ABSTRACTS OF TECHNICAL PAPERS

presented at the annual meeting of the Canadian Society of Animal Science (Eastern Branch), Charlottetown, Prince Edward Island, June 28, 1972. The author who presented the paper is indicated by an asterisk.

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Breeding and genetics


A study was conducted using ROP swine data on 1849 Yorkshire, 590 Landrace, 342 Lacombe, and 657 crossbred pigs. The traits studied were average daily gain on test, adjusted age to slaughter, carcass length, total fat, loin eye, percent ham of side, lean area/ham weight, and percent yield of trimmed cuts. Carcass measurements except percent yield of trimmed cuts were sex and weight adjusted. The data were first adjusted for the fixed effect of test date station subclass by least squares analysis. Nested analysis of variance with sires and dams within sires was used to estimate the variance components of sires and dams. The heritabilities of all eight traits were calculated by three methods, namely sire variance, dam variance, and by using both sire and dam variance components separately for each breed. Phenotypic and genetic correlations among these traits were also calculated.

Early measurements of swine performance. S. B. Kovalchuk and G. H. Bowman,* University of Guelph, Guelph, Ont.

Backfat measurements were taken on 192 pigs at 45, 55, 80, and 90 kg liveweight. Correlation and regression analyses were conducted to determine the relation between earlier measurements and measurements at 90 kg. In general, the correlations ranged from .4 to .7 with the lowest values for those weights separated by the greatest amount. The implication of early measurements in selection is discussed.


Some factors affecting probe estimates of backfat thickness on market hogs. J. R. Morris,* D. G. Luckham, and J. Gruden, Ridgetown College of Agricultural Technology, Ridgetown, Ont.

Backfat thickness was measured ultrasonically at the three regular probe sites on 96 Yorkshire and crossbred pigs to determine the effects of breeding, gender, probe site, body weight, and age of measurement prior to slaughter on the ability to estimate carcass backfat. Average backfat thickness was 1.45, 1.93, and 2.24 cm at 41, 65, and 87 kg body weight, respectively. Regressions showing the relationship of body weight and backfat were not parallel for breed, gender, and probe site (shoulder vs. midback vs. loin). However, these regressions appeared linear over the three periods of measurement. The simple correlation between average backfat thickness measured at slaughter and average carcass backfat was .75 (P < .01). r value for average backfat between 87 and 65 kg body weight was .57 (P < .01) and between 87 and 41 kg body weight was .37 (P < .01).


Birth and weaning data on 892 calves born to 249 cows and 25 bulls during 19 years were analyzed to study the change in performance with years, to determine the influence of sex, type of birth, age, and weight of dam, and to estimate some genetic parameters. From regression analyses, birth and weaning weights increased 0.14 ± 0.05 and
Forty-eight Holstein heifers were allotted to one of four sire-production proof categories, depending on the ROP milk-production proof of the sire of the heifer at the time she initiated her first lactation. Average proofs of the sires represented in the four categories were: +7.1, +2.4, −2.6, and −6.7, respectively, for BCA milk herdmate comparisons, and 3.69, 3.69, 3.89, and 3.78, respectively, for fat percent. Average first lactation 305-day actual production for the four groups of heifers was: 5296 ± 251 kg, 5365 ± 417 kg, 5242 ± 346 kg, and 4599 ± 485 kg of milk; 177 ± 11 kg., 161 ± 14 kg, 184 ± 13 kg, and 140 ± 14 kg fat; and 3.33 ± .17%, 3.00 ± .17%, 3.50 ± .14%, and 3.04 ± .17% fat, respectively.

Factors affecting protein content of milk. B. O. Esan, J. E. Mosley, and H. F. Macrae,* Macdonald Campus of McGill University, Ste. Anne de Bellevue, Qué.

Least squares analysis, which absorbed the effects of herds within breed, was used to evaluate the effects of lactation sequence, month of test, and stage of lactation on protein percentage and protein yield using 96,692 test-day observations from 492 herds representing Jersey, Ayrshire, and Holstein breeds.

Protein yield increased with milk yield, and protein percentage declined with increased lactation sequence. Protein yield reached peak levels in June and minimum levels in November for the three breeds. The fluctuation in protein percentage for a calendar year was 0.81, 0.81, and 0.56% as compared with 0.63, 0.55, and 0.34% for fat for Jersey, Ayrshire, and Holstein breeds, respectively. Maximum protein yield occurred in the first month and declined steadily to the end of the lactation. Maximum protein percentage occurred just after calving and declined to a minimum level between 45 and 75 days postcalving and rose gradually to the end of the lactation.

Selection pressures practiced among dairy cattle traits by Ontario artificial insemination units. M. G. Freeman,* E. B. Burnside, and T. R. Batra, University of Guelph, Guelph, Ont.

The selection pressures practiced on the dairy cattle traits of Holstein sires owned or leased by the three major Ontario artificial insemination organizations during the period 1958–71 were studied. Selection at three stages was considered: (1) among young sires selected to be progeny-tested; (2) among proven sires selected to return to service; and (3) among proven sires weighted by member use indicated preference for the body conformation traits over production traits in a ratio of 2:1.

Regression of progeny performance on pedigree indexes in dairy traits. M. G. Freeman* and E. B. Burnside, University of Guelph, Guelph, Ont.

Dairy sire indexes for milk yield computed by the herdmate-comparison procedure on a within herd-year-season basis are published in Canada by the ROP Division of Canada Agriculture. Cow Indexes (ETA's) using records on the cow and her paternal half-sibs are computed by the University of Guelph in cooperation with the ROP Division. ETA's are calculated within herd-year-seasons and additionally adjusted for days open, number of contemporaries or herdmates, and the estimated genetic merit of herdmates. Theoretical consideration of pedigree indexes computed by the selection index technique and based on sire indexes and ETA's indicates that the appropriate weights, in the upper limit, for the sire's index, the ETA of the dam, and the ETA of the maternal granddam are .5, .47, and .16, respectively. The latter two weights vary when the number of records or the number of progeny, or both, is small. The
regression of progeny performance on pedigree index for Holstein bulls progeny-tested in Ontario artificial insemination studies during 1958-65 is \( 0.34 \pm 0.09 \) BCA points. Similar theoretical consideration of pedigree indexes for body conformation (point score) utilizing both sire indexes and female phenotypic deviations from breedmates, asymptote rapidly to upper limits. The regression of progeny performance on pedigree index for the above group of bulls is \( 0.33 \pm 0.13 \) points.

**Parameters for age-adjusted dairy traits.** T. R. Batra* and I. L. Mao, University of Guelph, Guelph, Ont.

Canadian dairy production records have been adjusted for age effect by Breed Class Average (BCA), which were raw means for age classes computed in the 1950's. New BCA's were computed, using records made in 1959 through 1969, on a within-month basis after the elimination of herd-year and cow selection effects. The consequences of using different BCA's to adjust 305-day production records were investigated. Data consisted of records on six production traits for 51,044 Holstein first calvers with age at calving from 18 to 35 months. The production traits were actual milk and fat production, raw milk and fat production adjusted by present BCA's, and raw milk and fat production adjusted by new BCA's. Actual milk and fat production increased with the increase in age at calving up to 34 months of age. No distinct age trend was observed on both raw milk and fat means adjusted by the present BCA's. The curves for raw milk and fat means adjusted by new BCA's were essentially parallel to the ones adjusted by the present BCA's, but were lower on the average by 16 points for milk and 15 points for fat production.

**Age-month adjustment of Canadian dairy cattle records.** I. L. Mao,* E. B. Burnside, M. G. Freeman, and J. W. Wilton, University of Guelph, Guelph, Ont.

The BCA system for age correction presently used in Canada was proven to be ineffective because conditions necessary for nonbias do not hold in the current dairy cattle population. Age-month constants were estimated from 604,427 complete 2X ROP Holstein milk records during the years 1959-69 by the maximum likelihood method with elimination of biases due to herd differences, environmental trend, and selection based on previous performance. These constants showed that monthly age correction factors could not be adequately grouped into a few seasons. It was concluded that comparisons of individual records and bull proofs could be seriously biased if adjustments were not made for the joint effects of age and monthly seasonal differences. Additional work discovered considerable geographical differences in age-month constants. Constants for British Columbia were the highest among all regions, whereas those for Quebec and the Maritimes were low. Considerable differences were found between constants for Holstein, Ayrshire, Jersey, and Guernsey breeds. There was also some evidence that adjustment for age-month ought to be made on a within lactation basis.

**Effects of age, stage of lactation, and month of test on test-day yield of Holstein cows.** J. L. Robinson* and J. E. Moxley, P.E.I. Department of Agriculture and Forestry, Charlottetown, and Macdonald College, Ste. Anne de Bellevue, Qué.

Milk production data from 1170 Quebec Holstein herds on the Dairy Herd Analysis Service (DHAS) were analyzed to study the effects of age, month, and stage of lactation on milk, fat, and 4% fat corrected milk yields. Least squares estimates of age and month of calving on lactation yields were computed on a within-herd basis. Lactation milk yields varied 10.5% due to season and milk production increased 27.44% between 25 and 67 months of age. Least squares estimates of age, month, and stage at test-day on test-day yields were computed. Test-day milk yields varied 25.31% due to season and 37 months of age. Least squares estimates of age, month, and stage at test-day on test-day yields were computed. Test-day milk yields varied 25.31% due to season and 72 months of age. Record of Performance BCA indices and DHAS cow ratings were of equal merit in adjusting lactation yields for age effects. The cow rating was effective in reducing season effects. This study indicates that the use of the equation:

\[
(13/\text{age in months} + 0.01) \\
\left[ 2 \frac{36 - \text{age in months}}{3} + 0.82 \right]
\]

would improve the efficiency of age adjustment for the DHAS cow rating.

**Weight versus age as a basis for adjusting lactation records.** O. O. Burnaima* and J. E. Moxley, Macdonald Campus of McGill University, Ste. Anne de Bellevue, Qué.

The effects of lactation sequence, age, and body weight on milk and 4% FCM yield were evaluated in 7927 Holstein lactation
records from 439 Quebec herds. Various combinations of weight and age correction factors were evaluated by computing the repeatability and the error variance of sets of adjusted data. Weight and age correction factors appear to have about equal merit in adjusting production yields to a common base.


Most studies of carcass composition and meat quality of cattle slaughtered on an age or weight constant basis report many differences in carcass composition and meat quality. A study on 28 steers of five diverse breed groups, slaughtered at a constant backfat thickness of 1.27 cm, resulted in a range in slaughter age of 398–475 days of age and in slaughter weight of 360–468 kg. Differences were found in carcass grade that ranged from Canada Choice to Canada Commercial, Class 1. The carcass composition, as measured by the percent of physically separable bone, fat, and lean in the left side was essentially the same for all breed groups, the only difference being a lower percent bone in the breed group grading Canada Choice when compared with the breed group that graded Canada Commercial, Class 1. There were no significant differences in meat quality among the breed groups. The comparison of breed groups at an endpoint that effectively controls the major tissue variable in the carcass, percent fat, allowed each breed group to produce a product comparable in composition and quality. The lack of differences in carcass composition and meat quality across the wide range in carcass grades illustrates the ineffectiveness of grade as a quantity or quality predictor of steers at a comparable stage of development.

Crossbreeding swine. Reproductive traits of crossbred sows produced from one-way crosses among eight breeds. W. B. Holtmann,* M. H. Fahmy, R. D. Baker, T. M. MacIntyre, and G. R. Barr: Université Laval, Québec; Canada Agriculture, Lennoxville; Macdonald College; Canada Agriculture, Nappan; and Kemptville College of Agricultural Technology, Kemptville, Ont.

First generation hybrid gilts were obtained from one-way crosses between the following eight breeds: Yorkshire (Y), Landrace (LD), Lacombe (LC), Hampshire (H), Duroc (D), Berkshire (B), Large Black (LB), and Tamworth (T). Reciprocal crosses were not made. Approximately 30–35 gilts per cross were evaluated, a total of 1013 gilts distributed among the five cooperating stations. All crossbred gilts and sows were mated to Poland China boars to evaluate sow productivity based on first and second litter performance. Reproductive traits studied and their respective least squares means were percent gilts showing estrus, 95.5%; age at first estrus, 210.4 days; age at first farrowing, 354.2 days; percent farrowing a first litter, 87.8%; and percent farrowing a second litter after weaning a first litter, 81.1%. The crossbred gilts that were the most precocious were the LD × Y, T × H, D × Y, and B × Y, whereas those with the highest percent farrowed for first and second litters were the B × Y, LB × H, T × D, and D × Y. Significant differences (P < .01) were observed between stations for all reproductive traits studied except for percent gilts that showed estrus.

Growth performance of crossbred heifers from Charolais and Hereford bulls mated to Ayrshire and Holstein cows. L. A. Charette,* G. Lalande, W. B. Holtmann, and M. H. Fahmy, Université Laval, Québec, and Canada Agriculture, Lennoxville, Qué.

Université Laval and the Canada Agriculture Lennoxville Research Station initiated a beef and dairy cattle crossbreeding project in 1970 by inseminating in private herds Ayrshire and Holstein cows with semen of Charolais and Hereford bulls. The crossbred heifers born during the period November 1970 to May 1971 were purchased at 3–14 days of age. At Laval the heifers were reared inside, received a milk replacer, a grain mixture, and grass silage. At Lennoxville, the calves received whole milk, and were pastured during the summer. In the fall they were housed in a cold environment and fed grain and silage. Thirty to 40 crossbred heifers were raised in each cross at each station. Least squares methods of fitting constants were used to study the effects of station, breed cross, and dam calving sequence on body weight at 14, 91, 182, 273, and 365 days of age. The overall least squares means for body weight were 45.6, 82.6, 137.8, 212.4, and 290.0 kg, respectively. Effect of dam calving sequence was only significant (P < .01) for 14-day weight. Significant station × breed cross interaction was observed for 91, 273, and 365-day weight. The average body weight for the Charolais × Holstein, Charolais × Ayrshire,
Hereford × Holstein, and Hereford × Ayrshire crosses were 50.6, 48.8, 42.5, and 40.3 kg, respectively, at 14 days of age and 144.0, 143.4, 132.7, and 131.0 kg, respectively, at 182 days of age. At 365 days of age, the body weight for the crosses were 313.8, 308.2, 279.2, and 270.9 kg at Laval and 304.8, 287.8, 289.4, and 276.8 kg at Lennoxville, respectively.


Carcass data are presented for 172 bulls and 162 steers sired by Charolais and Simmental bulls out of Angus and Hereford cows and 148 straightbred Shorthorn bulls. Test animals were assigned at random within breed cross to three slaughter ages, 12, 13½, and 15 months. Charolais crossbreds were marginally superior to the Simmental crossbreds in rate of growth and in lean content (% yield of deboned defatted lean product in the primal cuts) but these breed of sire differences were approximately one-quarter the magnitude of the sex differences (bulls vs. steers). Bulls were substantially superior to steers in all performance traits at each of the three slaughter ages and the margin of superiority increased as slaughter age increased. Breed of dam had no measurable influence on any of the important traits. No interactions of sex or slaughter age with each other or with breed combination were evident. The straightbred Shorthorn bulls were markedly inferior to the crossbreds in growth rate and all measures of lean content. Shorthorn bulls at 12 months of age produced approximately the same yield of externally defatted product as the average for all crossbred steers (71.6 vs. 71.7%) but were 6 weeks younger and weighed approximately 80 kg less at slaughter (357 vs. 438 kg).

Meats

Role of ultrasonic measurements in beef bull selection. J. W. Wilton* and T. D. Burgess, University of Guelph, Guelph, Ont.

The possibilities of measuring fat thickness and loin-eye areas ultrasonically has created a potential for increased precision in measuring growth of lean meat in performance-tested beef bulls. The economic returns on offspring of performance-tested bulls is discussed with respect to value of the product and returns over both feed and fixed costs, with value of the product dependent on composition of the end market product. The relation of measurements on fat thickness and rib-eye area taken during a performance test to the value of the offspring is discussed, as is the relation between measurements and testing procedures. The relative efficiencies of various possible selection programs using different amounts of information are compared, using annual genetic progress in economic value as the criterion.

Ultrasonic techniques for predicting carcass merit. W. A. Gillis,* G. H. Bowman, and W. R. Usborne, University of Guelph, Guelph, Ont.

A total of 719 market weight pigs were used in a three-phase study to develop an ultrasonic technique that could easily be used for accurate evaluation of carcass yield. Phase one included 59 ROP test pigs that were measured live and in the carcass for backfat thickness at three midline sites, loin-eye area, and lateral fat:lean loin measurements at two sites. The relation and prediction of loin-eye area from a single measurement of loin-lean depth was determined in phase two on 526 pigs. In phase three, 146 pigs were used to compare three previously developed ultrasonic techniques. Results indicate that several accurate measurements of fat thickness in the live pig are most accurate ($r^2 = 74\%$) in the prediction of carcass yield. Loin-eye area can be predicted ($r^2 = 50\%$) from an accurate measurement of loin-lean depth, but the value of either loin-eye area or loin-lean depth is negligible in increasing ability to estimate carcass yield. It is recommended that four fat thickness measurements be taken in the live pig: two measurements be taken on both sides of the pig, one at midback plus 4 inches lateral, and the second, 5 inches anterior to the first measurement. This will result in approximately a 65% and 72% degree of precision for the prediction of ROP Index and percent trimmed lean cuts, respectively.
Relations of ultrasonic measurements of beef bulls with their 140-day feed gain tests. T. D. Burgess* and J. W. Wilton, University of Guelph, Guelph, Ont.

Ultrasonic measurements on fat thickness and loin-eye area taken between the 9th and 10th ribs were obtained on bulls on feed in the central beef bull-testing station at Guelph, Ontario. Measurements were taken at the start and at the end of the test. Fat thickness at the start of the test averaged .5 cm with a range of .4-.8 for 23 Charolais bulls, and .8 cm with a range of .5-1.1 for 90 Hereford bulls. End-of-test fat measurements averaged .9 and 1.4 cm with ranges of .6-1.4 and 1.0-2.3 for Charolais and Hereford, respectively. The start-of-test loin-eye areas averaged 48 and 41 cm² with ranges of 32-60 and 27-54 for Charolais and Hereford, respectively, and end-of-test loin-eye areas averaged 79 and 66 cm² with ranges of 58-95 and 44-86, respectively. The simple correlation of start-of-test fat thickness, end-of-test fat thickness, start-of-test loin-eye area, and end-of-test loin-eye area with 140 day average daily gains were -.13, -.07, .34, and .26, respectively, for Charolais, and -.03, .07, .05, and .34, respectively, for Hereford.

The new system of beef grades for the Canadian livestock industry. G. L. Locking,* Nova Scotia Agriculture, Ottawa, Ont.
The new Beef Carcass Grading Regulations will be implemented on September 5, 1972, and the drafting of the regulations has provided the opportunity for the inclusion of new carcass research data into a grading system that should give beef cattle producers a more accurate appraisal of beef carcasses than was possible under the old system. The knife ribbing of all youthful carcasses will permit the grader to take accurate fat measurements and assess quality factors that under the new system will play a more important role in grade determination. The drafting of new regulations has permitted the Livestock Division to study the entire aspect of carcass grade stamping and branding and correct some of the anomalies that existed in this area. Finally, the simplification of carcass grade terminology has been reviewed with a view to having it meet consumers' requests and to conform to demands for standardized grade nomenclature and color coding for all food products.

Predicting carcass merit of pigs. G. H. Bowman,* W. A. Gillis, and G. C. Smith, University of Guelph, Guelph, Ont.
Carcass data from 200 pigs were analyzed by multiple regression to determine the value of various measurements in predicting the lean cutout of pigs. On the basis of the data, the ease of collecting measurements, the ease of standardizing procedures, it is concluded that backfat thickness, loin-eye area, and trimmed ham constitute the only necessary and the best group of measurements to collect.

Physiology

The effect of Marek's Disease vaccine (THV) dosage level on mortality, condemnations, and market body weights of commercial broilers. D. C. Crober and Allan C. Cox,* Nova Scotia Agricultural College, Truro, N.S., and Canada Agriculture, Kentville, N.S.
A total of 3100 mixed sex broilers was used to study the effects of 0, ¼, ½, and full dosage levels of Marek's Disease (THV) vaccine on total and/or Marek's mortality, condemnations at processing, and body weights of commercial broilers. In part A of the study, 155 mixed sex broilers of each dosage treatment were reared intermingled in each of three pens. Part B involved two similar sized pens that had been subdivided such that 155 mixed sex broilers of each treatment group were reared separately. Total mortality and plant condemnations for Marek's Disease were not related to dosage level of vaccine received. Diagnosed Marek's mortality was 0.88%, 0.73%, 0.66%, and 0.56% for the 0, ¼, ½, and full dosage levels, respectively. Terminal average body weights for male birds given 0, ¼, ½, or full dosage were 1962, 1956, 1973, and 1939 g, respectively. Terminal average body weights for female birds vaccinated with 0, ¼, ½, or full dosages were 1592, 1599, 1597, and 1590 g, respectively.

A computer-based automatic data acquisition system for research in physiology. W. G. Hunsaker,* D. J. Buckley, and H. A. Robertson, Canada Agriculture, Ottawa, Ont.
An automatic data acquisition system has been developed that utilizes a "Nova" mini-computer as a central process controller.
Analog signals from transducers are amplified to the required voltage levels and then converted to an equivalent digital code or value by an analog/digital converter. These values are then stored in the computer, generally as cumulative or mean values, until output occurs on a magnetic tape recorder or teletypewriter. The inclusion of a scanner or multiplexing system enables time-sharing of a single measurement/recording subsystem by a number of input parameters derived from a variety of transducers. Each parameter is recorded on a separate channel. Maximum capacity is 112 analog channels, 16 input sense channels for recording discrete events, and 16 output control channels for controlling external devices. A computer program has been written that provides for control of data acquisition and some data reduction and storage. Channel selection, sampling time intervals, output interval, and other features are program selectable through the teletypewriter keyboard.


Because of the role of certain steroids in bone development and the potential interaction between environmental temperature and steroid output, the influence of environmental temperature on bone and steroid output was investigated. Two groups of four male swine were weaned at 4 weeks of age and then maintained at 2 or 20 C for 80 days on equalized caloric intake. Urine and blood samples were collected twice a week. After slaughter the femur, humerus, radii, ulnae, nasal turbinates, and nasal septa were collected. Urine and sera were analyzed for Ca and PO4 and the tissue samples for Ca, P04, collagen, and mucopolysaccharides. The urines were also analyzed for 17-keto steroids. Exposure to cold resulted in increased Ca and P04 excretion (P < .02) animals with a concomitant decrease in 17-keto steroid output. This would suggest that Ca and P04 utilization may have been impaired by cold. Examination of bone data suggested no difference in Ca and P04 concentration but the matrix of the bone from cold-stressed animals had a composition associated with much younger animals suggesting that maturation may have been retarded by the cold treatment and therefore Ca and P04 in diet could not be utilized and was excreted. The failure of the matrix to develop perhaps could be attributed to changes in steroid hormone output.

Influence of triiodothyronine on the level of luteinizing hormone in venous blood of ram lambs. L. M. Sanford, W. M. Palmer, and B. E. Howland, University of Manitoba, Winnipeg, Man.

Eight ram lambs (five Finnish Landrace and three Manarga) 7-8 months of age and weighing 34.1-46.3 kg were used to study the effects of induced hyperthyroidism on body weight, serum glucose, and luteinizing hormone (LH) levels and libido. Blood samples (5 ml) were collected from the jugular vein at 9:00 AM on 5 days and 9:00 PM on 24 days. Rams were injected subcutaneously with triiodothyronine (T3) at the rate of 125 µg on day 8, 250 µg on day 9 and 500 µg on days 10-17. Serum glucose was determined using an autoanalyzer, and serum LH by radioimmunoassay. T3 treatment for 10 days caused a nonsignificant loss of body weight averaging 1.9 ± .4 kg and a highly significant (P < .01) increase in serum glucose concentration from a mean of 66.2 mg/100 ml for the 7 days prior to T3 administration to a mean of 80.9 mg/100 ml during treatment. Mean serum LH concentration did not change appreciably during the treatment period. The mean value for the eight rams during treatment was .69 ± .04 ng NIH-LH-S14/ml as compared with .67 ± .04 ng NIH-LH-S14/ml prior to treatment. Considerable variation in LH concentration was observed within each ram. Rams showed an increase in libido as manifested by a greater frequency of mounting. Results suggest that increased serum glucose levels associated with hyperthyroidism do not alter the concentration of serum LH.


Two experiments involving eight pigs each were conducted to study the pig’s preference for a light-dark cycle. In the first trial, eight gilts with an average initial weight of 17.5 kg were placed in an environment where they had a choice between continuous lighting (CL) or continuous complete darkness (CCD). A 7-day adjustment period was allowed in the CL:CCD environment. The behavioral traits that were studied with the aid of a TV monitoring equipment were: (1) pig in CCD; (2) standing in CL; (3) lying in CL; (4) feeding in CL; (5) fighting in CL; (6) drinking in CL; (7) urinating or defecating in CL; and (8) playing in CL. Behavioral traits 1-3 were
Ruminant nutrition

Levels of metabolites in the blood as criteria of the energy status of cows in early lactation. L. J. Fisher,* J. D. Erfle, and F. D. Sauer, Canada Agriculture, Ottawa, Ont.

The blood levels of glucose (Gl), acetoacetate (AcAc), \( \beta \)-hydroxy butyrate (BHB), and plasma free fatty acids (FFA) were estimated in samples taken during each of the first 8 weeks of lactation from 66 cows in an experiment designed to evaluate the antiketogenic properties of propylene glycol. The intake of and requirement for metabolizable energy (ME) was calculated weekly for each cow and energy balance was correlated with the concentration of metabolite in the blood. The effects of week and percent of propylene glycol (0.3, 6, or 9%) in the grain mixture fed on these correlations were estimated. There were significant negative correlations \((P < 0.01)\) of \(-0.332, -0.349, \) and \(-0.337\) for energy balance and plasma levels of AcAc, BHB, and FFA, respectively, during the 1st week, and of \(-0.357, -0.307, \) and \(-0.252\) for energy balance vs. plasma FFA during the 3rd, 4th, and 5th weeks. Analyzed on a treatment basis all correlations between energy balance and blood components were significant \((P < 0.01)\). Compared with other treatments the 3% level of propylene glycol resulted in the highest correlations except for FFA vs. energy balance, which were \(-0.351, -0.492, -0.521, \) and \(-0.542, \) respectively, for 0, 3, 6, and 9% propylene glycol in the grain mixture.

Effects of feeding MHA on nutrient digestibility or milk production by dairy cows. A. J. Mushiri Begum* and G. M. Jones, MacDonald Campus of McGill University, Ste. Anne de Bellevue, Qué.

Twenty dairy cows that had completed at least one lactation were divided equally into four groups based on previous milk yield. A concentrate ration containing 14.5% crude protein was fed to all animals. Two groups received a ration containing 1.5% urea, and the other two groups were fed no urea. Cows in one urea group and the no-urea groups received 25 g MHA daily starting 10 days prepartum. Rations were fed for 60 days postpartum. Grass silage was fed free-choice to all cows. Milk production, milk protein, and milk fat percent were recorded weekly. Neither urea nor MHA was found to have any significant effect on milk production or composition \((P > 0.05)\). Four yearling sheep were used in a 4 \( \times \) 4 Latin square. Each concentrate ration was fed ad libitum to one animal during each of four 21-day periods. MHA was mixed in the concentrate at 0.2%. Feed intake and nutrient digestibilities were determined during the last 7 days. Feed intake data showed that dry matter consumption was similar among all animals. No favorable response was obtained with analog feeding. The digestibility of dry matter, protein, gross energy, and cellulose was not affected by the inclusion of MHA or urea in the concentrate. Nitrogen retention also was not improved by MHA feeding.
Performance of dairy cows fed complete corn-soybean diets. G. K. MacLeod,* D. G. Grieve, J. B. Stone, and M. G. Freeman, University of Guelph, Guelph, Ont.

Twenty-four Holstein cows including eight first-calf heifers were fed complete rations based on a two-crop program of corn and soybeans from 7 weeks prepartum to 28 weeks postpartum inclusive. Milk yield, milk composition, feed intake, and conditions of health were recorded. All animals were challenged and received complete feed on an ad libitum basis during the first 10 weeks of lactation, and were restricted to NRC requirements thereafter. During the standardization periods from weeks 1 to 10 and 18 to 22 inclusive, the ration consisted of urea-corn silage, rolled soybeans, and HM ear corn in proportions of 60:20:20 on a dry matter basis. During weeks 11–17 inclusive cows were randomly assigned to either HM ear corn or HM shelled corn. During weeks 23–28 inclusive cows were divided into three groups and performance was measured when zero, one-quarter, or one-half of silage dry matter was replaced with chopped mixed hay. Milk yield and milk composition were not significantly (P < 0.05) different when HM shelled and HM ear corn were compared or when hay was included in the rations. Intakes of all diets were satisfactory.

A comparison of corn, barley, wheat, and forage oat silages for lactating dairy cows. P. L. Burgess,* J. W. G. Nicholson, and E. A. Grant, Canada Agriculture, Fredericton, N.B.

Whole crops of corn, barley, wheat, and forage oats were ensiled and fed as the sole forage to a total of 48 milking cows in two 12-week feeding trials. In the first experiment, corn (25% dry matter (DM)) harvested in the early dent stage, and barley (34% DM) and forage oats (28% DM) harvested in the dough stage were compared. Holstein cows fed the three silages averaged 22.2, 19.7, and 17.9 kg of 4% FCM per day and consumed 1.66, 1.81, and 1.84 kg of silage DM per 100 kg body weight, respectively. In the second experiment, cows fed barley (30% DM), wheat (36% DM), or forage oat (27% DM) silage harvested in the dough stage produced 23.3, 21.8, and 22.2 kg FCM daily and consumed 1.70, 1.75, and 1.62 kg silage DM per 100 kg body weight, respectively. Corn silage was more efficient for milk production per unit of DM ingested than barley or forage oats, and barley, wheat, and forage oat silages were similar in feeding value. Milk fat, protein, and solids-not-fat percentages were unaffected by the type of silage fed.

Adaptation responses of lactating cows to urea. P. Narasimhalu,* R. Belzile, and G. J. Brisson, Université Laval, Qué.

A urea-free control (O-U) and medium (M-U) and high (H-U) urea rations were fed to a group of nine lactating cows for 6 weeks to observe adaptation responses to incorporation of urea in rations in gradual increments. The concentrate nitrogen of O-U was substituted with urea-N in weekly increments of 4 and 8% for M-U and H-U, respectively, and the final substitution values for the 6th week were 24% for M-U and 48% for H-U. The consumption of urea during the 6th week was estimated as 0.33 g/kg body weight and 0.66 g/kg body weight for the M-U groups and H-U, respectively. Replacing 24 and 48% of concentrate nitrogen with urea nitrogen had no significant effect on daily feed consumption, actual milk yield, body weight gains, blood hematocrit, and hemoglobin values. Other indices of adaptation responses will be presented.


Several modifications were made to the two-stage in vitro fermentation techniques for dry matter (IVDMD) and organic matter digestibility (IVOMD) determinations developed by Tilley and Terry (1963) and Alexander and McGowan (1966). These modifications include: (1) changing of the buffer medium, which resulted in a pH of 6.8–7.0 of the fermentation tubes during 48-hr fermentation periods; (2) treatment of substrates with weak enzyme–acid solution prior to incubation at 40 C; and (3) reduction in time for estimation of both IVDMD and IVOMD by 24 hr. There was no need for pH adjustments during fermentation as well as acidification at the end of the fermentation period. Digestion of substrates was completed in 24 hr instead of 48 hr. Both IVDMD and IVOMD determinations were made in one run and on the same substrates. To test this modified method, 13 corn and grass silages and their mixtures were dried and processed by five different methods so that there was a total of 65 samples. IVDMD and IVOMD were determined.
on all samples, comparing the modified method with the parent methods. Statistical analysis of data from the different methods showed no significant differences.

**Corn silage rations for dairy beef.** A. H. Javed,* G. S. Ositelu, and E. Donefer, Macdonald Campus of McGill University, Ste. Anne de Bellevue, Qué.

Twenty-four male Holstein calves, averaging 283 kg in weight were fed corn silage (30–34% dry matter (DM)) ad libitum for a 22-week period. Ground soybeans or a 32% protein commercial dairy supplement was fed to meet protein requirements. Overall average daily gains (ADG) were 1.0 kg with average daily feed consumption of 6.4 kg silage DM and 1.6 kg supplement. Feed efficiency (FE) averaged 7.8 and 8.2 feed DM/unit gain for groups fed the soybeans and commercial supplement. Average feed cost/kg gain (FC) was $0.38 assuming silage and protein supplement costs at $8.8 and $110 per 1000 kg. Two groups of six calves fed solely alfalfa silage (32% DM) or alfalfa and corn silage (62:38) had respective ADG, FE, and FC of 0.73, 0.93; 9.0, 7.0; and 0.26 and 0.21. The following year, 36 calves averaging 198 kg in weight were divided into six groups fed corn silage (28.5% DM) ad libitum for a 28-week period. Alfalfa silage (40.6% DM) or ground soybeans were fed as protein sources and additional energy was supplied to four groups from grain corn fed at 0.8% of body weight. Lowest ADG (0.61 kg) were obtained with the alfalfa–corn silage ration with FC ($/kg) at 0.24. Highest ADG (1.03 kg) were obtained with corn silage–soybean–grain corn rations with FC at 0.30. The most economical, although not highest, gains were thus made on all-silage rations.

**Effects of different dry matter determination methods and processing techniques on chemical composition and in vitro digestibility of corn and grass silages.** R. E. Larsen* and G. M. Jones, Macdonald Campus of McGill University, Ste. Anne de Bellevue, Qué.

Dry matter (DM) contents of 13 corn and grass silages and their mixtures were determined by: (1) toluene distillation (TD), corrected; (2) TD, uncorrected; (3) freeze-drying (FD); (4) oven-drying (OD) at 40 C; (5) OD at 65 C; and (6) moisture-tester at 120 C. TD, corrected for organic acids, ethanol, and ammonia in the aqueous distillate, showed significant increases ($P < 0.01$) in DM compared with other methods. Up to 12.8% loss of DM resulted from heat drying, depending upon the method and the sample. Silages dried by the different methods were analyzed for nutrient composition. No significant changes in cell-wall constituents or organic matter contents were observed. FD and OD at 40 C showed significant increases ($P < 0.01$) in gross energy and crude protein. OD at 65 C and moisture-tester at 120 C caused significant increases ($P < 0.05$ and $P < 0.01$) in ADF and ADL. Only FD silages showed significant increases ($P < 0.05$) in cellulose contents. In vitro cellulose digestibility of FD or OD (40 C) silages appeared to be more rapid in the initial phases of fermentation, but these differences decreased with time. The highest in vitro DM and OM digestibilities were obtained via FD and OD at 40 C of the silages. The lowest in vitro cellulose, DM, and OM digestibilities were observed with moisture-tester (120 C) silages.

**Net energy, metabolizable energy, and T.D.N. applications in predicting average daily gain for Ontario cattle.** D. I. Dickie,* P. W. Wilson, and T. D. Burgess, University of Guelph, Guelph, Ont.

Three studies and populations of animals were used to evaluate requirement equations for predicting average daily gain for beef bulls and steers fed in Ontario. Large variations in differences of predicted from actual gains occurred. Based on 468 animals, gains for both steers and bulls were generally underestimated = 20% using 1970 NRC net energy guidelines. Exceptions within treatment groups were evident. 325 individually fed bulls were used to compare predicted gains from values and equations involving T.D.N. (NRC 1963), net energy (NRC 1970), and metabolizable energy (ME) (ARC 1965). Findings indicate ME most closely predicts actual gains based on paired comparison $t$-tests of actual vs. predicted gain.

**Effects of housing and planes of feeding on liveweight changes of beef cows and their calves.** W. A. Jordan, E. E. Lister,* J. M. Wauthy, and J. F. Comeau, Canada Agriculture, Ottawa, Ont., and Kapuskasing, Ont.

Spring calving Shorthorns fed hay had a significantly higher ($P < 0.05$) yearly digestible dry matter intake (DDMI) and average daily weight change (ADWC) than those fed grass silage. DDMI was higher for cows kept year-round in an outside yard (OUT) than for...

Severe heat treatment (85°C for 30 min) of skim milk prior to spray drying significantly (P < 0.05) reduced gain to 12 days of age of Holstein male calves when the skim milk was incorporated in their diet compared with mildly heat-treated (60°C for 30 min) skim milk. Moderate heat treatment (74°C for 30 min) resulted in an intermediate rate of gain. Gain was unaffected by skim milk treatment at 19 and 26 days, and fat level (16.5 vs. 22.5% of dry matter) had no effect on gain at any time. Milk replacer intake was not affected by dietary treatment to 12 days of age. Heterogenous variance between treatments occurred for ration intake to 19 and 26 days of age. During the collection period (19-26 days), heterogenous variance between treatments occurred for nitrogen intake and retention. In each instance of heterogeneity the diet containing moderately heat-treated skim milk and low fat produced greatest variance, lowest nitrogen intake, and lowest nitrogen retention. The severity of alopecia was greater with high-fat than with low-fat diets. Calves receiving severely heat-treated skim milk in their diet required most antibiotic treatments for diarrhea.

Nutritive value of a FPC for young calves. G. J. St-Laurent* and G. J. Brisson, Université Laval, Québec.

Five groups of five Holstein male calves were fed graded levels of a water-dispersable fish protein concentrate (FPC) called CPSP-90. This product had the following composition: protein 88%, fat 1%, minerals 5%, moisture 6%, and had a strong fish odor and flavor. Protein proportions from FPC were as follows: 0, 20, 40, 60, and 80% for diets A, B, C, D, and E, respectively. All diets were calculated to contain 24% protein and 20% fat and compounded with Nacaseinate, skim milk powder, dried whey, tallow, dextrose, vitamins, minerals and antibiotics. Body weight gains (0-56 days) were respectively, 33.2a, 25.7b, 28.9ab, 26.1b, and 15.9c kg. Dry matter digestibility (28-35 days) was 95.7a, 92.7a, 93.1a, 92.8a, and 88b% and total protein digestibility was 93.7ac, 89.7bc, 88.5b, 87.3b, and 85.4b%. Calves fed FPC diets had increased levels of Ht and Hb after 4 weeks compared with controls. Blood glucose, RBC, WBC, platelets, urea, ammonia, plasma proteins, and cholesterol levels were not significantly affected. Meat quality was evaluated by using an official sensory technique on the longissimus dorsi and semimembranosus muscles. Undesirable odor and flavor were not detected. It is concluded that CPSP-90 could replace at least 60% of the proteins normally found in milk replacers.

Formaldehyde protection of soybean protein against ruminal digestion. D. R. McLaughlin*, F. D. Horney, and T. S. Neudoerffer, University of Guelph, Guelph, Ont.

The protection of soybean polyunsaturated fatty acids and protein, through a reaction with formaldehyde, was investigated. The study reported here dealt with the protection of the protein fraction. At a low level of feed intake, it was found that only 50% of the nitrogen intake could be accounted for at the duodenum when both extracted soybean meal (diet 1) and full fat extruded soybean meal (diet 2) were fed. Treating diet 2 with formaldehyde (diet 3) increased the recovery of nitrogen to 80%. Doubling the level of soybean protein intake for all diets increased the recovery of nitrogen at the duodenum to 65% with diets 1 and 2 and to 100% with diet 3. The extent of formaldehyde protection on the concentration of amino acids and their total flow was discussed.
Comparison of a high energy grain ration to a high-fat milk substitute diet for veal production. G. M. Jones, L. J. Martin, and H. F. Macrae, Canada Agriculture and Macdonald Campus of McGill University, Ste. Anne de Bellevue, Qué.

Nine Holstein calves were assigned to a calf starter (CS) comprised of rolled corn, soybean meal, 10% chopped alfalfa, 5% molasses, 5% animal fat, vitamins, and minerals (19% crude protein (CP)) and eight calves to a commercial vealer (CV) ration (21% CP, 21% fat). Two calves in each group were bulls. Vealer calves were fed according to manufacturer's recommendations. Starter was offered free-choice beginning at 1 week and calves were weaned abruptly from the vealer at 4 weeks. Heifer calves were slaughtered at 114–136-kg weights. Gains (kg/day) from 0-4, 5–7, and after 7 weeks of age were 0.15, 0.08; 0.25, 0.38 (P < .01); 0.77 and 0.72, for CS and CV, respectively. Gains for the entire period were: CS, 0.65; CV, 0.64 kg/day. Dry matter (DM) intakes (kg/day) were 2.15 and 1.20 (P < .01), and feed efficiencies (kg DM/kg gain) were 3.3 and 2.0 (P < .01) for CS and CV. Feed costs were $106 and $442 per 909 kg. Feed cost/0.45 kg gain were 21.6 and 46.2c for CS and CV (P < .01). Three calves fed CV were lost from the trial due to white muscle disease. Fat cover and meat color revealed no differences between CS- and CV-fed calves.


The effects of four formaldehyde treatments of rapeseed meal on the digestibility of dry matter (DM) and crude protein (CP), and on duodenal contents were determined using two wethers with reentrant duodenal cannulas. Treatment 1 consisted of 2 parts rapeseed meal mixed (v/v) with 1 part formalin (37% formaldehyde), held overnight, with excess formaldehyde washed out and the meal dried at 80°C. Digestibility of DM and CP were reduced. More total-N and protein-N reached the duodenum and N-retention was doubled compared with untreated rapeseed meal. Treatment 2 was similar to treatment 1 except that the formalin was diluted 1:1 with water. The digestibility of CP was decreased but there was no effect on DM digestibility or N-retention compared with a control meal that was washed. In treatment 3, formalin was diluted 1:10 with water and the solution was applied at the rate of 1 liter per 10 kg meal. The control meal was treated with water in the same way. There was no effect on digestibility of DM or CP. Duodenal flow of DM, and total-N, protein-N, and N-retention were all increased. Treatment 4 was similar to 3 except that the formalin was diluted 1:15 with water. Results were similar in direction to those of treatment 3 but of lower magnitude.

Comparisons among different milk replacer formulae for young lambs. G. J. Brisson and G. J. St-Laurent, Université Laval, Qué.

Three-day-old lambs were artificially fed milk replacer diets formulated with dried skim milk, whey powder, and tallow. The milks were maintained at about 15°C and offered ad libitum using a pipeline system. In one trial involving 65 crossbred lambs, diet A (25% fat, 25% protein) and diet B (20% fat, 23% protein) were compared with diet C (Ewelac). The average daily gains (ADG) for the lambs weaned at 4 weeks were 194 a, 171 a, and 264 b g for diets A, B, and C, respectively. For the lambs weaned at 6 weeks, ADG were 193 a, 169 a, and 263 b g for the same diets. At 108 days, post-weaning ADG were 186 a, 206 a, and 184 a g for the lambs fed diets A, B, and C, respectively. In a second trial involving 39 Finnish Landrace lambs, diet A was compared with diet D (30% fat, 24% protein) and diet E (23% fat, 20% protein). The ADG of the lambs weaned at 30 days were 266 a, 271 a, and 262 g for diets A, D, and E, respectively. The post-weaning ADG from 30 to 51 days were 262 a, 268 a, and 277 a g for diets A, D, and E, respectively. The milk replacer diets investigated had no significant effect on post-weaning rate of gain.


Full fat soybean flour (FFS) was prepared from dehulled soybeans by water and sodium bicarbonate treatment, ground in a colloid mill, heated for 1 hr at 93–100°C, and spray-dried. The FFS contained 21% fat, 46% protein, and 0.3 mg soybean trypsin inhibitor/g. Digestion coefficients by lambs fed milk replacers in which FFS supplied 0 (low-heat skim milk powder), 30 or 60% of the protein.
were: nitrogen 94, 95, and 92%; and energy 88, 92, and 92%, respectively. Nitrogen retention was 61, 62, and 55%. In formulas containing 50% of the protein from FFS, nitrogen retention by lambs was similar when the remaining protein was from either low-heat skim milk powder, or a mixture of skim milk and sweet cheddar whey powder, but was less with a mixture of whey and roller dried buttermilk powder (58 vs. 52%). There was no dietary effect on digestion coefficients. Weight gains of lambs to weaning at 12 or 18 kg liveweight were similar when the FFS supplied 0 or 24% of the protein in the milk replacer. This level of FFS had no effect on carcass dressing percent, finish, color, and cooking and taste-panel evaluation for lambs killed at 18 kg liveweight. A combination of FFS and milk by-products for milk replacers should reduce the cost of raising lambs.

**Comparative performance of Ayrshire vs. Holstein steers in the feedlot.** K. A. Winter,* Canada Agriculture, Charlottetown, P.E.I.

Eighteen bull calves, nine Ayrshire and nine Holstein, were used in this trial. They were weaned off a limited whole milk program at 7 weeks of age, then fed calf starter and hay free-choice. At 90 days of age, corn silage was offered at 1½% of body weight. The calves were castrated at about 4 months of age. At 160 kg (Ayrshire) and 180 kg (Holstein) liveweight the calves were changed to a 16% protein grower mixture plus corn silage up to feedlot weights of 251 kg (Ayrshire) and 275 kg (Holstein). During the feedlot period the steers were fed either (1) a barley-based grain mixture free-choice plus corn silage at 1½% of liveweight daily or, (2) corn silage free-choice plus a barley-based grain mixture at 1% of liveweight daily. Market weights were 417 kg (Ayrshire) and 434 kg (Holstein). Weight gains of the Holstein steers (1.0 kg/day) was only slightly better than with the Ayrshires (0.9 kg/day). Growth of the Ayrshire steers was more variable than of the Holsteins. The fastest growing Ayrshires equaled the best Holsteins, and the poor Ayrshires grew more slowly than the poor Holsteins. Carcass grades of the Holstein steers were slightly better, 2 standard, 5 commercial++, and 2 commercial carcasses, whereas the Ayrshire steers produced 2 commercial+++ and 7 commercial carcasses. Ribeye area and fat cover were 54.2 cm² and 1.2 cm for Ayrshires, 59.3 cm² and 1.6 cm for Holsteins.

**Effects of level of water and dry matter intake on the incidence of scour in milk replacer-fed calves.** D. G. Grieve, R. A. Willoughby, and R. P. Stiles,* University of Guelph, Guelph, Ont.

The frequency of scouring was studied in 36 Holstein calves fed a single source of milk replacer at 6, 8, and 10% dry matter (DM) and at 5, 7.5, and 10% of body weight (BW) from 3 days of age to 3 weeks. Overall, the incidence of scouring was higher ($P < 0.01$) at the 7–12-day interval in the trial than at the 1–6- or 13–18-day interval. Calves fed at the rate of 10% BW had a greater frequency of scouring days ($P < 0.01$) than the 5% and 7.5% groups, and there was no significant difference in the number of scouring days in groups fed different percentages of DM. It was concluded that a fluid intake of 10% BW caused an increased number of scouring days, but that the level of DM had no effect.

**Digestibility by sheep of maize with a genetically manipulated lignin content.** A. J. Gordon,* and T. S. Neudoerffer, University of Guelph, Guelph, Ont.

Troyer Reid maize ($Tr_{R}$) and its brown midrib mutant ($bm_{N}$) (Kuc and Nelson 1964) were harvested at 74 and 138 days old. Their dry matter (DM) contents were similar at 74 days but at 138 days of age $bm_{N}$ stalk had a higher DM content than the $Tr_{R}$ stalk (33.2% $Tr_{R}$, 39.5% $bm_{N}$). The crude protein content of the $bm_{N}$ stalk (9.5% and 9.8% DM at 74 and 138 days) was higher than that of the $Tr_{R}$ stalk (8.1% and 6.7%). The $bm_{N}$ plants had less phenylalanine, which suggests that the reduced lignin content found in this plant relative to its parent is due to a block in the synthesis of lignin prior to the involvement of phenylalanine. The chopped corn stalks were supplemented with a soybean protein concentrate, starch, and minerals so that both diets contained 13% crude protein. Digestibility was determined with six wether sheep, directly, by total collection of food and feces and by suspending bags of each diet in the rumen to overcome variability due to variation in food intake. Both methods revealed no significant differences between the two varieties, suggesting that the higher digestibility of the $bm_{N}$ maize reported by other workers may be largely due to its higher protein content. With the $Tr_{R}$ diet acid-detergent lignin was a better indicator of digestibility than the conventional acid-pepsin lignin but not with the $bm_{N}$ diet.
Applicability of whole rapeseed as a protein supplement. L. M. Cock,* Nova Scotia Agricultural College, Truro, N.S.

Brownoski rapeseed was harvested and fed without oil extraction to sheep in digestion stalls and pigs in market pens. The sheep were fed a ration consisting of chopped grass hay and whole (not ground) rapeseed at levels of 1000 and 100 g, respectively. There was a reluctance to consume the rapeseed initially but complete acceptance came by the end of 1 week. The average digestibilities were 48.6, 46.4, and 41.3% for dry matter, energy, and protein, respectively. Three groups of six Yorkshire Market Hogs were raised from approximately 38 kg to market weight of approximately 90 kg on rations varying from 0 to 15% rapeseed. The rations were composed of barley, rapeseed, and commercial protein supplement to provide 17% protein rations but not adjusted for caloric content. Rates of gain, feed consumption, and days to marketing were not significantly different among the three groups.

Effects of body condition on winter energy requirements of beef cows. W. Dietz* and B. A. Young, Alberta Dept. of Agriculture, Vermilion, and University of Alberta, Edmonton, Alta.

Thirty beef cows of mixed breeding but of similar skeletal size were used to assess the winter maintenance energy requirements of cows kept in three levels of body condition. Estimates of metabolizable energy (ME) required to maintain the cows at constant body weight were based upon measurements of food intake and body weight change. The energy required for maintenance was directly related to body weight of the cows and the magnitude of the cold stress imposed by the environment. The mean daily energy requirements for maintenance ranged from 132 to 156 kcal of ME per kg.30 Cows in thin body condition were cold-stressed at higher ambient temperatures than were cows in fat body condition. However, the total energy required to maintain the thin cows over the whole winter period was only 87% of that required by the fat cows.

All silage forage programs for raising dairy heifers to one year of age. D. G. Grieve,* J. B. Stone and G. K. MacLeod, University of Guelph, Guelph, Ont.

A long-term study comparing three forage treatments (1, corn silage; 2, corn silage and hay crop silage; and 3, corn silage and hay) was initiated by allotting 15 Holstein heifer calves to each treatment at 3 days of age. Treatments 2 and 3 contained 60% corn silage on a dry matter basis and 40% dry matter from hay crop silage (2) or hay (3). Whole milk (150 kg total) was fed to about 6 weeks of age, calf starter up to 16 weeks of age, and a grain mixture designed to complement each forage treatment was fed to meet growth requirements thereafter. Forage treatments were fed to appetite from 3 weeks of age. There were no treatment differences for growth in body weight, heart girth, or wither height between 3 days and 16 weeks of age, nor between 16 weeks and 12 months of age. Average daily gain in body weight from 3 days to 16 weeks for treatments 1, 2, and 3, respectively, were: 0.62, 0.64, and 0.63 kg; and from 16 weeks to 12 months were: 0.86, 0.84, and 0.83 kg. Average 12-month weights were 334, 323, and 323 kg for treatments 1, 2, and 3, respectively.

Milk replacer feeding systems for lambs. A. D. L. Gorrill* and T. M. MacIntyre, Canada Agriculture, Fredericton, N.B. and Napan, N.S.

Several modifications of the teat bar (Can. J. Anim. Sci. 51: 256, 1971) for feeding milk replacer to groups of lambs were studied. The cold liquid milk replacer was continuously circulated through the teat bar with a small plastic positive displacement pump (Jabsco electric drill pump, Jabsco Products, Costa Mesa, California) run at about 100 rpm, or a small piston pump. The pump was placed on the return line to minimize pressure on the nipples. Problems with foaming and fat churning were minimal when the pump speed was kept low, and air in the line from lambs sucking was removed from the return line. A centrifugal pump caused churning of the fat. Warm milk replacer containing insoluble soybean protein concentrate was fed to lambs twice a day from the teat bar. One end of the bar was attached to an opening in the bottom of a container, and the other end had an open vertical tube higher than the level of the milk replacer in the container. A group of 11 lambs was fed 20% solids milk replacer ad libitum twice a day for 13 days, and then restricted to 1000 g/day until weaning 10 days later. Average weight gains to weaning and to 10 weeks of age were 215 and 250 g/day, respectively. Total intake of milk replacer dry matter per lamb was 4.6 kg, at an estimated cost of $2.00.
Nonruminant nutrition

Effects of supplemental copper and vitamin E on the growth and backfat characteristics of the pig. J. I. Elliot* and M. A. Amer, Macdonald Campus of McGill University, Ste. Anne de Bellevue, Qué., and Université de Laval, Ste. Foy, Qué.

Five rations: (1) basal (B); (2) B + 200 ppm Cu; (3) B + 200 ppm Cu + 22 IU E/kg; (4) B + 200 ppm Cu + 44 IU E/kg; (5) B + 200 ppm Cu + 88 IU E/kg, were fed to crossbred pigs from 14.5-90 kg liveweight. Average daily gain (ADG) and feed conversion (FC) were calculated. Samples of backfat (BF) and liver were obtained at slaughter. BF samples were analyzed to determine melting point (mp) and unsaturated fatty acid (UFA) content. Liver samples were analyzed to determine Cu concentration. The presence of 200 ppm Cu and Cu + 22 or 44 IU E/kg in the diet improved ADG +5.6, +6.5, and 6.9%, respectively, and FC, +8.4, +5.4, and +6.0%, respectively, in comparison with the controls. The presence of 200 ppm Cu + 88 IU E/kg in the diet reduced ADG -0.7% and improved FC +0.3%. These changes were not significant. The presence of 200 ppm Cu in the diet resulted in a significantly ($P < 0.01$) increased liver Cu concentration. This was unaffected by the level of E in the diet. Significant ($P < 0.05$) decreases occurred in mp of the backfat when 200 ppm Cu or 200 ppm Cu + 22 or 44 IU E/kg were included in the diet. With the diet containing 200 ppm Cu + 88 IU E/kg a significant ($P < 0.01$) increase in mp and a decrease in percent UFA was noted.

Comparisons of east–west ROP rations. G. H. Bowman,* H. S. Bayley, W. R. Usborne, B. L. Walker, and M. Sanderson, University of Guelph, Guelph, Ont.

A randomized block experiment in which 384 gilts and boars were allotted to the barley base “Western” ROP ration and the corn base “Eastern” ROP ration revealed that these two rations gave similar performance for growth rate, feed efficiency, and backfat thickness. Each sex ate approximately the same amount of feed per day. Boars, however, were leaner, grew slightly faster, and were more efficient.

Effects of unsaturated dietary fats on the production and acceptability of pork. G. H. Bowman,* H. S. Bayley, W. R. Usborne, B. L. Walker, and M. Sanderson, University of Guelph, Guelph, Ont.

A randomized block experiment in which 128 pigs were allocated to eight rations was conducted to examine the effects of various sources of soybeans and rapeseed products on swine performance. As a dietary ingredient, soybean products were superior to rapeseed, and conventional protein meals were superior to whole seed products produced either through heat treatment or through reconstituting the processed oil and protein. Diets higher in unsaturated fats resulted in carcasses higher in unsaturated fats. The acceptability of the resulting pork, however, was not affected.

Effects of feeding fishmeal in a broiler-breeder ration. Allan C. Cox,* Canada Agriculture, Kentville, N.S.

A field experiment involving a 2500 bird broiler-breeder flock was conducted to study the effects of feeding fishmeal in a broiler-breeder ration on hatchability and progeny performance. The breeder flock, which had been in production for 10 weeks, was divided into a control group that received no fishmeal in their ration and a treated group that received a 6% fishmeal ration. Hatchability for the 6-week experimental period was 85.20% and 85.35% for the control and treated groups, respectively. Fishmeal in the ration resulted in fewer reject chicks, early and mid-term dead in-shell embryos, but increased the number of late in-shell dead embryos and pips. Progeny from the treated groups were heavier initially, gained slower, exhibited a lower mortality but a higher incidence of leg weaknesses. Efficiency of feed utilization did not differ between the progeny from the control and treated groups.

Effects of feeding additional vitamins during the latter stage of the production cycle on hatchability of broiler-breeder eggs. Allan C. Cox,* Canada Agriculture, Kentville, N.S.

A field experiment involving a broiler-breeder flock of 3250 birds that had been in production for 21 weeks was conducted to study the effects of feeding additional vitamins during the latter stage of the production cycle on hatchability. The breeder flock was divided into a control group that remained on its regular ration and a treated group that received additional vitamins in its ration. Hatchability of eggs set after the breeders had been on their respective treatments for 4 weeks was 78.85% and 84.74% for the control and treated groups, respectively. Relative to the control group, additional vitamins during
this period reduced the number of reject chicks, pips, early, midterm, and late dead in-shell embryos. Progeny from the treated group gained faster, were more efficient feed utilizers, and exhibited a lower incidence of leg weaknesses when compared with the progeny from the control group.

Effects of repeated three- vs. six-week weaning with Yorkshire sows. A. Rouse* and L. M. Cock, Nova Scotia Agricultural College, Truro, N.S.

Six pairs of litter mate sows were assigned randomly to lifetime treatments of 3- or 6-week weaning. The average of 20 weaning intervals has been 149 and 166 days for the 3- and 6-week intervals. Litter data were found nonsignificant for pig farrowed, birth weight, 6-week weight, days weaning to breeding, pigs marketed per farrowing, days to market, market grading, feed cost per lb of pig at 6 weeks, or total feed cost to market weight. The averages for 3- and 6-week treatment, respectively, for 6-week weight, pigs marketed per farrowing, and days to market were 9.5 and 9.5 kg, 10.3 and 10.7 pigs, and 171 and 172 days.

Comparative performance of boars, barrows, spays, and gilts. H. Peleneur, S. B. Kowalchuk, and G. H. Bowman,* University of Guelph, Guelph, Ont.

A split-plot experiment, in which 192 pigs made up of gilts, barrows, boars, and spays, was conducted to determine the effects of sex, genotype, and level of protein on production. Boars were distinctly leaner than barrows and spays and somewhat leaner than gilts. Their feed efficiency was distinctly superior to all other sexes. Further, when the level of protein was increased from 13 to 15%, boars responded more distinctly than did other sexes. Boars dressed less, but also had less total viscera than the other sexes. In general, the sexes ranked boars, gilts, barrows, and spays, boars being most distinct and having greater differences between the unaltered sexes than within.

Management

Penning systems for performance testing boars. V. Pavlick and G. H. Bowman,* University of Guelph, Guelph, Ont.

A randomized block experiment was conducted in which 60 boars were allocated to five penning systems that varied in both floor area and numbers of pigs per group. In general, boars seemed to adapt to each system and perform about equally. There was a trend, however, that suggests single boars in a liberal amount of space will perform best. Conversely, single boars in a very restricted space tended to perform at the lowest level.

A survey of disposal of male calves from Ontario dairy farms. J. E. Core,* J. B. Stone, T. D. Burgess, and P. A. Wright, University of Guelph, Guelph, Ont.

In recent years, there has been an increasing awareness of the use of male dairy calves as inputs for finished beef production. Little documented data was available on the number and use of such calves on Ontario dairy farms. A mail survey of dairy farmers was conducted to obtain information on the male calves born on their farms from August 1970 to August 1971. The number of dairy bull calves born (230,000) was found to be considerably lower than estimation from DBS statistics would indicate; indeed the number of dairy cows in the province (683,000) is much lower than DBS estimates (840,000). The rearing pattern of the dairy bull calves raised on the home farm was established, as was the destination of calves sold at a young age. 11% of the bull calves died at a young age, 1% were reared as breeding stock, 39% were reared for meat purposes on the home farm, and the remaining 49% were sold as bob calves. Of those reared on the home farm, one-half were raised as veal and the other half as beef. One-half of those sold were consigned to sales barns, one-third were sold directly to farmers, with the remaining being sold to drovers.