

Swine Species Symposium: Optimizing Swine Production for Lactating Sows and Young Pigs

1063 Nutritional management of sows during the perinatal period. S. W. Kim*, A. Saraiva, and Y. Zhao, *North Carolina State University, Raleigh.*

With improved genetic potentials, sows produce a larger number of fetuses than before and these fetuses possess genetic potentials to grow faster than before. Recent comparison shows that a porcine fetus is 40% heavier than 40 years ago. Thus the nutritional management of sows has been updated to reflect these genetic changes. Our recent study quantified nutritional needs for sows to support the growth of fetuses and mammary glands during gestation. Amino acid needs for fetal growth and mammary growth during late gestation (d 70 to farrowing) increased 19-folds and 24 folds, respectively, compared with those needs during early gestation (until d 70). Considering these increases, daily requirement of true ileal digestible Lys for a primiparous sows increases from 7 g (until d 70) to 15 g (d 70 to farrowing). Required qualities of proteins (i.e., amino acid ratios) also change with an advance of pregnancy as maternal, fetal, and mammary tissues have their unique amino acid compositions. Thus, sows can be under a severe catabolic status during late gestation if the feed does not provide sufficient amounts and qualities of proteins especially during late gestation. Under a several catabolic status, sows can have a limited nutrient supply for the growth of fetuses. Sows under a conventional feeding program had increased litter weight variations at farrowing (19%) compared with early gestation (3.0%). Our recent study also shows that sows under a conventional feeding program have a dramatic increase in a systemic oxidative stress during late gestation compared with early gestation when measured by plasma $\hat{\pm}$ -tocopherol (56% decrease), plasma retinol (57% decrease), and DNA damage in white blood cells (125% increase) which were sustained until the early lactation period. Increased oxidative damages in sows negatively affect the growth and health of fetuses. We proposed that sow feeding during late gestation should reflect the changed needs for amino acids and antioxidants because a proper feeding during late gestation will eventually help producing uniform and healthy piglets.

Key Words: amino acids, oxidative stress, sows

1064 Proper nutrition to optimize performance for lactating sows and young pigs. V. J. Pearson*, *Land O'Lakes Purina Feed LLC, Shoreview, MN.*

Feeding the sow for maximum reproduction involves recognizing that the nutrient requirements are different during different stages of the sow's reproductive life. Lactation, though only 2 to 6 weeks, is a critical stage of this sow's reproductive life. Feed intake at this stage is affected by genotype, lactation length, parity distribution, mycotoxins, environmental temperature, formulation of lactation feed, water availability and disease levels. The key point to optimize a sow's performance is proper feed management during lactation. The objective of the feeding program for lactating sows is to ensure that the sow consumes sufficient feed on a daily basis to meet her nutrient requirements such as protein, amino acids, energy, trace minerals, vitamins and major minerals. The nutrient requirements needed by the sow depend on her weight, milk yield and composition along with the environment she is in especially temperature. Since most of the information we need to make the proper calculations to feed the sow are not known the sow is fed to appetite. The appetite of a lactating sow is lower the first week and increases by 3 weeks. So optimizing feed intake of the sow is extremely important. Sows should have access to high quality water at all times; temperature should be

kept at 19–22°C. Water flow rate of 0.7 to 1 L per minute should be adequate. Sow data has demonstrated that approximately 20% of sows show a feed decrease for 2 to 3 d at the beginning of the second week. This caused a longer weaning-to-estrus interval, reduced farrowing rates and resulted in smaller subsequent litter size. Data has indicated even one day of the sow's consumption dropping below 1.8 kg will increase the chances of her being removed from the herd by 50%. Thus the sow should never be purposely deprived of feed. A feed allowance of 1.0% of the sows body weight plus 0.57 kg for each pig in the litter is a good guide to the minimum levels lactating sows should be daily fed.

Key Words: swine, lactation, nutrition

1065 Gene x environment interactions affecting litter phenotype in commercial sows. G. R. Foxcroft*, *University of Alberta, Edmonton, Alberta, Canada.*

Variation in litter growth performance after birth may be pre-programmed during embryonic and fetal development, yet may only express itself in the late grow-finish stages of production. Two particular hypotheses will be explored in the context of efficient pork production from contemporary sow populations: 1) Selection for increased litter size has resulted in indirect negative effects of intrauterine crowding on placental development in early pregnancy, leading to reprogramming of fetal development, less efficient post-natal growth performance, and adverse effects on carcass quality at slaughter. 2) Sow metabolic state at breeding can also affect the quality of litters born, acting through epigenetic mechanisms to affect early embryonic development. Effects of prenatal programming on postnatal health and survivability are also important, and are mediated through developmental limitations in immune, metabolic and gastrointestinal function in the early postnatal period. Negative pre-natal programming effects on post-natal performance are consistently seen in hyper-prolific sows that produce total numbers of pigs born that exceed uterine capacity for optimal birth weight. However, available evidence indicates that differences among litters is the major source of variance in pig birth weight in mature sow populations producing between 10 and 15 pigs per litter, with apparent repeatability of a low birth weight phenotype in this sow population. These developmental complications underlie the problems of managing low birth weight pigs through lactation and the nursery stage of production. Production strategies that might address variation in litter average birth weight and post-natal performance of litters include: 1) segregated management of litters based on birth weight phenotype, and 2) nutritional strategies in gestation and lactation and interventions in the farrowing house targeted at low birth weight phenotypes.

Key Words: sow, litter, phenotype

1066 Decision-making using swine records. J. Deen* and S. S. Anil, *University of Minnesota, St Paul.*

For sow herds, the objective function of decisions has historically been a simple maximization problem. Sow farms have been viewed as a mostly fixed cost enterprise with marginal production being viewed as having a very high profit margin. This was due to the fact that piglets were considered generic commodities after transfer from the sow herd. Though we see remnants of this attitude in record-keeping systems and pricing methodologies, we are seeing a greater emphasis on individual animal qualities. The major decisions at the individual pig level of

retention, treatment or euthanasia have focused in greater detail on its varied repercussions. For instance, culling a sow not only affects that sow, it also affects the quality of progeny and the utilization of building capacity; the treatment of a pig may not only have an effect on itself but also on surrounding pigs, especially when infectious pathogen transfer is a concern.

Record-keeping has not kept up with these potential considerations. Assumptions of normality and the independence of effects on outcomes need to be re-examined. Both atomistic and ecologic effects of decisions need to be considered. To measure these effects, individual animal characteristics and complementary observational analytic methods need to be utilized. Such measurement regimens and analytic processes are laborious and often complex and rely on

proper sampling and disciplined approaches. However, when we do such analyses we are finding that the assumptions of normality and equality of effects across the distribution are often erroneous. In fact, most insults and interventions affect subpopulations that can be best described as compromised individuals. For instance, the likelihood of being weaned alive and greater than 5 kilograms in weight can range from 8% for the lightest 10th percentile at birth to 96% for the heaviest 10th percentile. Such ranges and responses suggest that individualized records and care are needed to optimize rearing conditions and decision-making.

Key Words: reproduction, records, swine