ADSA Production Division Symposium: Production efficiency of the dairy cow

349 Genetics of productive life. Chad Dechow*, *Penn State University, University Park, PA.*

Historic selection for yield has improved the efficiency of dairy production for individual cows and current interest in direct selection for feed utilization aims to further increase productive efficiencies. However, herd efficiency will improve only marginally if selection practices reduce cow fitness levels and increase herd replacement rates. US genetic evaluations for productive life were introduced in 1994 and remain a robust general indicator of cow fitness levels. Productive life credits are limited to a cow's lactation cycle with early lactation weighted more heavily than late lactation. There is considerable variation in herd-life with a genetic standard deviation of 5 mo despite a relatively low heritability (8%). Factors that influence herd life vary across herds and have shifted over time as herd management has evolved. The relationship of productive life with body size has become increasingly antagonistic over time, whereas the relationship with yield has gone from a moderately favorable to a low association. Given the current US Holstein population structure, productive life is strongly correlated with higher cow fertility and lower somatic cell score. Deriving the economic value of longer productive life is complicated by shifts in milk price, heifer rearing and replacement costs, and cull cow value. This has led to varying degrees of emphasis on productive life in different countries and across time. The evaluation of productive life is also complicated by the necessity of a cow's life-cycle to be completed before her true productive life is known. Despite such challenges, higher sire productive life has been demonstrated to be associated with lower rates of daughter mortality and early lactation culling across a range of management systems. As dairy cattle breeders continue to emphasize productive and economic efficiencies, the need to consider traits related to cow fitness levels are of increasing importance to ensure that selection for cow-level efficiencies do not diminish productive efficiency at the herd level.

Key Words: productive life, genetic, efficiency

350 Economics of production efficiency: Nutritional grouping. Victor E. Cabrera*, *University of Wisconsin-Madison, Madison, WI.*

Nutritional grouping of lactating cows under TMR feeding systems has been discussed in the literature since the 70s. Most of the studies have concluded that using multiple, more-homogeneous TMR feeding groups is economically beneficial because of either or both nutrient cost savings or improved productivity. Nonetheless, there is not yet an absolute consensus or wide adoption. Latest studies using optimal basis for grouping and optimal diet specifications are reporting consistently greater income over feed cost ($/cow per yr) with multiple TMR groups compared with 1 TMR (3 TMR = 46 to 77 and 2 TMR = 21 to 45). Critical factors that determine the economic value of nutritional grouping are (1) basis for grouping, (2) diets' specifications, (3) effects on milk production, and (4) additional costs. It has been strongly documented that grouping cows according to their simultaneous nutritional requirements (a.k.a., cluster grouping) is optimal. Cluster grouping is superior to other methods such as grouping by DIM, milk production, or production and BW combined. However, the dairy industry still uses less than optimal grouping bases. Using cluster grouping would enhance the positive economic impacts of multiple TMR. Next, groups diets' specifications seem not to be optimal either. The concept of lead factors, which are only based on group average milk production are heavily used. Nonetheless, diets should be more precise following overall group nutrient requirements. Providing more precise diets will also be in favor of grouping economics. Next, an area that requires further attention is the potential negative effects of grouping on milk production because of either or both social interactions or diet concentration changes. Although the literature is inconclusive on this, latest studies indicate that multiple TMR largely outperform economically 1 TMR even after considering plausible potential milk losses of grouping. Finally, additional costs of management, labor, facilities, and equipment required for grouping are farm specific. The few studies that integrated these factors in their analyses found that multiple TMR would still be economically superior to 1 TMR.

Key Words: nutritional feeding, feed efficiency, cluster

351 Potential benefits of nutrition on reproductive performance of high-efficiency dairy cows. Milo Wiltbank*[1], Paulo Carvalho[1], Alex Souza[1], Paul Fricke[1], Mateus Toledo[1], Roberto Sartori[2], Jose Santos[3], Guilherme Pontes[2], Daniel Luchini[4], Francisco Penagaricano[3], Hasan Khatib[1], Katherine Hackbart[1], and Randy Shaver[1], *[1]University of Wisconsin-Madison, Madison, WI, [2]University of Sao Paulo, Piracicaba, SP, Brazil, [3]University of Florida, Gainesville, FL, [4]Adisseo, Alpharetta, GA.*

During the last century, increasing milk production has been associated with decreasing reproductive performance. However during the last decade, there has been a dramatic improvement in reproduction even as milk production continues to increase. The reasons for improving reproduction are multifactorial with dramatic improvements in reproductive management programs, advances in cow comfort and health management programs, and a turn-around in the genetics of reproduction underlying some of these gains. In addition, older research and many recent studies indicate that gains in reproductive performance require optimized nutritional programs including 4 specific areas that will be emphasized in this presentation. First, nutritional deficiencies in the prepartum diet can affect reproduction. As an example, recent research indicates that supplementation during the last month before calving with vitamin E in marginally-vitamin E deficient dairy cattle decreased retained placenta and stillbirths and increased subsequent reproductive performance. Second, nutritional deficiencies near calving and during the first 21 d after calving can have substantial effect on subsequent reproduction. In a recent retrospective study and consistent with previous results, we observed changes in BCS during the first 21 d after calving were associated with dramatic differences in fertility in high-producing lactating dairy cows. Third, increased insulin during the week before AI, potentially due to diets with high non-fiber carbohydrates, can have negative effects on fertilization and reproductive performance of ruminants. Thus, reducing insulin by targeted but subtle changes in feed intake or energy composition of the diet could be used to improve reproduction. Fourth, optimization of amino acid composition of diets may improve reproductive efficiency. Our recent research demonstrates that supplementing rumen-protected methionine altered gene expression in early preimplantation embryos and reduced subsequent pregnancy loss in lactating dairy cows. Thus, inadequate nutritional programs can reduce reproductive performance and optimized nutrition may augment reproduction even in herds with enhanced genetics and reproductive management strategies.

Key Words: fertility, nutrition