

A sire-advising program and mating plan for Italian Holsteins

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Abstract

Since 1988, the Italian Holstein Friesian Association (ANAFI) has been providing a service for selection of AI bulls and individual mating of heifers and cows. The service has the objective to maximise the genetic improvement of the farms. The sire-advising program and mating plan, with no ties to any AI commercial organisations, is implemented on farm, using a laptop computer, by the ANAFI classifiers together with the farmers. The algorithm uses linear programming to maximise a function (selection objective) chosen by the farmer (ILQM, EBV for protein kg, milk, mammary system, etc.). Also the farmer may set few limits: price of dose, reliability, and minimum threshold on certain traits. A list of bulls, which maximises the objective function given the pre-chosen limits, is suggested to the farmer. Then, the program proposes the distribution of semen for individual mating of heifer and cows, accounting for expected inbreeding of each mating. Moreover the mating plan suggests corrective mating using genetic indexes for conformation. Over 2000 farmers subscribe to this service, resulting in an extra 47% yearly genetic improvement (ILQM) compared to the average Italian genetic progress.

1. Introduction

The sire advising program is a service offered by ANAFI (the Italian Holstein Breeders Associations) to its breeders. This program does not have any commercial purpose and it is completely independent by any AI commercial organisation. The final objective is to offer the better mating for the cows and heifers in the herd, maximising the genetic improvement at the lower cost.

The computer program was implemented in 1988 for the Italian Holstein breed by Gerald Jansen and the staff of ANAFI, starting from a prototype, the program “Maxbull”, obtained by the Virginia Polytechnic Institute (Cassel and McGillard, 1983; McGillard and Clay, 1983; McGillard and Clay, 1983). The program is based on linear programming and it maximises a function (selection objective) chosen by the farmer (ILQM, EBV for protein kg, milk, mammary system, etc.). The mating

plan subscription is a service made available to farmers on request. Based on a technical discussion with the farmer, a technician of ANAFI will run the program directly in the farm, using a laptop computer.

2. The advising program

The plan is based on three main steps: the starting analysis of the farm, the selection of group of bull and, finally the specific mating of heifers and cows with each bull. These three steps are developed together with the farmer by one of the 27 technicians of ANAFI. The staff of the office of ANAFI is providing the constant support to educate technicians and to update the program with last genetic indexes and phenotypic data.

2.1 The general analysis of the farm

A first step of the mating program is the analysis of phenotypic and genetic levels of the farm, for

production and type traits, compared to the national average. The production data, and relative average, are also calculated for different categories of heifers, first parity or later parity cows highlighting the genetic and phenotypic progress for different traits in the herd. Finally a list of the farm top cows for selection index, production and type are printed. Part of this step is the discussion with the farmer to define the selection objective, limits and threshold. Concerning gene distribution, the program indicates bulls with the larger number of daughters and granddaughters in the herd.

2.2 Selection of bulls

After the general analysis of the farm the mating program start with the definition of base parameters and objectives of the plan. Minimum EBV of bulls for production and type traits, minimum number of necessary straws, maximum price for straw, and other limits can be set as thresholds in the program. The genetic level to be achieved and the relative importance for each trait define the objective. Using these values, given the complete group of bulls available in Italy and the relative updated estimated breeding values, the program will choose the optimum group of bulls for the subsequent period of time at the lowest cost. Average of the resulting group of bulls is presented for production and type traits and compared with the average of all bulls available (top 5% bulls).

2.3. Mating plan

The last part of the program suggests the best bull, chosen from the previous group, to be mated to each female in the herd. The choice accounts for the estimated breeding

values of the cow, considering traits to be selected for. The mating plan takes into account the inbreeding coefficient of the future progeny obtained with each potential mating. The program allows for a maximum of 6.25% of inbreeding, value estimated considering that grandparents and great-grandparents should be different animals. Output of the analysis is a list of all cows of the herd with the relative bull to be mated with. Moreover, a list of bulls, with detailed information, is given.

3. Diffusion of the service

Currently over 2,000 farmers have subscribed to the sire advising program, representing roughly 17% of the total number of farms registered in the ANAFI Herd Book. The service is implemented at a farm level by 27 technicians who cover all of Italy. Moreover, the sire-advising program is not the only service these technicians provide on the farm. Their main responsibility is type traits scoring of all registered primiparous cows. It is estimated that the time spent on mating program delivery occupies around 10% of their working time. Usually, herds that subscribe to mating plans represent the largest farms and mostly cover the more developed areas for dairy production. Last year about 144,000 cows were inseminated using bulls identified by the program. Some farmers have been using the service twice per year for 12 years.

4. Results

A group of 1,525 farms that subscribed to the mating program for at least 4 years was considered to evaluate the efficiency of the program (Table 1). The average estimated

breeding values of bulls identified by the mating plan were compared with the national average of all bulls available in Italy (Table 2). Differences of more than 300 kg for ILQM (Italian selection index) and 150 kg for milk were found in favour of

bulls chosen by the program. Positive differences were also evident for protein percent, and ICM (mammary composite index). These averages indicate that farmers using the mating plan are choosing bulls with a higher genetic level than the national average.

Table 1. Number of inseminations in Italy and inseminations suggested by mating program in farms that subscribed to the program for 4 years

	Insemination in Italy	Insemination mating plans
1995	1,408,848	222,496
1996	1,468,474	218,580
1997	1,471,361	193,073
1998	1,439,613	186,786

Table 2. Comparison between average estimated breeding values of bulls identified by the mating plan (MP) and the national average of all bulls available in Italy.

	ILQM		Milk		Fat %		Prot %		ICM	
	Italy	MP	Italy	MP	Italy	MP	Italy	MP	Italy	MP
1995	1,627	1,815	1,296	1,438	-0.05	-0.07	0.06	0.07	1.45	1.88
1996	1,772	2,049	1,400	1,559	-0.05	-0.05	0.07	0.09	1.58	1.86
1997	2,031	2,399	1,555	1,728	-0.06	-0.08	0.08	0.12	1.79	2.12
1998	2,156	2,563	1,619	1,920	-0.06	-0.06	0.1	0.11	1.90	2.38

Table 3. Comparison between average estimated breeding values of herds subscribing to mating plans (MP) and Italian averages.

	ILQM		Milk	
	Italy	MP	Italy	MP
1994 average EBV	-124	-498	-80	-91
1999 average EBV	603	571	498	683
Difference 99-94	727	1069	578	774
Annual genetic progress	145	214	115	155
Difference kg by year (MP-Italy)		69		40
Difference % by year (MP-Italy)		47%		35%

A similar comparison was repeated considering the genetic levels of the same group of herds (Table 3). In 1994 these farms had a genetic level lower than the national average. In 1999, the situation was reversed with higher average genetic value for ILQM) and milk kg for these herds that have been using the mating

program for the previous four years. Also interesting is the increase in genetic level of 35 and 47%, for milk and ILQM, respectively, in these herds following the program, in comparison with average national farms.

5. Limits and potential

The main limit to the diffusion of the program is the small number of technical people responsible for its implementation on farm. Due to the size of the country, the number of herds and increased interest in the program, additional staff would be desirable. Moreover, some aspects can be improved. At the moment the analysis is only based on the genetic and phenotypic level of herds and bulls. Economic aspects are only considered as the price of straw. However, a more comprehensive economic analysis should be implemented in order to evaluate the advantage of choosing a group of bulls accounting for expenses and profit of the farm. As part of this analysis the longevity should also be included, both as a functional trait for selection and as an economic cost. Different longevity is also associated with different time intervals to amortise the cost of insemination. Finally more attention should be placed on developing a better method to account for inbreeding in mating.

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