

FINLAND

EURECA “Cryoconservation – Background

1. Developments in cryopreservation of AnGR in Finland

The first AI organisation in Finland was founded in south-western part of the country in 1947. This was followed by altogether seven other organisations so that the whole country was covered by 1952. The common policies and operations were done by an umbrella organisation, which started as early as 1948. First the inseminations were carried out by veterinarians, although as early as 1949 a course was arranged to teach AI technicians.

AI started from the Ayrshire breed and quickly accommodated also Finncattle bulls. AI spread successfully and in 1955 some 20 %, in 1965 up to 80 % and ten years later practically 100 % of cows were inseminated.

The freezing of semen was tried in mid-50's and the large scale use started in 1961. A cost-efficiency as a guide line a large number of doses (around 40 000) was frozen from all young bulls. After this the bulls were slaughtered. When the progeny test result was ready, the semen storage was screened and the semen from poorer bulls was destroyed.

AI and specially frozen semen have opened up new avenues for international exchange of breeding animals. The Friesian breed was introduced to Finland from Sweden and Denmark. The first importation was in 1962. The breed was used to lower the milk fat % by crossing it to Finncattle. As a result the reduction of Finncattle was strongly accelerated.

The first embryo transfer in Finland was done surgically in 1979. When the prospects for dairy cattle breeding became promising, a more systematic development was initiated. Embryocentre Ltd was founded in 1986. There are now techniques available for embryo freezing, sex and marker diagnostics, ovum pick up and *in vitro* fertilisation.

The pedigree checking was initiated in mid-50's and a blood group laboratory started in 1955. In mid-90's the blood groups were replaced by DNA markers.

Finncattle is the most original Finnish cattle population. At the awake of needs to develop dairy production and to respond to breed formalism, the population was split into three breeds (Eastern, Northern and Western) over the years 1898 – 1906. The most original cows were found in small herds in the countryside periphery, while bigger farms had herds mixed with foreign breeds. The most influential foreign breed has been Ayrshire which quickly established a strong position in the South and moved over the country via AI in the 1950's. The 1960's initiated the introduction of Friesian, later upgraded by Holstein importations. The beef cattle breeds in Finland are all imported ones.

Among the Finncattle breeds, the Western type had a higher production and has maintained good popularity until today. The Eastern and Northern types were left in the background when the Finncattle breed societies were fused in 1947.

The awareness about the extinction of local breeds became apparent in Finland in late 1960's and early '70's. Prof Kalle Maijala was stimulating thinking on local endangered breeds in several forums, European, Nordic and domestic ones. First in mid-70's the agricultural colleges were asked to keep also local cattle breeds. A strategy paper was prepared as a joint Nordic action in 1982. It was recommending each country to take initiatives and the activity plan for Finland was written in 1984. This was a last moment to act, as there were only tens of animals left in Northern and Eastern breed. With a great effort of few persons, the Finncattle breeds were rescued and the main findings were moved to three prison farms.

Cryopreservation work started in the 1980's along the increased awareness about the risky state of endogenous breeds. A gene bank collection was established from the existing valuable storage. At that time there was semen stored only from Eastern and Western breed bulls and these were mainly proven bulls. The national programme for animal genetic resources started in 2004. The plan written in 1984 and the work since that was a good starting point for the more formalised programme. Also after joining EU, the agri-environmental programmes have subsidy elements to support the on-farm conservation.

Organisation

Right from the beginning, the bulls were purchased by AI organisations, in some cases the ownership was shared by several organisations. AI revolutionised the volume of progeny test. The genetic evaluation was carried out first by MTT. Computers were used very early, since 1950 exploiting the punch card system. Also the AI data was computerised in 1958. In 1963 the genetic evaluation computing was moved from MTT to AI umbrella organisation. The milk recording has always been done by ProAgria. The computing work is now done by Agricultural Computing Centre which is housed in the same building with ProAgria and breeding organisation. The AI umbrella organisation started in 1965. There is also a centralised dairy bull performance test. It is mainly following the early growth on the bulls and includes assessment for conformation and semen production.

The AI organisations have through collaboration managed to reduce operational costs and to devote resources to joint development work. This has meant closing down redundant bull stations or finding new functions for them. In 1967 there were altogether 19 either semen producing or delivering organisations. Currently in 2008 there are only four AI cooperatives left. The government support has been diminishing over the years and was last targeted to subsidise the breeding work in the North. Now the support has completely ceased. The dairy semen is produced jointly via a common chain of performance testing, collection of semen from young bulls, keeping the waiting bulls and production of semen from proven bulls.

Finland is now in close collaboration with Sweden and Denmark with the aim of sharing also resources in bull testing and use. This and the active international exchange of semen may be hampered by a low number of semen doses. Therefore the policy of slaughtering of young bulls has been abandoned and now bulls are kept alive until the proof is ready and the accepted ones can be kept in semen collection over a required period.

The bull and cow genetic evaluation is done jointly with Sweden and Denmark.

The *cattle breeding* is carried out by FABA Breeding. Its work covers

- overall coordination of breeding programme, setting breeding goals, data organisation, evaluation (jointly with the Nordic organisation NAV), selection of bulls and bull dams, mating plans for rare breeds, on-farm breeding plans

The ***data collection*** is carried out jointly by

- FABA Breeding – conformation
- ProAgria – pedigree and milk recording
- dairy industry – milk quality traits, somatic cell count
- veterinarians – disease records
- AI cooperatives – insemination results

The main AI co-operative is FABA Service. The AI co-operative are responsible for the semen exports and imports. Recently the number of exported semen doses has been around 60 000 per year. These have been mainly of Finnish Ayrshire bulls. The number of imported doses is much higher and would cover mainly Holstein bulls and beef breeds.

Embryocentre Ltd is owned jointly by breeding organisation, AI co-operatives, Valio Ltd (dairy) and Swedish breeding organisation.

In AI there are no competing organisations outside the mainstream operations while embryo collection and transfer is seeing an emergence of small independent commercial operators, mainly involved in import/export market. Some of the international major breeding companies have local sales persons in Finland.

The ***cryopreservation*** is planned at MTT by the coordinator for national programme. This would include choosing the bull and cow candidates and organising the technical operations. The actual technical work is then carried out by

AI co-operatives for semen cryopreservation

- bulls are taken to AI stations
- collection procedures and standards like in AI bulls
- storage (database) carried out by AI
- bulls bought and expenses paid by national coordinator (MTT)
- use of semen decided jointly by AI and GR programme

Embryocentre for embryo storage

- embryo flushings and freezing
- operational costs covered by national coordinator
- embryo storage (database) at AI station
- even IVF is used for emergency cases

The cryo operation framework is set by

Sanitary situation

- semen collection standards like for any AI bulls (allowing even exportation)
- embryo flushing team follows international standards

Legal aspects & responsibilities

- bulls are bought and owned by GR programme
- use of semen from some bull is decided jointly with AI and GR programme
- embryos are owned by GR programme

Sampling strategies

- both, in semen and embryo cryopreservation the aim is to preserve material from all the family lineages within a breed

Funding

- cryopreservation is part of GR programme coordinated and funded by MTT (Ministry budget)
- semen
 - purchasing bulls
 - health inspection
 - bull keeping at AI station
 - collection, freezing, storage and database
- embryos
 - inspections
 - hormone treatments, inseminations, flushings, freezing
 - freezing, storage and database

Legislation

The law on AI was stipulated in 1949. The advisory committee under Ministry of Agriculture and Forestry was monitoring and coordinating the development. Also veterinary authorities and animal breeding research took part in the committee work. The government has earlier supported local small organisation keeping good breeding bulls. The policy was gradually switched for enhancement of AI organisations. The law on AI set the basic requirements was keeping bulls and collecting semen and accepting the proven bulls.

When Finland joined EU, the directives on the use of reproduction technology – both AI and embryo transfer - and breeding operations were already in harmony with the EU legislation. At the moment the matters related to breeding and reproduction technology are reviewed and discussed in the advisory committee for animal breeding within Ministry of Agriculture and Forestry.

The exchange of animals, semen and embryos follows the sanitary regulations set by WTO.

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Collection and Analysis by breed or group of breeds

In Finland there are 3 local cattle breeds (Eastern, Northern and Western Finncattle) with less than 6500 cows, among them Eastern and Northern have less than 1000 cows (Table 1).

Table 1: Finnish local cattle breeds

breed	no.cows	semen	embryos	product	institute???
Eastern Finncattle (kyyttö)	450	yes	yes	milk	
Northern Finncattle (lapinlehmä)	400	yes	(yes)	milk	
Western Finncattle (länsisuomenkarja)	1300	yes	no	milk	

For all the Finnish local breeds there are semen doses stored. Two breeds have also embryos stored. The breeds are typically dairy breeds and milk is the most important product. The breeds used to be connected to their own region, which is now reflected in their name. At the moment all the three breeds are scattered around the country.

Description of the breeds

It is believed that keeping animals keeping and cultivating fields agriculture spread to Finland more than 4000 years ago and cattle had an established role since some 2500-3700 ago. The original Finncattle breeds belong to northern Fennoscandian polled breeds, which form a distinct group. There have been some importations over the centuries.

Eastern Finncattle

Animals are typically red coloursided with broad winding band on the back. The zigzag band has made people to call animals with a name kyyttö, a local nickname to adder living also in Eastern Finland. When animals were first registered in the 1910's, majority had horns. By the 1920's most of the animals were polled. The bulls weigh about 600 kg and are 135 cm high. The figures for cows are 118 cm and 440 kg.

The eastern part of the country – especially Karelia and Savo - was less affected by imported cattle breeds compared to the areas in the western and southern part of the country. The Eastern Finncattle cows were recognized as a separate breed in the 1890's. The keepers of the Eastern Finncattle founded a breed society in 1898 at the cattle show in Kuopio (Savo). This was the first cattle breeding organisation in Finland.

The Finncattle breed societies were fused in 1947 and keeping of the pure bred animals was carried out by devoted farmers. In the 1970's and '80's a new interest was stimulated to landrace breeds by prof Kalle Maijala. Eastern Finncattle population had gone very small and there were some 50 cows left and semen from 6 bulls. Eastern Finncattle cows were collected to form an in situ herd in a state owned prison farm. The numbers started gradually increasing. After Finland joined EU, a special subsidy has been paid to rare cattle breeds and the population size has gradually increased to some 450 cows. In 2005 the average milk yield was 3934 kg.

Northern Finncattle

Northern Finncattle is virtually white to light tan in colour, sometimes with a few red or black spots. These cows may have travelled to Lapland when people from the southern part of Finland moved up there, or from Sweden and Norway. The herdbook was established in 1905.

The breed declined dramatically over the period 1950-70. In early 1980's there were some 20 cows left and no bulls or semen. Like for other regions of the country Ayrshire and Friesian populations had also invaded into the north. Bulls from closely related Swedish Mountain breed were used in revitalising the Northern Finncattle population. Currently there are about 400 cows registered and also semen in cryo storage.

The Northern Finncattle are the smallest of the three Finncattle breeds. Cows average 110-115 cm in height and weigh 300-400 kg, bulls stand 128 and weigh 450-650 kg. Originally these cattle were mostly polled, coloursided to almost white. Selection has favoured white colour and it is believed that white animals are less attractive to mosquitos. Northern Finncattle are very healthy, e.g. tuberculosis has never occurred. Both cows and bulls can live very old. The average yield of Northern Finncattle cows in 2005 was 5053 kg of milk at 4.30% fat and 3.43% protein.

Western Finncattle

Western Finncattle is beige-brown, occasionally with some white markings or spots. These cows have been dominating in the best agricultural areas in the south and west. Breed society was founded in 1906 to keep the breed distinct from imported cattle.

The register contained by 1927 about 22 000 animals of which 12 300 cows and 3300 bulls belonging to almost 4000 members were registered in the herdbook. In 1930 some 60% of all milk-recorded cows in western Finland belonged to this breed. In the Finncattle, three breeds – Eastern, Western and Northern – were established. They were all amalgamated into one breed in 1946. Soon the Western type became dominant. However, due to increasing numbers of Finnish Ayrshire and crossing of Finncattle with black and white Friesian cattle, the breed declined, especially in the period 1950-70. Now there are only few thousand cows left of which three quarters belong to milk-recording. The population is now too small for running an efficient progeny testing for artificial insemination bulls. About 70 % of inseminations in Finncattle population are inseminated with young sire semen because the population is quite small. Using mostly young bulls keeps the genetic base as wide as possible.

The Western Finncattle are the largest of the three Finncattle breeds. Cows average 123 cm in height and weigh about 470 kg, bulls stand 140 cm at the withers and weigh 625-800 kg. At present, Finnish native breeds are usually polled. Originally also the Western type was mostly horned, but there was selection for polledness. By 1930, only 2% of the bulls and 30% of the cows

were horned. The average yield of Finncattle cows in 2005 was 6625 kg of milk at 4.36% fat and 3.47% protein.

Objectives of the breed management

The local breeds are kept mainly in private farms. There are three important large herds: one prison farm (Pelso, close to Oulu) has Northern Finncattle, while the Eastern and Western breed cows are kept at two rural colleges (at Kajaani and Tampere). The in situ conservation is coordinated by MTT. The animal registers are kept at FABAs Breeding which is also producing annually the mating plan.

Sampling strategies for semen collection

The aim is to have back up storage for in situ programme. Therefore gradually all relevant family lineages have been stored in the semen bank. The Western Finncattle is part of coordinated breeding programme and therefore has the largest volume stored. There are also more Western bulls from the period before 1980 and all the Northern bulls are stored only after 1980.

The semen collection is done at an AI station where the semen is also stored and entered into the database. Most of the semen is used by AI co-operative without jeopardising the long-term banking.

breed	doses	Number of bulls with		
		< 200 doses	200 < doses < 1000	> 1000 doses
Eastern Finncattle	61,718	10	16	17
Northern Finncattle	59,122	14	4	14
Western Finncattle	231,141	19	60	69

Finncattle breed	birth year	bulls	No. bulls by no. doses		
			< 200 doses	200 < doses < 1000	> 1000 doses
Eastern	< 1980	6	2	4	
	1980-99	22	8	12	2
	> 2000	15			15
Northern	< 1980				

	1980-99	20	14	3	3
	> 2000	12		1	11
Western	< 1980	42	10	31	1
	1980-99	69	9	26	34
	> 2000	37		3	34

Number of sires and doses in storage per breed

Earlier the number of doses per bull was smaller. Now almost all the bulls have more than 1000 doses collected.

Use of AI

Practically all cows, including the local breeds, are reproducing via AI. Some local breed herds have also a bull.

Collection and semen packaging

All the semen collection is done at an AI station.

In Finland, most of semen doses are packaged in 0.25 ml straws. Earlier pellets were used.

Storage sites

There is only one storage site, at Pieksämäki. It is owned by FABBA Service and fulfils the EU legislation requirements.

Legal aspects

Regarding the ownership and use of doses there are differences between the breeds. AI cooperative owns all the Western bull doses and decides about their use, except the older bulls for which the decisions are made jointly with the national programme. In Eastern and Northern breed, the doses are owned by both AI cooperative and national programme. All the use is decided jointly.

Funding

The current cryopreservation of Eastern and Northern breeds is funded from the national programme, while the collection and storage for Western one is a business run by AI cooperatives. The availability of funding is a major factor in restricting the activities.

Veterinary aspects

The semen collection and storage are done according to EU legislation. They follow the practices required for national and export use.

Information available

Most bulls have known parents. Only the oldest and more exotic family lineages have animals with unknown parents.

Animals belonging to recording scheme are automatically also given a predicted breeding value for all the traits.

Embryo collection

The embryo collection is focussed on the two rare breeds. The Eastern embryos are stored at the AI station and are also entered into the database. The Northern embryos are stored by a private veterinarian.

All the embryo collections are done by Embryocentre and financed from the national programme.