, especially as they contrast with the 1980 Mineral Tolerances of Domestic Animals publication.

Key Words: Toxicosis, Minerals, National Research Council

482 Potential adverse effects on humans consuming excess minerals in animal products. J. Greger*[1], F. Nielsen[2], and K. Klasing[3], [1]*University of Connecticut*, *Storrs*, [2]*Grand Forks Human Nutrition Center*, *Grand Forks, ND*, [3]*University of Califronia*, *Davis*.

The Committee on Mineral and Toxic Substances in Diet and Water for Animals was asked to identify potential risks to humans from consuming products from animals that ingested excess levels of minerals. This was complex question. These points had to be considered. Did a mineral accumulate in tissues of animals ingesting an excess level of the mineral? In which tissues (i.e. muscle, liver, kidney, bone, eggs, or milk) did the mineral accumulate? Was the accumulation different among species (e.g. poultry, cattle, swine, fish, other seafood)? How much of these tissues were ingested by the average adult and average child (categorized by age and weight) in the US? How much would individuals at the 99th percentile or those with unusual diets consume of these tissues? Using these data we estimated human exposure to minerals to humans consuming products from livestock that had ingested excess minerals. These estimates then were compared to the Tolerable Upper Intake Levels (ULs) (for boron, calcium, copper, fluoride, iodine, magnesium, manganese, molybdenum, nickel, phosphorus, selenium, vanadium and zinc) suggested for humans by the Food and Nutrition Board and WHO and FDA standards (for cadmium, lead, and mercury). We also had to consider the form or the mineral in the animal tissues when evaluating toxicity. For example, organic forms of arsenic in seafood have not been shown to be toxic and selenomethionine has different effects than selenite. These analyses demonstrated that chronic ingestion of high amounts of "protein rich" foods which were contaminated with excess (>5% by weight of the protein rich food) bone chips due to improper processing or the chronic ingestion of large quantities of organ tissues from animals that ingested excess minerals could result in humans consuming more of certain minerals than is considered safe.

Key Words: National Research Council, Mineral Toxicity, Effect on Humans

483 New developments in selenium toxicity. X. G. Lei*, *Cornell University*, *Ithaca, NY*.

Selenium is an essential trace element for both animal and human nutrition, but the gap between dietary Se requirements and chronic toxicity levels is relatively narrow. During the past two decades, major changes in our understanding of selenium biology have occurred. Using genomics tools, a total of 25 selenium-containing proteins have been identified in humans. Physiological functions of several selenoproteins have been well studied with the help of the gene-knockout mouse models. The potential of supranutritional levels of selenium in preventing certain types of cancers in humans has led to an interest in enhancing selenium concentrations in the edible animal products. Organic forms of selenium seem to serve that purpose well. However, the immediate risk of Se toxicity to the ecosystems has been highlighted by the fish kills and bird deformities at several aquatic resources as a result of Se bioaccumulation. Thus, establishing the accurate maximum allowable tolerable levels of selenium for various species has broad implications. The challenge is that these levels vary widely with the form and source of Se, exposure duration, nature of diet, and end points of tolerance.

Key Words: Selenium, Toxicity, Environment

484 The toxicity of minerals that may be advocated for animal health and production through reasons other than nutritional need. F. Nielsen*, *USDA/ARS/Grand Forks Human Nutrition Research Center*, *Grand Forks, ND*.

There are several mineral elements that are unlikely to be of toxicological concern under natural conditions for domestic animals, but whose tolerable intake levels may become of interest because of possible exposure through supplements given with the intention of boosting performance. These elements include silicon as sodium zeolite A that can increase chicken egg shell thickness, prevent parturient paresis in dairy cows, and decrease bone-related injuries in horses; rare earth elements that have been reported to increase feed conversion and weight gain in beef cattle, sheep, pigs, rabbits, chickens and ducks, milk production of dairy cattle, egg production of hens, and the output, survival rate and feed conversion of grass carp and prawn; boron that may enhance immune function and bone strength in pigs; lithium that may be useful as a food aversion agent for grazing animals; and chromium that apparently improves carcass characteristics in swine, immune response in stressed animals, and milk production in dairy cows. The fact that these elements have beneficial effects at intakes higher than that found with normal diets makes it important to determine when these higher intakes become excessive and result in toxicosis. The maximal tolerable intake of these elements can be influenced by dietary composition because their mechanisms of toxicity include interference with the utilization of other essential minerals (lithium, silicon, rare earths), enzyme inhibition (boron), and oxidative stress (chromium). The predominant sign of toxicosis of these elements is reduced growth. Recommendations for the maximal tolerable levels of these elements for animal health and the rationale for the recommendations will be provided at the symposium.

Key Words: Toxicity, Minerals, Ultra Trace Elements

485 New developments in heavy metal toxicity. K. Klasing*, *University of California*, *Davis*.

The Committee on Animal Nutrition of the National Research Council, National Academies of Sciences, established the Committee on Minerals and Toxic Substances in Diets and Water for Animals to update recommendations on maximum tolerable levels. Among the minerals examined, the heavy metals were of special concern. Cadmium, mercury, and lead are heavy metals that have a variety of industrial and domestic applications. These metals are not known to be nutritionally required by vertebrates but they are of to nutritionists because they are toxic at relatively low levels of exposure. Lead from batteries, paints, and contaminated soil is a common cause of accidental poisonings in animals. Mercury and cadmium have accumulated to high levels in some environments from a variety of anthropogenic sources. When consumed, these metals are not absorbed very efficiently from the intestines but they are excreted very slowly and they accumulate in tissues over time. Cadmium accumulates in kidney and liver, lead accumulates in kidney, brain and bone, and mercury accumulates in all tissues, including muscle. Levels of these metals in the diet and water that are tolerated by animals with no apparent effect result in unacceptably high levels in food products. Thus, the maximum tolerable levels of these metals in animal feeds have been based on issues of human health for decades. Toxicity of these metals in animals is due to several mechanisms. Their propensity to undergo redox reactions and their ability to bind to and deactivate antioxidants can cause cell death due to oxidative damage. These metals also antagonize the homeostasis of chemically related minerals that are nutritionally essential by impairing their absorption, transport, excretion, or incorporation into active sites of molecules. Mercury and lead affect development of the brain and the immune system while cadmium causes renal damage. Recommendations on the maximal tolerable levels for animal health and their rationale will be provided at the symposium.

Key Words: Lead, Mercury, Cadmium