INTRODUCTION

Faster genetic improvement in dairy herds is limited by naturally lower reproductive abilities, that is the reason why embryotransfer as the method for reproduction allows many possibilities for improvement of genetic basis of certain herds and whole populations. The development of embryotransfer till the commercial level in routine work, has the importance in two ways.

- First, remarkable improvement of genetic basis of nucleus herd by permanent immigration of qualitative genes by purchasing of genetically high quality embryos. By this manner, through the embryotransfer, the highly productive herd could be established.

- Second way is wide use of embryotransfer for obtainment of full sibs (brothers and sisters) and application of certain models of MOET program, which allows the reduction of generation interval, the improvement of selection intensity for achievement of higher annual genetic gain and apply new concept in test of bulls in wider population.

What is the MOET program and it's modalities?

Today worldwide are evaluated modalities of use of programs of the genetic improvement by use of embryotransfer and superovulation in so called MOET (Multiple Ovulation & Embryo Transfer) programs which are specified for different associations of cattle breeders in certain countries. The main goal is to use the superovulation and embryotransfer for production of larger number of full sibs, namely to control the most important lines of inheritance, which by it's relative importance shows the relation as follows (Lederer, 1988):

\[
\begin{align*}
\text{FS (father - son)} & \Rightarrow 45 \\
\text{FD (father - daughter)} & \Rightarrow 25 \\
\text{MS (mother - son)} & \Rightarrow 25 \\
\text{MD (mother - daughter)} & \Rightarrow 4 - 8
\end{align*}
\]

By use of embryotransfer and MOET program, which is incorporated in conventional program over artificial insemination, practically all important ways of inheritance are included. Today, all cattle raising developed countries started the concrete programs of MOET program, so:

**Denmark** - Since 1985, one experimental MOET raising program started (Fy - Bi Project), where 4 breeds of Danish cattle with 3 herds present nucleus herds of one mixed model of MOET nucleus breeding program. The reproduction is conducted only by embryotransfer and female animals remains in the nucleus till the end of lactation. The progeny originated from donor cows which are only bulls mothers, and were inseminated by bulls fathers from classic program for insemination. Since 1988 year started the nucleus inside selection of donors, where 20-25% of cows were introduced to superovulation.
Great Britain - Private company Premier Breeders is the largest service for embryotransfer, started in 1987 year the MOET nucleus program in central nucleus herd of 250 cows. This herd was established by import of embryos of 60 best cows from USA, Canada and New Zealand, and 25 best fathers from USA and Canada as well. It is interesting that the selection of fathers was done according to results of brother’s and sister’s ancestors in the nucleus herd, and not by classic results of test. With aim to reduce the generation interval, the selection in the herd was performed according to the results in first 90 days of lactation.

Canada - Canadian TEAM program (Total evaluation of Animals with MOET) is performed in 6 stations of Holstein Friesian and Eishire breeds. In this program in average was selected 30 donor cows from which 20 embryotransfer pregnancies was produced, and farms which participate in the program keep 6 females of different donors. This cows are donor candidates for TEAM. Male animals go to the Center for insemination when are 3 years old, when information for brothers are obtained according to the finished first lactation.

Germany - There is 3 programs in Germany. Program for Angler breed started by breeding of 15 bulls mothers and 3 fathers with repeated embryotransfer, and 80 calves were obtained. Calves, 40 males go to the station for performans test, from which 15 best are included to the test insemination, and 34 females go to 6 test herds where remain till the end of lactation. The best 10 are selected for open nucleus, and at the beginning of second lactation in the herd of the owner, undergo to embryotransfer. By this way this 10 cows and 5 selected fathers make the nucleus of the next generation.

Very interesting is the program of Osnabruck associations. This program represents the open MOET program, which consist on the next:

According to the first two controls of the first lactation of 10000 cows, 100 are selected, and they undergo to the program for superovulation, become inseminated with the best bulls from worldwide. The best 50, according to OHG index go to the donor station, where under same conditions are tested for 8 months in the second lactation. From these cows there is 300 progeny per year, which remain in adequate farms. After second lactation cows with test in the donor station return to owners and remain as embryo donors.

The task of our research is to evaluate the possibilities of use of embryotransfer and MOET program in our conditions in one nucleus herd of 800 cows of Holstein Friesian breed.

MATERIAL AND METHOD

In this work one nucleus herd of 800 Holstein Friesian cows where embryotransfer is performed was evaluated. The selection of embryo donor cows was done on 3 levels, depending on total index of cows, considering the milk amount, milk fat and crude proteins. From totally 226 performed embryotransfers, 67 true sisters was obtained, for calculation of selection index (SI) of bulls according to relation:

\[
SI = w_1 [b_1 (x_1 - x_i)] + w_2 [b_2 (x_2 - x_j)] + w_3 [b_3 (x_3 - x_k)]
\]

\[
w_1, w_2, w_3 = \text{economic effect for milk amount, milk fat and proteins}
\]

\[
b_1, b_2, b_3 = \text{genetic effect kg milk, kg milk fat, kg proteins}
\]

\[
b = R^\text{xr} \quad R = \sqrt{bxr} \quad \text{for bull sisters}
\]

\[
\Delta G = \frac{\partial g_{iru}}{L} \quad \text{- annual genetic gain}
\]
RESULT AND DISCUSSION

Calculated values of parameters of selection index and lactation production are presented in Table 1.

Table 1. Average milk production, milk fat and proteins of three sisters and value of selection index (SI)

<table>
<thead>
<tr>
<th>Sire</th>
<th>No. of full Sibs</th>
<th>Milk kg</th>
<th>Milk fat Kg</th>
<th>Milk fat %</th>
<th>Milk protein kg</th>
<th>Milk protein %</th>
<th>SI</th>
<th>Rang</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>8</td>
<td>7115</td>
<td>232</td>
<td>3.26</td>
<td>231</td>
<td>3.16</td>
<td>150</td>
<td>1</td>
</tr>
<tr>
<td>B</td>
<td>12</td>
<td>6796</td>
<td>243</td>
<td>3.57</td>
<td>220</td>
<td>3.23</td>
<td>77</td>
<td>2</td>
</tr>
<tr>
<td>C</td>
<td>13</td>
<td>6771</td>
<td>231</td>
<td>3.41</td>
<td>225</td>
<td>3.31</td>
<td>72</td>
<td>3</td>
</tr>
<tr>
<td>D</td>
<td>10</td>
<td>6355</td>
<td>208</td>
<td>3.28</td>
<td>205</td>
<td>3.23</td>
<td>-48</td>
<td>4</td>
</tr>
<tr>
<td>E</td>
<td>11</td>
<td>6310</td>
<td>230</td>
<td>3.65</td>
<td>209</td>
<td>3.31</td>
<td>-41</td>
<td>5</td>
</tr>
<tr>
<td>F</td>
<td>13</td>
<td>5829</td>
<td>222</td>
<td>3.81</td>
<td>191</td>
<td>3.28</td>
<td>-149</td>
<td>6</td>
</tr>
</tbody>
</table>

The estimated $\Delta G$ for amount of milk is

$$\frac{286 \times 3.87 \times 0.33}{4.5} = 81.47$$

in comparison with classic A.I. was $i = 1.4$, $r_n = 0.93$, $L = 6.5$, $\Delta G = 57.28$ which in respect to use of full sisters, lower genetic gain was obtained for 24.19 kg of milk.

According to the results of Lederer (1989) realized genetic gain in closed MOET program, in population of 20000 cows and including 80% of population by artificial insemination, annual genetic gain is 110 which is similar to the obtained results in our research. Similar calculation were obtained by Nicolas and Smith (1983).

Picture 1. Total genetic improvement depending on size of population in 80% of inseminations (Lederer, 1989)
In comparison with our research it is obvious that for our population of 20000 controlled cows of Holstein Friesian breed, closed MOET program is mostly appropriate.

CONCLUSION

There was 67 true sisters from 6 bulls of Holstein Friesian breed included in this research, in one nucleus herd of 800 cows. Values for selection index for bulls were calculated according to the value of corrected first lactation for milk amount, milk fat and proteins. The correction was done for the impact of season and year of production. Annual genetic improvement in closed MOET program was 81.47 kg of milk, which is with regard to classic artificial insemination more for 24.19 kg. According to this research, and in comparison to cited results of other authors, for our population of 20000 cows, the largest effects could be obtained by conduction of closed MOET program of development of nucleus herd and its incorporation in conventional program of artificial insemination.

REFERENCES