



Beef Cattle Breeding by Embryo Transfer Biotechnology

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Introduction

Between 2002 and 2005, the embryo transfer (ET) biotechnology of French beef cattle embryos was performed on local Romanian breeds, namely the Romanian Spotted and the Maramuresan Brown. The project was sponsored by the WB. As a contemporary method for intensive cattle breeding, the embryo-transfer of beef breeds was intended to introduce in a single generation new beef breeds in Transylvania and to control their adaptation to the regional environment. From a total of 47 embryos transferred (17 of Montbeliard and 30 of Charolais breed), 30 offspring were born (16 males and 14 females) with a ratio of almost 65% birth. Cautious selection of receptive caws allowed 22 normal births, while 8 births were dystocic and in other 6 cases (about 20% of the birth) a caesarean had to be performed. Up to now, all calves seem to grow well and none of them suffered from age specific digestive and respiratory diseases. By the age of 4 months the daily gain was of 1700g, similar to that found in the country of embryo origin. Efforts to expand the embryo-transfer in beef cattle are in progress, underling the new opportunities offered to farmers for a better economic result and an optimal exploitation of local agriculture resources.

Embryo transfer (ET) in beef cattle is an important reproductive technology pursuing two basic goals: to improve genetic selection by increasing the number of progeny from superior females or to expand the number of cattle in a farm in order to meet the market demands.

ET consists in donor selection, super-ovulation to produce an increased number of eggs released at oestrus, proper insemination of the donor female, embryo recovery generally accomplished through non-surgical techniques and their transfer to receptive caws synchronized to exhibit oestrus at approximately 7 days prior to embryo implant date, in order to match the age and stage of the transferred embryos (Groza I., 1996).

Although the surgical transfer seems more successful than non-surgical methods, abdominal or flank incision of cows under general anaesthesia makes it unpractical and this is an important obstacle for the routine and repeated ET on the same subjects. On the contrary, the non-surgical transfer is nowadays preferred being less expensive, it is quicker and does not involve surgery (Ilinca et al, 2000).

There are several factors influencing the achievement of ET such as: the recipient reproductive status, the quality of embryos, the quality of non-surgical transfer equipment, the epidural anaesthesia to relax and easier manipulate the reproductive tract, the magnitude of embryo signalling and the experience of operating technician (Janowitz, 1994).

In order to make a quick genetic improvement with guaranteed results in one generation we adopted the non-surgical transfer of beef embryos from French beef breeds to receptive cow of local origin (Leibo, 1984). There are several advantages of the ET such as: genetic improvement through females, obtaining more offspring from rare and valuable semen, quick improvement of genetic selection in small and medium size beef farms, simplicity and economics as compared to import of heifers or adult cows, zero risk for disease transmission, long term preservation of the frozen embryos, easier and better adaptation of new born calves to their new environment, spreading over of the valuable genes from cows that are not for sale, bull testing for recessive genetic defects (Groza et all 1993).

The present paper aimed to prove that a small proficient team with a mobile laboratory was able of programming, organizing and performing the non-surgical ET in several small and medium-size farms from Central and North-West Transylvania.

Materials and methods

The embryos were transferred between October, 2002 and November, 2005. The transfer programme began with the identification and optimal exploitation of valuable caws with high milk yields. The activities were intended to produce an embryo bank, to transfer embryos in 3 – 5 small and medium size private farms and to spread the know how to other farmers by lectures, tutorials, workshops, publicity leaflets and manuals. Meanwhile, 30 embryos of Charolais breed and 17 of the Montbeliard breed were imported (*Genetrans Group Agena*, France) in order to perform the non-surgical ET. The whole activity was part of a regional program aimed at obtaining, storing and transferring of embryos from local breeds, as well as the importing and transferring of beef cattle embryos.

French cattle breeds

The activities started with a gynaecological survey of several farms that allowed the evaluation of the quality of herds, the breeds reared, the nutrition, the exploitation characteristics and the mentality of farmers towards such technologies.

The target group was represented by cattle farms from North-West and Central part of Transylvania (the experimental pilot-farm of Cluj-Napoca and the private commercial societies of Basto Cluj-Napoca, AgroMoldovan Miraslău, Alba County, Petrești, Satu Mare County, Research Centre Jucu, Cluj County and Cristian, Sibiu County) as well as several individual cattle breeders from the counties of Cluj, Bistrița-Năsăud, Alba, Sibiu and Mureș.

Once the anamnesis and reproductive records were analysed, every potential caw was further clinically and para-clinically examined with a particular interest on the health and function of the reproductive organs. A metabolic profile was set up by blood analyses of several components as: total proteins, albumins, immunoglobulin, total lipids, triglycerides, cholesterol, phospholipids, hepatic enzymes, calcium, magnesium and phosphorus. Uterine biopsies were histologically and histochemically examined. Bacteriologic examinations of uterus were also performed. After all these complex investigations, 22 donor caws and 70 receptive caws were nominated and for the 92 individuals, gynaecologic leaves were established. We thoroughly followed all receptive especially in terms of nutrition, to ensure a normal metabolic state a normal reproductive function. The recipient caws were of Romanian Spotted (Siementhal type) and Brown of Maramures (Swiss Brown type) in good health, with several cycles to ensure the normal reproductive function, The embryo transfer was made on the 7th day after oestrus without any other treatment.

For the transfer of embryos we used a standard inseminating M.T. gun (figure 1) that is a rigid non-surgical instrument, easy to handle, that has been implemented by the Department of Gynaecology, Andrology and Obstetrics of Cluj-Napoca.

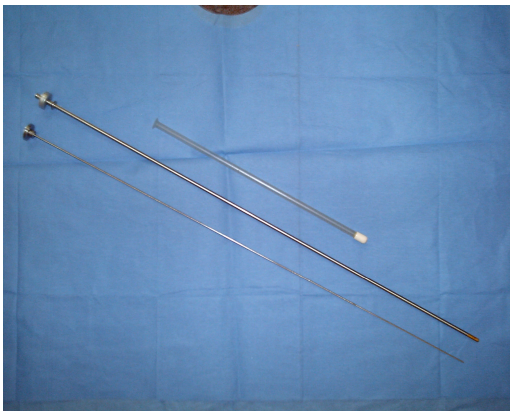


Figure 1. The rigid inseminating M.T. gun.

The non-surgical transfer of the thawed beef cattle embryos was made within the ipsilateral uterine horn after palpation of ovaries with corpora lutea. The ET protocol followed several steps: contention of receptive caw, thorough cleaning of the vulvae region, the epidural anaesthesia with 2 - 4 ml of 2% procaine 15 minutes prior the transfer, charging the transfer device, covering the straw and gun with the sterile sheath, insertion of the gun tip into the desired uterine horn quickly, smoothly and non-traumatically,

checking the ring of gun opening to be with lateral orientation and depression firmly the plunger, before gently exit of the instrument.

Following ET, the recipients were regularly examined to identify the pregnancy and its evolution until calving.

Results and discussion

From the total of 30 Charolais and 17 Montbeliard embryos transferred, 17 and 13 calves were born, respectively. This means that the overall ratio of calving was almost of 65% (30 calves out of 47 ET). The result is a reflection of cautious selection of recipients and of proficiency of ET team. There were 22 eutocyc deliveries, 8 difficult ones and in only 6 cases a caesarean had to be performed.

The ET calves showed a good adaptability and did not suffer from age-specific digestive or respiratory diseases. Moreover, they reached the growing rates of more than 1700 g/day when four-month old, as compared to those recorded in their country of origin.

The results showed that ET of beef cattle give reasonable good results when complex clinical and para-clinical investigations on recipients are performed, with beneficial effects on overall investment of applied ET in cattle.

From the target group represented by cattle farms from North-West and Central part of Transylvania and individual cattle breeders from the counties of Cluj, Bistrița-Năsăud, Alba, Sibiu and Mureș, the ET technologies were expanded in the counties of Satu Mare, Cluj and Alba. Before the ET program was implemented in the considered farms, selection and breeding were chaotic, either unidirectional, or lacking any clearly perspective. The reproduction was either natural or by artificial insemination without a clear breeding objective. As a result, the genetic value of the herds was rather questionable and the productions obtained were not justifying the investments. Although, a few individual caws had rather high performance, very few descendents of them were registered in order to have a good replacement and to improve the overall performances. The ET with frozen embryos from the two French cattle breeds Charolais and Montbeliard gave a proportion of 65% calving, as compared to the limits given by the literature of 50 – 65%. The reason for such results was certainly the good quality of the acquired embryos, the cautious selection of recipients, the collaboration and personal contribution of breeders and owners and last but not least, the proficiency of the ET team.

We consider that the results were also due to the undertaking of non-surgical ET, the usage of the rigid M.T. gun for the first time in Romania, the deliverance of embryos in the third middle part of the uterine horn ipsilateral to the corpus luteum. The rigid M.T. in ovulation gun allowed correctly and easy adaptation of the loading straw, facilitated the passage through the cervix, gave the possibility to control the orientation of the embryo evacuating hole and reduced the total time of intervention. The pregnancy ratio was clinically evaluated by anamnesis, inspection, palpation and listening, through internal trans-rectal and trans-vaginal examination and, complementary, with the aid of ecography. Using all these methods a clear situation was established within all farms and herds where ET was applied.

We consider that these very first ET's using beef cattle embryos are a good example and a good start for the extension of such biotechnologies in Transylvania. Economically speaking, if the average price of an imported embryo is around 100 Euro at a calving rate of 50% only, a beef calf is obtained for roughly 200 Euro, as compared to a few thousands or even a few tens of thousands Euro, the value of a precious bull. Moreover, the price of an embryo obtained locally from our own caws is of around 15 – 20 Euro only as it was shown by Groza et al (unpublished results). The advantages of ET for beef cattle breeds are obvious: a considerable lower price to pay as compared to the importation and transportation of live valuable genitors, the elimination of losses due to failure of adaptation, the zero risk for contagious diseases, the perfect adaptability of the new born to the local environment, including suckling colostrums with antibodies against diseases experienced by the surrogate mothers.

Beef calves are straightforward produced in a single generation and this accelerates a faster and better usage of local pastures. As a result, an economic production of very good quality beef becomes available on a market whereas pork still stands for around 70% of the meat consumption.

At a large scale the ET for beef cattle would accelerate the implementation of beef breeds in a region where only dual purpose breeds are reared. The presence of the beef cattle in the Transylvanian farms would certainly allow a better economy, an optimal valorisation of local resources and why not, a change of local preferences towards beef quality meat.

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