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Conference paper

DAIRY CATTLE BREEDING

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Dairy cattle breeding has become more sophisticated as time has progressed. Sire and cow evaluations methods have been constantly improved over the last several decades. Using these evaluations has resulted in increased genetic merit for production and for conformation traits for all countries that have organized breeding programs.

Concurrent with the changes in the industry, dairy cattle geneticists have improved sire and cow evaluations. One of these improvements is the use of test-day models. Test day models have a conceptual advantage because they correct for environmental effect that influence individual cow's production on a real-time basis. Ideally, test-day models can adjust for varying numbers of times milked within a lactation, month of calving, month of test, milking frequency, age, days in milk, progeny effects of different sires within herds, pregnancy status, and rBST treatments when they are recorded. Test days within lactation and across lactations are often considered separate traits. Since milk, fat, protein, and somatic cell scores (SCS) are frequently the primary traits of interest, a multiple-trait test-day model is indicated. As a result, test-day models can provide genetic evaluations for additional traits, such persistency, part-lactation yields, and first versus later lactations.

Test-day models that have been explored will be briefly discussed. 1) One approach adjusts test-day production for environmental effects, accumulates adjusted test-days into lactation totals, uses residuals for genetic evaluations, and provides producers management aids [Everett et al., 1994 J. Dairy Sci. 77 (Suppl 1) 267]. 2) Other models fit fixed and random effects simultaneously to test-day production and/or somatic cell counts. 2a) Fixed regression models where daily yield is considered a repeated trait within lactation and fixed regressions are included to account for stage of lactation within subclasses (Reents et al., 1995 J. Dairy Sci. 78:2858). 2b) Multiple-trait models where daily yields are considered separate trait by stage of lactation (Wiggans and Goddard, 1977. J. Dairy Sci. accepted). 2c) Random regression models where the shape of the lactation curve for an individual is modeled using fixed

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regressions to account for the general shape by subclasses. Random genetic regressions are used to model the genetic deviations of a cow's or sire's lactation curve from the fixed regression (Shaffer and Dekkers, 1994. Proc. 5 WCGALP 18:443). 2d) Covariance function models that attempt to describe variances and covariances of test-day yields based on continuous functions (Kirkpatrick et al., 1994. Genet. Res. 64:57).

Application of test day models is a formidable task. All test days are correlated as are all production traits. The choice of the appropriate test-day model to use is not clear and may be different across countries. If the model is not appropriate, genetic and environmental effects may be confounded. A criteria for choice of models may be to maximize the genetic effects and minimize the residual variance subject to unbiasness. Test-day models are being applied in Australia, New Zealand, and in the northeast part of the United States, and on a trial basis for SCS in Canada and Germany. Most of the heritability estimates of test-day yield from the test-day models are larger than from conventional models, though a few are smaller.

A second general topic of this session is international sire evaluation. These evaluations are currently computed from within-country evaluations. So, if estimated breeding values are improved within countries by using test-day models, international sire evaluations will also be improved. In recent years, the Holstein breed has been dominant for production traits, and particularly so where milk fat has been de-emphasized. Holsteins in the United States and Canada have historically been bred primarily for production and conformation traits, while in many other countries Holsteins were bred for the dual purpose of meat and milk. As a result, Holsteins from the United States and Canada have been extensively exported to many countries that wanted to emphasize increased production. Continuously importing Holstein quickly reduced differences between countries in the merit of native and imported cattle. As these differences became smaller, there was and is a need to choose sires that best fit the selection goals of a particular country. Thus, choices among sires in different countries based on expected performance in the importing country was needed. INTERBULL evaluations were developed to meet this need.

Comparing sires' breeding values when progeny tests are in different countries for importing to other countries is a formidable task. Evaluation methods have improved and data are much larger, which has allowed even better evaluations. The paper of Wickham and Banos shows 81,107 sires with progeny tests, as of February 1997, are in the INTERBULL data base. Of these, 53,659 were Holstein. The currently used method of evaluations is a multi-trait across country evaluation (MACE). The MACE method allows for genetic correlations to be less than one and recognizes the possibility of

genotype by environmental interaction across countries. Evaluations from the INTERBULL Centre supplies breeding values specifically for each country. The inclusion of a genotype by environmental interaction in MACE has stimulated more investigation of interactions in countries not now contributing data to the INTERBULL Centre. Some are reported in this session as are investigations on risk of using imported sires. That the INTERBULL evaluations are widely used is clear; 19 countries contribute data and 15 of these countries treat the INTERBULL comparison as official. Sires from Holstein, Jersey, Ayrshire, Guernsey, and Brown Swiss are included in the international evaluations.

Dairy breeding is no longer a country by country enterprise, but is now global in scope. There are many aspects to this globalization. Wickham and Banos report that the five most used sires produced 50% of all bulls born in 1990 that are in the INTERBULL data. This can, if continued, produce a level of inbreeding that may reduce calf livability and reduce fertility in addition to a slight reduction in production. Semen and embryos are now exchanged across countries to produce sires for AI in the importing countries. Different AI organizations could cooperate or merge operations on an international basis. A variety of breeding schemes can be visualized for the future based on evaluation of cows and sires across countries. INTERBULL evaluations will be improved even more when more data are available from countries with smaller dairy populations, and particularly when sires have their first progeny tests simultaneously in two or more countries.

UZGOJ MLIJEČNOG GOVEDA

Uzgoj mliječnog goveda postao je s vremenom kompliciraniji.. Metode za ocjenu rasplodnjaka i krava zadnjih se nekoliko desetljeća neprestano usavršavaju. Rezultat primjene tih ocjena je povećana genetska vrijednost proizvodnih i konformacijskih osobina u svim zemljama koje imaju organizirane uzgojne programe.

Istodobno s promjenama u industriji genetičari mliječnog goveda unaprijedili su procjenjivanje rasplodnjaka i krava. Jedno od ovih poboljšanja je upotreba modela dana testa. Modeli dana testa imaju koncepcijsku prednost jer ispravljaju djelovanje okoliša, što utiče na proizvodnju pojedine krave na osnovi stvarnog vremena. Idealno, modeli dana testa mogu se prilagoditi raznim brojevima mužnje u laktaciji, mjesecu telenja, učestalosti mužnje, dobi, danima mliječnosti, progenom djelovanju raznih rasplodnjaka u stadu, stanje trudnoće i tretiranjima rBST kada su zabilježena. Dani testa u laktaciji i kroz laktacije često se smatraju posebnim osobinama. Budući da su mlijeko, masnoća, bjelančevine i skorovi somatskih stanica (SCS) često osobine prvenstvenog zanimanja indiciran je model dana testa mnogostrukih osobina. Kao rezultat modeli dana testa mogu dati genetske ocjene dodatnih osobina kao što su ustrajnost, prinosi djelomične laktacije, te prve prema kasnijim laktacijama.

Ukratko će se raspravljati o istraživanim modelima dana testa.

1.) Jedan pristup usklađuje proizvodnju dana testa prema djelovanju okoline, skuplja usklađenje dane testa u ukupne laktacije, upotrebljava rezidue za genetska ocjenjivanja i pomaže proizvođaču u managementu.

2.) Drugi modeli prilagođavaju istovremeno stalne i slučajne učinke proizvodnji dana testa i/ili broju somatskih stanica.

2a.) Modeli stalne regresije gdje se dnevni prinos smatra ponovljenom osobinom u laktaciji, a stalne regresije su uključene za tumačenje stupnja laktacije unutar subklasa.

2b.) Modeli mnogostrukih osobina gdje se dnevni prinosi smatraju posebnom osobinom prema stupnju laktacije.

2c.) Slučajni model regresije gdje je oblik laktacijske krivulje za pojedinu životinju načinjen primjenom stalnih regresija za tumačenje općeg oblika subklasama. Slučajne genetske regresije primjenjuju se za oblikovanje genetskih devijacija laktacijske krivulje krave ili rasplodnjaka od stalne regresije.

2d.) Modeli funkcije kovarijance što pokušavaju opisati varijance i kovarijance prinosa dana testa na osnovi neprekidnih funkcija.

Primjena modela dana testa je golem zadatak. Svi su dani testa uzajamno povezani kao i sve proizvodne osobine. Izbor odgovarajućeg modela dana testa nije jasan i može se razlikovati u raznim zemljama. Ako model ne odgovara, genetski i okolišni se učinci mogu poremetiti. Kriterij za izbor modela može biti krajnje uveličavanje genetskih učinaka i umanjivanje rezidualne varijance ovisno o nepristranosti. Modeli dana testa sada se primjenjuju u Australiji, Novom Zelandu i u sjeveroistočnom dijelu Sjedinjenih Država, a na pokusnoj osnovi za SCS u Kanadi i Njemačkoj.

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