

Genetic Evaluations of Canadian Dairy Goats

B.P. Sullivan, May 2000

Summary

Canadian dairy goats receive genetic evaluations annually for milk, fat and protein yield, and for body conformation (type) based on eight linear type traits. Both recording programs are managed by the Canadian Goat Society (CGS) which utilizes the services of provincial dairy cattle programs for milk recording, and Canadian Livestock Records Corporation for pedigree data. CGS also operates a milk recording option where groups of breeders test in each others herds. Milk records from all provinces are processed by the Quebec Dairy Herd Analysis Service. Genetic evaluations are computed by the Canadian Centre for Swine Improvement based on an animal model for both yield and type and have been available since 1991. The yield evaluations utilize an individual test day model developed at the University of Guelph. Evaluations are computed for Alpines, LaManchas, Nubians, Saanens and Toggenburgs, and include records on animals that have at least 3 generations of registered sires. The evaluations released in the Spring of 1999 included 62 018 individual test day records from 11 778 lactations on 6 636 does. The type evaluations were based on 5 452 first classification records. A total of 19 781 animals (including ancestors) were evaluated for yield, and 19 640 animals for type. Test day records start in 1987 and type records in 1981. Official yield evaluations are published for bucks with at least 5 daughter records, and type evaluations for bucks with at least 3 daughter records. A selection index for yield traits gives equal weight to milk and fat yield genetic evaluations. A type index gives 35% weight to 4 mammary system traits, 23% to general appearance, 15% to feet and legs, 15% to body capacity and 12% to dairy character. A third index combines the above yield and type indices with 60% weight on yield and 40% on type.

Yield Evaluations

Annual genetic evaluations are computed by the Canadian Centre for Swine Improvement for milk, fat and protein yields based on monthly test day records collected under the Canadian Goat Society (CGS) milk recording program. Breeders can have the recording done by provincial dairy cattle milk testers, or a second option is to form a group with other breeders and to take turns testing each other's herds. In either case, all data collected under this program is processed centrally by the Quebec Dairy Herd Analysis Service, which is the organization responsible for dairy cattle recording programs in the province of Quebec. Pedigree data is collected by Canadian Livestock Records Corporation in Ottawa.

In 1998, there were 904 goats freshening in 44 herds across Canada, for an average herd size of 20.5 does. The number of goats tested has remained fairly constant over the years, but herd size is increasing while the number of herds is declining. Test day data is available starting in 1987. The evaluations produced in the Spring of 1999 included 62 018 individual test day records from 11 778 lactations on 6 636 does. Data was included from all lactations on Alpine, Lamancha, Nubian, Saanen and Toggenburg goats with at least 3 generations of registered sires. Including ancestors, 19 781 animals received yield evaluations.

Genetic evaluations are computed using a BLUP animal model and the individual test day records, as described in Schaeffer and Sullivan (1994). The model includes random effects for herd-test-date, animal and permanent environment within a lactation. Permanent environment between lactations is not accounted for in the current model. Fixed effects are also included to account for the shape of the lactation curve within breed-parity-age-season groups. The accuracy of the model varies with the stage of lactation, with the most accurate records occurring in mid-lactation, and lower accuracy in early or late lactation. The model applies different residual variance for each day in milk, with the effect that a record in mid-lactation contributes more to the evaluations than a record in early or late lactation.

Estimated Breeding Values (EBVs) for yield traits are computed such that the average of does in the base group for each breed is zero. Base groups are defined as does born in the last 5 years, except for Lamancha, where it is 10 years due to a smaller numbers of animals. Thus, positive values indicate a breed improver.

Heritability estimates are 0.29, 0.27 and 0.30 for milk, fat and protein yields, respectively. Permanent environment estimates are similar to heritabilities, giving repeatability within lactation of 0.65, 0.61 and 0.64, respectively. These heritability estimates are similar to estimates for full lactation yield over 305 days. Thus, evaluations based on several individual test days should be more accurate than from a single 305 day record. In the case of milk yield, accuracy of doe evaluations based on a single lactation record with increasing number of test days is 0.29, 0.35, 0.37, 0.39, 0.40, 0.40, 0.41, 0.41, 0.42 and 0.42 for 1 to 10 test days, respectively (Chesnais and Sullivan, 1994). It is interesting to note that evaluations based on just 3 test days per lactation are about 95% as accurate as for 10 test days. For the purpose of genetic evaluation, testing on a monthly basis is probably not necessary. Lower testing costs could result in more herds testing goats, which would be more important than the small loss in accuracy on individual animals.

Type Evaluations

Annual genetic evaluations for eight linear type traits are also computed by the Canadian Centre for Swine Improvement, based on records collected under the Canadian Goat Society (CGS) type classification program. CGS trains and employs classifiers who will visit breeder herds once per year during the summer months. Breeders must classify all first and second parity does, and have the option of classifying older does. Bucks are also classified, however, only doe classifications are used for genetic evaluations. At the moment, the first classification on a doe is included, but the plan is to eventually include the second classifications as well.

Type traits are scored on a scale of 1 to 9, with 1 being extremely poor, 5 average and 9 ideal. The eight traits evaluated are general appearance (GA), feet and legs (FL), dairy character (DC), body capacity (BC), medial suspensory ligament (SL), fore udder (FU), rear udder (RU) and teats (TE). With the aid of a hand-held computer, the last four traits are combined into an overall mammary system score, and all eight traits are combined into an overall final score. The relative emphasis given to each of these traits (as a % of final score) is 23 for GA, 12 for FL, 15 for DC, 15 for BC, 15 for SL, 8 for FU, 8 for RU and 4 for TE.

In 1998, there were 499 does classified in 61 herds. This number was low compared to earlier years. More importantly, in 1999, the number has increased to 1081 goats classified in 107 herds. This increase is associated with incentive programs in the province of Quebec, which are aimed to increase the number of commercial herds that are milk testing and classifying. Type records start in 1981, and the evaluations produced in the Spring of 1999 included a total of 5 452 first lactation records on Alpine, Lamancha, Nubian, Saanen and Toggenburg goats with at least 3 generations of registered sires. Including ancestors, 19 640 animals received type evaluations.

Genetic evaluations are computed for each of the eight linear traits using a BLUP animal model. The model includes fixed effects for herd, year, classifier, breed, age and stage of lactation. The interaction of herd-year-classifier, and animal are random effects. EBVs are expressed such that the average for each trait is 5 for does born in the base group for the breed. Thus, above 5 can generally be interpreted as a breed improver.

Selection Indexes

A production index (PINDEX) is computed which gives equal emphasis to milk and fat yield:

$$\text{PINDEX} = 100 + 0.14 * (\text{milk EBV}) + 4.4 * (\text{fat EBV})$$

A type index (TINDEX) combines the type EBVs with the same emphasis as used in the calculation of final score on farm:

$$\text{TINDEX} = 100 + (0.23 * \text{GA} + 0.12 * \text{DC} + 0.15 * \text{BC} + 0.15 * \text{FL} + 0.15 * \text{SL} + 0.08 * \text{FU} + 0.08 * \text{RU} + 0.04 * \text{TE} - 5) * 152$$

A combined production and type index (PTINDEX) combines the above with 60% emphasis on production and 40% on type:

$$\text{PTINDEX} = 100 + 0.832 * (\text{PINDEX} - 100) + 0.555 * (\text{TINDEX} - 100)$$

Each of these indexes has an average of 100 and a standard deviation of about 25 for the does included in the base group for each breed. Thus, indexes above 100 are generally breed improvers, with approximately 1 of 6 animals indexing above 125, and the top 2.5% above 150.

Official Buck Evaluations

Yield evaluations are considered official for bucks having at least 5 daughters with production records, and type evaluations require 3 daughters to be classified. Bucks that have progeny registered in the last five years are listed in the CGS Quarterly magazine if they are in the top 10 for any of the above indexes. The complete list of official buck evaluations is available on the Internet at <http://www.ccsi.ca/goats/> or on request from the CGS office.

References

- Chesnais, J.P. and B.P. Sullivan, 1994. Évaluation génétique et sélection des sujets d'élevage. Conseil des production animales du Québec. Journée d'information amélioration génétique caprine 1994.
- Schaeffer, L.R. and B.P. Sullivan, 1994. Genetic evaluation of dairy goats using test day yields. Proc. 5th World Congr. Genet. Appl. Livestock Prod.