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ABSTRACT

Milk production records of 306 Alpine, 72 LaMancha, 170 Nubian, 84 Saanen, and 235 Toggenburg does born in the Northeast from 1972 through 1979 were used to estimate trends of additive genetic value. Estimated transmitting abilities were doubled and averaged for all does born in each year to obtain yearly estimates of genetic value. Genetic trends from regression of yearly mean genetic value on year of birth for Alpine, LaMancha, Nubian, Saanen, and Toggenburg averaged 11.4, −7.9, 1.9, 14.6, and 11.7 kg per year. Genetic trends were less than theoretically possible, indicating that more effective selection schemes are needed, although because of the limited number of does, the trends may not represent actual trends.

INTRODUCTION

A goal of dairy goat breeders is to increase genetic value for milk production to increase efficiency and profitability of individual animals and entire herds. The potential ability to change a trait through selection is largely a function of how heritable the trait is and how much variation is exhibited by the trait. Studies in Norway and the United States indicate that milk yield of goats is highly variable (2, 6, 9, 10), and heritability of milk yield is similar for dairy cattle and goats (1, 5, 7, 13). These findings suggest that goat populations should respond to selection for milk yield. Predictions of theoretical genetic gain resulting from particular breeding programs have ranged from 1 to 3.8% (2, 8, 12, 14). These predictions indicate the possibility of achieving faster relative genetic progress by dairy goats than by dairy cattle.

To determine the effectiveness of any breeding program, genetic trend must be monitored. A method of estimating trend would be to predict the genetic value of all animals in the population and obtain the average for each year (15). Hintz et al. (4) used this procedure to estimate genetic trends of cows and sires in the Northeast. Estimates of genetic progress for dairy goats have not been reported. The purpose of this study was to investigate genetic trends of milk production among Alpine, LaMancha, Nubian, Saanen, and Toggenburg does in the northeastern United States.

MATERIALS AND METHODS

Estimated transmitting abilities of 337 Alpine, 94 LaMancha, 214 Nubian, 118 Saanen, and 270 Toggenburg registered does born from 1972 through 1979 and which were on National Cooperative Dairy Herd Improvement Program test in the Northeast were used. All available 305-day, mature equivalent (ME) lactation records of a doe and her relatives within a herd were used to estimate transmitting ability, which is defined as one-half of genetic value.

Projection factors for terminated and incomplete records were based on last sample day production (17). Mature equivalent adjustment factors were specific for breed, age of kidding, and season of kidding as furnished by G. Wiggans (personal communication) to the New York Dairy Records Processing Laboratory (DRPL). Calculation of estimated transmitting abilities was done by DRPL within breed from records surviving standard edits (R. Taylor, personal communication). Estimates of transmitting ability were made available by DRPL for this study. The best linear unbiased prediction (BLUP) procedure described by Henderson (3) and Slanger et al. (11) was used by DRPL to obtain the estimates. Heritability was

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TABLE 1. Distribution of does by herdmate presence.[a]

Herdmate presence	Breed									
	Alpine		LaMancha		Nubian		Saanen		Toggenburg	
	(No.)	(%)	(No.)	(%)	(No.)	(%)	(No.)	(%)	(No.)	(%)
Does with herdmates	306	90.8	72	76.6	170	79.4	84	71.2	235	87.0
Does without herdmates	31	9.2	22	23.4	44	20.6	34	28.8	35	13.0
Total	337		94		214		118		270	

[a]At least one other doe kidding in the same herd-year-season with a different identified sire.

.25, and repeatability was .40. When a doe has no herdmates, the herd-year-season and doe effects are confounded completely so that calculation results in an estimate of zero; therefore, these animals could not be included. Table 1 shows the number of does that could not be evaluated. The distribution of does with nonzero estimated genetic values by year of birth are in Table 2.

Predictions of transmitting ability were doubled to estimate genetic trends. A doe's estimated genetic value was used only in her year of birth. Genetic trends in the doe population were averaged by regressing yearly averages of does' estimated genetic values on year of birth.

RESULTS AND DISCUSSION

Average estimated genetic values by year of birth for the Alpine, LaMancha, Nubian, Saanen, and Toggenburg breeds are in Table 2. Annual genetic trends (regression of average estimated genetic value on year of birth) are in Table 3. Genetic trends among Alpine, Nubian, and Toggenburg breeds are for does born from 1972 through 1979, whereas trends for LaMancha and Saanen are for does born from 1974 through 1979 and from 1973 through 1979, respectively.

Estimates of average additive genetic value of doe by year of birth among each of the breeds fluctuated over the 8 yr. Saanen had the largest estimate, 14.6 kg, ($P<.05$). Estimates

TABLE 2. Average estimated additive genetic value for milk production in kilograms for does of five breeds born from 1972 to 1979.

Year of birth	Breed				
	Alpine	LaMancha	Nubian	Saanen	Toggenburg
1972	−65 (9)[a]	. . .	−53 (6)	. . .	−124 (4)
1973	−54 (10)	. . .	18 (5)	−75 (3)	−8 (11)
1974	−14 (16)	90 (7)	45 (10)	−45 (4)	−8 (16)
1975	−26 (24)	−30 (3)	1 (28)	−23 (6)	7 (28)
1976	17 (48)	−24 (13)	−15 (17)	−28 (8)	3 (32)
1977	21 (80)	30 (15)	−2 (39)	47 (23)	42 (47)
1978	−2 (73)	5 (23)	−7 (43)	15 (23)	5 (65)
1979	14 (46)	4 (11)	10 (22)	−2 (17)	−14 (32)
Total number	(306)	(72)	(170)	(84)	(235)

[a]Number of does in parentheses.

TABLE 3. Linear regression of yearly average estimated additive genetic value (in kg) on year of birth.

Breed	Residual degrees of freedom	Regression coefficient	Standard error of regression
Alpine	6	11.4[a]	2.8
LaMancha	4	−7.9	11.1
Nubian	6	1.9	4.6
Saanen	5	14.6[a]	5.1
Toggenburg	6	11.7	6.5

[a]Statistical significance of difference between estimated regression coefficient and a zero regression coefficient at .05 probability.

were similar for Alpine and Toggenburg does, 11.4 and 11.7 kg, although only the Alpine regression was significantly different from zero ($P<.05$). Gain for Nubian does was small, 1.9 kg and was not significantly different from zero ($P>.05$) as was the negative trend of LaMancha, −7.9 kg. All estimates are based on a limited number of does and may not represent the whole population as only a small percentage of all dairy goats are on official test.

Annual progress for the five breeds of goats was less than potential gain from theoretical breeding schemes (2, 8, 12, 14). The weighted average of annual genetic trend for the five breeds was 8.3 kg, but based on the production average of 725 kg for herds on test in 1979 (16), this increase is only about 1%. Despite the higher potential for genetic gain in dairy goats, realized gain in the dairy goat population is no higher than the realized 1% gain in dairy cattle breeding programs (15). Low estimates of genetic gain in the dairy goat population indicate that more effective selection schemes are needed to increase actual progress.

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REFERENCES

1 Auran, T. 1976. Studies on monthly and cumulative monthly milk yield records. III. Estimates of genetic and phenotypic parameters. Acta Agric. Scand. 26:3.

2 Dentine, M. R., and B. T. McDaniel. 1982. Potential genetic gains in U.S. dairy goats. Page 302 *in* Proc. 3rd Int. Conf. Goat Prod. Disease, Tucson, AZ.

3 Henderson, C. R. 1975. Use of all relatives in intraherd prediction of breeding values and producing abilities. J. Dairy Sci. 58:1910.

4 Hintz, R. L., R. W. Everett, and L. D. Van Vleck. 1978. Estimation of genetic trends from cow and sire evaluations. J. Dairy Sci. 61:607.

5 Iloeje, M. U., and L. D. Van Vleck. 1978. Review: Genetics of the breeding of dairy goats. J. Dairy Sci. 61:1521.

6 Iloeje, M. U., L. D. Van Vleck, and G. R. Wiggans. 1981. Components of variance for milk and fat yields of dairy goats. J. Dairy Sci. 64:2290.

7 McDowell, R. E., and M. Sands. 1978. The potential of the goat for milk production in the tropics. Mimeo No. 60, Cornell Int. Agric.

8 Rønningen, K. 1970. En utredning over sporsmal i tilknytning til utarbeidelsen av en avlsplan for geit. Inst. Husdyravl Nor. Landbrukshogsk. 54(31):25.

9 Rønningen, K. 1981. Expected genetic progress of milk yield in the goat with special emphasis on Swedish conditions. Int. Goat Sheep Res. 1:18.

10 Shelton, M. 1978. Reproduction and breeding of goats. J. Dairy Sci. 61:994.

11 Slanger, W. D., E. L. Jensen, R. W. Everett, and C. R. Henderson. 1976. Programming cow evaluation. J. Dairy Sci. 59:1589.

12 Sporndly, R., and K. Rønningen. 1977. Expected genetic progress in milk yield in goats. A preliminary study with special emphasis on Swedish conditions. Lantbrukshogsk. Medd. 278:26.

13 Steine, T. A. 1976. Genetic and phenotypic parameters for production in goats. Meld. Nor. Landbrukshogsk. 55:19.

14 Steine, T. A. 1982. Principles of selection for milk production in dairy goats. Page 19 in Proc. 3rd Int. Conf. Goat Prod. Disease, Tucson, AZ.

15 Van Vleck, L. D. 1977. Theoretical and actual genetic progress in dairy cattle. Page 543 *in* Proc. Int. Conf. Quant. Genet., Ames, IA.

16 Wiggans, G. R. 1982. Use of dairy goat records in selection. Page 23 *in* Proc. 3rd Int. Conf. Goat Prod. Disease, Tucson, AZ.

17 Wiggans, G. R., L. D. Van Vleck, and F. N. Dickinson. 1979. Projection factors for goat lactation records. J. Dairy Sci. 62:797.