ECONOMIC AND GENETIC EVALUATION OF BREEDING STRATEGIES FOR THE MEXICAN HOLSTEIN POPULATION.

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SUMMARY

Breeding strategies based on progeny test (PT), utilization of selected young bulls (YB), a multiple ovulation and embryo transfer nucleus of 512 cows (MOET), importation of semen of progeny tested sires from Canada and US to produce all the replacement cows (IM), and semen importation for sire-sire path combined with PT (PT+IS) or with YB (YB+IS), were evaluated for the improvement of milk yield of the Mexican Holstein population. Economic and genetic responses from yr 1 to 30 were obtained with deterministic modelling. The rank of strategies on cumulated genetic responses at yr 20 was: MOET, PT+IS, YB+IS, IM and PT with 1563, 1198, 1161, 896 and 822 kg/cow respectively. At yr 30 the ranking was: MOET, PT+IS, YB+IS, PT and IM with 2369, 1721, 1635, 1576 and 1210 kg respectively. The rank of strategies on economic benefits at yr 20 was: MOET, YB+IS, PT+IS, IM and PT with 1002, 881, 833, 381 and 330 Mexican $. At yr 30 the ranking was: MOET, YB+IS, PT+IS, PT and IM with values 1721, 1404, 1372, 762 and 708 Mexican $. The strategy YB+IS appear to be interesting in both genetic and economic terms. MOET nucleus deserves further evaluation versus PT in countries with low proportion of recorded cows.

INTRODUCTION

In Mexico more than half of the milk production of the country is obtained from Holstein or high grade Holstein cows. This population consisted on about 1 million of cows with 50,000 in milk recording (Montaldo and Castro, 1991). A system of genetic evaluation for bulls and cows for milk yield has been instrumented by the Asociación Holstein de México. Also, imported semen from Canada and USA is utilized to breed both replacement cows and bulls. However, the relative economic worth of competitive breeding strategies for this population has not being determined. The purpose of this paper is to compare a number of breeding strategies involving within population selection, importation of selected germplasm from Canada and USA and the use of an adult closed MOET nucleus (Nicholas and Smith, 1983).

MATERIALS AND METHODS

Breeding strategies based on progeny test (PT), utilization of selected young bulls (YB), a closed, adult multiple ovulation and embryo transfer nucleus of 512 cows (MOET), importation of semen of progeny tested sires from Canada and US to produce all the replacement cows (IM), and semen importation for sire-sire path combined with PT (PT+IS) or with YB (YB+IS), were evaluated for the improvement of milk yield of the Mexican Holstein population.

Genetic responses for milk production and their economic value from yr 1 to 30 were obtained with deterministic modelling of the replacement process (Searle, 1961), and the genetic superiority of the replacement females based on the expected genetic differentials of parents (Dickerson and Hazel, 1944). The model allow the use of local or imported germplasm in each of the selection paths,

and the use of different proportion of bulls of different origin in a particular selection path. The interaction genotype x environment was considered in the model. Production and economic responses were estimated with milk production corrected for age structure and reproductive pattern of the population.

The economic benefit was estimated as the net present value of 0.5 * cumulated yearly corrected milk yield response minus discounted costs, using a discount rate of 0.10. A constant age structure was assumed with a rate of replacement of 0.28. A population of 50,000 cows was assumed to be both the recorded population for PT and the population to improve. The heritability was assumed to be 0.20, the average ME production, 7000 kg/lactation, the phenotypic SD, 1400 kg. A genetic superiority of 687 kg for Canadian or US bull population over Mexican cow population was assumed at year 1, and a constant genetic trend of 68 kg/yr in ME milk for the exporting bull populations was assumed. A genetic regression of 0.50 for local response on imported bull's breeding values was utilized. Generation intervals were 3 years for pedigree selected bulls, 8 years for progeny test selected bulls, 4.46 for cows in the population and 4 years for bulls and cows in MOET nucleus (Montaldo, 1989). Average 1989 costs for imported semen of superior bulls, semen processing, bull maintenance, milk recording, embryo transfer and milk price were utilized in economic evaluations. Parameters were assumed to not change for the period studied. Inbreeding depression was not included in the model, supposing their increase could be very small avoiding close inbreed matings in a nucleus of 512 females (Jeon et al., 1990).

RESULTS

The rank of strategies on cumulated genetic responses at yr 20 was: MOET, PT+IS, YB+IS, IM and PT with 1563, 1198, 1161, 896 and 822 kg/cow respectively (Table 1). At yr 30 the ranking was: MOET, PT+IS, YB+IS, PT and IM with 2369, 1721, 1635, 1576 and 1210 kg respectively (Table 1). The rank of strategies on economic benefits at yr 20 was: MOET, YB+IS, PT+IS, IM and PT with 1002, 881, 833, 381 and 330 Mexican $ (Table 1). At yr 30 the ranking was: MOET, YB+IS, PT+IS, PT and IM with values 1721, 1404, 1372, 762 and 708 Mexican $ (Table 1).

Table 1. Genetic (ΔG) and economic (ΔE) response to breeding strategies at yr 20 and 30

Strategy	yr	ΔG (kg)	ΔE ($)
PT+IS	20	1198	833
	30	1721	1372
YB+IS	20	1161	881
	30	1635	1404
IM	20	896	381
	30	1210	708
PT	20	822	330
	30	1576	762
MOET	20	1563	1002
	30	2369	1721

DISCUSSION

The strategy YB+IS appear to be interesting in both genetic and economic terms in agreement with results of (Mpofu et al., 1993a,b). MOET nucleus deserves further evaluation versus PT in countries with low proportion of recorded cows, because their high genetic response in conditions of lacking infrastructure to insure an efficient progeny test. Slaybaugh-Mitchell and Berger (1993) found also MOET nucleus superior to IM for developing countries. Negative values obtained by Mpofu et al. (1993b) for MOET nucleus in Zimbabwe could be explained by the semen market characteristics (Montaldo, 1989). Probably to compare the net economic value/unit of semen obtained with their production cost for different schemes, could be a better approach. The genetic efficiency of a closed MOET nucleus is probably superior to those of an efficient progeny test program, even when the possible reduction in the genetic variance is accounted for (Dekkers and Shook, 1990, Meuwissen, 1991) however, practical drawbacks consisted on increased risk of disease in the nucleus and possible genotype x environment interaction between a closed nucleus and the offspring population. Utilizing open instead of closed nucleus could be a solution for most of these problems (Lohuis, 1993). IM do not appear to be effective in economic terms under the price structure utilized in this work. Mpofu et al. (1993b) report negative net economic responses at yr 25 for IM. An increase in selection intensity from 0.7 to 1.0 on IM strategy, had a negative affect in economic benefits because the semen price increases from 15 to 20 US dollars. Higher cost/dose used in PT+IS or YB+IS schemes (30 US dollars) was however compensated by the extra genetic gain obtained together with a much lower number of imported doses required only the sire-sire path.

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