CSAS Symposium: Are We Experiencing a Paradigm Shift in How We Feed Livestock As Industrial Agriculture Evolves in the 21st Century?

334 Are we experiencing a paradigm shift in how we feed livestock as industrial agriculture evolves in the 21st century? J. Newman,* *American Feed Industry Association, Arlington, VA.*

Myriad factors are imposing change in costs, sustainability, utilization and other factors on the animal food industry′s ability to use grains and resources for feedstuffs. An in-depth report commissioned by the feed industry will be presented that will examine the pressure to use feed ingredients for human consumption, the changing dynamics of grain production, the usage of grain for fuel production, environmental issues of using natural resources and the effect of climate change, among other issues. An economic forecast will be presented that will detail the state of the feed industry and future of it and its economic relationship to animal agriculture.

Key Words: future feedstuff availability, economics of livestock feeding, competition

335 Rethinking and expanding the role of co-products and crop residues as livestock feeds. S. S. Donkin*[1] and M. J. Cecava[2], *[1]Purdue University, West Lafayette, IN, [2]Archer Daniels Midland Company, Decatur, IL.*

Food and energy security are critical issues facing the world and it′s population. Population growth coupled with increasing wealth will expand demands for animal source foods. At the same time, the biofuels industry will continue expanding and altering processes resulting in new coproduct feeds having characteristics different than those of existing feed coproducts. Quality, quantity and affordability of energy containing feeds for food animal production will be a keen focus, as will efficiency of protein conversion. Record high corn, cereal and oilseed prices have intensified the adoption of alternative feeds and feed processing technologies for livestock production including increasing use of biofuel coproducts such as distillers grains, glycerol, condensed distillers solubles and most recently, crop residues such as straw and stover. Many of the former are geographically restricted and marketed through commodity channels whereas the latter are mainly disaggregated and geographically dispersed. Crop residues comprise approximately half of the dry weight of plants and therefore a high proportion of energy captured by plant growth is available for recovery once soil sustainability metrics are met. Corn stover and straw represent 2 of the most widely available feedstocks which may be collected and processed on-farm or in centralized depots to improve the metabolizable energy content of the residue. Pre-processing includes shearing-fragmentation followed by chemical and/or enzymatic treatments to partially depolymerize recalcitrant fiber. Historically, because of poor digestibility, stover and straw have been used in low amounts in dairy cattle diets mainly to provide fiber for rumen health. However, pre-processing technologies can improve digestibility of residues thereby increasing their value and use and in particular, feeding in combination with biofuel coproducts may enable substantial grain substitution in cattle rations. Resource assessments and animal performance data point to the potential for improved integration of both crop and livestock production to optimize food and biofuel production per unit of land mass.

Key Words: biofuels crop residues, corn replacement, food security

336 Feeding low starch diets to swine. A. D. Beaulieu*[1] and R. T. Zijlstra[2], *[1]Prairie Swine Centre Inc., Saskatoon, SK, Canada, [2]University of Alberta, Edmonton, AB, Canada.*

The increased cost of feed grains is forcing North American swine producers to consider greater usage of alternative ingredients, including co-products. Distillers dried grains with solubles (DDGS), a co-product from the ethanol industry is widely available, often at competitive prices. Ethanol is produced from fermentation of starch in grains, thus relative to the original grain, DDGS have reduced starch content. A typical corn-soybean diet for finishing pigs contains 50% starch and starch contributes 60% of the NE. High incorporation of DDGS or other co-products such as canola meal and wheat millrun, will reduce starch content by at least 45% and will increase fiber and protein content. Formulating these diets to be isoenergetic requires added fat and/or glycerol. Glucose, fatty acids and amino acids are oxidized within pigs for energy. Adequate amounts of either starch or lipid will spare protein, which is an inefficient fuel source. A starch requirement for pigs has not been defined; however, this requires re-examination with the current and potential further reduction in the starch content of swine diets. When growing pigs (25 to 40 kg BW) were fed semi-purified, isoenergetic diets, the efficiency of CP deposited (g CP/kcal DE intake) increased as starch content increased from 2 to 20% at the expense of crude fiber and fat. Further work is required using low starch diets that represent those encountered in commercial practice. The increased fiber and protein content typical of low starch diets can cause concerns for feed intake and growth performance. While the feed intake response has been variable, lean growth, measured as carcass lean, tends to be reduced when pigs have been fed diets high in low starch co-products. Knowledge of the effects of feeding low starch diets on performance and protein deposition is required to fully exploit low starch co-products for commercial swine production.

Key Words: swine, starch, DDGS

337 Alternatives to starch-based feeding programs for growing and finishing cattle. J. J. McKinnon*[1] and T. A. McAllister[2], *[1]University of Saskatchewan, Saskatoon, Saskatchewan, Canada, [2]Agriculture and Agri-Food Canada, Lethbridge, Alberta, Canada.*

In the last decade, there has been a shift to value-added processing of products from the grain and oilseed sectors. For example, the corn-based ethanol industry now ferments as much corn as the livestock sector uses for feed. While supply has kept pace with demand, corn prices have risen. In western Canada, canola production and processing is at record levels. The increase in seeded canola acreage has come at the expense of wheat, barley and oat. This trend is disturbing to the livestock sector which relies on feed barley and wheat as energy sources. To offset high prices and reduced supply, cattle feeders have turned to by-product feeds as alternatives to starch-based feeds. The nutritional profile of by-product feeds varies with the original grain or oilseed and the nature of processing employed. Consider dried distillers grains with solubles (DDGS), a by-product of ethanol production. Our results indicate that depending on the cereal grain fermented (i.e., corn, triticale or wheat), CP content will range from 30 to 40%, NDF from 33 to 44% and ether extract from 4 to 14%. Originally, fed as a protein supplement, DDGS is now fed as an energy source typically replacing 20% or more of the concentrate (DM basis) in finishing rations. Canola meal, a by-product

of the canola crushing industry is also high in CP (36 to 40%) and NDF (20 to 28%). As with DDGS, it has been fed as a protein supplement. Research in our laboratory has shown that it can replace barley grain at levels up to 30% of the diet DM in backgrounding diets, however in finishing diets feed efficiency is comprised when fed at this level. We have also shown that wheat bran, a by-product from pre-processing of wheat for ethanol can replace 50 to 100% of barely grain (DM basis) in backgrounding diets with no effects on daily gain; however, feed:gain is increased by 10 to15%. These are just a few examples of by-product feeds that can be fed to growing/finishing cattle. The key to successful utilization is knowledge of their contribution to metabolizable energy and protein supply, their effect on the site and extent of digestion and pricing relative to cereal grain sources.

Key Words: cattle, cereal grains, by-product feeds

338 Ethanol co-products for dairy cows: There goes our starch... now what? H. Paz and P. J. Kononoff,* *University of Nebraska-Lincoln, Lincoln.*

The rise of the corn-ethanol industry has resulted in a dramatic increase in the availability of distillers grains and solubles (DDGS) which can be used for animal feed. Although the dairy industry utilized approximately 25% of the yearly production of DDGS, research investigating the use of this feed in lactating dairy cow diets has only begun. The cost of ingredients that have traditionally been used for energy continues to grow, thus there is a need to understand the nutritional value of corn milling co-products and their potential impact on milk yield and composition. Two concerns with feeding DDGS are the potential to negatively affect milk fat and protein. Indeed publications note that these situations may occur but usually when diets are poorly balanced. Through a series of studies, we have developed feeding recommendations for DDGS and these will be reviewed. Additionally, using the NRC (2001) and data from a total of 27 published studies and 73 observations, we used a meta-analytical procedure to evaluate the impact of feeding corn milling co-products on lactating dairy cows. Data were analyzed using SAS and a random coefficient model to account for the random effects of experiment as well as the fixed effect for co-product (CoP) inclusion. For each experiment Metabolizable Protein (MP) and Net Energy of Lactation (NEL) were computed using NRC (2001) equations. All studies contained treatment serving as a zero control as well as diet treatments that contained CoP which averaged 17.6% of the ration DM. Based on our model, the inclusion of CoP did not affect DMI ($P = 0.31$) or 3.5% FCM ($P = 0.24$) which averaged 23.4 +/− 0.44 and 34.2 +/− 0.90 kg/d respectively. Additionally, the percent milk fat and protein in the milk was not affected ($P = 0.83$ and 0.51) and averaged 3.09 +/− 0.07 and 3.57 +/− 0.06% respectively. We also retrospectively evaluated the predicted flow of Lys and Met for these studies. As expected the modeled flow of Lys was significantly ($P < 0.01$) reduced from 6.45 +/− 0.06 to 5.81 +/− 0.05% of MP when CoP were included. Conversely the flow of Met was not affected ($P = 0.19$) and averaged 1.90 +/− 0.03% of MP. We tested the effect of CoP on the error associated with MP and NEL allowable milk calculations of the NRC model. The error associated with NEL allowable milk averaged 5.28 +/− 1.18 kg and was not affected by CoP ($P = 0.57$). Conversely error associated with MP was significantly ($P = 0.04$) higher for cows consuming CoP by 1.88 kg/d. These results reinforce the concepts that CoP can be used as a effective feed for lactating dairy cows.

Key Words: dairy, DDGS, nutrition