ACTA UNIVERSITATIS AGRICULTURAE ET SILVICULTURAE MENDELIANAE BRUNENSIS
SBORNÍK MENDELOVY ZEMĚDĚLSKÉ A LESNICKÉ UNIVERZITY V BRNĚ

Ročník LII 10 Číslo 4, 2004

PHENOTYPIC MANIFESTATIONS OF MILK EFFICIENCY OF COWS FROM EMBRYO TRANSFER

S. Minaříková, J. Žižlavský

Received: April 1, 2004

Abstract

MINAŘÍKOVÁ, S., ŽIŽLAVSKÝ, J.: *Phenotypic manifestations of milk efficiency of cows from embryo transfer*. Acta univ. agric. et silvic. Mendel. Brun., 2004, LII, No. 4, pp. 103-110

The effect of embryo donors and recipients of on milk efficiency of their female offsprings from embryotransfer was followed. Heifers and cows of Czech Spotted Breed were used as a embryo donors and recipients. The selected characteristics of milk efficiency – the quantity of milk (kg), the quantity of proteins (kg) and content of proteins (%) were analysed by using of variation-statistical methods and analysis of variance (programme Statistica, version 6.0) by the donors (31), recipients (74) and their daughters (74) from embryotransfer. These selected characterictics were analysed in the 1st and in the maximal lactations. Milk efficiency of the recipients was the lowest in the 1st and maximal lactation; the recipients produced 4991,4 kg, and/or 6082,86 kg of milk and 174,79 kg, and/or 213,5 kg of protein; however, this differences were significant ($P < 0,05$ and $P < 0,01$). The protein content in % in milk of recipients was 3,45% in the 1st and maximal lactation; i. e. 0,05% more protein (insignificant difference), and/or 0,13% more protein than the donors (significant difference, $P < 0,05$). Milk efficiency was the highest in the offspring in the 1st and maximal lactation; the daughters from ET produced 938,5 kg, and/or 1804,7 kg of milk more ($P < 0,01$), 41,28 kg, and/or 67,32 kg of protein more ($P < 0,01$), and 0,14% ($P < 0,01$), and/or 0,11% ($P < 0,01$) of protein more than the recipients, and 305,48 kg, and/or 823,26 kg of milk more ($P > 0,05$), 0,19%, and/or 0,24% of protein more ($P < 0,01$) and 28,55 kg of protein more ($P > 0,05$) in the maximal lactation than the donors. In the 1st lactation the daughters from ET produced 2,58 kg less protein than the donors; however, this difference was insignificant ($P > 0,05$). There was found the effect of donors was significant on milk efficiency of their daughters and the effect of recipients was no significant on milk efficiency of their female offsprings from embryotransfer. There was found too that already the milk efficiency from first lactations could be using for selection of embryo donors.

cattle, embryo transfer, donors, recipients, offspring from embryo transfer, milk efficiency

In cattle rearing embryo transfer is used particularly for target reproduction of breeding bulls but may be also important for accelerated reproduction of the female population for targeted formation of cattle herds. The success of embryo transfer in terms of the contribution to long-term genetic gain can be evaluated especially by assessing the breeding value of the parents and offspring. However, in order to complete this genotypic evaluation it is necessary to evaluate the phenotypic manifestations, which quantify the results of embryo transfer and create conditions for evaluations of the time and economic effect of this type of herd reproduction.

If we look at scientific literature it is obvious that conditions for creating families of cows are appearing repeatedly (ŘÍHA, cit. KADEČKOVÁ, 1996). Embryo transfer (hereafter ET) allows a purposeful formation of families, lines and breeds with a higher percentage

of protein in milk (LOUDA, MÁCHA, KUČERA et al., cit. KADEČKOVÁ, 1996). Thanks to computer technology we can afford complex evaluations of the cow family and elaborate individual mating plans in each herd (TICHÝ, cit. KADEČKOVÁ, 1996). In the opinion of VÁCHAL et al. (1987) and PŘIBYL (1989) the production of female material from ET is ineffective and the return of the invested funds is very long or non-existent. The main reason is that the milk efficiency of offspring from ET is not on the expected level. If this assumption were confirmed, then the existence of nucleus-MOET investigations would not be well-founded (CALLESEN et al., 1996). Basing on the analysis of her results KADEČKOVÁ (1996) discovered that in most cases we see that parents of corresponding breeding value are not selected for ET. FRELICH et al. (1991) reached the same conclusions. According to the present study the values of parameters of progeny testing for milk efficiency of fathers and mothers indicated that the selection of parents does not fully correspond with the intentions of ET to use to a maximal extent parents with a breeding value significantly higher than the average population. Such a selection of parents for ET cannot produce a higher genetic gain in the offspring born from ET. Therefore, from the very beginning of ET we investigate the maternal effect of the recipient organism on the biological value of the transferred embryo, foetus and born offspring, including pre-natal and post-natal losses. KVASNICKIJ et al. (cit. KADEČKOVÁ, 1996) claimed that the properties transferred from the genetic parents did not change with ET. MATTHES and PANICKE (cit. KADEČKOVÁ, 1996) confirmed that in the population of dairy cattle the maternal effect on the milk efficiency of the daughter is negligible. PREISINGER et al. (cit. KADEČKOVÁ, 1996) explained that the potential reason for the lower average milk efficiency of the group of cows born from ET could be the pre-natal effects of the mothers in the process of insemination and mothers in the process of ET and the differences in selection interventions of the breeder in the respective groups of cows. This means that the lower efficiency of cows born from ET is tolerated more than in other cows where culling is stricter. BRAUNER et al. (cit. ŘÍHA et al., 1999) and MAHELKA et al. (1996) say that the highly significantly lower milk efficiency of the group of fresh cows born from ET is associated with the effect of the internal environment of the recipients. They take into consideration the maternal effect of the recipient on the future efficiency of the progeny. Should this phenomenon be so important, the MOET models would have no sense and; moreover, according to catalogue data, about two thirds of the top breeding bulls listed in catalogues of renowned firms are offspring from ET. In his study PŘIBYL (1989) did not assume a negative effect of the recipient on the following efficiency of the progeny from ET. KADEČKOVÁ (1996) discovered that the efficiency of offspring from ET was significantly higher ($P < 0,01$) compared to offspring born to the same recipients after insemination. MIKŠÍK (cit. ŘÍHA et al., 1999) recommended investigations to be carried out into the breeding value of the recipients. DRAŽAN (cit. ŘÍHA et al., 1999) reasoned that if the breeding value of the recipients had an effect, ET would not be important. SUCHÁNEK (cit. ŘÍHA et al., 1999) also regard the maternal effect of the breeding value of the recipient on the progeny as possible, although very variable, and due to the effect of regression also difficult to prove. PREISINGER et al. (cit. VOŘÍŠKOVÁ et al., 1991) drew attention to the maternal effect of the recipients with a lower genotype value as compared to the donors. While evaluating the relation between the efficiency of breeding cows from ET and the recipients VOŘÍŠKOVÁ et al. (1991) discovered that the recipients had no effect on the offspring.

The objective of the present study was to compare the differences of the main phenotype parameters of milk efficiency in the first and in the maximal lactation of cows of embryo donors, recipients of embryos and their female offspring and also the variability of these commercial properties; in this way to estimate and evaluate the effect of the donor and recipient of the embryos on their offspring from embryo transfer.

MATERIAL AND METHODS

An experiment was established in a herd of Czech Spotted Cattle with a high level of milk efficiency (on average in year 1992 was 4669 kg of milk, 154 kg of protein and 3,30% of protein, and in year 2002 was 6969 kg of milk, 245 kg of protein and 3,51% of protein). Data on the milk efficiency and reproduction were obtained from the experimental workplace of the Department of Farm Animal Breeding, Mendel University of Agriculture and Forestry in Brno, i.e. ProAgro Radešínská Svratka in the Žďár nad Sázavou district. The experiment included 31 cows, donors of embryos, with above-average phenotypic and breeding values of milk efficiency. These cows were withdrawn from the natural reproduction process on a long-term or short-term basis. The average relative breeding value (RPH) of the cows for protein production used in embryo transfer was 118 and the average breeding value (PH) for protein production was 10,59 kg. Embryo transfer has been conducted at this workplace since 1992. We processed data on the milk efficiency and reproduction of the donors ($n = 31$, average length of the 1st lactation = 300,06 days and of the maximal lactation = 302,63 days) and recipients ($n = 74$, average length of the 1st lactation = 276,94

days and of the maximal lactation = 280,98 days), of embryos used in 1992–2002 and their daughters (n = 74, average length of the 1st lactation = 281,80 days and the maximal lactation = 302,27 days) born after embryo transfer, which had terminated at least one lactation. The following parameters were selected for evaluations of the milk efficiency of the cows – milk production per lactation, protein production per lactation and the content of protein in the milk. Czech Spotted heifers and cows in the herd were used as donors and recipients of the embryos. Insemination was used for reproduction and involved 31 Czech Spotted breeding bulls; the most frequently used bull was the bull with the register BJ 48 (in 26 cases), followed by ZB 5 (in 17 cases), REZ 316 (in 12 cases) and LC 278 (in 6 cases) in 1992–2002. Breeding bulls of an above-average breeding value for protein production were used for the insemination (RPH 114–126, PH 0,6–36,8 kg). The donors were superovulated with prostaglandin F_{2alfa} (Oestrophan) – FSH (Folicotropin, Spofa). The embryos were taken on the 7th day after the first insemination; standard methods were used for the cultivation of embryos, and/or their freezing and thawing. Synchronisation of the recipients involved two applications of prostaglandin F_{2alfa} (Oestrophan) in an 11-day interval. The embryos were transferred to suitable recipients into the ipsilateral uterine horn to the ovary with CL. The results were processed at the Department of Farm Animal Breeding of Mendel University of Agriculture and Forestry in Brno using variation-statistical methods and variance analysis in the programme Statistica, version 6.0.

RESULTS

The processing of results was focused on evaluations of the main parameters of efficiency using variation-statistical methods and variance analysis; milk production per lactation in kg, protein production per lactation in kg and the protein content in milk in %, in order to compare the results of milk efficiency of donors, recipients and their daughters from embryo transfer in the 1st and in the maximal lactations and to discover and evaluate the effect of the donor and of the recipients of the embryos on the efficiency of their offspring.

Tab. I gives the values of the basic statistical parameters of milk production in kg in cows in the 1st lactation; differences between the donor (D) – recipient (R) – offspring (O) and the statistical significance of these differences. The average milk production of donors, recipients and offspring was 5624,42 ± 1107,56 kg, 4991,40 ± 1498,72 kg and 5929,90 ± 1571,19 kg of milk, respectively. The difference in milk production between the donors and recipients (D-R) was +633,02 kg, significance 0,03154 ($P < 0,05$); between the recipients and offspring (R-O) –938,5 kg, significance 0,00410 ($P < 0,01$); and between the offspring and donors (O-D) +305,48, significance 0,29943 ($P > 0,05$). The results show statistically significant differences; milk production of donors was 633,02 kg ($P < 0,05$) more than recipients; the recipients produced 938,5 kg ($P < 0,01$) less milk than the offspring. The offspring produced 305,48 kg more milk than the donors, but this difference was statistically insignificant ($P > 0,05$).

I: *Milk production in kg in the 1st lactation*

MILK PRODUCTION (Kg)								
	n	Mean	Standard deviation	Standard error	Coeff. of variance	Difference/significance		
						D-R	R-O	O-D
Donor	31	5624,42	1107,56	198,92	19,69	+633,02		
Recipient	72	4991,40	1498,72	176,63	30,03		-938,5	
Offspring	71	5929,90	1571,19	186,47	26,50			+305,48
Total	174	5487,13	1523,00	115,46	27,76	0,03154+	0,00410++	0,29943

\+ $P < 0,05$
++ $P < 0,01$

Tab. II shows the basis statistical parameters of milk production of cows in the maximal lactation. It also shows the differences between the donor (D) – recipient (R) – offspring (O) and the statistical significance of these differences. On average, the donors, recipients and offspring produced 7064,26 ± 847,02 kg, 6082,86 ± 1990,63 and 7887,52 ± 1535,72 kg of milk, respectively. The difference in milk production between the donors and recipients (D-R) was +981,40 kg, significance 0,02242 ($P < 0,05$); between the recipients and offspring (R-O) it was –1804,7 kg, significance 0,00023 ($P < 0,01$); and between the

offspring and donors (O-D) +823,26, significance 0,05447 (P > 0,05). The results indicate that the differences were statistically significant; the donors produced 981,40 kg (P < 0,05) more milk than the recipients and the recipients by 1804,7 kg (P < 0,01) less than the offspring. The offspring produced 823,26 kg more milk than the donors; however, this difference was statistically insignificant (P > 0,05).

II: *Milk production in kg in the maximal lactation*

MILK PRODUCTION (Kg)								
	n	Mean	Standard deviation	Standard error	Coeff. of variance	Difference/significance		
						D-R	R-O	O-D
Donor	19	7064,26	847,02	194,32	11,99	+981,40		
Recipient	44	6082,86	1990,63	300,10	32,73		-1804,7	
Offspring	44	7887,52	1535,72	231,52	19,47			+823,26
Total	107	6999,23	1833,81	177,28	26,20	0,02242^{+}	0,00023^{++}	0,05447

\+ P < 0,05
++ P < 0,01

Tab. III gives the basic statistical parameters of protein production (kg) in the milk of cows in the 1st lactation; also the differences between the donor (D) – recipient (R) – offspring (O) and the statistical significance of the differences. The average protein production of donors, recipients and offspring was 218,65 ± 80,16 kg, 174,79 ± 53,01 kg and 216,07 ± 53,88 kg, respectively. The difference in protein production between donors and recipients (D-R) was +43,86 kg, significance 0,0023 (P < 0,01); between recipients and offspring (R-O) – 41,28 kg, significance 0,00163 (P < 0,01); and between offspring and donors (O-D) –2,58 kg, significance 0,84404 (P > 0,05). Basing on these results we see a statistically significant difference in protein production; donors produced 43,86 kg of protein (P < 0,01) more than recipients, and the offspring 41,28 kg (P < 0,01) more than the recipients. The offspring produced 2,58 kg protein less than donors; however, this result was statistically insignificant (P > 0,05).

III: *Protein production in the milk of cows in the 1st lactation*

AMOUNT OF PROTEIN (Kg)								
	n	Mean	Standard deviation	Standard error	Coeff. of variance	Difference/significance		
						D-R	R-O	O-D
Donor	20	218,65	80,16	17,92	36,66	+43,86		
Recipient	72	174,79	53,01	6,25	30,33		-41,28	
Offspring	69	216,07	53,88	6,49	24,94			-2,58
Total	161	197,93	60,66	4,78	30,65	0,00236^{++}	0,00163^{++}	0,84404

++ P < 0,01

Tab. IV gives the basic statistical parameters for protein production (kg) in the milk of cows in the maximal lactation; also the differences between the donor (D) – recipients (R) – progeny (O) and the statistical significance of these differences. On average the donors, recipients and progeny produced 252,27 + 80,34, 213,50 + 68,91 and 280,82 + 51,83 kg of protein, respectively. Differences in protein production

between donors and recipients (D-R) were +38,77 kg, significance 0,04495 (P < 0,05); between recipients and offspring (R-O) –67,32 kg, significance 0,00194 (P < 0,01); and between offspring and donors (O-D) +28,55 kg, significance 0,13792 (P > 0,05). The results show a statistically significant difference in protein production in kg; the donors produced 38,77 kg more protein (P < 0,05) than the recipients and the offspring 67,32 kg more (P < 0,01) than the recipients. The offspring produced 28,55 kg of protein more than the donors; this result was statistically insignificant (P > 0,05).

IV: *Protein production in the milk of cows in the maximal lactation*

AMOUNT OF PROTEIN (Kg)								
	n	Mean	Standard deviation	Standard error	Coeff. of variance	Difference/significance		
						D-R	R-O	O-D
Donor	11	252,27	80,34	24,22	31,85	+38,77		
Recipient	44	213,50	68,91	10,39	32,28		-67,32	
Offspring	44	280,82	51,83	7,81	18,46			+28,55
Total	99	247,73	70,29	7,06	28,37	0,04495^{+}	0,00194^{++}	0,13792

\+ P < 0,05
++ P < 0,01

Tab. V gives the basic statistical parameters of the protein content (%) in the milk of cows in the 1st lactation; also the differences between the donor (D) – recipient (R) – offspring (O) and the statistical significance of these differences. The average protein production of the donors, recipients and offspring was 3,40 + 0,16%, 3,45 + 0,20% and 3,59 + 0,21%, respectively. The difference in the protein content (%) between donors and recipients (D-R) was –0,05%, significance 0,28666 (P < 0,05); between recipients and offspring (R-O) –0,14 %, significance 0,00067 (P < 0,01); and between offspring and donors (O-D) +0,19%, significance 0,00004 (P < 0,01). Here we see statistically significant differences in the protein content (%) in the milk of cows; the offspring had 0,14% protein more (P < 0,01) than the recipients and 0,19% more (P < 0,01) than donors. The donors had 0,05% less protein than the recipients; however, this difference was statistically insignificant (P > 0,05).

V: *Protein content in milk of cows in the 1st lactation*

PROTEIN CONTENT IN %								
	n	Mean	Standard deviation	Standard error	Coeff. of variance	Difference/significance		
						D-R	R-O	O-D
Donor	27	3,40	0,16	0,03	4,71	-0,05		
Recipient	72	3,45	0,20	0,02	5,80		-0,14	
Offspring	70	3,59	0,21	0,02	5,85			+0,19
Total	169	3,50	0,21	0,02	6,00	0,28666	0,00067^{++}	0,00004^{++}

++ P < 0,01

Tab. VI gives the basic statistical parameters for the protein content (%) in the milk of cows in the maximal lactation; differences between the donor (D) – recipient (R) – offspring (O) and the statistical significance of these differences. The average protein content in the milk of donors, recipients and offspring was 3,32 + 0,14%, 3,45 + 0,20% and 3,56 + 0,21%, respectively. The difference in the protein content (%) between donors and recipients (D-R) was –0,13%, significance 0,01120 (P < 0,05); between recipients and offspring (R-O) –0,11 %, significance 0,02845 (P < 0,05); and between offspring and donors (O-D) +0,24%, significance 0,00012 (P < 0,01). The difference in the protein content (%) in the milk of cows was statistically significant; the protein content in the milk of donors was by 0,13% lower (P < 0,05) than recipients, and the offspring by 0,11% less (P < 0,05) than the recipients. A statistically significant difference was observed between the protein content (%) in the milk of donors and daughters and was by 0,24% higher (P < 0,01) in the milk of the offspring than donors.

VI: *Protein content in milk of cows in the maximal lactation*

PROTEIN CONTENT IN %								
	n	Mean	Standard deviation	Standard error	Coeff. of variance	Difference/significance		
						D-R	R-O	O-D
Donor	19	3,32	0,14	0,03	4,22	-0,13		
Recipient	44	3,45	0,20	0,03	5,80		-0,11	
Offspring	44	3,56	0,21	0,03	5,90			+0,24
Total	107	3,48	0,21	0,02	6,03	0,01120^{+}	0,02845^{+}	0,00012^{++}

\+ P < 0,05
++ P < 0,01

DISCUSSION

Milk efficiency of the recipients was the lowest and was the highest in the offspring in the 1st and maximal lactation; the daughters from ET produced 938,5 kg, and/or 1804,7 kg of milk more (P < 0,01), 41,28 kg, and/or 67,32 kg of protein more (P < 0,01), and 0,14% (P < 0,01), and/or 0,11% more protein (P < 0,05), than the recipients, and 305,48 kg, and/or 823,26 kg of milk more (P > 0,05), 0,19 %, and/or 0,24% protein more (P < 0,01), and 28,55 kg protein more in the maximal lactation than the donors (P > 0,05). In the 1st lactation the daughters from ET produced 2,58 kg less protein than the donors; however, this difference was insignificant (P > 0,05).

VOŘÍŠKOVÁ et al. (1991) discovered a difference of 267,4 kg of milk in favour of breeding cows from ET (3507 kg); the fat content was 0,12% higher in ET cows (i.e. 4,26%), total fat production per lactation in ET breeding cows was 147,3 kg and in recipients 134,6 kg; this difference was statistically significant. The correlation between the efficiency of daughters from ET and recipients was estimated and the result was that the recipients had no effect on the offspring.

MAHELKA et al. (1996) studied the effect of embryo transfer on the milk efficiency of dairy cows from ET and they discovered a highly significant difference between cows from ET and their sisters after insemination to the detriment of the cows from ET (644,7 kg of milk and 22,3 kg of fat). They compared the milk efficiency of cows from ET with their half-sisters from the same fathers and they discovered highly significant differences in terms of kg of fat and kg of fat + protein, to the detriment of the cows from ET. Comparisons between the milk efficiency of cows from ET and their half-sisters from 10 selected bulls showed insignificant differences (only 38,5 kg of milk).

FRELICH et al. (1991) explored the milk efficiency of donors and their contemporaries and the milk efficiency of breeding cows from ET and they discovered that the differences were significant only in the maximal lactation of the donors. The efficiency of donors was significantly higher (i.e. 5730,8 kg of milk) than of the mothers of the contemporaries (i.e. 5064,9 kg of milk), but the fat content of the donors was lower (4,08%) than of the mothers of the contemporaries (4,14%). The milk efficiency and fat content of breeding cows from ET was insignificantly higher, i.e. by 37–329 kg of milk and 0,05–0,08% of fat, respectively, compared to contemporaries from

insemination. The authors further indicated that the selection of parents was not in agreement with the intentions of embryo transfer, i.e. to make maximal use of parents of a breeding value considerably higher than average; in such a case we do not achieve a higher genetic gain in the ET offspring.

KADEČKOVÁ (1996) discovered that the milk efficiency of the ET offspring in kg of milk was significantly higher than in offspring from the same recipients from insemination (by 625,04 kg of milk, 3,571 kg of fat and 25,686 kg of protein). On the basis of analyses of the results she reported, like FRELICH et al. (1991) did, that parents of corresponding breeding value are not being selected for ET.

FRELICH et al. (1993, 1994) focused on a group of ET daughters of Czech Spotted and Black Pied dairy cows whose average milk yield in the 1st and 2nd lactations was 3940,7 and 4543,9 kg of milk, respectively, and was not significantly lower than the milk yield of daughters born from insemination by the same fathers; however, in the 3rd lactation it was significantly lower, i.e. 4642,0 kg compared to 5157,8 kg. Differences in the contents and amounts of fat in the milk were not significant.

A number of authors made comparisons of the milk efficiency between the ET progeny and contemporaries born from insemination and discovered low and insignificant differences.

PESOTSKAYA (1991) explored the efficiency of breeding cows of four different breeds born from ET and from insemination and she discovered that the differences among the groups in the 1st lactation were only 8–59 kg of milk and 0,1–0,4% of fat.

BUGROV and NĚVINNYJ (1990) reported differences in the efficiency in favour of the fresh cows from ET, i.e. 402 to 462 kg of milk.

BECKSCHULTE and TRAPPMANN (1993) also reported that ET brought an important economic effect compared to the other breeding programmes.

We can wrap up the results achieved when applying embryo transfer for the genetic improvement of cattle herds as follows. If we use above-average breeding cows in the herd as donors and above-average breeding bulls from the population of the Czech Spotted cattle, the use of cows as embryo donors can be based on their milk efficiency as early as in the 1st lactation; there is also a great probability that the protein content in the milk of cows and their offspring will increase. The variability of protein production will probably be lower and the variability of the protein content higher in the ET offspring compared to the embryo donors.

Using selected top cows as embryo donors in terms of their milk efficiency and the milk efficiency of their daughters as early as after their 1st lactation will bring a considerable breeding benefit. Embryo donors are genetically above-average cows; the recipients are cows and heifers in the herd. It is expected that the milk efficiency will automatically be higher due to the combination of the above-average genotype of the selected breeding bull and the above-average embryo donor. This fact was confirmed in all the investigated parameters of milk efficiency, with the exception of the protein content in kg of milk in the 1st lactation, when it was by 2,58 kg lower than produced by the donors; but this result was statistically insignificant ($P > 0,05$). The effect of the recipients on the progeny and on its efficiency was not confirmed in the present study either.

SOUHRN

Fenotypové projevy mléčné užitkovosti krav pocházejících z embryotransferu

Byl sledován vliv dárkyň a příjemkyň embryí na mléčnou užitkovost samičího potomstva pocházejícího z embryotransferu. Jako dárkyně a příjemkyně byly použity krávy a jalovice českého strakatého plemene. U dárkyň (31), příjemkyň (74) a jejich dcer (74) z embryotransferu byly pomocí popisných statistických metod a analýzou rozptylu (program Statistica, verze 6.0) vyhodnoceny vybrané ukazatele mléčné užitkovosti – produkce mléka (kg) za laktaci, produkce bílkovin (kg) a obsah bílkovin (%) za laktaci. Tyto vybrané ukazatele byly hodnoceny na prvních a maximálních laktacích. Nejnižší užitkovost vykazovaly příjemkyně na 1. i maximální laktaci, které vyprodukovaly 4991,4 kg, resp. 6082,86 kg mléka a 174,79 kg bílkovin, resp. 213,5 kg bílkovin, což byly statisticky průkazné rozdíly ($P < 0,05$ a $P < 0,01$) oproti dárkyním a dcerám z ET. Procentický obsah bílkovin v mléce příjemkyň byl 3,45 % na 1. i maximální laktaci, tj. o 0,05 % vyšší (statisticky neprůkazný rozdíl), resp. o 0,13% vyšší oproti dárkyním (statisticky průkazný rozdíl $P < 0,05$). Nejvyšší užitkovost byla zaznamenána u potomstva na 1. i maximální laktaci, kdy dcery po ET produkovaly o 938,5 kg, resp. o 1804,7 kg mléka více ($P < 0,01$), o 41,28 kg, resp. o 67,32 kg bílkovin více ($P < 0,01$) a o 0,14 % ($P < 0,01$), resp. o 0,11 % ($P < 0,05$) bílkovin více oproti příjemkyním a o 305,48 kg, resp. o 823,26 kg mléka více ($P > 0,05$), o 0,19 %, resp. o 0,24 % bílkovin více ($P < 0,01$) a o 28,55 kg bílkovin více ($P > 0,05$) na maximální laktaci oproti dár-

kyním. Na 1. laktaci dcery po ET vyprodukovaly o 2,58 kg bílkovin méně oproti dárkyním, toto však je neprůkazný rozdíl (P > 0,05).
Dále byl zjištěn významný vliv dárkyně na mléčnou užitkovost jejich dcer zejména v obsahu bílkovin v mléce krav, kde byly zjištěny průkazné rozdíly (P < 0,01). Vliv příjemkyně na samičí potomstvo pocházející z embryotransferu a jeho mléčnou užitkovost nebyl prokázán. Dále bylo zjištěno, že pro výběr dárkyň je možné využít výkonu již po prvních laktacích.

skot, embryotransfer, dárkyně, příjemkyně, potomstvo z embryotransferu, mléčná užitkovost

The study was supported by the NAZV QD 0 176 project.

REFERENCES

BECKSCHULTE, U., TRAPPMANN, W.: Comparison of different breeding plans for dual purpose cattle with a simulated population. 2. Method and results. Züchtungskunde, 1993, 65, 1: 12-27.

BURGOV, A. D., NĚVINNYJ, N. A.: Embryo transfer at a large dairy farm. Zootechnija, 1990: 67-69.

CALLESEN, H., LIBORIUSSEN, T., GREVE, T.: Practical aspects of multiple ovulation-embryo transfer in cattle. Animal Reproduction Science, 1996, 42: 215-226.

FRELICH, J., KRÁL, M., MARŠÁLEK, M., VOŘÍŠKOVÁ, J.: Užitkovost rodičů a samičího potomstva narozeného z embryotransferu. XV. Genetické dny, Sborník abstraktů, 16.-18. 9. 1991: 97.

FRELICH, J., VOŘÍŠKOVÁ, J., MARŠÁLEK, M., PAZDERKOVÁ, D.: Mléčná užitkovost prvotelek narozených z přenosu raných embryí. Živ. výr., 1993, 38, 11: 945-953.

FRELICH, J., VOŘÍŠKOVÁ, J., MARŠÁLEK, M., PAZDERKOVÁ, D.: Mléčná užitkovost a dlouhověkost dojnic narozených z přenosu embryí. Živ. výr., 1994, 39, 11: 949-960.

KADEČKOVÁ, J.: Využití příjemkyň v procesu přenosu embryí u skotu. Autoreferát doktorské disertační práce, MZLU Brno, 1996: 26 s.

MAHELKA, B., VYSKOČIL, M., BRAUNER, P., VITÁSKOVÁ, Š., MENŠÍKOVÁ, H.: Mléčná užitkovost a plodnost prvotelek narozených po embryotransferu. XVII. Genetické dny, Sborník abstraktů, 1.-3. 7. 1996: 104.

PESOTSKAYA, E. V.: The quality of cattle from embryo transfer in different breeds. Zootechnija, 1989: 54-56.

PŘIBYL, J.: Působení přenosu embryí na zvyšování genetické úrovně chované populace. Živ. Výr., 1989, 34, 3: 193-204.

ŘÍHA, J., MACHATKOVÁ, M., PETELÍKOVÁ, J., JAKUBEC, V., PYTLOUN, J., ŠEREDA, L., PAVLOK, A.: Biotechnologie v chovu a šlechtění hospodářských zvířat. Odborná publikace, VÚCHS Rapotín, 1999: 168 s.

ŘÍHA, J., ŽIŽLAVSKÝ, J., GOLDA, J., MIKŠÍK, J.: Mléčná užitkovost potomstva narozeného z ET. Výzkum v chovu skotu, VÚCHS Rapotín, 1999, 2: 13-18.

VÁCHAL, J., PŘIBYL, J., PODĚBRADSKÝ, Z., JÍLEK, F.: Studie genetických a ekonomických aspektů embryotransferu u skotu. Dílčí zpráva, VÚŽV Praha-Uhříněves, 1987: 60 s.

VOŘÍŠKOVÁ, J., FRELICH, J., MARŠÁLEK, M.: Vztah mezi užitkovostí příjemkyň a užitkovostí potomstva z ET. XV. Genetické dny, Sborník abstraktů, 16.-18. 9. 1991: 189.

Address

Ing. Simona Minaříková, Prof. Ing. Jiří Žižlavský, DrSc., Ústav chovu hospodářských zvířat, Mendelova zemědělská a lesnická univerzita v Brně, Zemědělská 1, 613 00 Brno, Česká republika