329 Influence of a phytogenic feed additive on performance of weaner piglets. A. Kroismayr*[1,3], T. Steiner[1], and C. Zhang[2], [1]*Biomin GmbH*, *Herzogenburg, Austria*, [2]*Biomin Feed Additive Co. Ltd*, *Shanghai, China*, [3]*University of Natural Resources and Applied Life Sciences*, *Vienna, Austria*.

This study was carried out to investigate the effect of a combination of essential oils and FOS (Biomin® P.E.P.) on performance parameters in piglets. 120 crossbred (Duroc x Landrace x Yorkshire) piglets, weaned at 23 d of age, were randomly assigned to two dietary treatments, comprising five replicates per treatment with twelve piglets per replicate. Piglets were fed ad libitum a commercial weaner diet based on corn and soybean meal, either supplemented or not supplemented with a phytogenic additive (Biomin®P.E.P., 125 g/t). Individual body weight (BW) of the piglets and pen feed consumption were recorded every 14 d and after the conclusion of the experiment. Data were subjected to ANOVA using SPSS software. During the first two weeks of the experiment, there were no treatment effects (P>0.05) on BW of the piglets (Table 1). However, from day 28 until the conclusion of the experiment, pigs fed the diet supplemented with the phytogenic feed additive were heavier (P<0.05) compared to pigs fed the control diet. Furthermore, supplementation of the basal diet with the phytogenic additive increased (P<0.05) pen feed intake by 10 % from trial day 1 to 50. Finally, Biomin® P.E.P. supplementation tended (P<0.1) to lower feed conversion ratio, measured from day 0 to 28 and 0 to 42, respectively. The data shows that the investigated phytogenic feed additive enhanced feed intake and growth performance. These data are consistent with the results of GOESSLING (2001) and KROISMAYR (2005). Furthermore, supplementation of diets with the same additive tended to improve feed conversion as reported by STONI (2005). The investigated phytogenic feed additive (Biomin® P.E.P.) had a positive influence on performance of weaner piglets.

References

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Table 1 Effect of Biomin® P.E.P. on body weight (kg)

	Control	Biomin® P.E.P.	P value
Weaning	6.4±0.05	6.4±0.07	0.891
14 d	9.5±0.21	9.8±0.16	0.237
28 d	14.7±0.64	16.3±0.30	0.035
42 d	21.9±0.85	24.2±0.46	0.025
50 d	26.1±1.02	29.2±0.52	0.013

Key Words: Piglet nutrition, Essential oils, Phytogenic feed additive

330 Liquid feeding of newly weaned pigs using whey permeate. T. D. Woods*, C. Zhu, E. Jeaurond, and C. F. M. de Lange, *University of Guelph*, *Ontario, Canada*.

Liquid feeding can reduce post-weaning growth lag in pigs and allows the use of liquid feed ingredients. A total of 378 newly-weaned purebred Yorkshire piglets (14-16 pigs per pen; initial BW 5.8 kg) were assigned to one of three treatments (8 pens per treatment): conventional ad libitum feeding of crumbled dry feed (Dry), liquid feeding of the crumbled dry feed (Liq), and liquid feeding whereby the whey present in the dry feeds was replaced with liquid whey permeate (LiqWhey). Pigs were fed according to a three phase feeding program. In Dry the three subsequent diets contained 20, 10 and 0 % whey. Whey permeate contained 35% DM and 4.8% CP within DM. Within LiqWhey, the inclusion level of whey permeate was kept constant at 20% of DM (4 pens; LiqWheyFix) or reduced from 20 to 10 and 0% of DM in the subsequent diets (4 pens; LiqWheyVar). Between phases, feed was changed gradually on days 8 to 11 and 27 to 30 post-weaning. Liquid fed pigs were fed 6 times daily (28% DM; 6, 9, 12, 15, 18, 21 h) using a computer-controlled liquid feeding system that only delivered meals when the trough was empty. During week 1, ADG (99 ± 10, 87 ± 9, 95 ± 11 g/d for Dry, Liq and LiqWhey, respectively) did not differ between treatments (P > 0.10), while F:G was better (P < 0.05) for Dry than LiqWhey (1.57 ± 0.21 vs. 2.09 ± 0.22; P < 0.05) and intermediate for Liq (1.94 ± 0.21). During week 5 and 6, treatment did not influence (P > 0.10) ADG (616 ± 55, 541 ± 57, 509 ± 107, 616 ± 58 g/d for Dry, Liq, LiqWheyVar and LiqWheyFix, respectively) and F:G (1.50 ± 0.31, 1.37 ± 0.30, 1.53 ± 0.48, 1.20 ± 0.25, for respective treatments). Also over the entire 6 week post-weaning period, treatment did not influence ADG (399 ± 26, 334 ± 27, 331 ± 51, and 377 ± 27 g/d; P > 0.07) and F:G (1.41 ± 0.14, 1.50 ± 0.14, 1.53 ± 0.27, 1.42 ± 0.14; P > 0.10). Liquid feeding did not enhance growth performance of weaned piglets, likely because of feed intake restriction. Liquid whey permeate represents an effective alternative for dry whey in diets for weaned pigs.

ADSA Southern Section Symposium: Practical and Applied Approaches to Managing Dairy Businesses in the Future

331 Labor management strategies in the next decade. D. C. Grusenmeyer*, *New York Farm Viability Institute*, *Syracuse, NY*.

Agricultural labor needs span a broad spectrum from hand labor to highly technical expertise and from production management to strategic business planning and finance. The first step in developing a labor management strategy for the next decade is envisioning who the labor force will be. Agriculture will increasingly depend on foreign labor, for the next decade primarily Hispanic, to fill a wide array of positions. Also, with the Graying of America and people staying in the workforce longer, there will be a wider age range in the workplace. Over the coming decade managers will have as many as three or four generations working in their business at the same time. The result will be a workforce with unprecedented cultural and generational diversity creating management challenges in building highly functioning teams and a smooth running work environment. The next driver for a labor management strategy is an evaluation of business labor needs. What types of positions will the business need as it grows? Will technology be adopted as a trade off against labor? Will new technology change the extent and type of education required for employees to function successfully in the business? Where and how will you recruit a workforce with the necessary attributes and skills? Will employees come from foreign countries, the ranks of the retired looking for new careers, from high school, technical school, community college or university? Each employee source has implications for recruiting, labor cost, workforce diversity, training and development needs, and employee retention. What are the opportunities and implications for attracting or developing a workforce? The final step in a labor management strategy is the selection and implementation of organizational and human resource management practices, such as standard operating procedures, an employee handbook, job descriptions, performance feedback systems, and training and development of the talent resource within the business. The appropriate labor management strategy will be different for each business given its' unique situation. This presentation will investigate some of the options.

Key Words: Labor, Employee, Management

332 Challenges for feeding dairy cows in the next decade. M. Hutjens*, *University of Illinois*, *Urbana*.

An industry survey of extension educators, consultants, and veterinarians conducted in 2001 revealed factors that would limit milk yield were transition cow management, feed bunk management, forage quality, and nutrient availability. This symposium paper will discuss factors that will challenge feeding high producing dairy cows. Herd size and management systems will determine feed delivery systems (pasture vs. stored feeds, number of groups, and feed storage systems). Feed efficiency will be broadened including dry matter conversion, protein capture, and energy balance. Rations will reduce nitrogen loss, lower manure phosphorous levels, and lessen odor emission. Nutrient sources may improve fertility (essential fatty acids), improve milk nutrient (CLA), increase nutrient absorption in the digestive tract, and increases rumen fermentation. Computer models will be used to predict rumen yield and achieve desired milk yield and components. Forage quality and yield will be balance to produce the optimum nutrient yield (such as Milk 2006) as forage breeders genetically improve forage quality. Feed additives will focus on statistical responses using type 1 and type 2 error analyses, increase rumen microbial yield, and reduce transition cow health risks. Economics benchmarks may include milk yield per stall, milk yield per acre, feeds cost per unit of dry matter, feed costs per 45 kg of milk produced, and milk yield per unit of dry matter evaluated by days in milk, parity, level of milk, and pen average. One concern will be resources to conducting basic and applied nutrition research as land-grant college research herds and trained applied dairy nutritionist may be limiting. The feed industry has a major role in this arena and can not rely on government or competitive grants to address feeding issues. Regional and national leadership will be required.

Key Words: Feeding, Challenges, Dairy cows

333 Future challenges for reproductive management of dairy cattle. P. M. Fricke*, *University of Wisconsin*, *Madison*.

Within a dairy herd, total milk production is determined by the proportion of cows producing milk at any given time and the level of milk production of the individual cows within the herd. Improving reproductive efficiency helps to maintain the maximal number of cows producing milk at optimal levels. Reproductive efficiency in dairy cattle currently is suboptimal primarily due to four factors: 1) poor detection and expression of estrus behavior, 2) a high incidence of anovular cows near the end of the voluntary waiting period, 3) poor conception rates of lactating cows, and 4) a high incidence of pregnancy loss for cows that conceive. Over the past decade, the development of hormonal protocols that synchronize follicular development, luteal regression, and ovulation thereby allowing for timed AI without the need to rely on visual estrus detection has helped to overcome factor 1 and to some extent factor 2 above, and development of systematic resynchronization systems for cows failing to conceive to an AI service is underway. Regarding factor 3, the body of scientific literature supports the notion that fertility of lactating dairy cows has decreased over the past 50 years. Factor 3 is closely related to factor 4 because fertility assessed at any point during pregnancy is a function of both conception rate and pregnancy loss. Development of strategies that reduce the rate of embryonic loss after AI will therefore result in an increase in conception rate. A final factor that negatively affects reproduction in dairy cattle is twinning, and the observation that twinning has increased in dairy cattle over time suggests a concurrent change in one or more of these causative factors during this same period. Management strategies need to be developed to avoid or mitigate the negative effects of twinning in dairy herds, especially if twinning rates continue to increase. Future development of reproductive management strategies during the next decade must be focused on both the applied and basic aspects of understanding and overcoming the limitations imposed by these factors.

Key Words: Anovular cows, Pregnancy loss, Twinning

334 Dairy facilities and cow comfort for the next decade. J. Smith*, J. Harner III, K. Dhuyvetter, and M. Brouk, *Kansas State University*, *Manhattan*.

The U.S. dairy industry is consolidating rapidly, resulting in fewer herds with a greater number of animals per herd. Producers are attempting to dilute fixed assets over a greater number of cows by utilizing employees to operate the facilities more hours per day. A number of factors will determine how decisions concerning dairy facilities are designed and constructed. These factors include investment cost, equity position, labor efficiency, milking parlor performance, cow comfort, environmental regulations, climate, management philosophy, urban pressure, milk marketing criteria and access to land for manure application. Producers must balance these factors with issues of cow comfort. When constructing new facilities they must choose between cow comfort and minimizing their investment in facilities per cow. The economic pressure of managing a dairy many times does not allow producers to construct facilities that maximize cow comfort. In recent years the emphasis has been placed on cow comfort and its impact on milk production, reproduction and health. A number of factors need to be considered concerning cow comfort when facilities are designed. Some of the major factors include feedline space, access to water, grouping strategies, group size, time spent milking, travel distances

to the parlor, cow handling systems, ability to manage heat stress and housing design (freestalls, bedded pack, and dry-lots). It is important that all the components of the dairy are compatible with each other. Local climatic and regulatory conditions will have a major impact on how dairy facilities will be designed and built in the future.

Key Words: Dairy facilities, Cow comfort

Animal Health: Immunophysiology of Host-Environment Interactions: Implications for Disease Pathogenesis and Health Management of Production Livestock

335 The effect of transport by road and sea on physiology, immunity, and behavior of beef cattle. B. Earley*, *Teagasc*, *Grange, Beef Research Centre, Dunsany, Co. Meath, Ireland.*

The overall objective of the studies was to investigate the physiological, hematological and immunological responses of weanling heifers transported to Spain, and of weanling bulls transported to Italy under EU legislation (91/628/EEC) and to evaluate the implications in terms of animal welfare. During these studies, appropriate physiological, hematological and immunological measurements were made on the animals which quantified the effect of transport (by road and sea) on the degree of stress imposed and the performance of the animals over a 38-day study period. Physiological, hematological and immunological parameters (including interferon-γ production, cortisol, protein, globulin, urea, white blood cell numbers and differentials, and haptoglobin) were used to determine the welfare status of animals, before, during and after the respective transport journeys. Age-matched control animals that were blood sampled for the same parameters at times corresponding to the transported animals were retained in Ireland as controls. Heifers transported to Spain, lost, 7.6% of their liveweight during the sea crossing to France. However, by the time of their arrival in Spain they had regained 3.3% of their liveweight and had fully recovered to their pre-transport liveweight values within six days of arriving in Spain. Weanling bulls lost 7.0% of their liveweight during the sea crossing from Ireland to France. The liveweight loss in control animals ranged from 1-2% during the same period. The percentage of time that bulls spent lying during the transport journey was 63.5% for the sea journey and 35.4% for the journey from the French lairage to the Italian feedlot. The performance (average daily gain kg/day) of all transported animals was greater ($P \leq 0.05$) than control animals from day 11 to day 38 of the studies. While transient changes in physiological, hematological and immunological parameters were found in the transported and control animals relative to baseline levels, the levels that were measured were within the normal physiological range for the age and weight of animals that were studied.

Key Words: Animal welfare, Transport, Immune function

336 Making sense about stress and immunity: Th1 and Th2 aspects of the immune system respond differently to stress. J. L. Salak-Johnson*, *University of Illinois*, *Urbana*.

Stress is generally considered to suppress the immune system which leads to an increase in disease occurrence in the face of a pathogen. The immune system serves as a primary defense against bacterial and viral challenges. The immune system is brought back to baseline levels after a challenge to homeostasis that involves the hypothalamic-pituitary-axis (HPA). Often, findings reported from various studies investigating the effects of stress on the immune system are conflicting and difficult to interpret. These discrepancies may be partly explained by the types and durations of the stressors and whether researchers measured Th1 or Th2 aspects of the immune system. Cytokines produced by the innate immune system lead to differentiation of the Th1/Th2 immune pathways. Activation of Th1 involves stimulation of cellular immunity and Th2 is associated with humoral immunity. When animals experience stress, it is possible that there is a shift toward either a Th1 or a Th2 response. For example, a certain stress may stimulate Th1 response while suppressing Th2, resulting in a shift toward a Th1. At any moment, animals have some certain balance between Th1 and Th2 immune arms, and stress can disrupt that balance by lowering Th2 and increasing Th1 cytokines and cell activity. How farm animals perceive the stressfulness of their environment depends not only on traditional environmental stressors (e.g., heat, cold, humidity, pollutants) but also on aspects of the social environment. Social status can interact with environments to cause unusual relationships. For example, dominant animals may have enhanced immune activation while subordinates have suppression of the same trait. This could help explain why individual animals in a group respond differently to stressors and disease challenges. A better understanding of the consequences and complex interactions between social and environmental stressors for both innate and adaptive immune traits must be developed so we can fully understand stress effects on immunity. Once these complex relationships are better understood, more effective interventions can be designed to improve animal health.

Key Words: Stress, Immune, Health

337 Nutritional modulation of innate immunity: Practical approaches. N. Forsberg*[1], S. Puntenney[1], Y. Wang[1], and J. Burton[2], [1]*Oregon State University*, *Corvallis*, [2]*Michigan State University*, *East Lansing*.

The immune system may be divided into the innate and antibody systems. The innate system provides a first line-of-defense and time for antibodies to develop. Included in the innate system are neutrophils. Neutrophils roll along the vascular wall via an adhesion molecule (L-selectin). In response to local production of IL8, neutrophils migrate toward pathogen and kill it. A third molecule links the innate with the antibody system. Specifically, activation of the innate system via pathogen up-regulates the antibody system via secretion of interleukin-1-beta (IL1B). The rate-limiting enzyme to IL1B synthesis is IL1-converting enzyme (ICE). We have used a variety of models to study effects of nutritional supplements on markers of innate immunity (L-selectin, IL1B, IL8R and ICE). Models included: 1) dexamethasone (DEX)-induced immunosuppression of sheep, 2) parturition-associated stress in dairy cattle and 3) shipping stress in sheep and beef cattle. Injection of DEX into sheep reduced L-selectin and IL1B ($P < 0.05$). Administration of the supplement restored normal levels of both markers ($P < 0.05$). Ability of the supplement to elicit this effect was enhanced ($P < 0.05$) by fungal pathogen. In dairy, parturition is a normal stress which brings about immunosuppression. We determined, using microarray analysis (BoTL-5 arrays) and quantitative RT-PCR, that supplementation of dry cows for 28 days prior to parturition causes up-regulation ($P < 0.05$) of over twenty neutrophil genes including ICE.