546 Development of standard methods to estimate manure production and nutrient characteristics from dairy cattle. D. Meyer*[1], J. Harrison[2], R. Kincaid[2], R. Koelsch[3], D. Mertens[4], W. Powers[5], W. Weiss[6], and P. Wright[7], [1]*University of California, Davis,* [2]*Washington State University,* [3]*University of Nebraska,* [4]*Agriculatural Research Service, Madison, WI,* [5]*Iowa State University.*

Standard tables published by the American Society of Agricultural Engineers identify production and nutrient characteristics of manure from livestock and poultry. The column used to represent dairy animals has been modified once since 1969. The modification merged two columns: heifers and mature animals. This combined column is being used beyond its original intent with the onset of comprehensive nutrient management plans. The table values were not intended to be used to estimate nutrients available for land application. Emphasis of current regulatory trends makes it imperative to have a more precise method to estimate nutrient excretion. The objectives of the current evaluation were to expand columns in the existing table to account for variation in growth and production levels and provide reasonable estimates of manure volume and nutrient excretion. Additionally, equations were developed to provide more precise estimates of nutrient excretion on a site-specific basis. Data from published and non-published experiments were reviewed to estimate manure and nutrient excretion based on dietary parameters. Columns representing a reasonable range in milk production quantities were developed at specific dry matter intake and nutrient composition. Rows accounted for daily excretion of feces, urine, TKN, P, K, Ca, Na, Cl, S, and some micro-elements. Equations were developed for the same parameters for use by dairies where land available for nutrient application is limited or environmental considerations require more precise estimates of nutrients excreted.

Key Words: Dairy, Manure Production, Nutrient Excretion

547 Evaluation of manure production and nutrient characteristics from dairy goats. D. Meyer*[1], E. Tooman, M. Hyman, and M. Lie, [1]*University of California, Davis CA.*

Standard tables published by the American Society of Agricultural Engineers identify production and nutrient characteristics of manure from livestock and poultry. The column used to represent goats does not differentiate between dairy and meat animals. The column assumes a linear relationship between body size and manure production or nutrient excretion. Table values are 4.1, 0.045, 0.011, and 0.031 percent of body weight for daily manure production, N, P and K excretion. Four lactating and three non-lactating, non-bred yearling does underwent total collections for seven days. A standardized pelleted goat ration was fed. Animals were fitted with indwelling urinary catheters. Feed, water, orts, milk, feces, and urine were measured daily and analyzed for DM, N, P, K, Ca, Na, Mg, Cl and urea. Dietary N concentration was 2.87%. Regression analyses resulted in equations: manure production (kg/d)=1.97 x DMI (kg/d); N excretion (g/d) =19.4 +.35 x N intake (g/d). These data do not support the existing table assumption of a linear relationship between body weight and manure production or N excretion.

Key Words: Dairy Goats, Manure Production, Nutrient Excretion

548 Horse manure production and composition. Jose Bicudo*[1], Laurie Lawrence[1], and Eileen Wheeler[2], [1]*University of Kentucky,* [2]*Pennsylvania State University.*

The amount, composition, and consistency of horse manure influence management and facility design. Physical and chemical properties of manure are mostly affected by the ration and environment. Physiological state (work, lactation, etc) of horses affects manure characteristics through ration composition and feed conversion efficiency under a given environment. Currently, most horse manure composition and production values do not account for differences in physiological state. The purpose of this study was to summarize available information on horse manure from as many sources as possible. Values for amounts and characteristics of fresh manure (feces and urine, as excreted), stable manure (with bedding), and as composted manure, were obtained from existing standards and databases. Public standards included those published by ASAE, MWPS and NRCS. In addition, published nutrition study values for nitrogen (N), phosphorus (P) and potassium (K) excretion were summarized. Values for N were relatively consistent among published sources, but there were larger variations for P and K that appear related to diet composition. When possible, data were classified by physiological state of the horse. There was reasonable agreement on average fresh manure production (23 kg). Most available stable manure values were associated with straw bedding. The second most common horse bedding was wood (shavings, chips or sawdust). There was wide variation in the amount of bedding incorporated into stable manure, which affects composition and amount. Using the limited values provided by commercial composting facilities, it appeared that nutrient characteristics of composted manure were similar to stable manure. Very little information was available on the organic matter, as measured by the biological or chemical oxygen demand, and micronutrient content of fresh, stable and composted horse manure. These data are needed to evaluate potential environmental impacts and degree of stabilization of stockpiled and composted manure.

Key Words: Manure, Environment, Composting

549 Development of standard methods to estimate manure production and nutrient characteristics from livestock operations: Beef cattle. G. Erickson*[1], B. Auverman[2], R. Eigenberg[3], W. Greene[2], T. Klopfenstein[1], and R. Koelsch[1], [1]*University of Nebraska-Lincoln,* [2]*Texas A&M University,* [3]*USDA Meat Animal Research Center.*

Standards set forth by the American Society of Agricultural Engineers for beef cattle manure characteristics are being updated. Only confined beef feedlot cattle will be evaluated for nutrient excretion. Manure is not collected from grazing livestock and accurate estimation of excretion across production systems for grazing livestock is difficult. Feedlot cattle will be separated into two categories: Calf-feds and Yearling cattle. Calf-feds are calves weaned and fed for >180 d in feedlots whereas yearlings would be defined as cattle that are >18 months of age at slaughter and fed for <120 d. These distinct types of cattle excrete quite different amounts of nutrients per d and encompass most finishing cattle. All other cattle types (Ex: short yearlings) can be extrapolated from these data. A feed intake and retention based model will be utilized for estimating nutrient excretion for given production situations. Model inputs will require DMI, initial and final body weights, and duration. A sensitivity analysis will be conducted to determine which inputs are vital for model use and accuracy. Estimating retained nutrients will be based on retained energy and retained protein equations developed by the NRC (1996). All other nutrients with available data will be calculated from retained protein. Nutrient excretion will be calculated as nutrient input minus nutrient retained. Model outputs will estimate DM, organic matter, N, P, K, Na, and selected trace element excretion similar to current table values. Recent survey data of feedlot nutritionists' formulation practices will allow for determination of appropriate average excretion values for N and P. The model may not accurately predict nutrient excretion for all diet scenarios utilized in the industry but this simplified approach will provide good estimates for the majority of feedlot cattle fed today.

Key Words: Nutrient excretion, Feedlot cattle, Standards

550 Estimation of manure nutrient excretion from swine based upon diet composition and feed intake. S. Carter*, P. Westerman, T. van Kempen, G. Cromwell, G. Hill, G. Shurson, B. Richert, and K. Casey, *FASS-ASAE Manure Standards Review Committee.*

Accurate estimation of manure and nutrient excretion is an essential component of environmental planning for new and existing swine production systems. Estimates of excretion generally are based on values published by the American Society of Agricultural Engineers (ASAE), Natural Resources Conservation Service (NRCS), and Midwest Plan Service (MWSP). However, these current estimates are average values and do not directly allow for modifying excretion based on changes in diet and feed intake. The increasing variety of feed ingredient options, changes in nutritional programs to match improving genetic potential,

and feeding strategies designed to reduce nutrient excretion impact the amount and composition of nutrient excretion. Standard methods for estimating nutrient excretion must adapt to these changes and provide methodologies reflective of the specific nutritional programs used in swine production. The ASAE, Federation of Animal Science Societies (FASS), and NRCS have initiated a joint effort to review existing standards and develop new, feed program-based models for estimating manure and nutrient excretion. The basic approach is a mass balance that calculates nutrient excretion as the difference in nutrient intake (diet and feed intake) and nutrient retention (production level, lean growth potential, etc). Published and recent unpublished studies that measured excretion will be reviewed for verifying this approach. Estimates will be provided for various classes of swine (e.g., gestating and lactating sows, finishing pigs) and for stage of growth or weight within class when appropriate. Nutrients anticipated for inclusion are N, P, K, Cu and Zn. If possible, volume and weight of manure excretion will be estimated based on dry matter intake and digestibility, with assumptions for water intake and feed wastage included. The outcome of the proposed work is to accurately estimate manure and nutrient excretion based upon diet composition and feed intake for various classes of swine.

Key Words: Swine, Nutrient excretion, Modeling

551 Opportunities for the animal scientist in the CNMP process and the EPA CAFO rule. A. L. Sutton*[1], [1]*Purdue University*.

The US. Environmental Protection Agency (EPA) is scheduled to adopt a new rule in December 2002 affecting confined animal feeding operations (CAFO) and potentially affecting animal feeding operations (AFO). The final decision has not been made designating the specific criteria for CAFO and AFO, however, in a unified strategy published jointly with USDA in 1999 and in the proposed EPA rule, EPA strongly recommended livestock and poultry operations to implement a comprehensive nutrient management plan (CNMP) to comply with the new regulations. If 1000 animal units remain as the level above which EPA designates CAFO, then over 11,000 livestock and poultry operations will need to create CNMP for their operations. If AFO are required to obtain CNMP (currently considered as voluntary) at the level of 300 AU or more, then over 45,000 operations will need the CNMP. One component of the CNMP is feed management that can affect the nutrient flow and balance of nutrients on the livestock and poultry operation. In many cases, feed ingredients are a major source of nutrients imported onto the operation. Research has shown that new diet manipulation technology and feed management practices can potentially reduce nutrient excretions from 10 to 60%. However, much of this technology has not been implemented in livestock and poultry operations. With the advent of new regulations being enacted, implementation of new technologies that are economically sound and environmentally sustainable is encouraged. Animal nutritionists and management specialists potentially have a key role in implementing scientifically sound and timely information to the animal industries. This can be accomplished by partnering with CNMP planners, becoming certified to conduct the CNMP process and/or assisting producers with diet formulations and feeding management practices. Technical service providers, nutrition consultants, extension specialists are in a position to assist in the CNMP process to maximize the potential to control the nutrient flow and balance within the livestock and poultry operations. The list of agencies and their role in the development and implementation of the CNMP will be discussed.

Key Words: Regulations, Feed Management, Diet Manipulation

552 National standards for estimating manure nutrient excretion based upon animal feed program. W. Powers*[1] and R. Koelsch[2], [1]*Iowa State University,* [2]*University of Nebraska*.

Environmental planning in animal production systems often requires an estimate of nutrient excretion. Standard values published by the Natural Resources Conservation Service (NRCS), American Society of Agricultural Engineers (ASAE) and Midwest Plan Service (MWSP) commonly have been used for this purpose. However, these current procedures do not reflect the impact of animal dietary decisions by producers on nutrient excretion. The increasing variety of feed ingredient options, changes in nutritional programs to match improving genetic potential, and feeding strategies designed to reduce nutrient excretion impact amount and composition of nutrient excretion. Standard methods for estimating nutrient excretion must adapt to these changes and provide methodologies reflective of the specific nutritional programs used in animal production. The ASAE, Federation of Animal Science Societies (FASS), and NRCS have initiated a joint effort to review existing standards and develop new, feed program-based models for estimating manure and nutrient excretion. Seven work groups have been established to recommend standards for the following three topics: 1. As Excreted - Feed Intake Summary: Characteristics of excreted manure will be defined based upon a mass balance approach using estimates of feed intake and animal retention and calculation of excretion by difference or other appropriate relationships. Work groups for five species (dairy, beef, poultry, swine, and equine) are established. 2. As Excreted - Average Summary: A review and modification of the existing ASAE D384.1 tables would define average characteristics of excreted manure for typical feed programs. 3. As Removed - Average Summary: An update or modification of MWPS-18 (Section 1) on Manure Characteristics would summarize typical manure characteristics as removed from typical animal housing and manure storage systems.

Key Words: Nutrient Excretion, Manure, Environment

553 Estimating nutrients and characteristics of manure for land application following storage. W.J. Powers*[1], J.C. Lorimor[1], and A. Sutton[2], [1]*Iowa State University,* [2]*Purdue University*.

Estimates of manure nutrients and characteristics are necessary for nutrient utilization planning purposes. Estimates of excreted nutrients can be obtained following a nutritional approach whereby mass balances of nutrients are established. Losses during storage that are specific to manure handling practices can be estimated and nutrients remaining, calculated. While calculations using site-specific data are most desirable for planning nutrient use of an individual site, table values are helpful in serving as a reference tool to provide values for non-specific scenarios. As part of a joint effort between the American Society of Agricultural Engineers (ASAE), the Natural Resources Conservation Service (NRCS), and the Federation of Animal Science Societies (FASS) currently available tables are under revision. The revised tables will reflect modern manure management, animal management, and feed management practices. Data will be solicited and included for animal production stages that reflect current operational practices. Specific tasks addressed by committee are to 1) define the species and management systems to be included in table, 2) define the appropriate physical, chemical, and biological characteristics to be included in table, 3) identify for each species/management system where credible data is available, 4) recommend average characteristics for manure as removed from animal housing or manure storage system, and 5) determine the value and/or need for reporting a range or standard deviation for characteristics. Characteristics to be included in the table include nitrogen, phosphorus, moisture content, and mass. Additional nutrients will be included where data are available. Production groups for each species will consider feed and water system contributions to nutrients stored in addition to manure characteristics influenced by manure handling practices. While estimates, only, will be provided in the new tables, the tables will serve as a starting point for predicting nutrients available following storage.

Key Words: manure, storage, nutrients

554 A phosphorus management survey on Northeast and Mid-Atlantic dairy farms in the US. J. D. Toth*[1], Z. Dou[1], J. D. Ferguson[1], R. J. Munson[1], L. E. Chase[2], K. F. Knowlton[3], R. A. Kohn[4], J. T. Sims[5], and Z. Wu[6], [1]*University of Pennsylvania,* [2]*Cornell University,* [3]*Virginia Polytechnic Institute,* [4]*University of Maryland,* [5]*University of Delaware,* [6]*Penn State University*.

On many farms rations formulated for lactating dairy cows exceed National Research Council recommendations for phosphorus (P). Ration P in excess of that required for body maintenance, milk production and reproduction will be excreted in manure, mostly in chemical forms potentially subject to loss in the environment. As the initial phase of a four-year, six-institution collaborative research project designed to develop optimal P management technologies in the Mid-Atlantic and Northeast region, we surveyed dairy farmers in New York (NY), Pennsylvania (PA), Delaware (DE), Maryland (MD) and Virginia (VA) on production and herd management parameters and producer opinions on issues related to dietary P levels. Questionnaires were mailed in January

2002 to a randomly selected subsample of 2500 out of the approximately 18000 dairy farms in the region. Rate of response exceeded 25%. Responses from the small number of dairy operations in DE were grouped with PA. Holstein (91% of responses) was the predominant dairy breed across all states. Lactating herd size averaged 97 for MD, NY and VA and 64 for PA. Mean daily milk production was 28 kg and similar for all states. Routine forage testing was reported by 80% of MD respondents and 82% from VA compared to 73% in NY and 72% in PA. In NY and PA, 18% of respondents reported they were aware of their ration P content compared to 28% in MD and 30% in VA. The majority of respondents replied they were aware of nutrient management regulations and issues, 98% in MD, 92% in VA, 87% in PA and 79% in NY. When asked if they had reduced diet P for their lactating herd, 28% of MD respondents replied affirmative, 21% of NY, 14% of PA and 29% of VA respondents. Questionnaire responses will aid us in identifying producers for project participation and in designing cooperative extension programs for improved P management in the region.

Key Words: Phosphorus, Dairy Rations, Dairy Producer Survey

555 The effect of improved crop yields on whole-farm mass nutrient balance. G.L. Albrecht*[1], D.G. Fox[1], G.J. Birdsall[1], H.G. Nafziger[1], L.E. Chase[1], and J.H. Cherney[2], [1]*Cornell University Department of Animal Science,* [2]*Cornell University Department of Crop and Soil Sciences*.

Prior research efforts have quantified that approximately two-thirds of nutrients imported onto a dairy remain on the farm, with purchased feeds comprising two-thirds of the imported nutrients. Replacing purchased feeds with farm-raised forages and grains can reduce the contribution of imported nutrients to nutrient balances on farms while maintaining or improving animal performance. Furthermore, reducing the mass balance of nutrients on farms has the potential to curb nutrient losses from agricultural production. A study was conducted to evaluate the changes in mass nutrient balance resulting from improvements in crop management and, subsequently, yield on a 400-cow dairy farm in Central New York State. Baseline crop production was documented during the 1999-growing season and a mass nutrient balance was determined for the following 12-month feeding period (FP1). The average 1999-growing season yields were similar to average yields from the 1996, 1997, and 1998-growing seasons; thus, such yields were assumed to represent the historical performance of the cropping program. Crop management was evaluated and a plan for improvement was developed and implemented during the 2000-growing season. The primary area for improvement centered on forage yield, because forage quality was consistently adequate at the case study farm. A second mass nutrient balance was performed for the subsequent 12-month feeding period (FP2). Through improvements in crop rotations, agronomic nutrient management, corn hybrid and maturity selection, weed control, and human resource management, corn silage, alfalfa hay crop silage, and grass hay crop silage yields were increased by 2.3, 1.8, and 1.4 tonnes of dry matter/ha, respectively, relative to past performance. The increase in farm-raised forage inventories allowed for reductions in purchased hay, corn silage, and protein concentrates and increases in overall forage content in the diets, relative to FP1. The rolling herd average remained at similar levels (11,540 kg for FP1 and 11,549 kg for FP2). The changes resulted in a 1.8, 1.7, and 6.8 tonne/yr decrease in whole-farm mass nutrient balance of nitrogen, phosphorus, and potassium, respectively.

Key Words: nutrient management, forage management, mass nutrient balance

556 Flows of N through a dairy herd. J. D. Ferguson*[1], Z. Dou[1], B. Vecchiarelli[1], S. Lees[1], J. Beach[1], and C. F. Ramberg, Jr.[1], [1]*University of Pennsylvania, School of Veterinary Medicine*.

The Marshak Dairy, a 200 free stall, green house facility was used to monitor N flow from feeding to waste collection. Animal housing and management was as follows: cows were housed in groups of 10 to 40 cows; stall surfaces were mattresses bedded with sawdust or wood shavings, alley ways were grooved concrete, feeds were offered as a TMR once a day to 10% refusal, and milking occured twice a day. Rations were formulated for three or four groups based on production and stage of lactation using the CPM Dairy ration program. Alley ways, parlor, and holding area were cleaned twice a day by flushing with recirculated waste water. Solids were separated by conveyor with liquids and fine particles collected by gravity to a holding pond. Liquid from the first pond was collected into a second pond for recirculation for flushing. One week per month was chosen for data collection. During the sampling week, 3 of 5 days were selected to collect samples of TMR, orts, feces, urine, blood, flush liquid, and solids from the separator pile. Daily samples of feed, feces, orts, and separator pile were composited and analyzed for DM, N, lignin, and mineral composition. Urine and blood were analyzed for ammonia, urea, and creatinine concentration. In addition urine was analyzed for P and K content. Feces and flush liquid were analyzed for ammonia, urea, P and K content. Daily records during the sampling week were collected for milk volume. Milk samples from Tuesday evening and Wednesday morning milkings were composited for for analysis of fat, true protein, milk urea, and somatic cell content by PA-DHIA milk laboratory. A total of 11 months were sampled from Nov., 2000 through Oct., 2001. Across all months, 146.4 animals were housed in the facility. Mean daily feed offered contained 80,125 g of N. Milk true N was 20,907 g (26.1% of intake); fecal N was 36,827 g (46.0% of intake); and urinary N was 22,801 g (28.5% of intake). Excreted urine was calculated to contain 21,835 g of urea N, of which only 1269 g of urea N was collected in the flush liquid at the separator. Ammonia N content of the flush liquid increased by 461 g after cleaning the facility. It was estimated that 25.1% of intake N was lost through ammonia volatilization from the dairy. Further volatile losses occur during storage of waste liquid.

Key Words: N flow, Dairy cattle, Atmospheric losses

557 Excretion of urine, feces, and nitrogen by lactating Holstein cows. L. M. Johnson*[1], J. H. Harrison[1], D. Davidson[1], and R. Kincaid[2], [1]*Washington State University, Puyallup, WA,* [2]*Washington State University, Pullman, WA*.

Data from 12 total collection metabolism studies conducted at Washington State University were combined and analyzed for excretion of urine, feces, and nitrogen. The objective was to evaluate differences in the amount of feces and urine excreted at varying levels of milk production. Urine and fecal output (wet basis), nitrogen intake, and nitrogen excreted in the urine, feces, and milk were measured for cows producing milk at the following levels; 1)$\leq$ 20, 2) between 20 and 30, 3) between 30 and 40, and 4)$\geq$ 40 kg per day. These data indicates that fecal output for a Holstein cow producing between 20 and 30 kg of milk per day will be similar to ASAE standards. Cows producing milk in excess of 30 kg per day excrete approximately 10 to 25 kg per day of wet feces in excess of ASAE standards. Predicted nitrogen excreted in the feces, urine, and milk was lower for the ASAE standards compared to data summarized in this study. These results suggest that the ASAE tables need to be revised to account for fecal and nitrogen output in high producing dairy cattle.

Item	ASAE standard for dairy cows		$\geq$ 20 - $\leq$ 20 kg		$\geq$ 30 - $\leq$ 30 kg		$\leq$ 40 kg		$\geq$ 40 kg	
	$\overline{x}$	SD	$\overline{x}$	SD	$\overline{x}$	SD	$\overline{x}$	SD	$\overline{x}$	SD
					(kg/d)					
Milk			14.7	5.5	25.0	3.1	34.4	3.0	50.6	12.9
				(kg/d	per	1000	kg of	BW)		
Feces	60		44.1	19.0	61.0	14.3	70.6	15.9	86.2	23.1
Urine			36.3	13.2	41.8	14.0	39.6	12.9	44.1	12.7
Intake N			0.820	0.23	0.994	0.20	0.960	0.14	1.009	0.20
Excrete N	0.45	0.096	0.811	0.15	0.988	0.18	1.049	0.15	1.265	0.30
Fecal N			0.271	0.09	0.345	0.08	0.366	0.08	0.464	0.14
Urine N			0.360	0.10	0.405	0.11	0.370	0.10	0.354	0.09
Milk N			0.160	0.04	0.238	0.05	0.313	0.06	0.446	0.14

Key Words: feces, nitrogen

558 Manure management, odor and diseases control. A. Itkin*, *A.I. Engineering Services, Ontario, Canada*.

Livestock producers are receiving much criticism for creating pollution and disease problems. Concurrently, farmers are experiencing production problems (costly manure removal, energy consumption, medicine cost and most importantly, barns are not safe working places). One of the long-standing and costly problems of handling manure has been the

absence of a simple, reliable, accurate and long-lasting system of manure handling were used in the industry, which assumed that manure would be held for some time in the barn. The Enterprise tendency to lager livestock production, with a concern for the quality of food in an efficient environment, requires a number of radical changes and development of new methods for proper and efficient manure management. I have devoted years to research, development, design and construction of livestock production (manure handling) in Russia and would like to share my approach to manure management. The barn environment has a major impact on animals and the objective is to provide an environment in the barn, which will allow achievement of optimal utilization of feed and highest production. In order to provide the livestock industry with adequate manure handling systems, which will be both technically and economically competitive. It is necessary to apply plumbing technology principles by excluding manure storage from being in close proximity to animals in the barn. This technology requires a manure reception structure with a flushing system in the pen and piping system for transportation of liquid manure. The plumbing technology approach offers proper sanitation and facilitates the barn being kept clean. My proven technology solves many existing problems:
1. Improved barn design eliminates odor in and around the barn. This will eliminate the odor nuisance with much less ventilation. I also allows for the ability to design a multi-level barn for wean-to-finish production. 2. Significantly improved environment increases productivity (pigs have higher rates of growth). Since the new system excludes retention of manure in the pen, it results in pigs being dry and clean. 3. Prevents spreading of diseases. Pigs will not have contact between pans through manure. This will allow for reduction in medicine consumption. 4. Rational use of water reduces the volume of liquid manure by 4-5 times and brings the moisture to 92-95selection of proper treatment and utilization technologies. 5. The technology reduces capital and maintenance cost and does not require special expertise to operate. The system requires a lesser degree of farmer's attention and can be incorporated into a computerized plant system. A completely new engineering design approach is a superior alternative in the design for livestock production. New and existing livestock producers will highly benefit from implementation of this technology.

Ruminant Nutrition
Fat

559 Use of the CPM-Dairy fat sub-model to predict absorption of total and individual LCFA from different fat supplements. P.J. Moate*, R.C. Boston, and W. Chalupa, *University of Pennsylvania, Kennett Square, PA.*

There is growing interest in the non-caloric effects of feeding fat to dairy cows. Improved fertility is associated with increased absorption of linoleic acid (C18:2) and low milk fat syndrome is associated with increased absorption of vaccenic acid (C18:1trans). Until now, no ration formulation programs have predicted the absorption of the major LCFA in dairy cows. CPM-Dairy has a new fat sub-model that describes intake, ruminal lipolysis, ruminal biohydrogenation, de novo synthesis of LCFA in the rumen and intestinal absorption of C12:0, C14:0, C16:0, C16:1, C18:0, C18:1trans, C18:2 and C18:3 acids. In this simulated comparison, a 650 kg cow was fed 25 kg of a basal diet (26% alfalfa silage, 26% corn silage, 22% steam-flaked corn, 14% soybean, 2% blood meal and 10% mineral mix/LCFA supplement). The basal diet provided 500 g of LCFA. In addition, supplemental LCFA (400 g) were provided in the mineral mix in the form of Megalac (M), Megalac R (MR), Energy Booster (EB), Tallow (T), Roasted Soybeans (RSB) or Whole Cotton Seed (WCS). Intestinal digestibilities of M and MR were predicted to be higher than the basal diet because rumen non-lipolysed fatty acids in the form of calcium salts have higher intestinal digestibilities than rumen non-lipolysed fatty acids in the form of glycerides. To increase amounts of C18:2 absorbed, C18:2 must either be in a form that protects it from ruminal lipolysis (MR) or the feed ingredient must contain high amounts of C18:2 (RSB). However, with RSB, there is also an increase in absorbed C18:1trans which might lower milk fat test.

Parameter	Basal	M	MR	EB	T	RSB	WCS
LCFA †							
Intake (g/d)	500	400	400	400	400	400	400
Rumen Escape (g/d)	15	54	54	0	2	16	1
Duodenum (g/d)	659	400	400	400	400	404	404
Absorbed (g/d)	479	327	337	291	293	298	300
Intest. Digestion (%)	73	82	84	73	73	74	74
C18:1 trans †							
Intake (g/d)	0.1	0.0	0.0	1.6	5.2	0.0	0.0
Duodenum (g/d)	37.0	2.3	11.0	1.9	5.6	39.7	30.3
Absorbed (g/d)	29.0	1.8	9.1	1.5	4.4	31.2	23.8
C18:2 †							
Intake (g/d)	225	28	127	7.2	18.8	230	157
Duodenum (g/d)	58	17	77	0.7	2.2	54	12
Absorbed (g/d)	48	17	76	0.6	1.8	43	10

† from basal diet or supplement

Key Words: Cattle, Fatty Acids, Digestion Model

560 Effects of feeding raw and micronized flaxseed on yield and composition of milk form Holstein cows. Arif Mustafa*[1], Yvan Chouinard[2], and David Christensen[3], [1]*McGill University,* [2]*Universit Laval,* [3]*University of Saskatchewan.*

Nine multiparous Holstein cows were used in three 3 x 3 Latin squares to investigate the effects of feeding raw and micronized flaxseed on milk yield and milk fatty acid composition. Three diets were formulated to meet nutrient requirement of dairy cows in early lactation: A control diet with no added flaxseed (C); a raw flaxseed diet (RFS); and a micronized flaxseed diet (MFS). The level of flaxseed in RFS and MFS was 7% of the diet DM. Feeding flaxseed to dairy cows had no effect on DMI or milk yield. However, energy- corrected milk was higher for cows fed MFS than for those fed RFS or C. Supplemental flaxseed reduced milk fat percentage without affecting the concentration of milk protein or milk lactose. However, yield of milk components was not affected by feeding flaxseed. Concentrations of short-and medium-chain fatty acids were decreased while the concentrations of long-chain fatty acids were increased in milk of cows fed RFS and MFS compared with cows fed C. Feeding flaxseed to dairy cows can alter milk fatty acid composition, but only minor effects on milk fatty acid composition can be expected by feeding micronized versus raw flaxseed.

Key Words: Flaxseed, Micronization, Milk fatty acids

561 Influence of barley grain variety on fatty acid synthesis and the expression of fat metabolism genes in bovine adipose tissue. E. Okine*, E. Norberg, D.R. Glimm, G.R. Khorasani, and J.J. Kennelly, *Department of AFNS, University of Alberta, Edmonton, Alberta, Canada.*

Our hypothesis was that ruminal rate of DM and starch degradation of grain varieties influence expression and protein abundance for genes encoding fatty acid synthase (FAS) and acetyl-CoA carboxylase (ACC) in subcutaneous bovine adipose tissue. Hulled (Falcon), hulless (Oxbow) barley varieties and corn were used in this experiment. Fifteen lactating Holstein cows were blocked into 5 groups according to parity, calving date, and milk yield. Cows in each group were randomly assigned to 3 dietary treatments following a 2-wk covariate period and were fed the test diets for 8 wks. Diets contained 55% concentrate and 45% forage (DM basis) and were fed once daily as a TMR. Milk yield and milk composition were not affected ($P > 0.05$) by grain type, but DMI (19.3 vs. 22.9 kg/d, $P < 0.05$) and DMI as percentage of BW (3.0 vs. 3.5%, $P < 0.05$) were lower for animals fed barley compared to corn-based diets. Levels of C18:0, C18:1 in adipose tissue were similar ($P>0.05$) for hulled barley and corn but different ($P<0.05$) for hulless barley fed cattle. There were no differences ($P>0.05$) in mRNA expression of ACC and FAS in cows fed different diets. FAS protein abundance in adipose tissue was 1.9 and 1.7x lower ($P<0.05$) for cows fed the hulled than for cows fed the hulless variety or corn. ACC protein abundance was 2.1 and 2.6x lower ($P<0.05$) in adipose tissue of animals fed hulless compared to hulled and corn fed cows. However, activities of these enzymes were not