ABSTRACTS OF TECHNICAL PAPERS

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Graduate Student Competition


The report is part of a study to evaluate the use of large dairy breeds in crossbreeding for beef production under range conditions. Dairy-beef crossbred (DBC) cows were obtained by using Brown Swiss, Holstein or Simmental bulls on Hereford and Beef Synthetic cows. Data from 1971 to 1980 were used. Least squares analyses were computed. Comparisons were made among the different dairy breed crosses of the DBC cows. The DBC cows were mated to Hereford bulls, Calves of Holstein crossbred (HOX) cows had a heavier mean birth weight than those of Simmental crossbred (SIX) cows but similar to those of Brown Swiss crossbred (BSX) cows (P < 0.05). Mean weaning weight and mean weight of calf weaned per cows exposed to breeding followed the same pattern as for birth weight (P < 0.01). The DBC cows were also compared with Hereford (HE), Beef Synthetic (SY), Dairy Synthetic (DY) and Beef Crossbred (BC) cows. Calves of SY and DBC cows had similar mean birth weights while calves of DY cows had the heaviest and calves of HE cows the smallest (P < 0.01). Calves of DBC and DY cows had similar mean weaning weights. Calves of SY and BC cows also had similar, but smaller mean weaning weights than those of DBC and DY cows. Calves of HE cows were the smallest. Mean weight of calf weaned per cow exposed to breeding followed the same pattern except that calves of SY cows had a larger value than calves of BC cows (P < 0.01). As a percent of original number of cows exposed to breeding, DBC had 11% more cows alive after 6 yr of age than HE cows but was not significantly different from the other breeding groups (P < 0.05).

Effects of B-carotene status on reproductive efficiency of dairy herds. B. Farmer*, E. Block, and B. Laarveld, Macdonald College of McGill University, Ste. Anne de Bellevue, Quebec H9X 1C0.

Pour estrus detection in dairy cattle appears to be a major cause of poor reproductive efficiency in Quebec. Recent evidence suggests that B-carotene (B-car) is not only important as a precursor of vitamin A but is also involved in reproduction. One-hundred Holstein herds were randomly selected from DHAS. Feed and bulk-milk samples were obtained from each herd and jugular-blood samples were obtained from five cows within each herd. All samples were analyzed for B-car and vitamin A. The average and range of B-car in hay, haylage and corn silage (µg/kg) was: 31.8, 5.0 – 98.2; 46.9, 9.3 – 102.9; 1.6 and 1.1 – 4.3, respectively. Concentrates contained little B-car. The average and range of B-car in plasma was 288 and 62 – 1121 µg/100 mL. The average and range of vitamin A in plasma was 115 and 38 – 210 IU/100 mL. Although plasma B-car and vitamin A varied (P < 0.01) between herds there was a significant correlation (r = -0.24) between plasma B-car and plasma vitamin A. The average content of bulk milk B-car and vitamin A was 9.4 µg/100 mL and 254 IU/100 µL. There were significant correlations between B-car content of plasma and milk (r = 0.74), between vitamin A content of plasma and milk (r = 0.32), and between plasma vitamin A and milk B-car (r = -0.28). No correlations were found for blood parameters and calving interval or days open. This lack of correlation appears to be due to management-related factors, i.e., time to first breeding. Correction factors for management have not been made yet.
First and last test day lactation correction factors for fat. A. Lapostolle*, J. F. Hayes, and J. F. Moxley, Macdonald College of McGill University, Ste. Anne de Bellevue, Quebec H0A 1C0.

Macdonald College herd test-day data were analyzed to estimate the bias and sampling error in the test interval method of calculating lactation fat yields and to develop correction factors for first and last test-day fat yields. The data had been collected on a weekly basis for November 1969 to November 1979, and involved 1150 lactations in all. Records with missing birth dates or lactations of less than 183 days were eliminated. Also, any lactations with more than 2 consecutive wks of missing fat weight (except in December of each year) were eliminated. Lactations still in progress at 365 days were terminated at that date. After the above restrictions were imposed, the data consisted of 722 lactations. For each lactation, a sampling scheme corresponding to the DHAS official test option was simulated, i.e., 12 tests per year at irregular test intervals. The date of first test was chosen by a uniform distribution random number generator; a lower limit of day 5 in lactation and an upper limit of day 25 was imposed for the first test. The date of second and later tests was chosen by a normal distribution random number generator; the mean interval between test days was 30.5 days, the standard deviation was 5 days, and upper and lower limits of 15 and 40 days, respectively, were imposed. Biases, sampling errors and correction factors were computed and will be presented at the conference.

Selenium-arsenic interrelationship in the nutrition of the weanling pig. L. L. Morrison* and E. R. Chavez, Macdonald College of McGill University, Ste. Anne de Bellevue, Quebec H0X 1C0.

This experiment was conducted to study the effect of dietary arsenic (As) at subtoxic levels (100 ppm) on functional selenium (Se) status as determined by glutathione peroxidase (GSH-Px) activity in piglets. Twenty weanling piglets (3 wk of age) were fed Se (0.1 ppm) and As (0.100 ppm) in a 2 x 2 factorial design for 6 wk. A significant As/Se interaction effect was observed on weight gain and feed consumption but not feed efficiency. Control animals (-As + Se) had significantly higher weight gain and feed consumption compared to pigs receiving As supplementation. Hematocrit, hemoglobin and whole blood iron concentrations were not significantly affected by dietary As or Se. Spleen, liver, muscle, kidney and fecal samples from As-supplemented pigs had significantly higher As concentrations. Plasma protein concentration was significantly decreased in As-supplemented groups. Plasma GSH-Px activity was significantly affected by Se and a dietary As/Se interaction. Arsenic supplementation enhanced the enzyme activity in pigs receiving supplemental Se, while enzyme levels were lowered in pigs receiving no Se supplement. Arsenic appears to enhance an adequacy or deficiency of Se when measuring GSH-Px activity in weanling pigs.

Nutritional status in early lactation and reproductive performance. L. Rastogi*, R. K. Moore, J. F. Hayes and J. E. Moxley, Macdonald College of McGill University, Ste. Anne de Bellevue, Quebec H9X 1C0.

The nutritional status during early lactation has been reported to affect reproductive performance. Since October 1979 the DHAS program computes net energy (lactation), crude protein, calcium and phosphorus requirements based on 1978 NRC estimated requirements. The intakes of these nutrients are computed for each cow where a complete feed analysis and estimated intake of each feed is indicated. The monthly test day data for Holstein cows, in 810 official DHAS herds, with a complete lactation followed by a calving date occurring on or before April 1981, were used in this study. The first 90-day nutrient requirements and inputs were computed for each cow. In a model which included herd, season and age of cow, the effect of input as a percent of requirements of the nutrients on days to first breeding and days to conception were computed. The effect of these nutrient levels on these reproductive measures are reported with and without level of milk production considered in the model.

The irreversible loss of tyrosine in chronically catheterized ovine fetuses in utero at 120–130 days of gestation was determined from plateau specific activity following the continuous infusion of L−(U−14C) or L−(2,3,5,6 3H) tyrosine without prime dose. The irreversible loss calculated from (14C) tyrosine infusion was 4.362 ± 0.76 (SEM) mmol/day/kg (n = 3) and from (3H) tyrosine was 3.778 ± 0.78 mmol/day/kg (n = 4). Since values based on irreversible loss have been reported to result in an overestimation of fetal utilization of substrates, dual labelling experiments in which (3H) tyrosine was infused into the ewe and (14C) tyrosine into the fetus simultaneously were undertaken. Under these conditions, the net utilization is the sum of net transfer across the placenta and fetal endogenous production. These values were calculated from plateau specific activities of both the tracers in the maternal and fetal compartments. The net placental transfer, endogenous production and net utilization of tyrosine for the fetus were 0.640 ± 0.54, 1.885 ± 0.45, and 2.478 ± 0.46 mmol/day/kg, respectively (n = 3). Maternal tyrosine production and net utilization were respectively 0.736 ± 0.22, and 0.712 ± 0.23 mmol/day/kg (n = 3). From the ratio of the plateau specific activity of blood (14CO2) and (14C) tyrosine it is estimated that the fraction of net utilization of tyrosine used for oxidation amounts to 10.4 ± 4.72% (n = 3). In a single experiment designed to study the effect of maternal starvation for 48 h, this fraction increased from 6.53 to 60.0%.


Fifty-seven Yorkshire gilts were housed in 16 basement pens at 110 days of age to study the effect of four types of fluorescent light upon growth, puberty, ovulation rate, fetal number, fetal sex ratio, pineal weight and the retina. Gilts exposed to red light achieved puberty later (P < 0.01) and at heavier weights (P < 0.05) than gilts exposed to cool white light, full spectrum daylight, or ultraviolet light. All gilts were exposed to a photoperiod of 16 h of each respective light source daily, with 8 h of darkness. Heavier pineal glands (P < 0.05) were also observed in the gilts exposed to red light, indicating that a heavier pineal gland may be associated with delayed puberty. In addition, there was a significant trend (P < 0.01) across all treatments for the older animals to exhibit heavier pineal glands at slaughter. There were no significant differences noted in average daily gain or feed efficiency attributable to the four lighting treatments. When the gilts were slaughtered at no less than day 40 of gestation, no significant differences were found in ovulation rate, fetal number and fetal sex ratio between treatments. A histological investigation of the retina from the gilts did not reveal detectable damage due to the ultraviolet light or other light treatments. It is concluded that the gilts were responsive to those regions of the light spectrum below red. Cool white fluorescent light appears to be the most economical fluorescent lighting for maintaining optimum growth and reproductive performance in the breeding herd.

Genetic and environmental effects on conception rates in QDHAS herds. S. Des Marchais*, R. K. Moore, J. F. Hayes, and J. E. Moxley, Macdonald College of McGill University, Ste. Anne de Bellevue, Quebec H9X 1C0.

A retrospective study of reproduction records was carried out to estimate the effect of genetic and environmental effects on dairy cattle reproductive performance. The artificial breeding records, covering breedings, between January 1978 and August 1980, in 172 DHAS Holstein herds, distributed over 7 of the 12 Quebec agricultural regions, were collected from the regional AI breeding clubs. The records included cow identification, breeding date and service sire identification. These data were merged with DHAS data which included pedigree, production records, calving dates and disposal data where applicable. Models were designed to estimate the effects of region, herd, year-season, age of cow and service sire on the reproductive measures; days to first service, days to conception, percent conception on first service and number of breedings per conception. A second set of analyses was used to estimate the
relative importance of genotype and herd management on abnormal intervals between repeat breedings where conception did not occur on first service. A third analysis compared conception rates based on a single service versus multiple services in a single estrus period.

Trace minerals and dairy cattle reproductive performance. E. Lawlor*, B. Laarveld, K. F. Ng Kwai Hang, and J. F. Hayes, Macdonald College of McGill University, Ste. Anne de Bellevue, Quebec H9X 1C0.

A survey of 100 Quebec dairy herds was undertaken to determine trace mineral status. Five cows from each herd were studied to determine: mineral variability (cobalt, copper, manganese, zinc, phosphorus, calcium, magnesium) of dairy cattle feeds; adequacy of dietary mineral intake; effects of mineral nutrition on reproductive performance (calving interval and services per conception); and the usefulness of milk mineral analysis in determining nutritional status. Significant differences between regions were found for feed mineral content, especially for hays and corn silage. Dietary Zn intake appears to be adequate whereas Cu intake may be subclinically deficient. Co and Mn intakes may be inadequate under present feeding practices. Milk iodide analysis indicates that dietary I₂ intake is adequate. Correlations between mineral intake and milk and plasma mineral content are not significant. Correlations between milk and plasma mineral levels and indices of reproductive performance are also not significant. Absolute mineral intake of Co, Cu and Mn are significantly correlated to reproductive performance and probably represent overall nutritional status.

Genetic and environmental effects on cell counts on a lactation basis. H. Monardes*, J. F. Hayes, and J. E. Moxley, Macdonald College of McGill University, Ste. Anne de Bellevue, Quebec H9X 1C0.

Monthly somatic cell count data were obtained for Holstein and Ayrshire cows having completed 42, 472 and 4997 lactations, respectively, in 871 herds participating in the official option of the Quebec Dairy Herd Analysis Service (DHAS — PATLQ). Monthly cell count data were transformed to log scale and when processed (transformed and untransformed) to obtain a single somatic cell count measure per lactation. Preliminary results based on MINQUE estimates of genetic and environmental components of variance yielded estimates of heritability ranging from 0.06 to 0.09 in both breeds, in the case of data transformed to a log scale, and from 0.06 to 0.21 and 0.06 to 0.10 in Ayrshire and Holstein, respectively, in the case of untransformed cell count data. Correlation estimates, in Ayrshires, between cell count lactation totals and 305-day milk yield, fat yield, protein yield, fat percent, and protein percent, respectively, varied from −0.34 to −0.68, −0.06 to −0.62, −0.22 to −0.78, 0.26 to 0.84 and 0.14 to 0.88 for genetic correlations and from −0.15 to −0.20, −0.16 to −0.21, −0.11 to −0.17, −0.02 to −0.05 and 0.08 to 0.13 for phenotypic correlations.

Selenium-iron interrelationship in the nutrition of the weanling pig. L. L. Morrison* and E. R. Chavez, Macdonald College of McGill University, Ste. Anne de Bellevue, Quebec H9X 1C0.

The effects of dietary iron (Fe) and selenium (Se) on glutathione peroxidase (GSH-Px) activity in the plasma of growing pigs was investigated. Twenty weanling pigs (3 wk of age) in a 2 × 2 factorial design with Fe (0, 150 ppm) and Se (0, 0.1 ppm) as the factors were studied for 6 wk. The 10 piglets allotted to the non-Fe-supplemented diets received no iron shots at 3 days of age while the 10 piglets receiving the Fe-supplemented diets were injected intramuscularly with 200 mg Fe as Fe-hydroxide at 3 days of age. Dietary Fe and Se had no significant effects on body weights, feed efficiency or organ weights. Hematocrit, hemoglobin and whole blood Fe concentration were significantly lower in the pigs receiving the diets without Fe supplementation. The Fe concentration was significantly lower in the livers of piglets without Fe supplementation, but the differences were not significant in spleen and bone marrow samples. Iron-supplemented pigs had significantly lower plasma protein concentrations than non Fe-supplemented

For the purpose of building a simulation model of beef cattle growth, a system-oriented model has been developed. By using analytical techniques, the mathematical functions to fit the growth function have been derived. The analytical solution for Brody's model revealed the existence of two stages in the growth pattern of female cattle: pre-inflection and post-inflection growth. Age-weight data of beef cattle from the University of Alberta ranch in Kinsella consisting of 203 Beef Synthetic (SY), 144 Hereford (HE) and 28 Dairy Synthetic (DY) females were used for the computation of model parameters, degree of maturity at birth and at inflection point. The mean value for degree of maturity at birth was found to be 6.8% and the mean inflection point was found to be 36% of mature weight. For the validation of the model, another set of 15 females, 5 of SY, HE and DY were used. Polynomial regression analyses of age-weight data were computed to yield least square (LSQ) curves with which the simulated curves were compared. The performance of the model was tested for the 15 individual females in three ways: (a) A graphical presentation comparing the values of the model with the LSQ curves, (b) the coefficients of variation (CV) of forecast deviations were calculated as percentages of the means of the LSQ curves, and (c) correlation forecast (r²); i.e. correlation between model and LSQ curve. The overall CV for the individual cows was found to be 10.11% ± 0.025 and the r² 0.958 ± 0.0864.

Calving ease and calf survival as a service sire trait. H. St. Arnaud*, J. F. Hayes, and J. E. Moxley, Macdonald College of McGill University, Ste. Anne de Bellevue, Quebec H9X 1C0.

A total of 123,477 calving records of Holstein cows were reported by dairymen on the DHAS program, from 1 Sept. 1979 to 31 May 1981. These records were used to study genetic and environmental variation in calving ease data and to examine a sire evaluation procedure for calving ease as a service sire trait. Calving performance was defined as: 100 — easy or slight assist; 50 — hard pull; 0 — surgical. Two populations were considered: the first included only first-calf heifers, and the second grouped all other parities. Preliminary analyses, using least squares procedure, examined the effects of herd, month (or season, for population 1) of calving, sex of calf, size of dam, age at first calving (considered as three age groups) or parity, and sex of calf × size of dam and sex of calf × age or parity interactions. For both populations, month (or season) of calving and sex of calf were significant (P < 0.01), and size of dam (P < 0.05). Also, age at first calving was significant (P < 0.05) for population 1. The interactions and parity (in the case of 2nd and later calvings) were not significant. Mixed model procedures were used to estimate sire (S) and error (E) variance components, using a model that included the effects of herd, sex of calf, size of dam, season of month of calving and age at first calving or parity. For first-calf heifers, 296 sires were represented, and 380 sires for other parities. Heritability estimates, obtained as four times the ratio S/E + E, were 0.04 and 0.01 for the two populations, respectively.

Dietary ME levels and reproductive performance of caged turkey hens. J. Thompson*, C. W. C. Chan, and S. P. Touchburn, Macdonald College of McGill University, Ste. Anne de Bellevue, Quebec H9X 1C0.

Young broiler-type turkey breeder hens in individual cages were inseminated artificially during a 12-wk production period. These birds were fed diets formulated using practical ingredients to supply 14% crude protein, 2.25% Ca and 0.35% inorganic phosphorus. The dietary treatments used were three energy levels, 2.7, 2.9 and 3.1 Mcal metabolizable energy per kilogram; and two forms of Ca, all limestone or
oyster shell replacing 2/3 of the limestone. Each of the six diets was fed to 48 hens. Hatchability and egg specific gravity were increased ($P < 0.05$), late embryonic mortality decreased ($P < 0.05$) and 7-day incubation weight loss was reduced on the diets with 2/3 of the limestone replaced by oyster shell flakes. These results indicate a beneficial effect of oyster shell substitution on reproductive performance. This was especially evident at the highest dietary energy level, 3.1 Mcal/kg. As dietary energy level increased, food consumption decreased. The levels of 2.7 and 2.9 Mcal/kg resulted in similar reproductive performances. Birds fed the 3.1 Mcal/kg diet with limestone as the Ca source had significantly lower production ($P < 0.05$) than birds fed the same energy level but with oyster shell flakes replacing 2/3 of the limestone. This could have been due to the higher average daily feed consumption on the oyster shell diet. 14.5 g vs. 136.4 g on the limestone diet. The depressed egg production on the 3.1 Mcal diet without oyster shell may be due to the failure of the birds to consume a sufficient amount of protein for optimal egg production, 19 g·hen$^{-1}$·day$^{-1}$ vs. 20-22 g·hen$^{-1}$·day$^{-1}$ on the other dietary treatments.

Seven generations of selection for duration of fertility of frozen-thawed chicken semen. Y. F. Yousif*, G. A. Ansah, and R. B. Buckland, Macdonald College of McGill University, Ste. Anne de Bellevue, Quebec H9X 1CO.

The fertility levels of frozen-thawed and fresh semen of seventh generation roosters of a line selected for duration of fertility of frozen-thawed semen and those of an unselected control line were determined. In two trials, a maximum of two individual ejaculates from 108 selected and 72 control line males were frozen, thawed, deglycerolized and reconstituted. The reconstituted semen from each male was inseminated to a maximum of six tester hens as was fresh semen from each of 106 selected and 61 control line males in a single trial. All estimates of fertility of frozen-thawed and fresh semen were significantly ($P < 0.01$) higher for the selected than the control line with the means ± SD for frozen-thawed semen being: percent fertility (2-8 days) 47.4 ± 23.0 and 27.6 ± 6.0, duration of fertility (days) 5.9 ± 2.7 and 3.4 ± 2.5, and percent fertility during duration of fertility (49.6 ± 21.9 and 32.1 ± 25.3). The percent hatchability of fertile eggs of frozen-thawed semen was not significantly ($P < 0.05$) different in the selected and control lines, the mean ± SD being 86.3 ± 16.9 and 83.8 ± 22.6. For fresh semen the mean ± SD percent fertility (2-8 days), duration of fertility (days) and percent fertility during duration of fertility in the selected and control lines, respectively, were: 89.6 ± 9.9 and 81.7 ± 21.7; 13.3 ± 1.5 and 12.0 ± 3.5; 80.3 ± 9.1 and 74.0 ± 17.5.

Effect of parturition on sow urinary creatinine. L.A. Bate* and R.R. Hacker, University of Guelph, Guelph, Ontario N1G 2W1.

Total urine production was collected with indwelling catheters in 13 Yorkshire sows. The catheters were maintained in place from day 109 postbreeding, until day 4 postpartum. Sows were weighed at the beginning and end of trial and piglets' birth weight recorded. Urinary creatinine (UC) was measured three times a day between day 5 prepartum and day 4 postpartum. UC remained unchanged during days 5, 4 and 3, and decreased slightly ($P > 0.05$) during days 2 and 1 prepartum. After parturition, UC levels increased ($P < 0.001$), reaching peak values on day 2 postpartum and declining thereafter to approximately prepartum values. Differences in UC were not detected between the three collection periods of the day. However, large differences ($P < 0.01$) existed between animals. Correlation coefficients between litter weight (LW) and changes in UC excretion for days 1 and 2 postpartum were 0.746 and 0.749, respectively ($P < 0.01$), while for days 3 and 4 postpartum, the correlation coefficients were only 0.349 and 0.463, respectively ($P > 0.05$). Prediction equations based on LW were developed for estimating changes in UC excretion from sows at parturition. Results presented indicate that if UC is to be utilized as an index for expressing concentrations of urinary metabolites, during the first 2 days following parturition, correction must be made for changes in UC excretion which occurs as a consequence of parturition.
Systems for harvesting, separating and utilizing alfalfa. D. Ganesh* and D.N. Mowat, University of Guelph, Guelph, Ontario N1G 2W1.

Soil erosion and fertilizer costs are becoming major concerns in producing corn. Thus, interest is increasing in using alfalfa in rotation. Alfalfa has several advantages over soybeans in rotation with corn (e.g. soil conservation, nitrogen incorporation, labor distribution). On the other hand, marketing alfalfa is difficult and it is not a concentrated source of protein like soybeans. However, approximately 45% of the alfalfa plant is leaves containing roughly 28% protein. If leaves could be economically separated on the farm, the need to buy soybean meal for supplemental feeding of growing beef cattle or high producing dairy cows could be eliminated. The remaining stems could be used to maintain dry cows or ground to feed growing cattle on integrated farms. A system was designed to simulate harvesting and storing alfalfa in various forms (as round bales, stacks, low-moisture or wilted silage). Alfalfa, separated into leaf-stem fractions before feeding, was compared to a soybean-soybean meal control. At current prices, costs of the alfalfa system were slightly lower for hay forms (round bales, stacks) with low leaf losses. However, feeding separated alfalfa from silage systems could save integrated beef producers up to 15% in feed costs assuming separation can be successfully accomplished.

Periparturient behavior of beef cattle. N.M. Lewandrowski* and J.F. Hurnik, University of Guelph, Guelph, Ontario N1G 2W1.

Fifty-two cow-calf pairs were observed from 2 days prepartum through 3 days postpartum. Closed circuit television cameras connected with time lapse videorecorders were used for continuous monitoring. Locomotion and ingestion differed significantly \((P < 0.05)\) between day 2 and Day 1 prepartum. Standing and walking time both increased while feeding decreased in the 24 h prior to parturition. The majority of feeding (67\%) occurred from 0600 to 1800 h. Mean time from rupture of the chorioallantoic membranes until fetal expulsion was 98.5 ± 37.8 min. Calvings were evenly distributed throughout the day. Cows maintained a close individual distance with their calves which resulted in greater walking time on the first 2 postpartum days. Both resting and feeding time increased \((P \leq 0.05)\) after the day of parturition. Mean time taken by calves to stand and suckle was 58.3 ± 63.6 and 131.2 ± 123.9, respectively. Daily suckling frequency was greater for Hereford (13.7) than for crossbred (7.0) calves. Approximately 61\% of suckling occurred between 0600 and 1800 h and 39\% between 1800 and 0600 h.

The milk consumption and behavior of neonatal piglets. N.J. Lewis* and J.F. Hurnik, University of Guelph, Guelph, Ontario N1G 2W1.

This experiment was designed to study the relationship between the milk consumption of, the weight of, and the nosing by, individual piglets on the sow. Milk consumption was recorded on days 2, 4, 6 and 8 of the lactation. Two consecutive recordings were taken at 1-h intervals by weighing the piglets before and after nursing. Weights were recorded on the same days. Differential nosing, which was defined as stimulation of teats not observed during nursing, was recorded at 5-min intervals, 24 h per day on days 1, 3, 5 and 7. Correlations were calculated after removing differences due to sow variability. The recorded weights of the piglets (mean ± SD; g; n = 106-128) were 1420.4 ± 241.4, 1736.2 ± 285.4, 2159.1 ± 426.4 and 2612.9 ± 417.8 on days 2, 4, 6, and 8 respectively. The weight gains recorded for the same periods were 159.3 g ± 65.1 g, 303.1 g ± 85.1 g, 401.2 g ± 127.7 g, and 432.7 g ± 90.1 g. The average milk consumption recorded for day 2 was 15.9 g ± 8.2 g, for day 4 21.1 g ± 8.7 g, for day 6 25.4 g ± 9.3 g and for day 8 31.5 g ± 11.3 g. The average number of nosings on days 1, 3, 5 and 7 were 29.6 ± 13.0, 11.1 ± 7.0, 12.3 ± 8.3 and 11.0 ± 6.4. This represents 10.3\%, 3.9\%, 4.2\% and 3.8\% of the total recorded activity for each pig. The correlation between weight and milk consumed was significant on all 4 days; \(r = 0.27, 0.50, 0.43\) and 0.38 on days 2, 4, 6 and 8, respectively. The weight gain was significantly correlated with milk consumed on days 4, 6 and 8; \(r = 0.38, 0.40\) and 0.36, respectively. Nosing was significantly correlated with milk consumption on day 2 \(r = 0.27\) and day 4 \(r = 0.39\).
Nosing was correlated with weight $r = 0.41$ and weight gain $r = 0.52$ on day 3. Used teats appear to be nosed more often than unused teats.

**Prostaglandis in fresh and frozen bull semen.** R.J. Pierce* and B.R. Downey, Macdonald College of McGill University, Ste. Anne de Bellevue, Quebec H9X 1C0.

A radioimmunoassay method was adapted for the measurement of prostaglandin E (PGE) concentrations in bull semen. Samples of two ejaculates, collected twice weekly from each of eight Holstein bulls, were assayed both in the fresh state and after undergoing routine processing and freezing for artificial insemination. Based on preliminary results, PGE levels were found to range from 81.3 to 233.6 with a mean ± SEM of 136.9 ± 7.3 ng per mL fresh semen. Concentrations of PGE in the same semen after dilution and freezing ranged from 0.7 to 19.2 with a mean of 7.8 ± 0.98 ng per mL. There was no significant difference between PGE concentration in first and second ejaculates. As well, there was no correlation between PGE levels in fresh semen and sperm motility, sperm concentration or post-thaw sperm quality as determined by microscopic examination. However, there was evidence to suggest that semen PGE concentrations differ among bulls and that these differences may be related to the percentage of motile sperm.

**Treatments to protect soybean and canola proteins from rumen degradation.** Z. Mir*, G.K. Macleod, J. Buchanan-Smith, D.G. Grieve, and W.L. Grossum, University of Guelph, Guelph, Ontario N1G 2W1.

Soybean and canola meal proteins were protected from rumen degradation by treating with heat (110°C for 2 h), formaldehyde (0.89/100 g protein), sodium hydroxide (3% DM basis), whole fresh blood (1.5 L/kg meal) or fish hydrolysate (1.5 L/kg meal). The effect of these treatments on in situ nitrogen digestibility was measured by incubating nylon bags (10-micron pore diam) containing a 5-g sample in fistulated steers fed at maintenance level. Nitrogen disappearance was measured after 4, 6, 12, 24 and 36 h of incubation. Most effective protection from rumen degradation was achieved for both soybean and canola meals by formaldehyde, sodium hydroxide, fresh whole blood and fish hydrolysate. In vitro pepsin digestion and protein quality using rat growth trials were investigated for unprotected and protected soybean meal and their residue remaining after 24 h rumen incubation. Pepsin digestion data indicate that protected and unprotected soybean meal are available for proteolytic digestion. Amino acid profiles of protected, unprotected meals and residues were not different. Protein efficiency ratio (PER) and net protein ratio (NPR) rat assays conducted at a dietary protein level of 10% indicate that the protein quality was significantly reduced by addition of formaldehyde or sodium hydroxide. Addition of blood to soybean meal did not affect protein quality. N digestibility was decreased by formaldehyde by not by other treatments.

**Poster Presentations**

**The effects of partial defaunation on rumen metabolism in sheep.** D.M. Veira*, M. Ivan, and P.Y. Jui, Agriculture Canada, Ottawa, Ontario K1A 0C6.

A diet containing corn silage and ground corn (1:1) with urea (11.4% CP) was fed twice a day to six sheep fitted with duodenal re-entrant and rumen cannulae for two periods. During the first period defaunation was attempted using only phenol ethylene oxide. Defaunation was complete in three sheep and partial in three sheep in which a reduced population (14 × $10^4$) of the small protozoa Entodinium simplex was observed. During the second period the sheep were inoculated with a normal population of protozoa
which became well established \((16.8 \times 10^3)/\text{mL}\). Apparent stomach digestion of organic matter (OM), acid detergent fiber and starch was lower when the protozoa were eliminated or reduced, though this was only significant \((P < 0.05)\) for OM \((46.2 \times 52.2\%)\) and starch \((85.5 \times 89.2\%)\). Duodenal flow of non-ammonia nitrogen (NAN) was greater when protozoa were eliminated or reduced, 1.34 vs. 1.13 g NAN/g N intake \((P < 0.05)\) or 2.43 vs. 2.07 g NAN/100 g DM intake \(.1 > P > 0.05\). Though there was a greater flow of diaminopimelic acid (DAP) \((P < 0.05)\) during total or partial deamination there was no difference \((P > 0.05)\) in the calculated bacterial N flow/100 g OM digestion in the stomach due to changes in the bacterial N:DAP ratio. When protozoa were absent or present in small numbers, NH3 in the rumen was lower, there was a greater decrease in pH after feeding, rumen liquid volume and dilution rate were unaffected, total volatile fatty acids were increased and the molar proportions were similar except for isobutyrate and isovalerate which were higher.


The monosaccharide composition of the crude hemicellulose of samples of freshly harvested forages, ensiled preparations of the forages and of the feces of sheep fed the silages was determined by means of gas-liquid chromatography of the alditolacetate derivatives. The ratio of arabinose to xylose (rax) of the hemicellulose of grass-alfalfa forage was 0.39 while that of barley forage was 0.22. Ensiling reduced the rax of crude forage hemicellulose by 15-50% and there tended to be a further reduction in the hemicellulose of the feces. Fraction A hemicellulose rax was reduced by ensiling, but that of fraction B was slightly increased.

**Trends in Canadian pork carcass indexes.** G.H. Bowman*, University of Guelph, Guelph, Ontario N1G 2W1.

Frequency distributions of 61 000 carcasses measured in 1965 in comparison with 10 000 measured in 1980 indicated that carcass weight has increased from 155 to 170 lb on average and total backfat (the sum of shoulder + loin) has decreased from 3.20 to 3.11 inches. The relationship between weight and fat has modified slightly. In 1965 an increase of 10 lb in weight was associated with an increase of .157 in. in total fat. In 1980 the association was 0.32 in. On a weight constant basis total backfat has decreased by 0.30 in. In the packing plant, however, this improvement has been largely negated by an increase of approximately 0.20 in total fat because of the increase in weight. The general fat-lean ratio of pork carcasses moving through the industry has only improved marginally on average in 15 yr. Most of the fat removed through improvement has been added back on by producing heavier carcasses. Because heavier carcasses index better, indexes have increased by about 0.41 points on average because of shifts in weight. The reduction in backfat, on a weight constant basis, however, has resulted in an increase of approximately 2.5 index points. Thus Canada has increased carcass weight without increasing fatness; and on average carcasses are slightly leaner.

**Effects of fermented or acid-preserved feed on acid-base balance in calves.** J.H. Burton*, University of Guelph, Guelph, Ontario N1G 2W1.

Thirty-two weaned heifer calves were randomly assigned to four dietary treatments in which source of protein was varied. Soybean meal provided 25% of the dietary protein in treatment 1 while high quality haylage (treatment 2), haylage + dry hay (treatment 3), or haylage + dry hay + whole fish hydrolysate (treatment 4) supplemented the protein in the grain portion of the remaining diets. Crude protein contents of diets 1 through 4 throughout the experimental period of 14 wk were 18.6, 15.6, 15.0 and 15.5%, respectively. No significant differences were observed in daily dry matter intake, feed efficiency or average daily gains. The latter averaged 0.91, 0.87, 0.88, and 0.87 kg for treatments 1 through 4,
respectively. Blood samples were analyzed for pH, PO₂, PCO₂, HCO₃⁻ and BUN. The only significant
treatment effect was on BUN where the levels were 13.24, 7.31, 7.70, 8.91 mg/100 mL for treatments 1
through 4, respectively. These results indicate that crude protein intakes of about 17 g/wt kg⁻0.75 are
sufficient to maintain adequate growth in the replacement calf whereas levels of 20 g/wt kg⁻0.75 or more
may be wasteful. The newly weaned calf is apparently able to control satisfactorily acid/base balance on
diets containing up to 50% high quality alfalfa haylage or haylage + whole fish hydrolysate.

Urea space and fat thickness as predictors of beef carcass composition. S.D.M. Jones* and J.S.
Walton, University of Guelph, Guelph, Ontario N1G 2W1.

Fifty-five beef animals (30 steers, 25 cows) were evaluated ultrasonically for subcutaneous fat thickness
with a Scanogram between the 11th and 12th ribs. Urea space was also estimated using the dilution
principle by the infusion of a known amount of urea. All cattle were slaughtered 3 days later and the half
carcass separated into fat, lean and bone. Urea space (R² = 0.48) and liveweight (R² = 0.48) alone
explained a similar amount of the total variance of lean weight. There was no additional increase in
variance explained when urea space and liveweight were used together to predict lean weight. Fat depth
explained an insignificant proportion of the total variance in lean weight (R² = 0.01). Urea space (R² =
0.37) and liveweight (R² = 0.46) explained significant amounts of the total variance of carcass fat, but
the variance explained by fat depth alone (R² = 0.08) was surprisingly low. The best prediction of carcass
fat was provided by a regression equation which included all three measured variables (urea space, fat
depth, liveweight R² = 0.54, residual coefficient of variation = 20.7%).

Methods to determine dominance in cattle. T. Tennessen* and H.W. Gonyou, University of Illinois,
Urbana, Ill. 61801.

The dominance orders of four groups of six feedlot steers were determined using four methods in order to
study the relationships between competitive and aggressive measures of dominance, body weight,
height, and weight gain. Two aggressive orders were constructed based on threats and bunts at the time of
mixing, and during the following 16 wk. After 16 wk, the feed allotment to each pen was reduced to 30%
of ad libitum intake for a period of 3 days. Two competitive orders were then established using feed as a
resource. In the first competition, each pen of six was tested for 15 min and time spent eating recorded for
each individual. After an additional 24 h of restricted feeding, a second competition was conducted based
on a 3-min feeding encounter between each pair of steers (15 pairings per pen). The results were such that
 correlations between the various dominance measures were not significant. The measures of body size
and growth were not significantly correlated with the dominance orders. Our results suggest that the
observed dominance order of a group of steers is affected by the social and competitive nature of the test,
and that caution should be used in extrapolating dominance rankings from one social context to another.
Each of the rankings we used was manifested within a different social situation. Therefore it seems that
the context of interactions may influence their outcome, even within the simplified environment of the
feedlot pens.

In vivo digestibility of wood fermented by white rot fungus ganoderma. R.E. McQueen*, A.E.

Poplar shavings (PS) were fermented with the white-rot fungus Ganoderma applanatum and the
digestibility by sheep and chemical composition was determined. PS were autoclaved at 121°C for 60 min
and semi-solid fermentation of 5-kg batches done in 70-L plastic cans by mixing with 10 L sterile pH 4
mineral solution and 4.5 L inoculum of submerged Ganoderma culture and fermenting for 4 wk at 25°C
with passive aeration through tubes inserted into the mass. Free liquid drained out of the cans and was
returned to the mass daily. Batches were mixed weekly and the product dried by 25°C air stream. Average
fermented PS dry matter (DM) composition was 81.1% NDF, 62.4% ADF and 9.0% lignin. Fermented PS and timothy hay were hammer-milled through a 2.2-cm screen and mixed with urea to give iso-N diets of 8% protein. Hay was substituted with PS to give three diets of 0%, 15% and 30% PS diet (FPS). The four diets were fed ad libitum to four sheep in a 4 × 4 Latin square plus 100 g/day of soybean-mineral supplement (45% CP). DM intakes (g/kg BW 0.75) for diets 0% PS, 15% PS, 30% PS and 15% FPS respectively were 65.8, 65.3, 65.9 and 94.2; respectively % DM digestibilities were 50.6, 51.1, 48.7 and 42.2; % DE were 41.6, 43.1, 39.8 and 39.3; % NDF digestibilities were 43.4, 44.9, 43.9 and 37.9. PS digestibility to sheep was equivalent to ground timothy hay at up to 30% of the diet. A sheep fed 45% PS in a preliminary trial lost 6.5 kg BW in 20 days and PS digestibility by different was 0%. In vitro true digestibility of fungal mycelia grown on starch was 73.5%.

Composition, keeping quality and digestibility of wet corn fiber. G.K. Macleod* and D.G. Grieve, University of Guelph, Guelph, Ontario N1G 2W1.

Mean analysis and standard deviations on 48 samples of wet corn fiber (WCF), a corn wet-milling feed product, taken at regular intervals over a 6-mo period were as follows: % dry matter (DM) 36.9 ± 3.3, crude protein 12.1 ± 0.9, ether extract 2.5 ± 0.5, acid detergent fiber (ADF) 14.5 ± 2.1, lignin 0.87 ± 0.43, ADF-insoluble N 0.10 ± 0.01, ash 0.59 ± 0.19, Ca 0.03 ± 0.01, P 0.13 ± 0.02, Mg 0.07 ± 0.02, K 0.20 ± 0.07 expressed as % of DM. Levels of Mn, Cu and Zn were 4 ± 1.7, 3 ± 1.2 and 21 ± 5.6 mg/kg DM, respectively. Amino acid composition was consistent and approximated grain corn in balance. Keeping quality was determined on four batches of fresh WCF with or without preservatives in open garbage cans at 5, 20 or 30°C for up to 28 days. WCF at 5°C required no preservatives for at least 23 days whereas at 20°C, WCF remained free of visible mold, yeast and color changes for 2-7 days and at 30°C for 1-4 days. Widespread spoilage was avoided in most cases for 20 days when 1% propionic acid (wt/wt), 0.75% formic acid (wt/wt) or 1.5% formaldehyde (wt/wt) was applied initially. Apparent digestibilities by steers of SCF dry matter, energy, crude protein and ADF were 75.2, 73.3, 67.6 and 56.1 percent, respectively. Digestibility energy value of SCF was 3.29 kcal per kg DM.


Genetic and phenotypic parameters were estimated for immunoglobulin (Ig) levels in a research herd of Canadian Holstein Friesian females. The radial immunodiffusion technique described by Mancini was utilized to determine levels of IgG1, IgG2, IgM, and IgA in serum samples drawn from a population of 190 daughters of 22 AI sires. The statistical model included the fixed effects of age, stage of lactation and parity; as well as the random effect of sire. Heritability estimates for IgG1, IgG2, IgM, and IgA were 0.68 ± 0.29, 0.85 ± 0.20, and 0 respectively, based on the SAS MIVQUE (0) method of estimation. The mean Ig levels were 1088.94 ± 658.65, 681.01 ± 242.98, 359.34 ± 150.06 and 63.67 ± 36.64 for IgG1, IgG2, IgM and IgA, respectively. A regression analysis indicated that age, stage of lactation, parity and sire ratings of production (direct sire comparisons), accounted for 6%, 37%, 2% and 3% of the total variance in Ig levels, respectively. Positive correlations between IgG2 levels and clinical mastitis (r = 0.24 P < 0.001), and incidence of enzootic pneumonia (r = 0.13 P ≤ 0.0662) existed, indicating that further investigation of IgG2 behavior on a larger sample size would be warranted. No significant correlations were found connecting Ig levels with levels of production.

Prediction of carcass fat levels in broiler chickens. D.L. Patterson and G.W. Friars*, University of Guelph, Guelph, Ontario N1G 2W1.

One hundred and twelve female broilers from four pure lines were studied for several fat traits, liver traits, and yolk plasma triglyceride levels. The phenotypic correlation between plasma triglyceride from
starved birds and weight of total fat in the carcass was 0.04, not significantly different from zero, and the average triglyceride level was 32 ± 1.3 mg/dL. Plasma triglyceride levels in 29 non-starved birds (mean level 84 ± 5 mg/dL) had a simple correlation of 0.27 with weight of total fat in the carcass. No line differences were seen for triglyceride levels. The simple correlations between weight of total fat in the carcass and liver weight, percent liver moisture, and percent liver fat were 0.52, −0.28 and 0.24, respectively, all significantly different from zero. The simple correlations between percent liver fat and starved bird plasma triglyceride level was 0.16. In a further study of 529 pedigreed birds of one line, phenotypic correlations between total fat in the carcass and liver traits were 0.32 (± 0.04) for liver weight, −0.06 (± 0.04) for liver percent moisture, and 0.17 (± 0.04) for liver percent fat. The respective genetic correlations were −0.18 (± 0.24), −0.55 (± 0.40) and 0.59 (± 0.25). The best equation to predict total fat in the carcass, determined from the 529 observations, was: weight of total fat = 852 + 0.17 carcass weight − 12.91 carcass percent moisture, with an $r^2$ of 0.82. However, on a pure line basis liver percent moisture did contribute significantly to the regression equation in one of the sire lines, giving an $r^2$ of 0.65. The best single predictor of carcass fat percent was abdominal fat pad weight, with liver traits and blood plasma triglyceride levels being of little value.

**A national sire evaluation scheme for total milking time.** L.A. McClelland*, E.B. Burnside, L.R. Schaeffer, and C.B. Williams, University of Guelph, Guelph, Ontario N1G 2W1.

Measurements on total milking time (TMT) in seconds were collected from 1978 to 1981 on a population of 21,853 Holstein Friesian cows across Canada. Milk yield (kg) at test milking was recorded along with birth, test and calving dates. The mean milking time was 6.25 min. Genetic evaluations on 2390 sires were obtained by best linear unbiased prediction using a model that included herd-year of calving effects, random sire and residual effects, and covariates for the linear and quadratic effects of milking yield, age and stage of lactation. Additive genetic relationships among sires were included in the analysis. Two hundred bulls with repeatabilities greater than 54.9% and daughters in five or more herd-years were categorized into five groups (very fast, fast, average, slow, and very slow) on the basis of the standard deviation of their proofs. The sire proofs ranged from −40 sec to +50 sec with a mean of ± 1.2 sec and standard deviation of 18 sec. Sire and error components of variance were estimated by maximum likelihood procedures resulting in a heritability estimate of 0.16. A decrease in average TMT of 30 sec per cow would amount to a labor saving of 5 h per cow per year assuming a 305-day lactation.

**Genotype × temperature interaction for growth traits in rainbow trout.** L.R. McKay*, G.W. Friars, and P. Ihssen, University of Guelph, Guelph, Ontario N1G 2W1.

Low water temperatures restrict the growth of rainbow trout (*Salmo gairdneri*) in Ontario. The purpose of this study was to determine whether genotype × temperature interactions exist for growth traits of rainbow trout, in order to design appropriate selection programs to improve growth in cool water. A total of 750 fish from 35 full-sib families were included in the study. Each family was split into two groups, one raised at 7°C for 4 wk, the other at 15°C. Six different growth parameters were analyzed: absolute gain in weight (AGW) and in fork length (AGF); relative gain in weight (FGW) and in fork length (RGF), i.e. absolute gain divided by initial size; and instantaneous growth rate for weight (IGW) and fork length (IGF). Analyses of variance revealed significant family × temperature interactions for all of these parameters except AGW. The genetic correlation estimates between growth at 7°C and growth at 15°C were 0.945 (AGW), 0.636 (AGF), 0.534 (RGW), 0.639 (RGF), 0.544 (IGW), and 0.600 (IGF). The rankings of the performances of the families changed somewhat from 7°C to 15°C and vice versa. These results indicate a genotype × temperature interaction for growth in rainbow trout, suggesting the need to rear and select stocks at 7°C when optimal growth in ground water at that temperature is desired.
Monogastric Nutrition

Nutritive value of brewers' by-products for neonatal piglets. J.C. Petten* and E.R. Chavez, Macdonald College of McGill University, Ste. Anne de Bellevue, Quebec H9X 1C0.

This study was undertaken to evaluate the nutritive value of brewers' yeast for feeding neonatal piglets. Experiments were carried out with piglets weaned at 2 days of age and put onto liquid feeding with different milk replacer formulas, up to 10 days after which they were fed dry creep feed. In the first experiment, brewers' yeast was compared to whole cow's milk (control) as the only source of dietary protein. Another treatment included was a combination of these two in equal proportions. Average daily gain for 6 wk was significantly greater for piglets receiving milk than those receiving brewers' yeast. The combination of milk and brewers' yeast gave average daily gains (ADG) not significantly different from control animals. Body organs (as % of live weight) at the end of the experimental period indicated that piglets receiving brewers' yeast alone had significantly greater kidneys than control animals. This effect was not observed in animals fed the combined diet. No significant differences in liver, heart or spleen size were observed. Fecal protein excretion per kilogram liveweight per day was significantly greater in piglets receiving brewers' yeast alone or in combination with milk, than control animals. In the second experiment, whole cow's milk, brewers' yeast, soybean protein and 50% brewers' yeast and 50% soybean protein were compared as sources of protein in liquid and creep diet of piglets. The ADG were 282, 86, 134 and 122 g/day, respectively. Piglets receiving brewers' yeast had significantly greater livers, kidneys and fecal protein excretion than any other treatment group. No significant differences were observed in heart and spleen size.

Effect of breed, diet, sex or weaning weight on market pig performance. A.G. Castell* and J.H. Strain, Agriculture Canada, Brandon, Manitoba R7A 5Z7.

Post-weaning performance of market pigs is influenced by the individual's identity (e.g. breed, litter origin and 'sex') as well as by imposed criteria (e.g. diet). To investigate these effects, two boars (B), two barrows (b) and two gilts (G) were selected from each of 12 Lacombe (L) and 12 Yorkshire (Y) litters. Progeny from three litters were assigned to three pens, each containing six pigs of the same breed and 'sex.' Within each breed group, two, 16% CP, pelleted diets (ROP = 13.42, MND = 12.61 MJ DE/kg) were fed, ad libitum, from 15.3 kg (Y) or 20.2 kg (L) to 89-kg market weight in a design, including two replicates, with 'sex' as a split variable within litters. Within breeds, diet did not affect (P > 0.05) growth rate (L: ROP = 781, MND = 806; Y: 637 and 654 g/day, respectively), feed intake (2.21, 2.45; 1.85 and 1.95 kg/day, respectively) or feed/gain (2.90, 3.07; 2.95 and 3.02, respectively). In contrast, many carcass criteria affected by diet appeared to be breed-related. Differences between B, b, and G for live performance were greater in Y than L and significant sex effects on some carcass criteria were found only in one breed group. While, in general, the superiority of B over b for most criteria was confirmed, the results suggested that for optimum performance the dietary regimen should be related to the type of pig.

Energy value of Canola meal in growing-finishing pigs. E.R. Chavez*, Macdonald College of McGill University, Ste. Anne de Bellevue, Quebec H9X 1C0.

An experiment was conducted to determine the energy value of Canola meal for growing-finishing pigs. Twelve animals, six males and six females, were used per treatment. The experimental treatments included: 1 — a control, corn-soy-bean meal diet; 2 — 15% Canola meal diet, isoproteic to control; 3 — as 2 supplemented with soybean oil, isoproteic and isocaloric to control and 4 — reference diet for treatment 2. Two diets were formulated in each treatment, one up to 50 kg liveweight and a second one up to market weight. The experimental period was divided into three growing-finishing phases for metabolic work: Phase 1 included animals between 25 and 50 kg, phase 2 between 50 and 75 kg and phase 3 from 75
to 95 kg liveweight, approximately. Animals were kept in groups of six to a pen except for 1 wk in each experimental phase during which they were transferred into individual metabolic cages for fecal and urine collection and energy determination of the diets. The total collection method for 3 consecutive days was used. Energy values for Canola meal calculated from energy values determined in diets 2 and 4 were for DE 11,757, 13 414 and 13 941 kJ/kg of dry matter (DM) with ME values of 10 719, 12 189 and 12 557 kJ/kg DM in phases 1, 2 and 3, respectively. These results indicated that the energy value of Canola meal significantly increased from early growing to finishing pigs. Overall animal performance was significantly lower for pigs receiving Canola meal diets compared to the control animals.


The effect of feeding 2.2 kg every day or 4.4 kg every other day, at 0800 h during gestation on reproduction performance was studied in an experiment, using a total of 128 Lacombe and Yorkshire gilts. Prior to farrowing, half of the gilts in each group were fed at 2000 h for the final 10 days of gestation, to study the effect of change in feeding time on time of farrowing. All gilts were housed in outside dirt lot pens during gestation and moved into confinement for farrowing. Feeding every other day significantly ($P < 0.05$) lowered the gestation weight gain (35.3 vs. 42.1 kg) followed by a reduced weight loss during lactation (5.2 vs. 11.6 kg) compared with the daily-fed group. Both groups were similar with respect to mean number of live pigs born, piglet birth weight (kg), weight gains (kg) to 3 and 5 wk of age and number of pigs weaned (9.20, 1.27, 3.93, 7.90, 7.61 vs. 9.05, 1.25, 3.85, 7.89, 7.80). A significant feeding interval and breed interaction indicated that alternate day feeding reduced the number of live pigs born for Yorkshire (8.60 vs. 9.50) but not for Lacombe gilts (9.50 vs. 8.90). Feeding at 2000 h did not increase the number of farrowings during daytime; however, it significantly decreased the rate of mortality during first 24 h after birth. Alternate day feeding also had similar effect in reducing the rate of mortality during first 24 h after birth. The results of this study indicated that alternate day feeding during gestation had no adverse effect on reproductive performance except for Yorkshire gilts, which had significantly lower number of live pigs born.

**Effect of vomitoxin on gain and feed intake of growing pigs.** D.W. Friend*, J.J. Elliot, H.L. Trenholm, B.K. Thompson, and K.E. Hartin, Agriculture Canada, Ottawa, Ontario K1A 0C6.

Twelve gilts (39 ± 4 kg) were assigned to four pens of three pigs each. Gilts in two pens were given ad libitum a grower diet containing 70% vomitoxin-contaminated (1.2 ppm) wheat (V); the diet of the other pigs contained 70% clean wheat (C). Eighteen older gilts (75 ± 4 kg) were assigned to pens of three pigs each; four pens with diets as before (C and V), and two with a diet (CV) containing 35% contaminated and 35% clean wheat. Pigs fed diet V lost weight within the first 3 days and their average body weight by the end of the 21-day experiment was less than that of pigs fed diet C; the effect was less pronounced for the CV pigs. Intake of diets V and CV declined initially especially in the younger pigs, but improved consistently thereafter; considerable variation in response indicated differences in tolerance level. Post-mortem examination of the 18 larger pigs revealed some coloration of the stomach (cardiac region) in those fed vomitoxin wheat. Twenty-eight barrows and 28 gilts were assigned to given diets in each of four replications of each sex; pigs were penned and fed individually. Vomitoxin-contaminated wheat substituted (0, 20, 40, 60, 80 and 100%) for clean wheat (70%) in a grower diet; a positive control diet was also fed to all pigs for a pre-test period of one week. Pigs were killed at 90 ± 5 kg; those fed the higher level of vomitoxin wheat showed lower levels of feed intake. Differences in body weight gain were NS, but feed:gain rations were different ($P < 0.05$) among diets. This result was probably due to the significant reduced feed intake and weight gain shown in the first week by pigs fed the high vomitoxin diets. There were no post-mortem trends among diets.

Sixty-one gilts, bred at puberty then individually penned, were fed at a rate of 1.2 kg once daily until day 84 of pregnancy, 1.4 kg to day 99 then 1.6 kg to farrowing. Thirty of the litters were weaned at 21 days (21W), the others within 12 h of birth (OW). In each group, some gilts were marketed 12 ± 3 days post-weaning; the others were rebred. Twenty-two contemporary, unbred control gilts were treated from puberty to marketing similarly to the bred gilts; 13 other gilts randomly selected at 91 kg were used as market weight controls. Age at puberty averaged 164 days (137-189 days range); bred gilts were heavier ($P < 0.01$) than unbred gilts at both 85 and 100 days but not immediately post-farrow. Number of piglets born average 9.1 total (3-15 range) and 8.5 alive (1-15 range); cross-fostering was practised. Carcasses of the weaned gilts were lighter in weight and had less backfat thickness than the unbred controls of the same age and the lighter, younger market weight controls. Total percent age yield of trimmed deboned meat was not affected significantly. Sensory evaluation for flavor, juiciness and tenderness of loin (m. longissimus) and ham (m. semimembranosus) meat from all carcasses did not reveal any significant differences between the market weight gilts and those of the other four groups. For the 21W and OW gilts bred for a second cycle, time from weaning to breeding averaged 23 and 38 days and embryo mortality 15-21%, respectively, at 30 ± 3 days pregnant.

**Protein and tallow levels in corn-soybean meal diets for market swine.** J.R. Morris* and D.G. Luckham, Ridgetown College of Agricultural Technology, Ridgetown, Ontario N0P 2C0.

A study involving five trials and 396 pigs was conducted to evaluate the economic growth and carcass merit response of market weight pigs fed fortified corn-soybean meal diets containing three levels of crude protein (12, 16 and 20%) and supplemented with three levels of stabilized animal tallow (0, 3 and 6%). The pigs were floor-fed and raised on a partial slatted floor in a conventional forced-air ventilated swine finishing barn. Initial weights for the various trials ranged from 16 to 32 kg with market weight at approximately 98 kg. Barrows and gilts were penned separately. The addition of the tallow to the diet generated faster growth ($P < 0.01$) better feed conversion ($P < 0.01$) and fatter carcasses ($P < 0.01$) in pigs. Increasing the crude protein levels in the diet improved growth rate ($P < 0.01$), feed conversion ($P < 0.01$) and promoted leaner carcasses ($P < 0.01$). The effect of crude protein was greater for the traits observed between 12 and 16% crude protein than between 16 and 20% crude protein. Gilts grew slower ($P < 0.01$) and produced leaner carcasses ($P < 0.01$) than the barrows. No significant first- and second-order interactions were detected among sex, dietary tallow levels and dietary crude protein levels. Using current prices for pork, the various feed ingredients and weaner pigs, an economic analysis determining a relative net income on a finishing barn basis revealed that a 16.5% crude protein diet with no additional tallow was the most economical diet to feed.


Feeding trials were run to evaluate the effect of a commercial feed supplement, Protec (Alta Lipids Canada Ltd.), on broiler growth. In the first trial a total of 360 one-day-old female chicks were divided into three equal groups. Group 1’s diet was supplemented with Protec; group 2’s diet was supplemented with “unprocessed” Protec and group 3’s diet was not supplemented. The birds were fed starter ration for 4 wk followed by grower rations for 4 wk which contained 3.4% and 7.5% Protec, respectively, when supplemented. The second trial was similar to the first except that male chicks were used. Both the processed and unprocessed Protec supplemented broilers had 5-30% faster rates of growth in the first week of the trials than the unsupplemented, however, differences in growth rates in subsequent weeks were not significant. There was a much higher incidence of leg problems in the supplemented groups. The feed conversion efficiencies (FCE) for the Protec, unprocessed Protec and unsupplemented diets were 2.06, 2.17 and 2.18, respectively, for the females and 1.80, 2.23 and 2.08, respectively, for the males. Processed Protec improved the FCE in both male and female broilers.
Use of distiller's by-product in rations for broilers. L.E. Phillip* and E.R. Chavez, Macdonald College of McGill University, Ste. Anne de Bellevue, Quebec H9X 1C0.

The study was conducted to determine the effect on performance of broilers of feeding brewer's yeast (BY) as a supplement to a corn diet. Two-hundred day-old chicks were divided into 20 groups of 10 and randomly allotted to four diets in which BY replaced 0 (control), 50, 75 and 100% of the crude protein (CP) from soybean meal (SBM). All diets were formulated to be isonitrogenous at 21% CP from 0 to 4 wk (phase 1) and 18% CP from 4 to 9 wk (phase 2). In phase 1, the chicks were raised in Petersime batteries and then transferred in phase 2 to floor pens. Body weights and feed consumption were measured every 2 wk. At the end of the trial, the birds were slaughtered and the liver, heart and spleen removed and weighed. Replacement of 100% or 75% of the CP from SBM with that from BY reduced (P < 0.01) body weight by 50% at 4 wk and by 30% at 9 wk. Replacement of 50% of the SBM crude protein led to a decrease (P < 0.01) in body weight from 895 g to 641 g at 4 wk and from 2885 g to 2421 g (P < 0.01) at 9 wk. Feed:gain ratios for the period 0-4 wk changed from 1.68 (control diet) to 2.51 and 2.69 (P < 0.01), respectively, with the 100% and the 50% BY replacement levels. Feed:gain ratios for 0 to 9 wk were 2.21, 2.71 and 2.91 with the control, 100% and 50% BY replacement levels, respectively. Measurements of pepsin digestibility in vitro revealed that 88.9% of the CP in BY was susceptible to enzymatic hydrolysis compared to 71.5% for Torula yeast and 95.5% for isolated soybean protein. Liver and heart weights (% of body weight) increased, respectively, from 1.93 to 2.36 (P < 0.01) and from 0.57 to 0.69 (P < 0.01) when BY replaced 100% of the SBM crude protein.


An experiment was conducted to assess the supplementation of sulfur-amino acids, inorganic sulfate and organic sulfate in mink diets on pelt quality. Ninety pastel male mink were used for 179 days, from about 7 wk of age to pelting time. Animals were randomized into individual cages in one of the following dietary treatments: (1) control diet; (2) as 1, supplemented with 0.5% DL-methionine; (3) as 1, supplemented with 0.8% L-cystine (equivalent basis with methionine); (4) as 1, supplemented with 0.5% potassium sulfate; (5) feather-meal at 10% level in the control diet replacing fresh animal by-products, and (6) as 5 at 20% level. Feed was provided daily on an ad libitum basis and water was available at all times from automatic nipples. At the end of the experimental period the control group averaged 1770 g. DL-methionine supplementation improved pelt quality, and average return per pelt (40.18) was increased by more than 51 compared to control minks (38.92). Supplemental L-cystine did not show any significant effect either in pelt quality of size compared to control, given similar average return per pelt (38.82). Supplementation of potassium sulfate significantly reduced pelt quality, giving a lower return per pelt (37.59) than control. Fish meal at 10% level appears to slightly improve both pelt quality and size, giving a greater average return per pelt (40.58) than controls. At higher level (20%) feathermeal although pelt quality was improved, the size of the pelt was greatly reduced giving an average return per pelt (32.32), much lower than control mink.


Effects of vitamin B-12 supplementation of diets containing propionic acid (PA) or calcium propionate (CP) on serum lipids and lipoproteins were studied utilizing 80 crossbred pigs averaging 22.5 kg. Isonitrogenous and isoenergetic diets, based on barley-soybean meal, containing 0, 3.5 or 7% PA or CP were fed with and without the addition of 4.95 mg vitamin B-12/kg diet. Addition of PA depressed intake while CP did not cause a depression in intake. Addition of PA or CP depressed serum total cholesterol, HDL cholesterol, LDL cholesterol and serum triglycerides. Livers from PA- or CP-fed pigs were slightly heavier in comparison with control animals. The livers from these pigs had an increased lipid content
which appeared to be the result of an increase in phospholipids. In addition, PA- and CP-treated pigs showed increased liver cholesterol ester and decreased free fatty acids. Supplementation with vitamin B-12 mollified the effects of PA or CP. The data indicate that the reduction in serum cholesterol is not simply a reflection of a reduced dietary intake but arises from a direct effect of PA on cholesterol metabolism. Lower levels of HDL suggest that one mechanism by which PA reduces total serum cholesterol is through a shift in body cholesterol from serum to the tissue pool.

Production and Management


The California mastitis test (CMT) was done on 1883, 1041, and 1229 milk samples from Holstein (H), synthetic Ayrshire based (A), and crossbred (C) lines of cows, respectively, to study the effects of line, year of calving, season of calving, parity, and month of lactation. CMT scores from composite samples drawn bimonthly during lactation for each cow were coded from 1 to 5 and transformed to log scale to normalize the distribution. Each cow was classified into one of the four categories: negative — no evidence of inflammation and no mastitis organisms isolated; positive — evidence of inflammation and mastitis organisms isolated; group 3 — mastitis organisms isolated but no increase in leucocytes; group 4 — leucocytes increased but no mastitis organisms isolated. Of the samples tested, 64.4% were negative. The incidence of subclinical mastitis as judged by CMT score was significantly ($P < 0.05$) higher in H line and lower in the A line when compared with C line cows. The percentages of positive samples were 19.9, 11.1, and 16.2% for H, A, and C line cows, respectively. CMT score increased with lactation number and stage of lactation and was higher for cows calving from April to June. Sixty-seven percent of the samples were culturally negative. Microorganisms were isolated from 16.1, 35.8, 57.5, 73.9 and 80.7% of the samples showing a CMT reaction of negative, trace, 1, 2, and 3, respectively. The main pathogen found in the present study was staphylococci (55.6%), other organisms isolated were streptococci (20.6%), Klebsiella (20.3%), and coliform (3.0%).

Milk pricing systems and dairy cattle selection and management. J.E. Moxley*, J.F. Hayes, and K.F. Ng Kwai Hang, Macdonald College of McGill University, Ste. Anne de Bellevue, Quebec H9X 1C0.

Sophisticated statistical procedures for indexing sires and cows are being developed without consideration of the product value of milk produced. The Canadian industrial milk quota system has created additional dairy cattle selection problems. By reducing fat composition and maintaining his quota, a dairy farmer can improve his gross returns but reduces product value. Canadian, United States, New Zealand and the Netherlands milk pricing systems are presented. Sire indexes for the Quebec AI proven sires in service during 1980 have been computed for each pricing system. Selection based on these sire indexes and actual sire used, based on first services, have been compared to measure how efficient they are in improving theoretical milk product value.

Response to feed recommendations in Q-DHAS herds. J. Jalbert*, R.K. Moore, and J.F. Hayes, Macdonald College of McGill University, Ste. Anne de Bellevue, Quebec H9X 1C0.

In October 1979, DHAS commenced computing net energy (lactation), crude protein, calcium and phosphorus requirements based on 1978 NRC estimated requirements. The intakes of these nutrients are
computed for each cow where a complete feed analysis and estimated intake of each feed is indicated on test day. The monthly test day data for 930 official DHAS Ayrshire and Holstein herds cumulated between October 1979 and April 1981 were used to compute the first 90-day lactation nutrient requirements and inputs for cows with complete data. The 90-day and 305-day milk, fat and protein yields for each cow were computed. In a model which considered herd, season and age of cow, the effect on nutrient input levels as a percent of nutrient requirements on 305-day production measures was estimated. Changes in production in herds using the complete feed report versus those not reporting this information are compared.

**Variation in milk protein content and composition.** K.F. Ng Kwai Hang*, J.F. Hayes, and J.E. Moxley, Macdonald College of McGill University, Ste. Anne de Bellevue, Quebec H9X 1C0.

Individual milk samples from approximately 2800 Holstein-Friesian cows in 63 dairy herds enrolled in the Quebec Dairy Herd Analysis Service program were collected monthly for analyses from November 1979 to March 1981. A total of 24,405 samples were analyzed for total protein, casein, serum protein and somatic cell counts. Joint estimates of the effects of calendar month of test, stage of lactation, age of cow and somatic cell count on milk composition were obtained using a least square model. The mean values for protein, casein, serum protein and somatic cell counts were: 3.39 ± 0.002%, 2.70 ± 0.003%, 0.69 ± 0.009% and 323,000 ± 4000 per mL of milk, respectively. Protein, casein and serum protein contents were significantly affected by calendar month, stage of lactation, age of cow and somatic cell count. The highest concentrations of protein, casein and serum protein were observed during the first 10 days of lactation with values of 3.80%, 3.05% and 0.75%, respectively. These values declined until 60 days in lactation and then increased during the latter part of lactation. As the cows became older, their milk contained more serum protein and less casein. An increase in somatic cell counts resulted in an increase in total protein and serum protein, whereas the casein content was not affected.


The data on body weights were obtained from 694 first lactations, 519 second lactations and 329 third lactations of H- and A-line cows born in five Research Branch Stations. The H-line cows were from the mating of Research Branch Holstein cows with Research Branch, Canadian and U.S. Holstein bulls whereas the A-line cows were from the mating of Research Branch Ayrshire cows with Research Branch, Canadian, U.S. and Finnish Ayrshire bulls as well as Brown Swiss and Norwegian Red bulls. Body weights were taken at calving, 56, 112, 168, 224 and 280 days of first lactation, and at calving and 112 days of second and third lactation. The model for analysis contained fixed effects for station, year of birth, line, sire group within line and sire within sire group within line along with age at calving as a covariable. The effects of station, line, sire group and sire were significant (P < 0.05) on the body weights taken at various ages of the first three lactations. Sire group was found to have no significant effects on the body weight changes at various periods except from 56 to 112 days of first lactation. The weight changes from 56 to 112 days of first lactation varied from 7 kg for progeny of U.S. Holstein to 19 kg for progeny of Canadian Holstein in the H-line whereas they varied from 2 kg for progeny of U.S. Ayrshire to 16 kg for progeny of Brown Swiss in the A line. Weight loss from calving to 56 days of first lactation and weight gain from 168 days to 224 days of first lactation were significantly negatively associated phenotypically, with 308-day milk yield of first (-0.24, -0.17) and second (-0.11, -0.12) lactations.
Growth rate of heifers as related to milk yield and composition. L.J. Fisher*, J.W. Hall, and S.E. Jones, Agriculture Canada, Agassiz, British Columbia VOM 1A0.

First lactation records for 400 Holstein heifers over a period of 16 yr were analyzed with the purpose of determining the relationship between milk yield and rate of body weight gain during the first lactation. Milk yield per 60-day intervals was also related to the variables: age and weight at calving, sire and season of the year. Average age and weight at calving was 815 days and 519 kg, respectively, while average total milk yield was 5544 kg/lactation, and body weight gain was 56 kg. Average body weight gain was -24, +15, +16, +23 and +27 kg while average milk yield was 1259, 1217, 1104, 1024 and 940 kg for the intervals 0-60, 61-120, 121-180, 181-240 and 241-300 days, respectively. Total milk yield was linearly related to total weight gain but not to age or weight at calving. This relationship explained only 5% of the total variation and was unaffected by season but varied from sire to sire. Milk yield during the first 120 days was positively related to both weight at calving and to weight gain during that interval. Milk yield from 121 to 240 days of age was also related to calving weight but not to age at calving nor to weight gain during that interval. The degree of these relationships varied among sire groups. The analysis of these data indicated the advantage of the larger heifer at calving in terms of milk production during the early stages of lactation. The relationship between body weight gain and milk yield during the first lactation indicated the importance of a high plane of nutrition to sustain both growth and production.

Condensed acid whey as a source of dietary energy for calves. L.J. Fisher*, M.J. Douglas, and K. Giles, Agriculture Canada, Agassiz, British Columbia VOM 1A0; and Fraser Valley Milk Producers Assoc., Sardis, B.C.

Evaporated condensed whey (50% solids) was mixed with Canola meal (1 kg/100 g) and allowed to solidify. These whey blocks had a dry matter content of 75%, a protein content of 14.8%, an ash content of 14.0% and a consistency that could be cut with a knife. The whey blocks were fed free choice in combination with either a starter ration or chopped hay to Holstein bull calves 28-84 days of age. The trial consisted of four groups of eight calves each assigned to one of the following treatments: A, starter ration ad libitum; B, starter ration (0.5 kg/day), whey ad libitum; C, chopped hay ad lib and D, chopped hay (0.5 kg/day), whey ad libitum. Whole milk continued to be fed at 10% of body weight until 49 days of age. Feed intake, body weight gain and feed conversions were measured from day 28 to 49 and day 50 to 84; blood samples were taken for metabolite and mineral analyses. One calf on treatment A and four on treatment B suffered from chronic bloat during the latter part of the trial. Whey comprised 80% of dry matter intake when fed with the starter ration and 90% when fed with hay. Body weight gain (kg/day) and total dry matter intake (kg/day) were 0.85, 0.77, 0.68 and 0.92; 2.55, 2.62, 2.15 and 3.00 for diets A, B, C and D, respectively. Blood hematocrit was consistently higher for calves on diet A while blood glucose was lower for calves on treatment C. The calves fed hay had lower plasma magnesium levels. Blood urea nitrogen (mg%) was 11.5, 8.1, 14.7 and 5.7 for treatments A, B, C and D, respectively. It was concluded that the condensed whey was an excellent source of energy for young calves when fed with chopped hay, but when fed free choice with grain it resulted in a high incidence of bloat.


Twelve young and 12 mature lean Holstein cows were fed a high energy diet to appetite based on high moisture corn and haylage. In addition, six young and six mature cows were slaughtered at the start of the trial to estimate initial body composition. Mature cows were initially 45 kg (P < 0.05) heavier than young cows. There were no differences between young and mature cows in average daily gain (1.37 vs. 1.49 kg/day) or dry matter feed conversion (8.46 vs. 8.31). There was no decline in average daily gain during the feeding period, although dry matter feed conversion increased for both young and mature cows before

Shredded newsprint is a potential source of bedding for livestock but because it may contain low levels of certain heavy metals and PCBs, significant voluntary consumption of newsprint by animals would be undesirable. To determine consumption levels, 18 Holstein cows in midlactation (average 19 wk) were used in a double latin square design. Squares represented access to shredded newsprint or chopped hay in the feed manger except during feeding time. Within squares, cows were allotted to each of three complete mixed rations over three 6-wk treatment periods. Rations comprised hay crop silage, corn silage, high moisture grain corn and soybean meal with roughage: concentrate ratios of 30:70 (LR), 50:50 (MR) and 70:30 (HR). Mixed rations were fed according to individual cow requirements for energy depending on body weight, milk yield and milk fat percent. Cows were allowed 4 h after each of two feedings per day to consume their allotted mixed ration. Voluntary consumption of newsprint was only 0.3 kg per cow per day or 2% of total dry matter intake while for those offered hay, consumption was 2.6 kg or 15% of total dry matter intake. Intakes of mixed rations were unaffected by roughage: concentrate ration or newsprint versus hay. However total dry matter consumption (mixed ration plus newsprint or hay) was higher for cows offered hay (17.3 kg) than those offered newsprint (15.1 kg). Levels of heavy metals in milk or blood samples of cows with access to newsprint were within normally accepted ranges. PCBs were at undetectable levels in all cases. Bedding cows with newsprint in unlikely to result in a significant consumption or contamination of animals or their products.


This project was set up to compare the palatability and utilization by ruminants of dried rye distillers' grains plus solubles (RDG) with dried corn distillers' grains plus solubles (CDG). Eighteen lactating dairy cows were randomly assigned to two groups. Each group was fed a diet made up of 50% concentrates and 50% alfalfa cubes. In one group the concentrate contained 15% RDG and the other group 15% CDG. Animals were allowed a 1-wk adaptation to the diets before starting an initial 6-wk feeding period. Following the initial 6-wk period the animals were switched to the other concentrate diet over a 1-wk period followed by a final 6-wk feeding trial. The daily feed intakes indicated similar feed intake patterns. Concentrate intakes, cube intakes and intake as a percentage of body weight were 10.7, 10.7, 3.56 and 10.8, 10.6, 3.58 for the RDG and CDG diets, respectively. Daily milk, fat-corrected milk and fat percent averaged 21.4, 18.0, 2.94 and 22.3, 18.4, 2.82 for RDG and CDG diets, respectively. Body weight change was identical on both rations (.48 kg/day). During the last week of each 6-wk feeding period, three animals on each treatment were subjected to a total collection digestion trial. Dry matter, organic matter and crude protein digestion for the animals on the complete ration were 67.5, 69.1, 73.5 and 68.1, 70.2, 74.0 for the RDG and CDG diets respectively. In conclusion RDG can replace CDG with no negative effect on feed intake or milk production.
Effect of winter feeding on cow and calf weight change profiles. Gary H. Crow* and W.E. Howell, University of Saskatchewan, Saskatoon, Sask. S7N 0W0.

The winter feeding program for beef cows is one aspect of beef cow management which may be a production bottleneck limiting calf weaning weights. Since the beef calf is largely dependent upon its dam for nutrient supply until weaning, cow nutritional management is expected to be very important. In addition to the management aspect, better understanding of the effects of cow nutrition on calf performance has implications for the genetic evaluation of beef cattle. In an experiment conducted with beef cows at the University of Saskatchewan Termeuende Farm, two levels (100% and 130% of NRC recommendations for TDN intake) of winter hay intake (1 Dec. - 26 Mar.) were imposed in a factorial manner upon a mature cow group (Herefords) and a group of predominantly first-calf heifers (Angus x Hereford, Hereford, and Simmental x Hereford). Differences in cow weights between treatments at calving were achieved with the mature cow group. With the heifers, hay intake was adjusted on 1 Feb. with the result that the high and low intake heifer groups received similar total amounts of hay over the feeding period and did not differ in weight at calving. Birth weights and ADG of calves from these heifers were not affected by winter treatment. Winter feeding level significantly influenced average daily gain from birth to weaning ($P < 0.05$) but not the birth weight ($P > 0.05$) of calves from mature cows.

Breeding and Genetics

The use of doppler sound for pregnancy diagnosis in the ewe. W.E. Howell* and W. Lough, University of Saskatchewan, Saskatoon, Sask. S7N 2R3.

The early detection of pregnancy in sheep would provide a means of elevating the reproductive efficiency of the operation either through culling down or repeat mating of those declared non-pregnant. The present work was undertaken to determine the performance parameters of a commercially available instrument using an external probe for pregnancy detection in a commercial sheep operation. Groups of Finn cross ewes bred in the spring and fall were subjected to ultrasound examination by the same technician at intervals of 4-7 days beginning 4-8 wk after introduction of rams. Of the spring-bred ewes, 28 of 32 pregnant ewes were detected (88%) by the ultrasound instrument. The earliest detection was at 46 days of gestation with 100% accuracy of detection occurring at and after 71 days. Of 636 examinations of the fall-bred ewes, 448 (70%) were correct in their assessment of the ewe's condition. Of the 188 errors, 165 (88%) occurred prior to 71 days of gestation. The detection accuracy at 71 days was calculated to be 90% in these fall-bred ewes. The error was entirely in the direction of declaring a pregnant ewe to be non-pregnant. The results with ewe lambs were less accurate than for the older ages largely because of the tendency to nervous movement of the young animal upon application of the probe. It was observed that as foetal numbers increased, accuracy (>90%) at earlier stages of gestation improved (51 days for quads, 61 days for triplets, 71 days for twins, 91 days for singles). This would seem to be largely a function of the increased probability of focusing on a foetal umbilicus as their numbers increased. While pregnancy may be detected with acceptable accuracy by mid-gestation in sheep using an external Doppler ultrasound probe, hormonal assay techniques of blood or milk may prove more accurate for earlier diagnosis of pregnancy.

Age effects on heritability of egg production and quality. J.S. Gavora*, K. Ahlen, L.E. Liljedahl, and C. Weyde, Agriculture Canada, Ottawa, Ontario K1A 0C6; and University of Agricultural Sciences, Uppsala, Sweden.

Pullets of generation \( F_2 \) from crossing seven commercial Leghorn stocks were produced by 158 sires and 458 dams. Individual egg production was recorded daily and egg quality was measured on one egg per
bird taken at 4-wk intervals. The data were summarized and analyzed by 28-day periods starting from the day each bird laid the first egg thus giving results synchronized by physiological age. For the 2nd to 14th 28-day periods, mean egg production decreased, egg weight increased and albumen height, shell thickness and strength, as well as egg shape index (width/length), decreased. Average percent heritability estimates from sire variance components for periods 2-14 were 18 for egg production, 66 for egg weight, 23 for egg mass, 43 for egg shape index, 42 for shell thickness, 28 for shell deformation and 54 for albumen height. Significant reduction in percent heritability with age was observed in egg production, egg weight, egg mass, shell thickness and albumen height with the respective reductions per period of \(-0.6, -2.8, -1.0, -1.9, \) and \(-1.8\%\). The reductions in heritability were a consequence of an increase in the within half-sib family components, while the sire variance components were relatively stable. This indicated that the sensitivity of the organism to environmental changes or stimuli may have increased with physiological age and that importance of non-additive genetic variation, also included in the within half-sib variance component, may have become larger in older birds.

Mathematical models in poultry egg production. I. McMillan*, J.S. Gavora, and R.W. Fairfull, University of Guelph, Guelph, Ontario N1G 2W1; and Agriculture Canada, Ottawa, Ont. K1A 0C6.

Egg production curves for groups of hens when expressed on a weekly, biweekly or monthly basis, show a rapid increase to some maximum level from which production falls off at a slower rate. Most individual hens exhibit this production pattern although some deviate significantly from it. Production curves have been described by nonlinear exponential models but can be fitted to simpler equations such as polynomials in time or, after the maximum rate has been achieved, either by linear or log linear curves. Using egg production records, adjusted for ‘age at first egg’ for each hen, several egg production models were compared for their ability to describe average weekly data. The same models were compared on the basis of their predictive ability for 51-wk production using the initial 15 wk or 20 wk of egg laying data. It was found that both the quadratic equation and an exponential model produced fits to the production data that had coefficients of determination of the order of 0.90. The exponential model was superior to the quadratic equation for 51-wk production prediction from both initial 15 and 20 wk of collected data. The predicted values for the exponential model were generally within 6% of the actual 51-wk production, while the predicted values from the quadratic equation were very far from the actual values.

Use of linear measurements in ROP bull testing programs. Gary H. Crow* and W.E. Howell, University of Saskatchewan, Saskatoon, Sask. S7N 0W0.

The recent introduction (1 July 1981) of a frame scoring system for feeder cattle in Canada has stimulated renewed interest in the use of linear measurements in beef cattle Record of Performance (ROP) testing programs. Reported here are the results of an analysis of hip height (HH), heart girth (HG), start of test weight (SW), final weight (FW), test gain (TG) and ultrasonic backfat (BF) collected on Angus, Charolais and Hereford bulls completing the 140-day test at the Saskatchewan Central Beef Cattle Test Station, Saskatoon in the 2 years, 1980 \((n = 265)\) and 1981 \((n = 212)\). HH measurements on the 1980 test group were taken on 2 Apr., the day following the final test weighings. For the 1981 test group, HH and HG were measured on 7-8 Jan. and 17-18 Mar. with the final test weighings on 31 Mar. The 2 yr data were analyzed separately. Results from these analyses were consistent in that the effects of dam age and bull breed on HH were significant \((P < 0.05)\) in the 2 yr. In both years, bull age had no significant effect \((P > 0.05)\) on any of the HH measurements. HG measures collected in 1981 were significantly affected by dam age, bull breed and bull age. Within-breed and year correlations were calculated. It was found that final HH was significantly \((P < 0.05)\) correlated to starting and final weights in all three breeds in both years. HG measurements collected in 1981 were strongly correlated to all other measurements in all three breed groups. To use HH and HG in bull testing, age of dam and breed adjustments would be necessary. Their relationship to the subjective frame score must also be clarified.

Phenotypic, environmental and genetic trends were estimated for several growth traits in a purebred Hereford (HE) and a Beef Synthetic (SY) population. A total of about 3000 records for the period 1970-1978 from the University of Alberta Ranch at Kinsella were available for the analyses. Three techniques were used to estimate the trends. These were: (1) use of control population, (2) repeat mating design, and (3) BLUP. I. Using a control population it was determined that the genetic trend in birth weight of HE was 0.06 ± 0.21 as compared to 0.28 ± 0.22 kg/yr in SY. Genetic gains of 9.7 ± 5.4 g/day for preweaning average daily gain (ADG) and 1.81 ± 1.03 kg/yr for weaning weight were recorded in HE. The corresponding values in SY were 7.5 ± 4.9 g/day and 1.65 ± 0.92 kg/yr. II. Using a repeat mating design, positive phenotypic trends were obtained for all the traits. Birth weight showed a negative genetic trend of -0.26 ± 0.12 kg in HE and -0.27 ± 0.20 kg/yr in SY. Preweaning ADG and weaning weight in HE showed a genetic gain of 3.25 ± 2.77 g/day and 0.13 ± 0.60 kg/yr, as compared to the corresponding gains of 7.76 ± 3.25 and 0.93 ± 0.53 in SY. III. BLUP estimates of genetic gains in HE and SY for birth weight, preweaning ADG and weaning weight were 0.08 ± 0.06 and 0.07 ± 0.06 kg/yr, 4.2 ± 1.2 and 4.8 ± 2.3 g/day, and 1.10 ± 0.21 and 0.86 ± 0.43 kg/yr, respectively. In general, response to selection was more favorable in the SY population than in the HE.

**Repeatability of measurements of beef cow efficiency.** J.W. Wilton* and H. Song, University of Guelph, Guelph, Ontario N1G 2W1.

The repeatabilities of traits influencing efficiency of production of beef cows were estimated using data on 261 cows having up to three parities each. Cows were individually fed on a haylage: corn silage diet and calves were creep-fed a mixture of haylage and oats. During the finishing period, calves were fed basically a corn silage and high-moisture corn diet with feed intake determined by consumption per pen of 1-4 animals of similar breeding divided by animal days. Calvings were over a 7-yr period in both spring and fall (experimental group). Repeatability estimates were obtained by Henderson’s Method III. The statistical model included experimental group by parity subclass, sex of calf, breed group, cow and error effects. Estimated repeatabilities were 0.24 for calf weaning weight; 0.19 for calf slaughter weight; 0.33 and 0.14 for estimated metabolizable energy (ME) consumed by cow and calf to weaning and to slaughter, respectively; 0.11 for the ratio of ME consumed to weaning weight and 0.06 for the ratio of ME consumed to slaughter weight. Repeatabilities of differences between estimated returns from sale of calf and fixed costs were 0.17 up to weaning and 0.09 up to slaughter. Repeatabilities to weaning were higher than to slaughter because they were influenced more by the cow than the calf which had a sample half of genes from the dam. The repeatabilities indicate that culling of cows on measurements associated with efficiency could be effective.

**Factors influencing dystocia in three breeding groups of beef cattle.** M. Makarechian* and R.T. Berg, University of Alberta, Edmonton, Alta. T6G 2E3.

Data from 2964 calving records of three breeding groups of beef cattle, Hereford, Beef Synthetic and crossbred at the University of Alberta Ranch at Kinsella were analyzed by the least squares procedure to study the relative importance of some major factors and their interactions on the incidence of dystocia. Dam weight at calving was the most important factor influencing calving performance followed by the interaction between calf birth weight and age of dam. The effects of age of dam and calf birth weight were both highly significant. The incidence of dystocia was considerably higher among heifers calving at 2 yr of age as compared to older cows. The interaction between age of dam and breeding group was highly significant. Hereford heifers encountered the highest incidence of dystocia. While sex of calf did not have a significant influence on calving performance when calf birth weight was held constant, the interaction between sex of calf and age of dam was significant. These significant interactions emphasize the
importance of interrelationships of major factors influencing the incidence of dystocia. The effects of sire and dam birth weights were both significant but not considerable when calf birth weight was held constant. All factors considered in the model accounted for over 39% of total variation in calving performance.

Genetic aspects of casein in milk. J.F. Hayes*, K.F. Ng Kwai Hang, and J.E. Moxley, Macdonald College of McGill University, Ste. Anne de Bellevue, Quebec H9X 1C0.

Individual milk samples were obtained monthly from November 1979 to March 1981 from approximately 28 000 Holstein-Friesian cows in 63 herds enrolled in the Quebec Dairy Herd Analysis Service program. In all 24 405 samples were assayed for total protein and casein. Twelve hundred complete lactations were represented in the data, of which 867 were sire-identified. After further data editing, 583 lactations in 59 herds and representing 34 sires were available for analyses. The model used in the statistical analyses of the data included the effect of herds, calendar month and parity as fixed effects and sires and error as random effects. Maximum likelihood estimates of genetic and environmental components of variance were used to estimate heritabilities and genetic and phenotypic correlations. Heritabilities of casein yield, casein percent and casein number (percent casein in protein) were estimated to be 0.07 ± 0.08, 0.24 ± 0.13 and 0.17 ± 0.10, respectively. Genetic correlations between casein yield and milk yield, fat yield, protein yield, fat percent and protein percent were 0.75, 0.03, 0.98, 0.11 and −0.01, respectively, and corresponding phenotypic correlations were 0.92, 0.87, 1.01, −0.01 and 0.02, respectively. Genetic correlations between casein percent and milk yield, fat yield, protein yield, fat percent and protein percent were −0.80, 0.12, 0.03, 0.00 and 0.91, respectively, and corresponding phenotypic correlations were −0.25, 0.11, 0.04, 0.56 and 0.80, respectively. Genetic correlations between casein number and milk yield, fat yield, protein yield, fat percent and protein percent were −0.08, −0.29, −1.04, 0.19 and −0.38, respectively, and corresponding phenotypic correlations were 0.04, 0.04, 0.04, 0.00 and −0.23, respectively.

Genetic differences among herds for milk yields. L.R. Schaeffer*, University of Guelph, Guelph, Ontario N1G 2W1.

Cow estimated transmitting abilities (ETA) for milk yield and fat percent derived by best linear unbiased prediction methods were used to compute averages for each herd and year of calving subclass. Means and variances of herd averages were tabulated according to province code, herd size, and year of calving. The genetic trends in herd averages within herd size categories were positive for milk yields and negative for fat percent. The variance of herd averages has increased since 1958 within herd size categories, but has decreased over all herds due to a shift in size of herds since 1958. Herds with fewer than 20 cows represented 31.7% of the herds in Canada in 1977 while in 1958 they represented 72.4%. However, in 1977 the larger herds did not show any genetic advantage over smaller herds. Ontario herds of size 20-49 cows showed greater variability in genetic averages for milk and fat percent than in any other province. Correlations among traits on a herd average basis have not changed in the last 10 yr even though herd averages have changed substantially over the same period. Herd genetic differences accounted for only 2.05% of the herd phenotypic differences for milk yield and 12.74% for fat percent.

Calving ease statistics in Ontario and methods of sire evaluation. R.A. Cady and E.B. Burnside*, University of Guelph, Guelph, Ontario N1G 2W1.

Records of calving ease have been collected on a continuing basis by the Ontario Dairy Herd Improvement Corporation since May 1980. As of May 1981, 30 376 records have been collected for five dairy breeds; the majority being for Holsteins (29 506). Information collected included dam and sire ID, size and parity of cow, date of birth, sex of calf, calf size, vigor and a calving ease score which was (1) for
unassisted, (2) easy pull, (3) hard pull and (4) surgery. Malpresentations were noted in a comment column. Breed statistics were calculated. Holsteins have more dystocia problems than all other breeds and a higher neo-natal calf mortality than any other breed except Jersey. The frequency of calving scores for Holsteins were (1) 57.5%, (2) 29.8%, (3) 12.1% and (4) 0.4%. Overall stillbirth rate for Holsteins was 8.1%, the stillbirth rate for heifer dams was 12.7% vs. 6.4% for cow dams. Stillbirth frequencies increased with increasing calving ease scores. Holstein sire evaluations were done, using a model which included fixed herd-year-season effects, a fixed cow size-sex of calf-parity effect, a random sire of calf effect and error. The relationship matrix was included in the evaluation. Variance components were estimated using Henderson's new method. These yielded a $h^2$ equal to 0.075 for Holsteins. Evaluations were done for 1233 bulls. Ratings were reported as difficult ($<\mu + 1$ SD), average ($1\ SD - \mu + 1$ SD) and easy ($<\mu - 1$ SD).

Calving ease and calf survival as a trait of the sire's daughters. Alain Lapostolle*, J.F. Hayes, and J.E. Moxley. Macdonald College of McGill University, Ste. Anne de Bellevue, Quebec H9X IC0.

A total of 44 252 Holstein records, collected on the Dairy Herd Analysis Service program from September 1979 to March 1981, and identified by the cow and the cow's sire, were analyzed for calving performance as a trait of the sire's daughters. The definition for ease of calving assigned a value of 100 if calving was unobserved, unassisted or slightly assisted; a value of 50 if much assistance was required; and a value of 0 if surgery was required. For purpose of analysis, the data were divided into those for heifers, those for second and later parities, and finally all parities were considered together. The data were analyzed using a linear model which included the effects of herd, age of cow (expressed in months in the case of heifers and parity in the case of older cows or when all cows were considered), seasons of calving, sex of calf, and interactions (age by season of calving, age by sex and sex by season of calving) as fixed effects; sires and error were included as random effects. Results indicated that parity, season of calving and parity by sex were significant ($P < 0.01$) when all parities were considered, but for the heifers, month of calving, sex ($P < 0.01$) and age ($P < 0.05$) were significant. Heritability, estimated as four times the ratio of the sire to the sum of the sire and error variances, was 0.04 for heifer data. Rank correlations between sires' proofs indicated that sires ranked differently for calving ease of their daughters then they did for calving ease of their mates.


Data on conception rate, gestation length, ease of calving, and placental condition were obtained from 269 heifers and 525 cows as mates of the pureline foundation phase sires of the National Cooperative dairy cattle breeding project. Calvings from January 1973 to December 1974 were included. Groups of service sires included were Research Branch Ayrshire, Finnish Ayrshire, Canadian and U.S. Ayrshire, Brown Swiss, and Norwegian Red bulls in the Ayrshire-based A line and Research Branch, Canadian, and U.S. Holstein bulls in the Holstein-based H line. The data were analyzed by least squares separately for heifers and cows using a model containing fixed effects for station, year of calving, season of calving, sex of calf, line, service sire group within line, service sire within sire group within line, and birth weight of the calf as a covariable. In addition, for heifers age at calving was used as a covariable and for cows lactation number was added in the model. The effect of line and service sire group within line were significant ($P < 0.01$) on gestation length both in heifers and cows. The average gestation length of H line heifers (277.9 days) and cows (279.3 days) were significantly shorter than A line heifers (280.4 days) and cows (282.8 days), respectively. The shortest average gestation lengths were 276.0 ± 1.4 and 278.4 ± 1.1 days for Research Branch Ayrshire heifers and cows, respectively, when mated with Canadian Ayrshire bulls while the longest were 284.1 ± 1.3 and 286.5 ± 1.1 days, respectively, for Research Branch Ayrshire heifers and cows mated to Brown Swiss bulls.

Survival from first through fourth lactations and the incidence and cost of health care were recorded on 1522 lactations of H line and 1051 lactations A line cows in the five project herds. The H line cows resulted from the foundation matings of Research Branch, Canadian and U.S. Holstein bulls to Research Branch Holstein cows. Matings of Research Branch Ayrshire cows to Research Branch, Canadian, U.S. and Finnish Ayrshire, U.S. Brown Swiss and Norwegian Red bulls produced the A line foundation cows. Health care case and cost records were summarized by lactation for each of seven categories; respiratory, reproductive, metabolism, mastitis, udder injury, injury and other. Progeny of the Research Branch Holstein bulls had the least total health cost and were intermediate to the progeny of the Canadian and U.S. Holstein bulls in most categories. Daughters of U.S. Holstein bulls had the highest mastitis and udder injury costs while having the lowest respiratory, reproductive and metabolism costs. Among the A line progeny groups, daughters of the U.S. and Finnish Ayrshire sires had the largest reproduction cost and the least mastitis cost. The progeny of the Brown Swiss bulls incurred the least total health cost per lactation. Only differences due to herd and disposal reason category (death from natural causes; culled or died from injury, disease or other; culled for low production or fertility) were significant (P < 0.05) for age at disposal. Cows leaving the herd due to disease were 557 days younger than cows culled for low milk yield (1795 vs. 1238 days). No line or sire group differences were found for disposal age.

Physiology and Meats

Bovine culdoscopy. B.R. Downey*, K.J. Betteridge, and P.C. Lague, Macdonald College of McGill University, Ste. Anne de Bellevue, Quebec H9X 1C0.

A culdoscopic technique for the observation of bovine ovaries in situ was developed. A stainless steel trochar with cannula 45 cm in length was designed and constructed and an inflatable rubber cuff was cemented to the distal end of the cannula. The diameter of the cannula was sufficient to allow the passage of an endoscope (Storz Co., Tutlingen, Germany) attached to a fiber optic light cable and light source. A plastic and nylon cannula, designed to be left indwelling in the vaginal wall, was also constructed. With the animal under epidural anesthesia and with the aid of a plexiglass speculum, the trochar and cannula were made to penetrate the upper fornix of the vagina. By rectal palpation, proper position of the cannula was ascertained, after which the trochar was removed and the cuff was inflated with 20 mL saline. To test the technique, six heifers in mid-luteal phase of their estrous cycles were superovulated with PMSG and prostaglandin. Each animal was implanted with an indwelling catheter and ovaries were observed and photographed every 8 h up to 11 times. Observations were confirmed at laparotomy 7 days later and were supported by peripheral plasma progesterone profiles.


Circulating levels of reproductive hormones were assessed for adult rams treated with triiodothyroïne (T3). Five rams were given daily sc injections of T3 (250 μg in 1 mL saline) over a 15-wk period (July-Oct.), and five additional rams were injected with vehicle only. During the 2 wk preceding and the 17 wk following the onset of treatment, single blood samples were collected (1500 h) every 3 or 4 days by venipuncture from the jugular vein; sera were pooled by week and assayed for T3 and glucose concentrations. Blood samples were also collected every 20 min for 8 h (0900-1700 h) during wk -2, +3, +5, +9, +13 and +17 relative to onset of treatment; serum pools representing the 8-h periods were assayed for testosterone (T), LH, FSH and prolactin concentrations. Treatment produced an
immediate and sustained 10-fold increase ($P < 0.01$) in serum $T_3$ level. However, $T_3$ levels in treated rams were below normal ($P < 0.05$) during the 2-wk post-treatment period. Serum glucose concentration was increased 20% ($P < 0.01$) by wk 2 of treatment and remained elevated until cessation of $T_3$ injection. Treatment with $T_3$ also resulted in minor elevations in rectal temperature during wk 2 and 5 of treatment ($\sim 2^\circ C$, $P < 0.05$), and a reduction in body weight by wk 13 (10%, $P < 0.05$). $T$ levels increased sevenfold between July and October. Treated rams exhibited higher ($P < 0.05$) levels in September (wk 9 of treatment) and lower ($P < 0.01$) levels in November (wk 2 post-treatment), relative to control rams; lower $T$ levels in November were associated with decreased ($P < 0.05$) LH and $T_3$ levels. FSH and prolactin levels were always comparable for both groups of rams. $T_3$ treatment appeared to produce a transient increase in circulating $T$.


Various parameters of reproductive function were assessed for adult rams treated with triiodothyronine ($T_3$) over a 15-wk period (July-October). Five rams were given sc injections of $T_3$ (250 µg in 1 mL saline), while five additional rams were injected with vehicle only. Scrotal circumference (SC) measurements were taken every 2 or 4 wk. Blood samples were collected by venipuncture from the jugular vein every 20 min for 8 h (0900-1700 h) during wk $-2$, $+3$, $+5$, $+9$, $+13$, and $+17$ relative to the onset of treatment; serum pools representing the 8-h periods were assayed for testosterone ($T$) concentration. Three ejaculates were collected from each ram during wk $-1$, $+5$, $+10$ and $+15$, and semen quality assessed. Libido was tested during wk $-2$, $+4$, $+6$, $+10$ and $+14$ by penning rams individually with two estrous-induced ewes for 4 h and recording ejaculation and mounting frequency. SC measurements were comparable for all rams during the initial 13 wk of treatment, but were below normal ($P < 0.05$) for treated rams ($33.1 \pm .7$ vs. $25.1 \pm 1.1$ cm) by wk 15 (October). Seasonal increase in circulating $T$ occurred between July and October with treated rams exhibiting higher ($P < 0.05$) levels in September (wk 9 of treatment) and lower ($P < 0.01$) levels in November (wk 2 post-treatment) than control rams. Seminal plasma $T$ levels for treated rams were also above ($P < 0.01$) and below ($P < 0.05$) normal in August (wk 5 of treatment) and October (wk 15 of treatment), respectively. Treated rams ejaculated 25% more spermatozoa ($P < 0.05$) in August than did control rams. Ejaculation and mounting frequency were always comparable for all rams. $T_3$ treatment appeared to have a slight, transient, beneficial effect on some reproductive processes of rams.


Cows from the Holstein-based line, Ayshire-based line and their crossbreds of the National Cooperative Dairy Cattle Breeding Project which calved during 1980 were randomly assigned to one of four pens in the loose-housing barn with year-round confinement. During the 6-mo periods, estrus was detected by casual observation (January-June) and by four methods (July-December) namely: (1) herdsman (H) — observation daily for two 1-hr periods, 0600 to 0700 and 1700 to 1800 h; (2) androgenized female (A) — female treated with testosterone and equipped with a chinball marker, and KaMaR heat detectors on cows; (3) casual observation (C) as for the 1st 6 mo and, (4) KaMaR heat detectors (K) only. Each estrus was recorded and cows were inseminated at each estrus subsequent to 56 days postpartum. The estrus detection rate in the first 6 mo (65%) exceeded that of the last 6 mo (46%). During the last 6 mo estrus was detected in 53, 49, 46 and 36% of the cows by the H, A, C and K methods, respectively. There were no significant ($P > 0.05$) differences among the three lines for the detection of estrus prior to 56 days postpartum during either period. The efficacy of KaMaR heat detectors was diminished by accidental triggering against the restraining bars. From July to November, two androgenized females, lacking aggressiveness, identified fewer cows in estrus than a third such female (November-December).

Three groups of four sheep were given either rolled barley plus canola meal (674 g OM, 18.3 g N/day), chopped alfalfa hay (979 g OM, 26.5 g N/day) or chopped brome grass hay (1070 g OM, 21.7 g N/day). Two sheep from each group were exposed to ambient temperatures of 1-5°C or 22-24°C for 5 wk per period in a crossover experimental design. Estimates of ruminal transformations of N were made using ruminally-infused $^{58}$Co-EDTA and $^{103}$Ru-P as digesta flow markers. $^{15}$N-ammonium chloride and $^{15}$N-urea were infused sequentially into the rumen and jugular vein. Cold exposure did not affect N digestibility for the barley diet, but significantly reduced that for alfalfa and brome grass hays from 75.2 to 71.7% and 60.8 to 57.0%, respectively. Postruminal digestibility of non-ammonia N (NAN) was not depressed significantly during cold exposure but it increased NAN flow from the rumen on the hay diets. The majority of this increased flow comprised undegraded dietary N. Urea recycling from the blood contributed significantly approx. 2.3, 1.4 and 4.7 g N/day to the rumen, comprising 15, 10 and 30% of ammonia entering the rumen pool for sheep given the barley, alfalfa and brome grass diets. The depression in N digestibility of hay in the cold-exposed sheep of this study appears to result from depressed ruminal digestion.

Control of androstenone (boar taint) by active immunization or testosterone. Daniel L. Grinwich* and R.L. Cliplef, Agriculture Canada, Brandon, Manitoba R7A 5Z7.

Lacome boars ($n = 16$) were injected sc with 2 mg 5 α androstenone-oxine-BSA conjugate at 12, 14, 16, 19 wk of age to generate serum 5 α androstenone (5 α one) antibodies. Alternately L boars had 200 mg testosterone-impregnated silastic implants (TIs) inserted sc 12, 14 wk. Littermates assigned at 12 wk age included: control boars, TI barrows, control barrows, gilts ($n = 16$/group). Serum was collected weekly from all six groups (12-13 wk) and fat by biopsy (16-22 wk); 5 α one was measured by radioimmunoassay of serum/fat. A decrease in serum 5 α one levels was noted in 5 α one-immunized (Im) boars and TI boars at 21 wk serum 5 α one: control boars 83 ± 0.12 ng/mL, Imboars 0.41 ± 0.07, 0.28 ± 0.07 ng/mL. The 21-wk levels in serum of control barrows, TI barrows, gilts: 0.41 ± 0.07, 0.31 ± 0.06, 0.28 ± 0.07, respectively; all groups had lower serum 5 α one levels than the control boar group ($P < 0.05$). Unexpectedly, a very poor correlation between serum and fat 5 α one levels was observed ($P > 0.05$). Despite evidence of an upward trend in serum 5 α one levels in control boars 16-22 wk fat 5 α one levels were not significantly different at 16-22 wk. Fat 5 α one levels at 16 wk were not different from that at 22 wk for any of the groups. Nor did the mean fat 5 α one levels in control boars differ significantly from the other five groups at any of the sample periods ($P < 0.05$) though the levels tended to be higher in the Im group, lower in the TI group. These results suggest that despite differences in z serum 5 α one level boars, barrows, gilts, fat 5 α one levels are equivocal at near market weight. Gift of 5 α one 3H by Syntex Co Palo Alto Calif is gratefully acknowledged.

Relationship between backfat thickness and total body fat in 90-kg boars. J.I. Elliot* and A. Fortin, Agriculture Canada, Ottawa, Ontario K1A 0C6.

Forty-eight Yorkshire boars were individually fed from 56 ± 3 days of age to slaughter at a mean body weight of 90.9 kg ± 2.90 (SD) and mean age of 147 days. Following slaughter, backfat thickness measured with a ruler at the last rib and 15 cm posterior to the last rib, corresponding to the Canadian ROP measurements, varied from 12 to 24 mm and 13 to 30 mm, respectively. The chemical fat (ether extract) content of the carcass (including internal fat), viscera (empty of feed residues) and head was determined. Average daily gain and feed efficiency from 56 days of age to slaughter were 0.85 kg ± 0.07 and 2.53 ± 0.24, respectively. Relationships between weight or percentage of chemical fat (total, carcass, viscera and head) and backfat thickness (last rib) were determined. Linear regression coefficients for weight of fat in carcass, viscera and head and of total fat were 0.38 ($P < 0.05$), 0.007 ($P > 0.05$), 0.007 ($P > 0.05$)
and 0.39 (P < 0.05), respectively and as a percentage of body weight, 0.40 (P < 0.05), 0.005 (P > 0.005), 0.004 (P > 0.05) and 0.41 (P < 0.05), respectively.

The influence of carcass fatness on broiler feed efficiency. J.R. Chambers*, A.A. Grunier, and A. Fortin, Agriculture Canada, Animal Research Institute, Ottawa, Ontario K1A 0C6.

Sixty commercial broiler chickens of each sex were housed individually in cages and had feed consumption and weight gain measured between the ages of 28 and 48 days. The broilers were fasted at least 18 h and slaughtered when 49 days old. Eviscerated carcasses were ground and analyzed for chemical composition. Respective male and female means for feed efficiency (gain/feed) and carcass traits were as follows: feed efficiency (28 to 48 days) 0.47 and 0.44; carcass weight 1289 and 1100 g; percentage fat 17.7 and 20.0; percentage moisture 61.9 and 60.2; percentage protein 17.7 and 17.2 (wet basis) and 46.5 and 43.4 (dry matter basis); percentage ash 2.55 and 2.42. Correlations between feed efficiency and chemical component percentages were --0.57 for fat; 0.56 for moisture, 0.44 for protein and 0.24 for ash. The correlation with protein expressed as a percentage of carcass dry matter was 0.55. High correlations were observed among percentages of fat, moisture and protein, the latter on a dry matter basis. Multiple regression models containing carcass weight and chemical component percentages as predictors accounted for up to 56% of the variation in feed efficiency. More efficient broilers were leaner, and, due to the strong relationships among fat, moisture and protein, these components appeared to have comparable value for predicting feed efficiency.

Sensory evaluation of light, heavy and yearling lamb. W.E. Howell*, A. Sumner, and G.H. Crow, University of Saskatchewan, Saskatoon, Sask. S7N 0N0.

To determine the validity of market price penalties on sheep exceeding stated weight and age limits, a study was conducted to evaluate consumer acceptability of meat from carcasses from sheep of various weights and ages. Acceptability was based on three sensory panel evaluations of flavor, aroma, texture, juiciness and color of roast legs from live weight (43.4 kg) and heavy (53.2 kg) ewe lambs and from yearling ewes (57.9 kg), all of Finish Landrace × Dorset breeding. Although there were slight variations in sensory evaluations between the panels (a result of differences in ages and eating experiences of the panel groups?) there was no significant difference in the scoring of, and hence the preference for, any of the three weight/age categories in the pooled sensory evaluations. Since the heavier and older sheep in this study provided roasts which were as acceptable as those from lighter younger animals, there appears to be no justification for imposing market price penalties on heavier animals. In the absence of a penalty, lamb producers could be encouraged to use more efficient, more rapidly growing, heavier breeds of sheep in crossbreeding systems to provide the market with a greater weight and age range of product to suit a variety of consumer preferences.


The influence of sodium pentobarbital on motility and fertilizing capacity of ram sperm stored at 5°C was studied. Sperm was collected by artificial vagina from 10 adult rams housed in total confinement under a decreasing light pattern. Pooled semen was divided into six equal portions and diluted with four parts of isotonic skim milk diluent consisting of 11% reconstituted skim milk, enriched with antibiotics and pH adjusted to 6.8 with 800 mV trisodium citrate; osmolality of 320 mOsm/kg water. Each portion contained either 0, 50, 100, 150, 200 and 300 mg sodium pentobarbital/L diluent. Extended semen samples were cooled at 0.3°C/min to 5°C and stored for up to 7 days. Although the overall spermatozoa motility in diluent containing 150 mg of sodium pentobarbital was higher (P < 0.05) than in the remaining diluents, the magnitude of the difference was small. The average percent sperm (73%) motility and forward sperm
progression (4.0) for all sodium pentobarbital concentrations observed at the start of storage declined gradually to 22% and 2.1, respectively, after 7 days. The pregnancy and lambing rates of 70% and 63.3% in ewes inseminated at synchronized estrus with semen extended with 150 mg of sodium pentobarbital and stored for 1 day did not differ significantly from the respective rates of 73% and 66.7% in the synchronized ewes inseminated without sodium pentobarbital. The data indicate that sodium pentobarbital had a limited effect on preserving motility of stored ram sperm and no effect on fertility.

Ruminent Nutrition


Four steers (309-343 kg) were each fed 5.5 kg daily of long or ground mature grass hay in equal portions every 2 h. Feed boluses collected at the cardia, rumen digesta and faeces were wet-sieved using screen sizes of 6.8, 4.0, 3.2, 2.0, 1.0, 0.71, 0.50 and 0.25 mm. The first-order rate constant of flow from the rumen of each rumen particle group was calculated as the estimated flow of the particle group at the duodenum divided by the pool size of that particle group in the rumen. The rate constants of 2.0-, 1.0-, 0.71-, 0.50-mm and 0.25-mm particle groups were similar (mean 1.17 days⁻¹), indicative of a homogenous small particle pool. The rate constant for 2.00-mm particles (0.99 day⁻¹) tended to be less and that of 0.25-mm particles more (1.41 day⁻¹) than that of the intermediate particles. The rate constants of 3.2-, 4.0-, and 6.8-mm particles were less at 0.60, 0.23 and 0.001 day⁻¹, respectively, indicating a gradational increase in resistance to movement from the rumen. There was a tendency for the small particle rate constants to be greater with long hay (1.27 day⁻¹) than ground hay (1.07 day⁻¹). The rate constant of ¹⁰⁹Ru-P was 0.96 day⁻¹ and that of ⁵¹Cr EDTA was 1.86 day⁻¹.

Corn silage preserved with cold-flow ammonia and its digestion by steers. J. Buchanan-Smith*, University of Guelph, Guelph, Ontario N1G 2W1.

Corn was harvested on two dates at 22 or 30% DM and, at both dates, was either ensiled without additive or with cold-flow ammonia (1% DM basis). Ammonia caused silage to have higher pH, lactic and acetic acids and true protein-N. Acetic acid was higher in 22% vs. 30% DM silage but otherwise DM did not affect composition. Recovery of DM was 86.92, 86.02, 80.21 and 79.06% for untreated 30% DM, ammonia-treated 30% DM, untreated 22% DM and ammonia-treated 22% DM silages, respectively. Corresponding recoveries of nitrogen were 99.24, 85.41, 82.09 and 70.76%. Recoveries of nitrogen from added ammonia were between 50 and 60%. Silages were fed for 98 days to yearling steers. Untreated silages were either unsupplemented with protein (NEGCON) or supplemented with NPN (POSCON) and compared to ammonia-treated silages. There were no interactions between DM and protein. DM intake (DMI) and average daily gain (ADG) were higher for 30% vs. 22% DM silage. DMI (kg/day), ADG (kg/day) and DMI:ADG for NEGCON, ammonia-treated and POSCON (SEM in parenthesis) were 6.70, 7.82, 7.82 (0.13); 0.82, 1.26, 1.18 (0.031); 8.28, 6.20, 6.65 (0.19). In a digestion trial evaluating 30% DM silage only, digestion of DM, organic matter and ADF was greatest for ammonia-treated corn and least for unsupplemented corn with NPN-supplemented not significantly different from ammonia-treated corn.


Treatments of high moisture shelled corn were compared in diets containing approximately 60% (DM basis) corn silage. In an initial digestibility trial, treatments were: (1) ensiled, ground; (2) 1.5% (wt/wt)
mixture of acetic: propionic acid, whole; (3) 2% (wt/wt DM basis) anhydrous ammonia, whole. Treatments were evaluated with six yearling steers in a double 3 x 3 latin square design. Urea was included in the ensiled and acid-treated corn diets to supply sufficient nitrogen. Ammoniating whole corn resulted in similar starch and energy digestibilities compared to ensiled ground corn. However, a large decrease in starch digestibility occurred with acid-treated whole corn. Digestibility of acid detergent fiber was greater (P < 0.05) with both ammoniated and acid-treated whole than ensiled ground corn. In a feedlot trial, two high moisture corn treatments compared were: (1) ensiled, ground; (2) 3.7% (wt/wt DM basis) urea, whole. Eighty Hereford yearling steers compared the two corn diets each with or without monensin. Temperatures rose steadily within bins plateauing approximately 2½ wk after storage. The amount of urea which hydrolyzed to ammonia varied depending upon location within bins. A total of 1.4% DM loss occurred during storage. Urea treatment tended to slightly reduce liveweight gain and feed efficiency. Monensin decreased intake (P < 0.05) and slightly improved feed efficiency (P > 0.05) with both types of corn. Effects of monensin on rumen VFA were similar with both corn diets. Type of corn had no effect on rumen VFA proportions.


Two trials were conducted to study the effects of adding buffers to various all-concentrate beef cattle rations. In trial 1, ninety-six crossbred steers, average weight 290 kg, were randomly assigned to four treatments. Each treatment contained three equal replicates. A sodium bicarbonate (NaHCO₃) level of 0.8% was mixed into the steam-rolled barley ration for two treatments. For the 112-day feeding period the pooled ADG, feed/head/day (F/H) and feed/unit gain (F/G) were 1.22 kg, 8.61 kg, 7.05 for NaHCO₃-fed steers and 1.39 kg, 8.84 kg, 6.36 for the controls, respectively. A second trial was conducted to examine the effects of a combination buffer, 50% NaHCO₃ and 50% limestone (CaCO₃) on feedlot performance when Avoparcin was included in the ration. One hundred and sixty Hereford steers, average weight 362 kg, were randomly allotted to four treatments in a 2 x 2 factorial design. Each treatment contained five equal replicates. Steam-rolled barley rations were formulated to contain 0 or 2% buffer and 0 or 44 g Avoparcin per tonne. During the first 28 days of the feeding trial, Avoparcin appeared to improve ADG (1.72 vs. 1.56 kg) and F/G (6.05 vs. 6.71). Feed intake per day was not affected by Avoparcin. For the total period, combination buffer did not affect (P > 0.05) ADG, F/H and F/G which were 1.54 kg, 10.23 kg, 6.73 for Avoparcin treatments and 1.60 kg, 10.45 kg, 6.60 for treatments without Avoparcin, respectively. For the same period, ADG, F/H, F/G were 1.58 kg, 10.45 kg, 6.65 for the buffered treatments and 1.56 kg, 10.23 kg, 6.67 for treatments without buffer, respectively. These treatment effects were not significant (P > 0.05). Treatments did not appear to affect carcass quality.


Cation exchange capacity of neutral detergent cell walls was measured using copper adsorption. Exchange values ranged from 10.0 to 99.81 meq per 100 g cell wall. Legumes and processed meals tended to be the highest. Extensive analysis of timothy hay, alfalfa, sugar beets, corn silage, oats and wheat middlings after in vitro fermentation indicate a positive correlation of lignin with exchange capacity. Maillard products in processed feeds probably account for their higher values (29.01-99.81 meq/100 g CW). The high cell wall adsorption capacity will be relatively less significant if the cell wall represents a small percentage of the dry matter intake and/or if intake is low. Exchange variability among foodstuffs in conjunction with particle size and rate of fermentation plays an important role in rumen ecology. Intake of foodstuffs with a large cation exchange capacity and high cell wall content will help buffer against gastrointestinal acidosis caused by rapid fermentation and volatile fatty acid production.
Effect of nitrogen from brewers’ yeast on cellulose digestion in vitro. L.E. Phillip* and E.R. Chavez, Macdonald College of McGill University, Ste. Anne de Bellevue, Quebec H9X 1C0.

To determine the relative impact of nitrogen (N) from brewers’ yeast (BY) on cellulose digestion in vitro (IVCD), additional N sources provided by ribonucleic acid (RNA), casein, urea and isolated soy protein (SP) were studied in an artificial rumen. All N sources provided 33.5 mg N per tube. Steam-treated aspen wood (0.18% N, 52.4% cellulose) was used as a standard substrate. A rumen-fistulated cow, fed alfalfa hay, served as the source of inoculum. The solid phase of rumen digesta was hand-mixed with phosphate buffer (pH 7.0) to dislodge adherent bacteria. The mixture was then filtered through cheesecloth to produce an incubation medium (pH 7.0) comprising the phosphate buffer extract and a nutrient solution. Samples were incubated at 39°C for 3, 6, 12, 24, 48 and 72 h and at the end of each period the pH was determined. The samples were centrifuged and analyzed for osmolality, ammonia and cellulose. Over 90% of the cellulose in aspen wood was digested after 48 h, with little difference among N sources. After 12 h of incubation, IVCD (%) was greatest with yeast (30.9 ± 4.10) and least with urea and SP. Addition of RNA to the medium resulted in an IVCD of 21.7 ± 5.5 after 12 h. The pH values, averaged over all incubation periods, were 6.12 ± 0.39, 6.43 ± 0.16, 6.47 ± 0.10, 6.40 ± 0.15 and 6.62 ± 0.03 for BY, RNA, casein, SP and urea, respectively. Corresponding estimates of osmolality (mOsm/kg) and ammonia levels (MgN/100 mL) were 395 ± 39, 391 ± 47, 381 ± 30, 351 ± 41 and 385 ± 23; and 15.3 ± 12.7, 19.9 ± 19.6, 25.8 ± 16.7, 16.9 ± 15.0 and 34.6 ± 16.2, respectively.


Potato-hay silages were made from 5:1 and 3:1 ratios by weight of field-run potatoes and chopped hay in November. There was considerable seepage from the silo with the 5:1 ratio, and dry matter contents of the silages were 38% for 5:1 and 41% for the 3:1. Both silages were well preserved and showed little difference in chemical composition of the dry matter or in the digestibility of dry matter or crude protein by sheep (DM, 61–62%; CP 45–51%). The silages were fed to yearling beef steers averaging 400 kg in weight at the start of a 57-day feeding period. There were 10 individually fed animals on each of three treatments: (1) 5:1 silage ad libitum plus 2.5 kg/day for a 18.6% CP concentrate, (2) 5:1 silage ad libitum plus 0.5 kg/day of a 34% CP supplement, and (3) 3:1 silage ad libitum plus 2.5 kg/day of the 18.6% CP concentrate. It was anticipated that energy intakes and gains would be similar for treatments 2 and 3 and higher for treatment 1. Steers given treatment 1 gained faster (1.12 kg/day, P < 0.01) than those given treatment 2 (0.86 kg/day) or treatment 3 (0.94 kg/day). Conversion of dry matter consumed to liveweight gain was more efficient for treatment 1 steers (P < 0.01) but the feed costs of gains were lowest for the treatment 2 steers. It was concluded from this and earlier studies that satisfactory silages can be made from ratios of potatoes to chopped hay varying from 5:1 to 5:2 but that a ratio of 4:1 is about optimum.

Quality of both hay and milk replacer on the performance of dairy heifer calves. Bertrand Lachance, R. Bouchard, G. Roy*, and K. Beauchemin, Agriculture Canada, Lennoxville, Quebec J1M 1Z3.

Forty-eight Holstein heifer calves were used for 17 wk in a 32 factorial experiment. The three were types of hay (timothy or timothy-red clover), levels of soybean concentrate in the milk replacer (45 or 65%) and drying methods of the replacer’s whey (spray or roller). The heifers were weaned off the 23% CP milk replacer after 5 wk. The 18% CP concentrate was fed ad libitum to a maximum of 2.25 kg/day. The timothy and timothy-red clover hays (7.9 and 15.7% CP, respectively) were fed ad libitum. Hay types had no significant (P > 0.05) effect on average daily gain, feed efficiency and intakes of hay, and dry matter which were, respectively, for the timothy and timothy-red clover hays, 0.78 and 0.72 kg, 3.2 and 3.3, 109 and 99 kg, 294 and 286 kg. Level of vegetable protein in the milk replacer had no significant effect (P > 0.05) on these parameters. Although the difference was not significant, average daily gain during the milk feeding period was 15% better for heifers fed the replacer with 45% vegetable protein.
The method of drying the whey did not affect ($P > 0.05$) average daily gain, feed efficiency and intakes of hay and dry matter which were, respectively, for the spray and roller whey, 0.74 and 0.76 kg, 3.2 and 3.3, 101 and 107 kg, 283 and 297 kg while the intakes of concentrate were different ($P < 0.05$) at 170 and 178 kg, respectively. In conclusion, the quality of both the hay and the milk replacer had no effect on the performance of heifers receiving a maximum of 2.25 kg of concentrate for the first 17 wk of life.