Welcome at the 26th ESF-Congress in Austria

Dear Simmental Fleckvieh Cattle Breeders of Europe!

Dear Congress Participants!

We are very pleased, that you have accepted our invitation and came to the 26th Congress of the European Simmental Federation here in Austria.

A special highlight of this five-days' program is the 26th General Assembly of the EVF on September 5th, 2005 in the spa town Baden near Vienna. After the statutory items on the agenda we want to thank and honour 4 rendered personalities of the European Cattle Breeding for their decades of work in the interest of European Cattle Breeding. Afterwards 4 lectures about current topics from our breeding work will follow. Experts from the field of practice as well as from the field of science will talk. New aspects concerning a closer cooperation within Europe are expected and we hope to gain also new cattle breeding countries for future collaboration within our community.

Because of the change of basic conditions for cattle breeding in general and for the dual-purpose breeding in particular breeding foundations are asked to provide their 120.000 cattle breeders within Europe with economically necessary and biologically justifiable cattle breeding advices and strategies. High stability and the large export of dual-purpose breed all over the world are the best proof, that this has already been successful in the past. More and more breeders are favouring breeding goals and breeding programs, which do not focus on incredible output but on delicate balance and economic utility. The dual-purpose breed "Simmental Fleckvieh" corresponds to this target completely. Therefore we are confident to manage future task on this topic.

This conference brochure may be used as an information and reference book to understand the Austrian situation about cattle breeding. But it was also produced to publish all our very interesting lectures.

Fleckvieh Austria would highly appreciate, if the 26th European Congress can contribute to a further effective and sustainable rising trend of European cattle breeding.

Chairman	Managing Director
ÖR Rudolf Pumberger	Ing. Richard Pichler

Foreword

I am happy that Austria is the host of the 26th Conference of European Simmental Fleckvieh Breeders.

Austria is actually predestined for hosting this renowned event. Of the approximately 2 million Austrian cattle 80 % belong to the Simmental breed. Of these 1.6 million Simmental Fleckvieh stock about 1.1 million are to be found in breeding farms, and are therefore subject to performance recording and are part of the breeding program "Fleckvieh Austria". Many of the Austrian cattle breeding associations that attend to Simmental Fleckvieh have been existing for more than 100 years. They provide the basis for 18,000 production farms that make the greatest part of their agricultural income by means of Simmental breeding. This is of tremendous importance for the production of milk and beef as well as for the cultivation of the beautiful Austrian landscape.

As the Austrian state is aware of this important task of cattle breeding it pays for 50 % of the cost of milk performance recording and 60 % of the cost of data evaluation and breeding value estimation. By means of this subsidy it is made easier for smaller and medium-sized production farms to continue producing breeding cattle of top quality.

The Austrian Simmental Fleckvieh breeders have always been aware of their central role in Europe. Austria traditionally is an export-oriented cattle breeding country. Together with the breeding associations it has become possible to win back the faith of important importing countries in East and Southeast Europe after the BSE-caused bans and to help develop the livestock breeding in these countries by means of livestock supplies.

In this connection I am especially happy that the Austrian Simmental breeders have not confined themselves to supplying livestock, but have always been eager to assist these importing countries by means of advice on the development of performance recording, breeding associations and the optimum feeding of the animals.

I do hope that the international guests of this conference will get a substantial insight into Austrian Simmental breeding and be able to take some valuable impulses for a successful Simmental breeding home with them.

I wish the European Simmental Fleckvieh breeding further abundant success.

Josef Pröll

Minister of Agriculture

Ladies and Gentlemen, Dear European Simmental Fleckvieh Cattle Breeders,

I am very pleased that the 26th Congress of the European Federation of Simmental Cattle Breeders will take place in my native country Austria and important parts of the agenda are to be set in my closer home Lower Austria. The high proportion of Simmental Fleckvieh, 80% in all of Austria and 90% in Lower Austria, demonstrates the great importance of that cattle breed in this country.

In accordance with the perspective of the EU and its emphasis on sustainable agriculture, I entirely agree that Simmental Fleckvieh cattle breeding should not follow extreme breeding aims, but pay attention to a balancing between economic necessity and biological limitations.

I want to express my gratitude to all those responsible for European Simmental Fleckvieh breeding for their understanding.

Agrarian policy of the EU tries to retain a multi-functional agriculture. This is taken into consideration in the subsidy of animal breeding, and in particular of cattle breeding.

We need the balance between a profitable production of individual farms, market orientation and sustainability.

Former surplus production of milk and beef, including high costs of commercialization, are now successfully under control. This allows necessary developments in our agricultural companies and farms. The organized cattle breeders have always regarded further developments as their target. Therefore they are in a fairly good position in the increasingly stronger international competition.

The presently brisk demand for breeding cattle is confirmation for the important activity of breeding. The Austrian Simmental Fleckvieh is a typical European cattle breed, which has spread in all the world within the last 100 years. Austria has contributed to this expansion.

Since Austria belongs to the countries with high exports of breeding cattle, it is essential that the high level of breeding and the products from cattle breeding are shown in public in regular intervals.

This will be done again this year. Participants of the European Congress of Simmental Fleckvieh breeders come from 18 member states and will also visit the Simmental Fleckvieh show at the “Rieder Messe”.

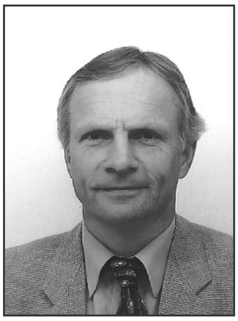
I feel sure that there will be a number of interesting professional discussions that will set off positive impulses for further developments in European Simmental Fleckvieh breeding.

My best wishes for the proceedings of the Congress and the future of the European Simmental Fleckvieh breeding.

Agnes Schierhuber

Member of the European Parliament

Words of welcome



Ladies and Gentlemen,

dear Simmental Fleckvieh breeders,

the European Simmental Federation (ESF) was founded in Munich in 1962 and has developed multifarious as well as prolific activities since. In spite of various obstacles and restrictions caused by given conditions the breeders and experts of the now 18 European member countries have met altogether 25 times in conferences, two of which, that is to say in 1968 and in 1985, took place in Austria.

This year's 26th general assembly in Baden/Vienna and other events will certainly intensify the existing animated exchange of experience, observations, scientific results as well as breeding livestock and semen.

As a task of outstanding importance of the European Simmental Federation the standardization of breeding methods in the member countries and the further genetic improvement of the European Simmental Fleckvieh population are to be given special emphasis. The standardization of the exterieur evaluation has been successfully practiced and developed and will enthusiastically be improved even further. For 12 years an organized joint exchange of testbulls, which aims at improving the comparability of breeding values among the European Simmental countries, has been taking place. The increasing cooperation in the fields of breeding value estimation and genom analysis research has to be seen as another extremely positive signal. Now the steady economic competition situation of the Simmental Fleckvieh breed that has been achieved has to be defended and the merits especially regarding the performance traits of beef and fitness (e.g. udder health, metabolic stability) have to be developed further.

This year the European Simmental Federation will for the first time honour persons from the member countries who have rendered the development of European Simmental Fleckvieh breeding an especially great service. Therefore we have the particular joy to congratulate Ms Dipl.-Ing. Roza Toth, Dr. Gottfried Averdunk, Dr. Alphons Gottschalk and Professor Dr. Horst Kräußlich on their achievements.

We are giving a warm welcome to the delegates of the European Simmental Fleckvieh family, which represents more than 100,000 registered breeders and a total population of approximately 10 million Simmental cattle. Let us give our special regards to our hosts, the Simmental Fleckvieh breeders and breeding associations of Austria. We would like to express our gratitude to the organizers of this conference, first of all the chairman ÖR Rudolf Pumberger and the manager Ing. Richard Pichler, as well as the entire team of people involved, for the meticulous preparation of this conference.

We hope for lively participation, enriching personal contacts, animated discussions, interesting experiences, beautiful impressions and new impulses for the Simmental Fleckvieh breeders of Europe.

Representing the board of the European Simmental Federation

Dr. Georg Röhrmoser, Secretary

Chances and Risks of Dual-Purpose Simmental Fleckvieh Breeding in the 21st Century

H. Kräußlich

1 Introduction

The period of dairy cattle breeding, which is just coming to an end, started approximately 40 years ago when the use of deep-frozen cattle semen had become practicable. In this period, as it is still today, the breeding progress in the first lactation performance has been decisive for its success. The unwelcome side-effects of this unilateral breeding strategy have been known for a long time, yet, have only very recently been taken seriously.

In this period the US Holstein breeding has been by far most successful globally. This is the reason why the unintended side-effects of the selection are most distinctly recognizable and have been analysed most thoroughly in this population.

In order to find a solution of this problem two strategies are currently discussed and tested: the breeding value estimation of the so-called "functional traits" and high weighting of these traits in the selection index, as well as the use of heterosis effects according to the example of poultry and pig breeding. In order to examine the possibilities of the heterosis strategy pure bred Holstein cows are compared with crossbreding cows (F1) in big cattle farms in the USA (California).

2 A comment on the Californian experiment in the German issue of the magazine "Holstein International" (issue 467, 2004)

"We are running out of time"

Leading insemination stations are already reporting a surprising demand for sperm of other breeds for commercial crossbreeding. Each Holstein breeder must take these new instruments, which are useful in the selection of management and health traits, seriously. If the message that is conveyed by the Californian experiment is ignored, the dominant position of Holstein breeding in dairy cattle husbandry will be put at risk. The speed at which Holstein breeders around the globe will react to these challenges will certainly affect the appearance and the colour of the cows that will be used in the cattle farms in the next 10 to 20 years."

The "Californian Crossbreeding Experiment" is the US research program "Genetic Selection and Crossbreeding to Enhance Reproduction and Survival of Dairy Cattle", Project Number S 1008, Oct. 2002 – Sept. 2007.

3 The selection is too slow to adopt to changed market conditions – the market is developing more and more rapidly.

The Holsteinizing of the European Schwarzbunt breed and the superseding of the European Braunvieh by Brown-Swiss in this period of dairy cattle breeding, which is phasing out, confirm the correctness of this theory.

Ferdinand Malik, head of the Management Centre St. Gallen, explains these connections, which are valid for the entire economy, as follows:

"The market has no foresighted but only an observing impact. The market does not tell us where and how the resources should be employed, but only where and how they should have been employed. At the time this sign is given by the market it is already too late."

4 In the "Californian Experiment" Montbéliarde bulls are used.

In the standard work "Genetics of Cattle", edited by R. Fries and A Ruvinsky (1999), 20 breeds that are primarily used for milk production are mentioned. One of these is the Montbéliarde breed. Altogether five of these breeds are selected to produce F1-cows from Holstein cows. In the first evaluation (providing this provisional result) the F1-cows from the crossbreeding of a Montbéliarde bull with a Holstein cow achieved the highest milk yield in the first lactation. It is the only crossbreeding type that beats the purebred Holstein cows in milk performance.

5 Dual-purpose Fleckvieh breeding, an alternative to crossbreeding?

The more unilaterally and intensively the selection is, the earlier and more strongly unwelcome side-effects occur. In pig and poultry breeding these problems could be satisfactorily solved by means of hybrid breeding programs. In cattle breeding this solution is considerably impeded by the long generation interval and the low reproduction rates. A solution of this problem by means of biotechnology is not to be expected in the foreseeable future. Especially for those farms that disapprove of the imbalance of the herd and the organisational effort that commercial crossbreeding programs result in an optimal dual use system provides a good alternative. From my point of view the dual use of Fleckvieh has the chances to meet the expectations of these farm managers. The lactation performance that is currently achieved by good Fleckvieh farms is already sufficient for these farms. What is in need of improvement is lifetime production. Therefore it is high time to give special emphasis to permanent performance concerning the selection, even if the generation interval is prolonged by this measure.

According to Holstein International, fall 2004, the message from the USA is:

"Today milk producers do not aim at maximum performance any more, they want profitable performance by unproblematic cows."

The economic pressure to achieve maximum performance is lower with the dual use cow than with the specialized dairy cow owing to the following reasons. One reason are the higher prices of beef cows and male calves. If it is possible to improve the productive life of the Fleckvieh cow, the resulting substantially lower replacement costs represent a further reason.

The continuation of the improvement breeding of Red-Holstein, which used to prove successful, is counterproductive for this strategy and additionally causes negative signals for the global market.

6 Professional milk production strategies

In the USA ("high input") and in New Zealand ("low input") production strategies that are recognized worldwide have been developed. In Switzerland the program "Opti Milch" has the purpose to optimise the "high performance strategy" and the "permanent pasture strategy" for the respectively suitable Swiss locations. The results find not only national but also international recognition.

Also for the "dual purpose cow" professional production strategies (both for intensive and extensive production) ought to be developed. The reputation of the dual-purpose cow is not good among experts. It is considered to be out-of-date and antiquated. Breeding efforts and a professional dual-purpose production system could change this. The development of such a system will only be feasible, if the people in charge of the Fleckvieh associations in Germany and Austria make an effort to realize it, and if the respective national scientific institutions are ready and able to cooperate.

7 A global marketing plan for the dual-purpose Fleckvieh breed

Breeds that will not be present in the future period of cattle breeding on the global market are endangered of ending up as genetic reserve. In order to be successful on the global market apart from the breeding program and the production strategy the name of the breeding product, the brand name is significant. This has to be clear and unambiguous in order to be able to be correctly assigned to the product worldwide. In this respect the dual-purpose Fleckvieh breed is tremendously disadvantaged. Within the ESF and also the global association the terms "Fleckvieh" and "Simmental" are assigned to very different breeding products. This ambiguous use of terminology might be compared to the Confusion of Tongues at Babel.

The clearing-up of this confusion of terms will without doubt be difficult. Traditions that also involve emotions play an important part in this matter. Yet, this clarification of terms is indispensable.

8 Conclusions

The development of the breeds of Holstein-Friesian and Fleckvieh Simmental have differed extremely in the recent 40 years. The Holsteinizing of the Schwarzbunt dual-purpose populations has caused a worldwide standardization of the Schwarzbunt cow. The global crossbreeding of Fleckvieh Simmental into beef cattle populations and of Red-Holstein into the Swiss Simmental population has resulted in an extreme diversification of the Fleckvieh Simmental breed. Both breeding plans have been extremely successful. In the next 10 to 15 years to come the points for the future development will be set anew. I hope and wish that we will succeed in developing the dual-purpose Fleckvieh into a breed of worldwide importance.

Future requirements for performance testing and breeding aims

B. Luntz, Bayerische Landesanstalt für Landwirtschaft, Institut für Tierzucht, Grub

Although Simmental Fleckvieh is recognized worldwide today as dual-purpose breed, the focus in the last years has been on the selection of traits in the milk production. Retaining the beef performance an increase in the milk yield was definitely noticeable. This development was important to keep the Simmental Fleckvieh breed competitive in the economic trend.

Meanwhile many companies have reached a level where management and environmental design for the exploitation of the genetic potentials are the limiting factors. There is a demand for the willing cow to deliver high performance, without any additional workload for the management.

In contrast to this the longevity of our cows has continuously decreased in the last years. In figure 1 the Bavarian Simmental Fleckvieh data shows a decline of feeding days from the mid-nineties onwards.

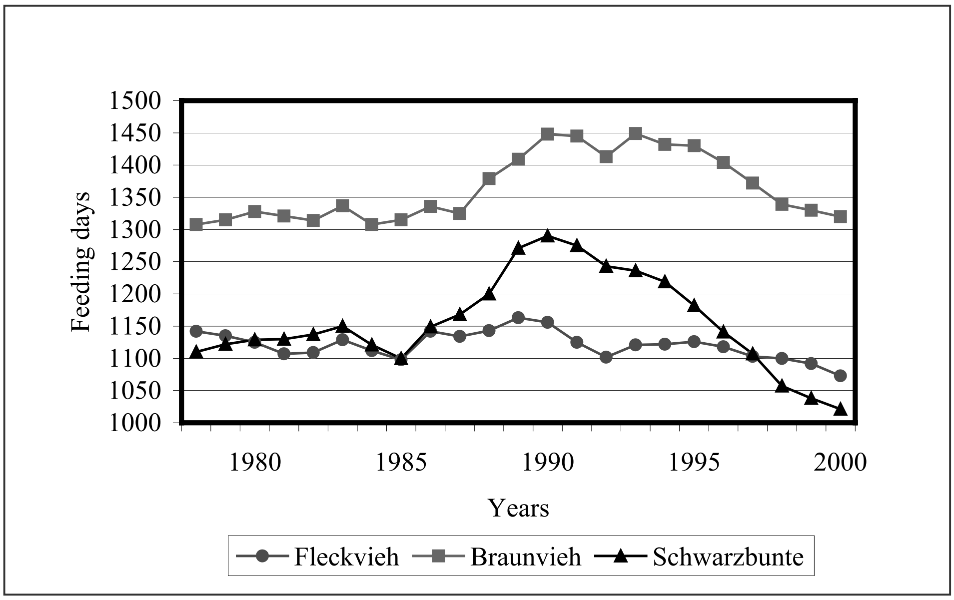


Figure 1: Feeding days of the culled cows by breeds

For many companies a reversal has become a significant cost factor. Internationally for most cattle breeding companies there is a trend towards stronger emphasis on cost reducing traits, which are subsumed under functional traits. In Simmental breeding there are still some possibilities open in this regard. Therefore one of the most urgent tasks of performance testing will be to pay more attention to those characteristics.

1 What are functional traits?

Functional traits are considered part of animal health. According to Swalve (2003) functional traits reduce the cost on the input side of production and take into consideration the marketing of animal products.

The main problem in the breeding evaluation of this health and fitness traits is the generally low heredity. According to Distl (2001) there is a great genetic variability in our breeds which should be used. Particularly the trait health combines a number of components which refer to various organs. The following illnesses as breeding aim characteristics are being discussed:

- fertility interference
- metabolic disorders
- udder disease
- feet and legs

In Scandinavia those illnesses have been recorded and dealt with. Lower heredity can be compensated in several ways. The breeding aim for Norwegian cattle stipulates a proportion of 40 % of test bulls, so that 250 to 300 daughters result from that.

Alternatively it is possible to integrate parameters into the breeding value estimation. For the criteria somatic cell count we use in the breeding value estimation a parameter, because the actual trait “mastitis” cannot be measured.

In some areas the inclusion of additional data in the stations performance test seems promising, but cannot be done in all populations due to the costs. Therefore future approaches should aim to integrate traits outside the traditional system of farm performance tests. Future findings of the molecular genetics will support the classic possibilities.

2 Breeding possibilities for the improvement of health in udder and claws

Among all the health relevant traits the area of udder and feet and legs deserve particular attention. In the Simmental Fleckvieh breeding programme udder health is recorded through the parameter of somatic cell count. Heredity with a cell count of 0,10 is about twice as high as the actual trait mastitis with about 0,05. Both traits refer only partly to the same facts, since the correlation of the traits lies at 0,65 (Swalve 2003).

Surveys from Scandinavia show that a detailed recording of traits is possible, and the findings of the Danish cattle population justify this effort.

Here the Danish model is taken to represent the Scandinavian breeding strategy. In an integrated system of farmers and veterinary doctors all the treatments are registered and assigned to the specific animal in a central data bank. On the basis of that data a health index is set up with 100 as average. According to Danish statistics the frequency of mastitis in daughters of bulls with >107 is only half as high as from bulls with an index of <93. Interesting is also the correlation to other traits.

Table 1:Percentage of cows with at least one treatment in the time of 10 to 100 days after birth (acc. to Hansen 2000).

Illness	1. Lactation		3. Lactation	
	Rote Dänen	Dänische Jersey	Rote Dänen	Dänische Jersey
Udder	21,9 %	23,6 %	27,9 %	21,3 %
Fertility	11,6 %	2,5 %	15,3 %	5,1 %
Metabolism	2,8 %	2,2 %	12,0 %	9,9 %
Feet and legs	6,0 %	3,8 %	5,0 %	2,3 %

Table 2:Correlation Udder health index (= EGI) to other traits in Danish Holstein cows

Characteristics	r zu EGI
Milk yield	-0,25
Feet and legs	0,19
Udder	0,31
Temperament	-0,16
Other illnesses	0,44

This udder health index comprises also selected characteristics for type traits. Compared to the sole criteria of somatic cell count the accuracy can be greatly increased.

Also other research supports the Danish results. According to Boettcher et.al (1998) accuracy can be increased by 15 % when the traits somatic cell count, milking speed and udder depth are combined in the udder health index (instead of cell count as breeding value only).

Another approach for the improvement of the health of herds is the assessment of claw traits.

The practical importance is not to be underestimated, in particular for loose housing.

A frequent topic of discussion is the question, whether in the past the intensive breeding for milk yield led to a general neglect of feet and legs. However, if we consider the genetic trend towards feet and legs, a slight rise in the breeding value of feet and legs in the Simmental Fleckvieh test bulls of the last few years can be noted.

Surveys for particular claw characteristics are not new, but were negligible in the past.

At present a project is trying to systematically classify claw parameters for the German Holstein population, with the aim of setting up a breeding value estimation for a claw index.

Health data from the farms as well as additional information from the claw groom are to be used. For the German Simmental Fleckvieh population Distl (1999) found out that heredity for claw measurements is 0,2 to 0,5, so that breeding efforts seem to be successful. Relations between claw measurements and functional time of usage show a value of 0,06 to 020.The problem lies certainly in data recording. So far the hoof height was recorded with the classification of progeny. An extended recording of claw traits would be possible, but a description is problematic, due to various management situations.

3 Which possibilities are there for the future?

The idea of a more exact trait recording within the progeny testing involves also the aspect of bull testing. Daughters in test herds allow a more comprehensive data recording. A feasible approach would be an integrated data recording system as we have seen in Scandinavia. Already in 1997 the programme BayHerd was set up in Bavaria, which is a joint project between LKV Bayern and the Veterinary Chamber of Bavaria. All treatments for the monitoring of herds are to be recorded on the farms so that they can be used for breeding purposes. A project with the same objective was set up in LKV Baden-Württemberg.

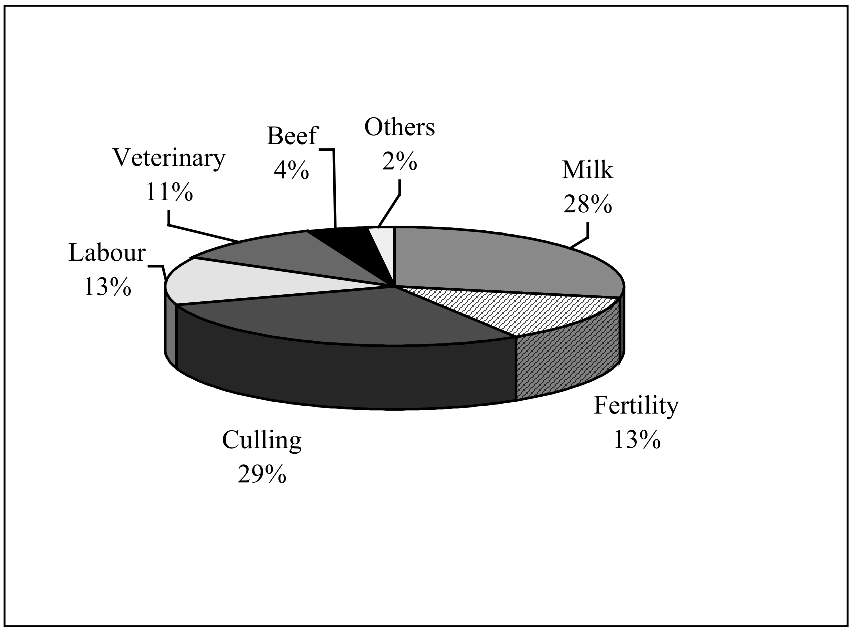


Figure 2: Economic loss resulting from illnesses of legs and feet (Distl 1999)

In a central data base "animal health" specific treatments are recorded and by including diagnosis data can be applied in the breeding value estimation. In the long run such a common data bank in RDV makes sense.

A recording of further traits within the scope of the classification of progeny needs to be weighed. Too much information might have a negative effect and must be questioned on its validity for practical purposes. In Bavaria and shortly also in Austria second evaluations are done, which can be an element in the mosaic of functionality. Furthermore results from the BCS-recording and the trait locomotion constitute further parameters.

Feasible is also a functional type traits index, which enables us to do a ranking of bulls according to type traits. All relevant type traits for longevity should be combined.

4 Testing of bulls

It is the aim of bull testing to get most reliable results from the testing. Reliability means that in further tests the results are as close as possible. For testing bulls different systems exist: in Austria the regulation of second calving is in use, while in most German stations the stipulated minimum proportion is about 20–25 %. The French organisation Urceo tests the bulls in 7.500 companies on the basis of a breeding value list for female animals on the farm.

The test bulls should have the same level for mating as the positive selected bulls. In that case the daughters of test bulls would then have an equivalent rival in the stable, which would be absolutely advantageous for the stability of breeding values.

Since functional traits come more and more into focus the number of daughters from test bulls should not be too few. In Bavaria the numbers of daughters per test bull considered for a breeding value estimation has levelled out at about 100.

Modifications in breeding aims in favour of traits with lower heredity may demand a greater number of daughters. In Canada the rule is that at least 100 daughters should be aimed at. (Doormal 2002).

However, there are also surveys in which for controlled tests in contracted companies 60 to 80 daughters per bull are sufficient (Schomaker 2001).

When building up a test herd it is important to check, how much a genotype-environment interaction will influence the test result. Also the size of the herd has an influence on the breeding value estimation (Swlave et.al 2001) Under the conditions of Holstein–breeding value estimation the daughters of test bulls from larger herds achieve a higher weight, so that with the same number of daughters safety tends to increase in regions with larger herds.

According to Dodenhoff (2003) an important aspect in bull testing is the transregional use of testing. As diagram 3 shows more test bulls are acquired by associations, but that does not necessarily mean that they are commonly tested.

The cooperation of Bavarian and Austrian insemination stations is a landmark in the right direction. Thus there are connections between regions and the bulls are tested on a wider basis. The Italian breeding organisations, for instance, put great emphasis on an ideal spread of test bull semen. Companies in different parts of the country with very different conditions for production test the bulls in the individual stations. According to Callegaro

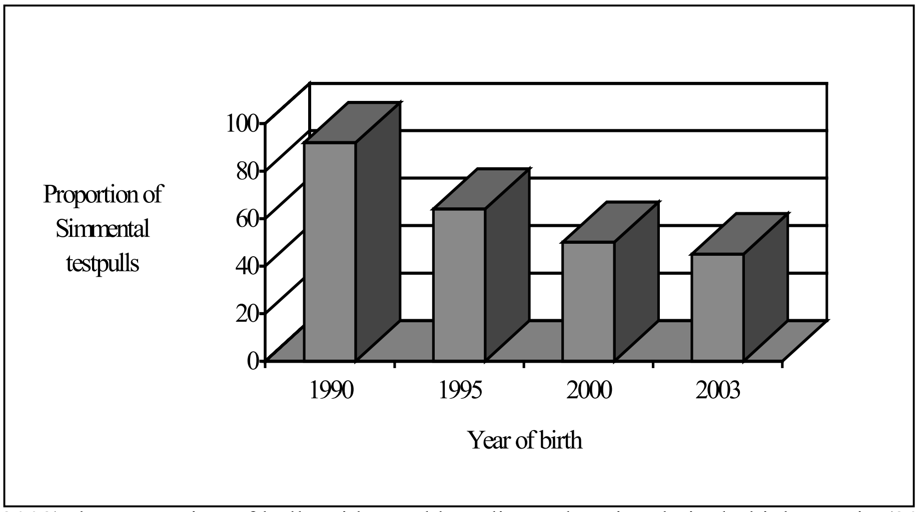


Figure 3: Proportion of Simmental testbulls in the ownership of one Bavarian insemination center

(2002) the proportion of bulls with good breeding values is relatively high. König (2002) maintains that a trans-regional use of tests as well as an improved data structure would contribute to create new markets for the organisation. Highly positive tested and selected bulls will be used more intensively in a wider population.

5 Young cow or older bull dame?

Some years ago already Graser and Averdunk (1992) found out that the age of the bulldam has an influence on the success of the test in the selection of her son. As can be seen in diagram 4 the average of bulldams has decreased since the mid-nineties.

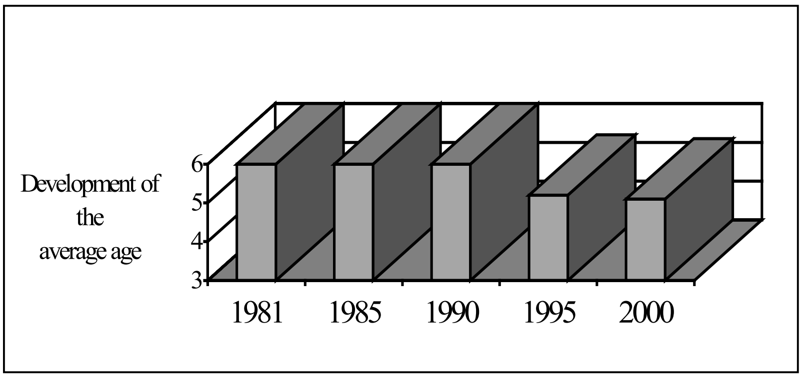


Figure 4: Development of the average age of bull dames in Bavaria.

In the course of an innovative breeding programme more young cows and young cattle are being used in ET since 1998 in Bavaria. Beside a good initial performance also the milk yield is estimated to be high. Soon it will show whether the shorter interval between generations can compensate the reduced safety at the time of selection.

Too great expectations in bulldams with a high life performance and a lower total merit index, connected with the hope of a long productive life (ZW = BV) of her sons must be viewed sceptically. Analysis of Bavarian data material have shown that. And when old bulldams are mated with new sires, just coming from being tested, such a method cannot work.

6 Avoid narrowing of line

A frequently asked question is: how much inbreeding in a population can be tolerated?

The consequences of an increase in inbreeding is knows, but the different lines within a breed are under economic pressure. Strongly positive bulls are used widely, while variations with a lower level of performance are cut short in the breeding programme. This method accelerates the breeding progress, but leads to higher degrees of inbreeding. Table 3 indicates the domination of individual sires.

The table shows that of the bought test bulls in 2004 – about 50 % descend from 5 different fathers. Of the total of 448 test bulls 69 have a father who shows up only once in that test year. That is a very uneven use of bull sires in the breeding programme. For Simmental Fleckvieh the inbreeding coefficient is still relatively low, in contrast to other breeds.

Table 3: Most frequent fathers in 2004 of test bulls in Bavaria.

Name	HB-Nr.	n	%
Regio	191190	78	17
Hippo	187293	52	12
Poldi	184248	46	10
Repuls	169110	22	5
Rumba	605190	19	4
		217	48

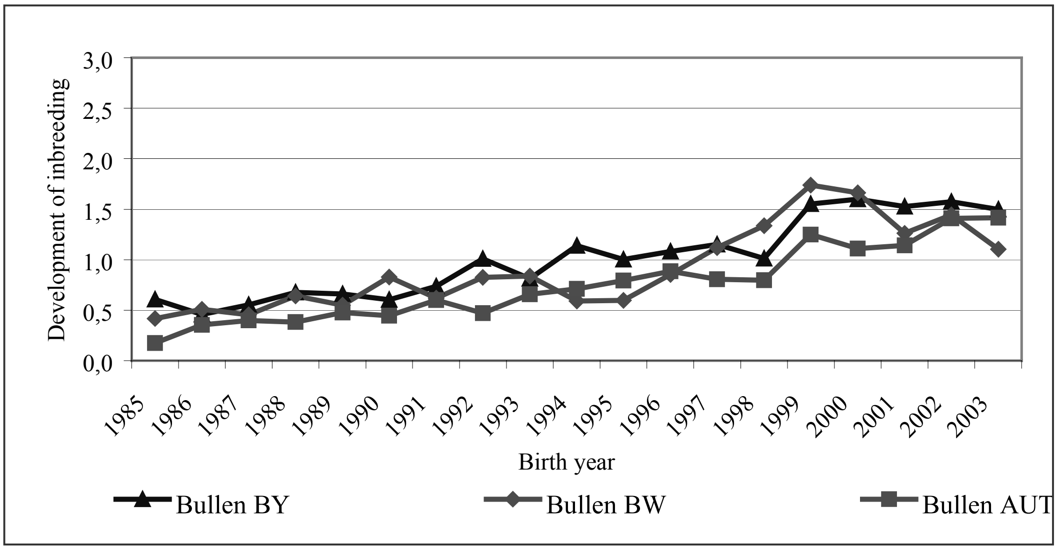


Figure 5: Development of inbreeding – by the year of birth of Simmental bulls.

The development should be continuously checked so that the diversity of lines is assured.

Results of research on American Jersey cows indicate that an increase in inbreeding by 1 % reduce the longevity of cows by 40 days. Through the extensive use of very positive tested and selected bulls a further increase in inbreeding is to be expected in the coming years, and there will also be a corresponding supply of bulldams.

7 Inclusion of Red-Holstein

Cross-breeding of Red-Holstein with Simmental Fleckvieh has proved to be unfavourable. In Bavaria an evaluation of test bulls with a proportion of over 25 % Red-Holstein has shown that of 34 test bulls (beginning with the birth year 1990) only three have reached the permits for insemination. Particularly functionality in regard to legs and feet and somatic cell count are significantly limited, therefore a further inclusion of Red-Holstein in Fleckvieh breeding cannot be recommended. Furthermore the character of a dual-purpose breed becomes questionable.

8 Summary

In regard to the rising pressure of expenses and the heavy workload in companies the significance of traits relevant to health will continue to gain in importance. In addition to that the demand for high product quality goes hand in hand with a changed consumer awareness.

The protection of animals and a correct animal husbandry are in the focus of public interest.

The performance test will have to incorporate a more precise recording system of health data, in which the computer could find greater application. Most companies have now internet access.

Moreover, companies have to take more and more responsibility for the recording of data. Whether a test herd is the appropriate instrument is worth considering.

Reserves in the breeding programme could be achieved through a wider spread of bulls sires.

That puts demands on the structure of organisations. The aim of testing must be to achieve most reliable results. Despite the rising pressure of expenses for the organisations it is important for the survival of dairy farms to work with heredity results that provide a solid basis. Depending on the economic conditions all possibilities need to be exploited.

In future the great challenge for insemination stations will be to assure the ideal use of test bulls, without a loss of data accuracy.

Breeding strategies for Simmental Fleckvieh from the point of view of breeding associations

Dr. F. Führer, NÖ Genetik

1 Breeding aim

The economic conditions and the subjective opinion of breeders call for breeding programs that surpass pure performance and index breeding. For the definition of the breeding aim essential progress was made by means of the introduction of the total breeding value (GZW). Taking the breeding progress of all recordable traits into account permits a further development towards a biologically balanced breeding aim and an objective evaluation of all functional traits instead of recording merely performance. Especially the total breeding value emphasizes the outstanding variety of performance of Fleckvieh. Nevertheless, a slight decline in productive life also for Fleckvieh is noticeable.

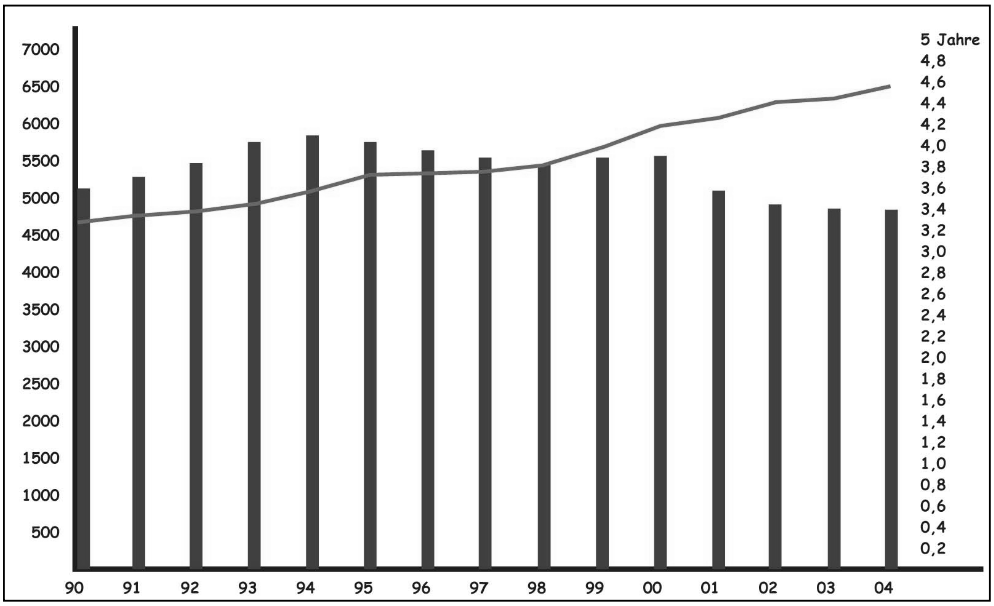


Figure 1: Development of milk performance and productive life in Lower Austria (1990 to 2004)

The wish for unproblematic, healthy cows is as old as organized cattle breeding. Quotation by Prof. Dr. Vogl, Munich 1906: "It is breeding for performance if it is practiced in a most unbalanced way knowing no bounds, yet, still sought to be enhanced that undermines the health of many breeding animals already in the womb and from early childhood on."

A breeding association as representative of breeders therefore demands breeding strategies that have to take health, fertility and above all also type as a further health trait into consideration. Naturally, a breeder does at the same time not expect a reduction of milk and beef performance. This is going to be the future challenge.

2 Reliability

2.1 Supra-regional testing of bulls

The improvement of the validity of the testing is one of the most important demands for the future. The breeders will lose faith in our expensive methods if the top list turns out to be a flop list 3 years later. A wrong understanding of competition leads to high insemination figures of sires that in terms of total breeding value rank most highly on the top lists. Much too often disappointment concerning type or performance reliability follows. Mistakes made with other breeds must not be repeated with Fleckvieh. In this respect the synchronous testing carried out in two or more populations represents an alternative. The possible influence of local population effects decreases and the evaluation of the type traits is carried out by organizations independent of each other. As a consequence the results will be more readily accepted in both countries in which the testing is carried out. In an analysis of the breeding values of a second insemination the bulls of these supra-regional programs attract particularly positive attention.

2.2 Insemination with test bull semen for the second calf

In Austria this system is most commonly used. The advantages are the offspring of the testbulls in all herd classes as far as performance and environment are concerned. The descendants represent the entire genetic spectrum of a population and admit a more distinct conclusion concerning the heredity performance of the bull especially regarding the traits of muscularity and udder. In the control year of 2004 73.3 % of the first-calf cows were inseminated through testbulls in all Austria. This percentage varies from 29.7 to 89.6 % for different breeding organizations.

Table 1: Number of bulls of the station Wieselburg tested supra-regionally 1978 – 2004

Year	Number	Owner
1978 - 1983	23	Wieselburg, Meggle, Oberösterreich, Landshut
1984	12	Wieselburg, Meggle
1985	12	Wieselburg, Meggle
1986	9	Wieselburg, Meggle, Landshut
1987	8	Wieselburg, Meggle
1988	10	Wieselburg, Meggle, Landshut
1989	7	Wieselburg, Meggle
1990	9	Wieselburg, Meggle, Grub, Bauer, Landshut, Marktredwitz
1991	11	Wieselburg, Meggle, Landshut
1992	15	Wieselburg, Meggle, Grub, Bauer, Landshut, Marktredwitz
1993	17	Wieselburg, Meggle, Landshut, Plemenari Brno
1994	27	Wieselburg, Meggle, Landshut, Hessen
1995	28	Wieselburg, Meggle, Landshut, Marktredwitz
1996	33	Wieselburg, Meggle, Eusema, Irland, Frankreich, Hessen, Landshut, Marktredwitz, Würtenberg, Salzburg, OÖ
1997	36	Wieselburg, Meggle, Landshut, Eusema, RZO, Oberösterreich, STMK
1998	63	Wieselburg, Meggle, Eusema, Hessen, Marktredwitz, RZO, FIH, OÖ
1999	80	Wieselburg, Meggle, Eusema, FIH, Irland, Frankreich, Oberösterreich
2000	95	Wieselburg, Meggle, Eusema, Oberösterreich, Neustadt, FIH, Frankreich
2001	79	Wieselburg, Meggle, Eusema, Höchstädt, Oberösterreich, Irland
2002	85	Wieselburg, Meggle, Eusema, Italien, Genetic Austria, Frankreich, Plemo
2003	120	Wieselburg, Meggle, Höchstädt, Neustadt, Italien, BVN, Eusema, Genetic Austria, Frankreich, Plemo
2004	66	Wieselburg, Meggle, Höchstädt, Landshut, Italien, Eusema, Genetic Austria, Irland, Plemo, Frankreich

2.3 Higher numbers of testbulldaughters

A higher number of testbulldaughters can only be achieved by means of an increase in the percentage of testbull inseminations and a decrease in the number of testbulls. Yet, the breeding progress and the marketing of breeding livestock requires a minimum percentage of tested and selected bulls of 70 % of the insemination figures. For this reason it is necessary to improve the proportion of the daughters available for breeding value estimation before taking this step. This proportion is 10 : 1 in the ideal case, that is to say 500 inseminations lead to 50 daughters with first lactation and should not fall short of 15 : 1. The best possible number will be 100 – 150 daughters in a combined supra-regional recording. 200 – 300 daughters, a figure repeatedly demanded by scientists, is not feasible, as the acceptance of the use of testbulls would decrease within breeders.

2.4 Second evaluation of tested and selected bulls in selective mating

The corresponding evaluation of testbulldaughters after the 3rd calf ought to be intensified further and also integrated into breeding value estimation. The remaining rate is to be regarded as part of the functional traits.

3 Economic efficiency

The costs of the breeding programs have to be financed by means of the price of semen and the (herd-book) registration charges. Independent performance recording is an indispensable condition in order to get reliable breeding values. The maintenance of exhaustive performance recording is one of the most important challenges in Fleckvieh breeding, which is due to the fact that it is mainly marked by small herd sizes. Public subsidies are to be seen as direct support of a sustainable cattle breeding. This is why it will be impossible to do without them also in future. The technical possibilities that the modern milking technology provides as well as electronic data transfer must be employed further in this field. Apart from that regional units have to be brought together in breeding programs. Structures that permit the use of the best sires of all Simmental Fleckvieh populations worldwide have to be built up. Especially Holstein breeding has shown how the breeding progress is enhanced by means of global cooperation so that the breeding programs become important economic factors. The Simmental Fleckvieh countries of Central, Eastern and Southern Europe have to be integrated into the Simmental Fleckvieh community even more strongly. Also the established methods of breeding value estimation and data acquisition should be available in all countries as soon as possible in order to make a consistent Simmental Fleckvieh breeding standard feasible.

Table 2: Testing programs in comparison

	Fleckvieh AUT	Fleckvieh BRD	Sbt BRD	USA	Canada	Frankreich	Holland
First inseminations	763.830	1.987.709	2.432.312	7.300.000	900.000	2.596.000	1.190.000
No of testbulls	181	680	900	1.469	409	660	350
Total proportion of first inseminations (FI) (no of) testbulls	**4.220**	**2.900**	**2.702**	**5.000**	**2.247**	**4.000**	**3.500**
No of artificial insemination organizations	6	12	16	9	7	34 Regiozenter	3
No of breeding programs	6 (1)	12	14(4)	5	2	2	2
First inseminations per breeding program	127305 (763.830)	165.642	173763 (608.000)	1.460.000	750000 Semex	1.300.000	970000 HG
No of testbulls per breeding program	30 (181)	56	76 (225)	299	350 Semex	330	320 HG

4 Enhancement of success

4.1 Embryo transfer

The efficiency of breeding programs contributes essentially to their economic success. The practice of embryo transfer is indispensable for an efficient breeding program. In recent years a decline (in embryo transfer) caused by low prices of breeding livestock and legal problems with veterinary drugs (the registration of FSH) was noticeable. Breeders frequently placed too great hopes in this technique for their own breeding farm, although the disappointment of breeders was often due to the selection of the wrong embryosires. However, with bulldams the practice of embryo transfer is meaningful in any case. Especially the connection with marker-supported selection opens up new possibilities in this field.

Table 3: Embryo transfer with donor cows of varying fertility in Lower Austria

Category	Average no of usable embryos	Average no of not-inseminated + degenerate embryos
Old cow (not productive any more)	1,40	2,60
Cows without fertility disorder	6,98	5,68
Cows with one fertility treatment	5,58	6,53
Cows with repeated fertility treatment	2,74	6,35

4.2 Marker assisted selection

If the knowledge about vital genetic is available, marker assisted selection absolutely has to be integrated into breeding programs. In this connection especially genes concerning protein yield or fitness traits are of interest. The selection of several full-brothers generated by embryo transfer by means of genetic markers would open up new breeding possibilities. In order to realize this a tight breeding program and the cooperation of all Simmental Fleckvieh populations would again be necessary.

4.3 Stationary recording of bulldams

In the European Simmental Fleckvieh population this possibility has not yet gained acceptance. The emerging costs can only be born by rather big organizations and with the background of global marketing possibilities. The advantages over the selection in many breeding farms emerge from higher performance reliability and better observation possibilities of bulldams with regard to somatic cell count and fertility. As with marker assisted selection also for this method international cooperation is required. An open nucleus-system with bulldam recording organized by contract in private breeding farms could be most easily realized.

5 Multifunctionality

Because milk performance is not the only advantage the Simmental Fleckvieh breed has to offer, with this breed more than with others a variety of traits has to be taken into account. Out of this a substantial superiority of Simmental Fleckvieh in competition might develop.

5.1 Type traits

Apart from the satisfaction of the breeder's eye these traits serve especially the enhancement of health and fertility. The condition for a perfect type is the skeleton, which in spite of an increase in body size and growth rate, has to remain in a certain anatomical balance. Owing to the morphogenetic breeding of the recent 100 to 150 years Simmental Fleckvieh has a first-rate constitution of the spine, pelvis position and articular development. The external evaluation that restricts itself to the side view does not take the possibilities of a Simmental Fleckvieh cow into account. With Simmental Fleckvieh also the "third dimension" has to be included. Its outstanding body width, an extraordinary chest and pelvis capacity amount to the same biological result in terms of feed conversion and functioning of organs as the long and wide rib vault demanded of the dairy breed.

In 2004 about 450 young cows (approx. 6 weeks after their calving were measured for the chest with. The average result was 51,9 cm. The average pelvic with of 53,8 cm was determined in the linear description done for the type evaluation. Both measurements present the actual standard for Fleckvieh in Lower Austria.

Some catching up will be required in Simmental Fleckvieh breeding concerning keeping the quality of udders. Breeding value top lists frequently force sires that are distinguished by excellent udder heredity onto the sidelines. In this respect a higher weighting of udder quality in the ranking of sires is required.

5.2 Somatic cell count

With increasing performance the somatic cell count becomes a problem also for Simmental Fleckvieh. However, since it is not by definition linked up with milking speed and milk yield there exist promising future selection possibilities. The advantage of Simmental Fleckvieh in this health trait must not be lost.

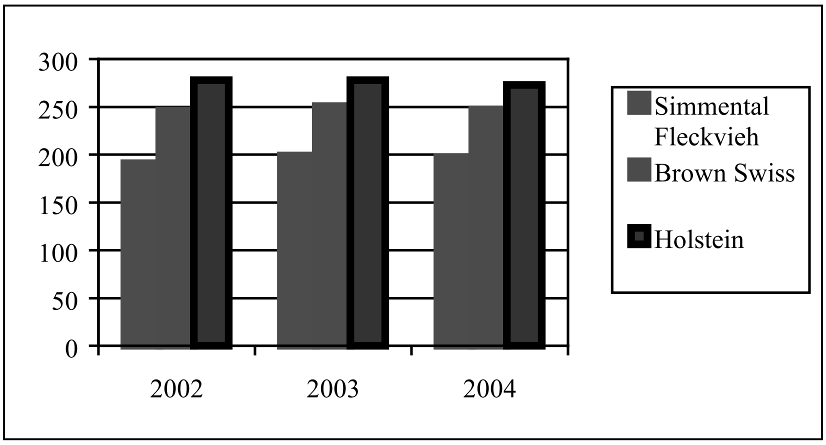


Figure 2: Somatic cell counts of the different breeds in Lower Austria 2004

The breeders do not understand the high weighting of ancestry performance in breeding value estimation concerning the somatic cell count or type, because the breeding values differ substantially from the absolute values. In the search for new bull sires the problem that the same bloodlines keep managing to predominate arises. Concerning their use as bull sires it would certainly be revealing to evaluate the sires according to their absolute values for functional traits.

5.3 Beef performance

This vital merit of the Simmental Fleckvieh breed has been neglected in the breeding process in recent years. Apart from the fact that the marketing of cows and calves provides an additional source of income in the course of milk production, beef performance is also part of the health and morphological traits. Due to the extraordinary muscularity of a Simmental Fleckvieh cow an extraordinary metabolic stability in situations of strain is to be expected. Nevertheless, it does not make sense to evaluate beef performance with young cows at the beginning of lactation by means of muscularity. To practice beef performance recording data from performance testing of breeding bulls (illustration 3) and from progeny testing must be used.

5.4 Fertility

Fertility problems are becoming one of the most cost-intensive factors in dairy husbandry. This gradually proceeding negative trend in connection with a substantial enhancement of milk performance has to be stopped. In order to increase the heritability in this trait data acquisition has to be improved (Sölkner and Egger-Danner, 2003). The selection for maternal fertility is becoming increasingly important, which would require its higher weighting in the total breeding value. Additionally, half-subjectively recordable traits, such as the intense of the heat, should be integrated into the fertility breeding value.

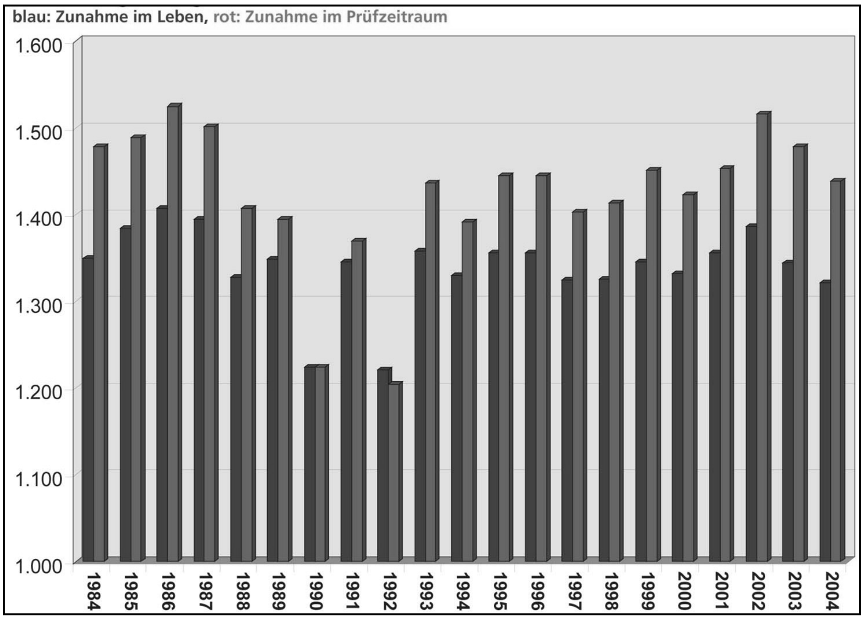


Figure 3: Development of daily gains of young Simmental bulls in the (own-?) performance testing station of Rosenau (1984 – 2004)

5.5 Temper

For an unproblematic dairy husbandry the cows absolutely have to have a quiet temper. For this reason the integration of this trait in breeding value estimation has to be possible in future. Provisional research has shown a significant genetic effect with temper and milking behaviour.

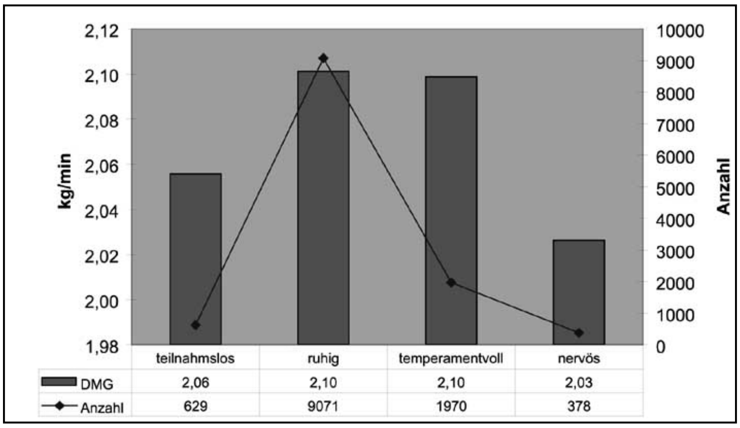


Figure 4: Connection between temper and milk rate

5.6 Transparency

The calculation of an index has to be transparent also for breeders and dairy farmers. The high weighting of ancestry performance and the taking into account of correlations between individual breeding values lead to breeding values that find no sympathy with breeders and farmers. The actual observations are going to be of continuing interest to those doing the practical work and should be allowed to be evaluated for the selection of bulls, especially in selective mating. Apart from that the narrowing of bloodlines is encouraged by linear index selection.

6 Conclusion

Simmental Fleckvieh is the most multifarious cattle breed globally. The breeding programs have to take this into consideration and to guarantee the highest measure of reliability. This is permitted by the technical possibilities of our time. One condition is the worldwide cooperation of all Simmental Fleckvieh countries in the realization of breeding programs, as this has already been demonstrated with other global cattle breeds. In particular the Simmental Fleckvieh countries of Central, South and East Europe have to be integrated into this cooperation. If we do our work persistently and pay attention to the balance of nature, Simmental Fleckvieh will continue to grow in importance globally.

Research project results in marker assisted selection and use in breeding practice

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1 Introduction

Cattle breeding applying classical methodologies for breeding value estimation and consistent selection have been very successful in the past. Traits that have been intensively selected for, especially milk yield, have genetically changed drastically in recent decades. Figure 1 shows the steady genetic upward trend for milk yield for the Austrian Fleckvieh population. Nevertheless also protein- and fat percentage, which were scarcely directly selected for lately, changed genetically. Fitness traits tended to deteriorate due to their antagonistic relationships to milk yield and only since they have been incorporated into the total breeding index they have stabilized again.

The fundamental basis for this success is the BLUP breeding value estimation methodology. This methodology assumes that traits like milk yield are influenced by a huge number of genes, each with a very small effect. However spectacular progress in genetical research in particular in the field of molecular genetics in the last 20 years has allowed us to reassess this assumption. The new technologies enabled to sequence the human genome. Although often misinterpreted this „only" allows us to read the genetic code of all chromosomes not implying that we fully understand its functioning

At the moment a lot of genes with big effect are being localized. Once they have been found we try to elucidate their functions and exact mechanisms resulting.

This search is like looking for the proverbial needle in a haystack since the genetic code of a single gene is only a few hundred to a few thousand base pairs long whereas the whole genome of mammals (including man and cattle) is made up of 3 billion base pairs.

Still, due to the ongoing substantial advances in molecular genetic techniques we succeed more and more often in localizing genes. Nevertheless identifying the mode of action of genes and predicting their effects is further complicated by interactions with other genes and modifications due to the environment and will remain very cumbersome also in the future.

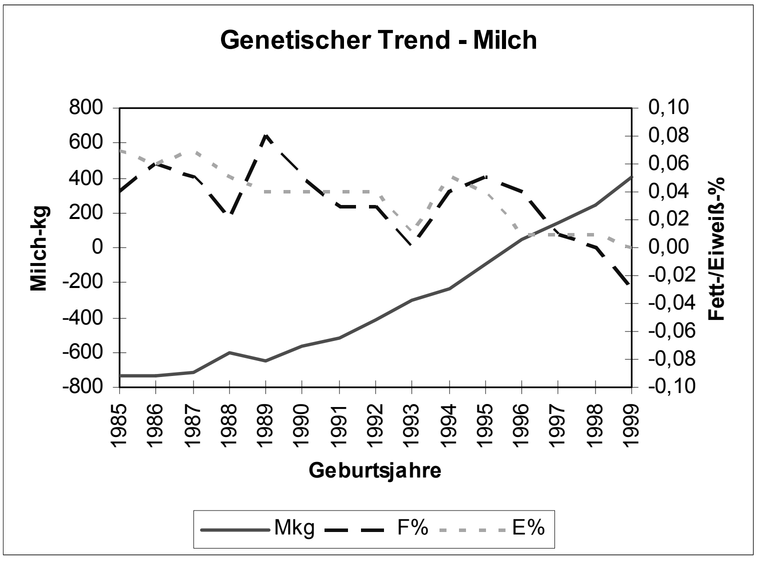

Figure 1: Genetic trends in the Austrian Fleckvieh population

It however still seems reasonable to explore gene effects and to use this information in breeding.

In the following I want to introduce findings on a particular gene, which was already localized and whose mechanism is understood, as an example, on how genes are searched in the EU founded BovMAS project and possible ways on how these findings can be utilized for practical breeding in the Fleckvieh population.

2 DGAT1 (acylCoA-diacylglycerol-acyltransferase 1)

DGAT1 is an enzyme that plays an important role in the fat metabolism in mammals. It was extensively studied with respect to its connection to obesity in humans. The mode of action of DGAT1 was elucidated and the responsible gene for DGAT1 synthesis found in the mouse as a model organism. Because big regions of the genome are genetically conserved between species it was possible to infer a likely region on the cattle genome that harbours the gene, from its position on the mouse genome, and consequently find the gene also on the cattle genome. After successful localization of DGAT1 on the cattle genome the gene was sequenced. In other words the order of DNA subunits necessary to produce the enzyme was identified. Two different variants, which differ in an important subunit of DNA, were detected. The differences on the level of DNA lead to 2 different variants on the level of proteins i.e. two different variants of the DGAT1 enzyme (alanine-variant und lysine-variant).

Thaller et al. (2003) working at the Institute for Animal Breeding at the Technical University in Munich investigated the frequencies of these variants in the Fleckvieh and Holstein Friesian population as well as the effects of the different variants on milk-, fat- and protein yield and fat- and protein percentage.

While both variants are at approximately equal frequencies in the Holstein Friesian population (lysine-variant at 55 %), the lysine variant is very rare in the Fleckvieh population (7 %). This variant increases fat percentage in the Fleckvieh population by about 0.3 % and protein percent by about 0.1 %., unfortunately it has also got a negative influence on milk yield (about 200-250 kg less). Fat yield is higher (appr. 10 kg) for the lysine-variant while protein yield does not differ significantly between the 2 variants. Effects of both variants found in the Holstein Friesian population are very similar to the ones found in Fleckvieh.

Recently, he working group of Prof. Fries und Dr. Thaller from the Technical University in Munich also investigated the influence of different DGAT1-variants on the intramuscular fat content of Charolais and Holstein Friesian sires. They could show that fat content for individuals homozygous for the lysine variant was 2% higher in musculus longissimus dorsi and the joint.

3 The BovMAS project with respect to Fleckvieh

BovMAS is an EU financed project-cooperation that was started in October 2001at the Institut für Tierzucht at the Ludwig-Maximilian-University in Munich (project coordinator), the Department of Genetics at the University of Jerusalem, Sezione di Allevamenti Zootecnici at the University of Bologna, the Faculta di Medicina Veterinaria at the University of Milan and the Division of Livestock Sciences at the University of Natural Resources and Applied Life Sciences Vienna. **BovMAS** is an acronym for **bov**ine (cattle-) **M**arker **A**ssisted **S**election. The full title is as follows: „Quantitative Trait Loci Affecting Milk Production: Mapping and Utilization for Marker Assisted Selection in Dairy and Dual Purpose Cattle".

This very ambitious project aims at identifying many genome regions, which harbour genes with a measurable influence on a quantitative trait. Such loci are called **Q**uantitative **T**rait **L**oci - **QTL**.

Identifying causative genes, like in the case of DGAT1 is very difficult. A way around this problem, which still allows us to make use of molecular genetic information are so called molecular markers, which are located in vicinity of the QTL.

This approach will be described in more detail later on.

The first step is to identify QTL for milk yield and protein percent in dairy and dual purpose cattle. In a second step effects of the identified QTL on other traits that are important for breeding and economics are investigated. Thus effects on fat percentage, fat yield, somatic cell count (SCC), calving ease, stillbirth and Non Return Rate (NRR90) are studied to avoid possible negative side effects on these traits in the case of MAS for the found QTL for milk yield and protein percent.

The project investigates 5 cattle populations in 4 countries, namely the Fleckvieh population in Austria and Bavaria, Brown Swiss cattle from Bavaria, Austria and Italy, and Holstein from Israel and Italy, as well as a backcross population of the Red Holstein sire Redad to Fleckvieh. 10 paternal half sib Fleckvieh families and 8 paternal half sib families from the backcross population were chosen for this project, according to the number of progeny tested daughters, the relationship between the sires and their importance for the actual breeding population.

Tabel 1: Chosen sires for the Fleckvieh population in Austria and Bavaria

ID	name	sire/maternal grandsire	country / number of sampled daughters	
Fleckvieh				
040000236901233	Dones	Disko/Hannes	AT	2.525
040000225790364	Landon	Larsen/Pikkolo	AT	1.699
040000040568233	Malf	Morello/Half	AT + DE	2.990+882
276000919241350	Steffen	Streitl/Ferry	DE	2.033
276000913892370	Samurai	Steg/Zamur	DE	2.554
276000910950070	Sport	Stress/Romit	DE	2.063
276000911278331	Zitat	Zeus/Penny	DE	2.275
276000912065622	Zeusor	Zeus/Ost	DE	1.635
276000918035013	Winzer	Horwein/Zeus	DE	2.233
276000917042828	Honer	Horb/Hexer	DE	2.130
Backcross RH*FV				
040000399879932	Raudi	Radi/Prolett	AT	3.173
040000074173633	Rumsi	Radi/Streif	AT	2.253
276000913008210	Rexon	Rex/Haxon	DE	2.012
276000913770147	Reder	Renner/Zenall	DE	2.163
276000915732780	Renger	Renner/Sambach	DE	2.054
276000919284387	Renno	Renner/Penner	DE	1.470
276000914872599	Honnef	Horb/Renner	DE	1.667
276000919253926	Utnach	Uterino/Radi	DE	2.051
Sum				**39.832**

The Institut for Tierzucht at the Ludwig-Maximilian-University in Munich with Professor Förster and Dr. Medjugorac are the responsible partners for genotyping and subsequent analysis for the Austrian-Bavarian Fleckvieh and RH*FV - backcross families.

The Division of Livestock Sciences at the University of Natural Resources and Applied Life Sciences Vienna performs comparisons of different variants of MAS with conventional breeding strategies for complex breeding goals with respect to economical and genetic gains achieved in the different scenarios.

3.1 QTL-search

The biochemical material of the genome consists of DNA (deoxyribonucleic acid). The DNA is built up of subunits, which differ with respect to the base they are carrying (4 possible bases). The sequence of these DNA subunits ciphers the genetic code. The whole genetic information (genome) is organised in chromosomes, whereas 2 strands of DNA always form a chromosome. The chromosomes (30 pairs in the case of the cattle genome) are located in the cell nuclei.

DNA fragments that carry the code for enzymes are called genes. During formation of gametes (sperms and eggs) the chromosomes are split into their 2 single strands of DNA and one of each strand remains in the gamete. During fertilisation when egg and sperm cell fuse, the genetic material of the parents is mixed. At each single locus of an individual there is always on variant of a gene (allele) that the individual inherited from its sire and one that comes from its dam. If 2 loci on a chromosome are located close together they will tend to be inherited together. This is called linkage between these 2 loci. Whenever 2 loci are located "far away" on a chromosome, then during meiosis (formation of gametes) there is a higher change that the 2 DNA strands are crossed over and that fragments of DNA are exchanged between the paternal and maternal chromosome. This event is called recombination. When we search for QTL (map QTL) we make use of these 2 above mentioned phenomena.

The fundamental problem in QTL mapping is that we cannot „see" the QTL itself because we do not know its DNA sequence and where about in the genome the QTL is located. Molecular markers on the other side are short fragments of DNA whose DNA sequence and location in the genome we know. That is why we can make them visible quickly and easily with the help of molecular genetic methods

Within the BovMAS project we find (map) QTL applying the so called Daughter Design in combination with selective genotyping. (See Figure 2).

The sire in this figure is heterozygous at the 2 loci, which means he carries 2 different alleles at the marker locus (M, m) as well as at the putative QTL locus (Q, q). If the 2 loci are located closely together the probability for recombination between them during meiosis is small, hence about half of the daughters of this sire will inherit **M** and **Q** together and the other half **m** and **q**. In other words there is linkage between the paternal alleles **M-Q** on one side and **m-q** on the other side. The maternally inherited alleles (**x**, **x**) at these 2 loci are of no importance in a Daughter Design.

Applying a Daughter Design, daughters of a sire are grouped according to their performance in a specific trait and selective genotyping means that only for example the best and worst 10% of daughters are used for QTL mapping. If we find sire marker allele **M** with higher frequency among the best daughters and sire marker allele **m** more often among the worst daughters then we can infer that there is a QTL with alleles **Q** and **q** close to this marker locus. In other words we assume that marker allele **M** is linked to the "good" QTL allele **Q** and that marker allele **m** is linked to the "bad" QTL allele **q**. This QTL is responsible for the difference in performance of the daughters having inherited one or the other QTL allele and because of linkage also one or the other sire marker allele. The marker provides information on where about on the genome QTL are located.

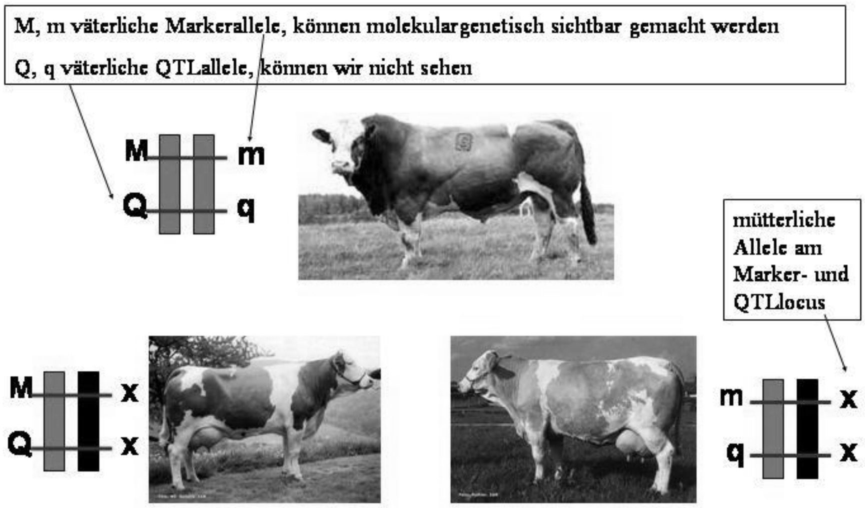

Figure 2: The Daughter Design

4 Preliminary results

Until now the whole cattle genome has been searched for linkage between QTL and 201 markers for milk yield and protein percent in a so called global genome scan in each of the 18 families listed in Table 1. QTL were identified for both traits (milk yield and protein percent) in a big number of genome regions. Out of all the significant genome regions the 5 most interesting ones were chosen. These genome regions are on chromosomes 3, 9, 11, 13 and 20. These were analysed with additional molecular markers to determine the position of the identified QTL more precisely. The biggest effort (fine mapping) is made in the 2 most promising regions on chromosomes 13 and 20. The result of the global scan on one chromosome is pictured exemplarily in Figure 3. The length of the chromosome (in centimorgan, cM) is plotted on the x - axis. The red dotted line represents the so called test statistic, which is a measure for a QTL on the chromosome. In Figure 3 the test statistic is highest at 38 centi morgan which is the most likely position of a QTL on this chromosome. The height of a test statistic depends to a large extent on the number of markers analysed. Therefore this chromosomal region will be fine mapped with additional markers to render more precisely the QTL.

5 Potential utilisation of the identified QTL in breeding

Whenever molecular genetic information is utilized in breeding we call this approach marker assisted selection (MAS). In doing so we practically do not distinguish whether the causative gene influencing the trait of interest or only molecular markers for the QTL are known. The benefit of molecular genetic information in both cases lies in improved estimated breeding values in particular for young individuals without own performance or progeny testing information. The information on the genes is formally incorporated in the BLUP breeding value estimation. Research at VIT - Verden, has shown that estimated breeding values of young bulls including DGAT1 and information on one additional marker in breeding value estimation have a higher correlation with breeding values after progeny testing compared to estimated breeding values for young bulls, which are solely based on pedigree index.

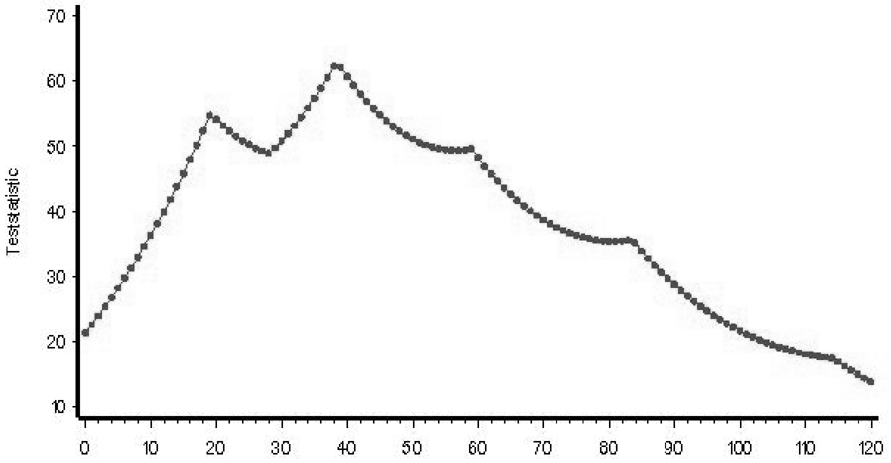

Illustration 3: Example graph of QTL search via a global genome scan

Estimated breeding values of proven bulls with and without molecular genetic information differ barely, because the collected progeny information is more exact than the knowledge on a small number of genes.

What is important though is the possibility to distinguish, based on molecular genetic information, among young full brothers, which are assigned identical pedigree index breeding values in conventional breeding value estimation. The improved pre - selection of young bulls can be considered the most important contribution of molecular genetic information in progeny testing schemes.

6 Planned implementation of marker assisted selection for the German and Austrian Fleckvieh breeding population

The BovMAS project together with precursor projects (ADR1 und ADR2) carried out at LMU Munich, at TU Munich and at LfL in Grub have produced numerous results proving a sound standing basis for the decision on whether or not to implement marker-assisted selection in the Fleckvieh population in Austria and Germany, which is already closely linked through a massive exchange of sires and a common breeding value estimation. Representatives of the "Arbeitsgemeinschaft Österreichischer Fleckviehzüchter" and the „Arbeitsgemeinschaft Süddeutscher Rinderzüchter" have in principle agreed on working out a common basis for marker-assisted selection.

To accomplish this task investment in infrastructure i.e. a logistic for routine DNA sampling and analysis, establishment of a databank for genomic data and modification of the current model for breeding value estimation are necessary. A further prerequisite are genotypings of sire families which have not been part in any of the research projects so far, as well as a final choice on QTL to be considered for MAS. A preliminary meeting has been held and an interim list of QTL including QTL for yield traits as well as for fertility, calving ease and stillbirths identified.

Keeping in mind that conventional breeding without molecular genetic information is very successful, necessarily raises the question of common sense of investments in establishing infrastructure and running costs for marker assisted selection. This question is not easy to answer since immediate gains through additional selection response will presumably be modest ranging within a few percent. On the other hand the additional prorated costs per test bull are not high. Implementation of MAS stands for entering the world of a new technology in which the knowledge aggravates unproportionally at the moment. Cattle breeding is an extremely innovative sector, in which technical innovations (e.g. the very complex BLUP breeding value estimation) were rapidly accepted and implemented. If this happens not loosing sight of the ultimate goal of a high performing AND healthy, vital cow MAS will arguably be beneficially to the breeders as well as the animals.

7 Acknowledgement

We want to thank all responsible people at the recording and breeding organisations, insemination centres and last but not least all breeders for their collaboration, which has enabled the success of the BovMAS project.

Strategies of European Fleckvieh Cattle Breeding to optimize dual-purpose breeding particularly for beef production

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1 Introduction

The Fleckvieh breed, while internationally recognized as a dual-purpose breed is primarily used as a beef production animal in Ireland. However because of ever increasing pressure to improve efficiency, it is now accepted in Irish cattle breeding that beef production characteristics should be included in the national dairy cattle breeding programme. This development was accepted following a comprehensive review of the national cattle breeding programme. This review was initiated by the Irish Cattle Breeding Federation (ICBF) which was established in 2000 to organize and coordinate all cattle breeding functions. These breeding functions were conducted by the Irish Department of Agriculture up until that time. ICBF is owned by the main organisations which make up the cattle breeding industry. These are:

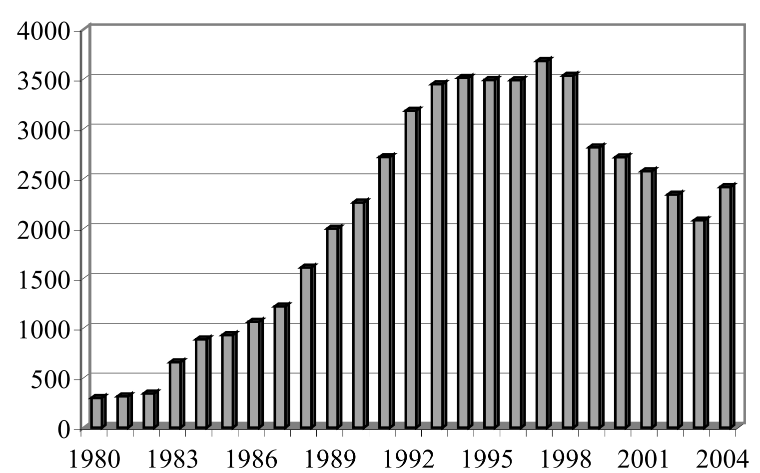
- Commercial and Pedigree Farmers
- Breed associations
- Milk recording organizations and
- Artificial Insemination bodies

The federation is funded by Government grant, a proportion of ear tag sales revenue and fees for services provided. Its mission is to ‘ achieve the greatest possible genetic improvement in the national cattle herd for the benefit of Irish farmers, and the Dairy and Beef industry and members’. Since its creation, ICBF has undertaken a major review of the organization of all cattle breeding functions in Ireland. Research was initiated immediately in three main areas. These were, genetic evaluation, data management and breeding scheme design. Some of the material described in this paper resulted from this review, which is still ongoing. Some of the findings may have application for dual purpose breeds such as the Simmental/Fleckvieh.

2 The Simmental/Fleckvieh breed in Ireland

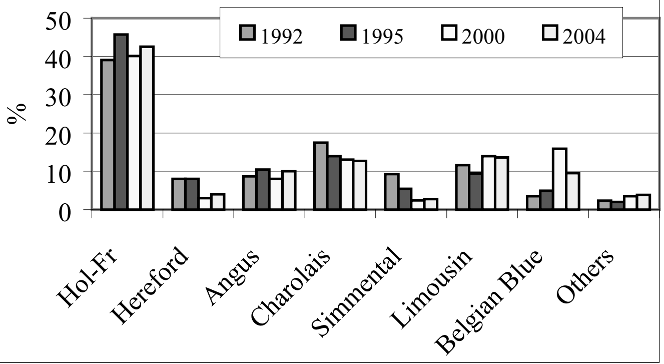
The Simmental/Fleckvieh breed was first introduced into Ireland from Austria in early 1971. Simmentals were later imported from Switzerland, Germany and France. Figure 1 shows the expansion of the pedigree Simmental/Fleckvieh herd in Ireland since 1980. Ireland traditionally does not produce commercial beef from pure breeds. Beef is produced through cross breeding which exploits the benefits of hybrid vigour and the long-established availability of replacement suckler beef cows produced as a byproduct from the matings of beef sires on the dairy herd. However with the ever-increasing infusion of Holstein genes into the dairy herd, change is underway and increasing numbers of beef cows are now being bred from within the beef herd. This holsteinisation of the dairy herd has had some influence on the use of the Simmental/Fleckvieh breed which has resulted in a decline in the registration levels of Simmentals over the last number of years as shown in Figure 1. This decline in registrations has now been halted as a result of a coordinated approach undertaken by the Simmental herdbook and its breeders in conjunction with ICBF. This has resulted in a significant improvement in beefing quality.

Figure 1 Registrations by year



Artificial insemination usage is given in Figure 2, and compares the trends since 1992 for the Simmental/Fleckvieh breed. Though usage levels for Simmental are now relatively low the declining trend now appears to have been reversed.

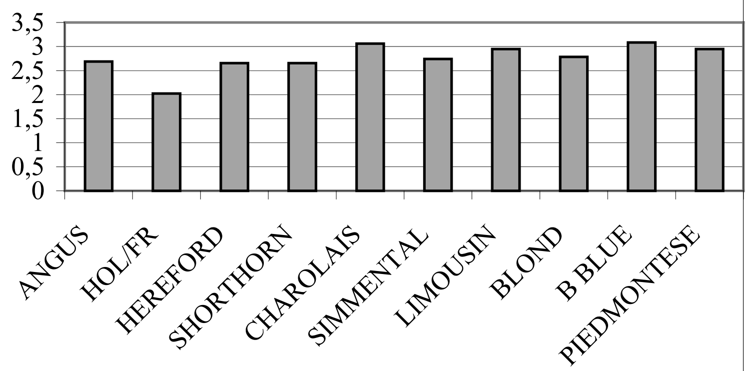
Figure 2 Trend in AI use by breed



This decline in the use of Simmental/Fleckvieh was taken up by more extreme beef type breeds such as the Belgian Blue where usage in the dairy herd has increased significantly. Figure 3 shows the breed effects for conformation based on the EURO classification grid when beef breeds are crossed with Holstein Friesian cows. Conformation is an important determinant for sire selection in the commercial herd. The Simmentals main competitors are the Charolais, Limousin and Belgian Blue breeds.

Developments such as these and the major reform of the common agricultural policy, with the introduction of a fully decoupled support system for beef in Ireland, fully justified ICBF's strategy of comprehensively reviewing and updating the genetic evaluation system to best serve the needs of Simmental/Fleckvieh and other breeds in Ireland.

Figure 3 Comformation



3 Features of the Beef industry

ICBF sought tenders for and contracted consultants to assist it in the review of the beef industry's requirements. In undertaking this task it was important to recognize that beef production in Ireland has a number of unique features which determined the choices made:

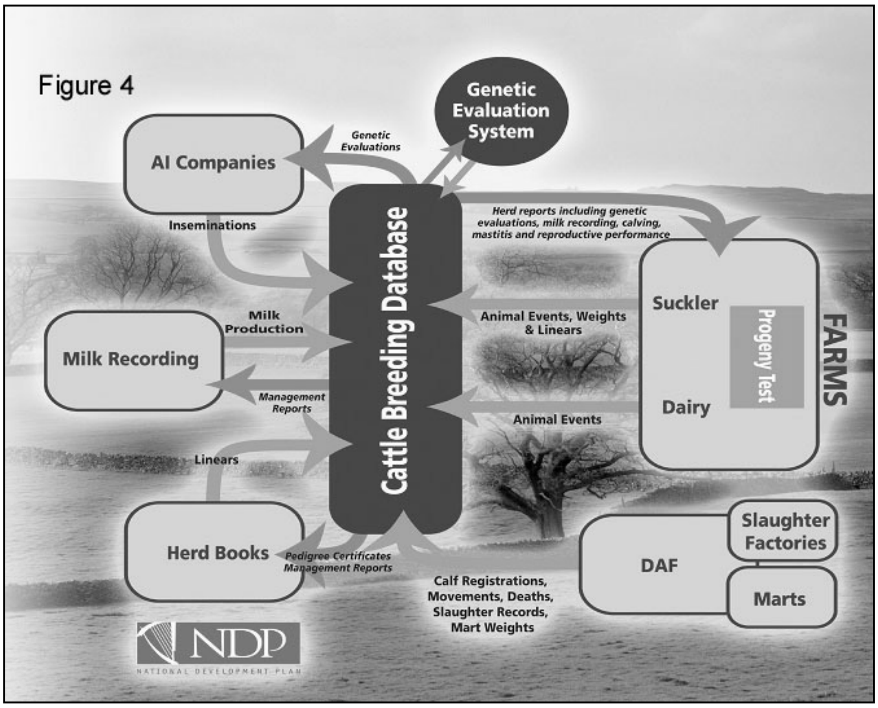
- 90% of production must be exported
- Beef production from the beef cow herd is based on cross bred cows mated to a variety of breeds, hence the need for an across breed common evaluation system;
- About 600,000 dairy cows are mated to beef sires;
- A large proportion of animals are exported live at approximately nine months of age for finishing in Europe and thus there is a need for a weaning index;
- Beef bulls must satisfy a wide variety of roles in beef production as they will be used in both the dairy and the beef herds hence a range of traits must be evaluated;
- Bulls must be evaluated for a wide variety of traits and hence the selection of sires at farm level can become complex. Sub-indices are therefore considered most useful here;
- Breeding herds are small necessitating the use of crossbred data in the evaluation process generated from many locations as shown in Figure 4;

4 Central Cattle Breeding Database

A core requirement resulting from the review of the national genetic evaluation system was the need to establish a central cattle breeding database to manage the capture and storage of data. This was the first major task to be undertaken by ICBF. Historically cattle breeding activities were disjointed and used a number of databases which were very poorly linked. Up to forty unlinked sources of data were identified in the integration process. In addition there was excessive duplication of activities in the system. There were multiple animal identification systems in existence often with duplicate ID's, which needed to be standardised. The model agreed upon to record much of the primary data was that of the "single point of entry" concept which would load data only once to a central database either directly in respect of animal recording details or though the Identification and Registration system operated by the Department of Agriculture in the case of registering newly born animals.

In 1996 Ireland introduced an Identification and Registration database system, which is managed by the Department of Agriculture and where it is obligatory for all cattle to be registered at birth. More recently this I&R database was augmented by a Central Monitoring and Movement System (CMMS), which tracks all of the movements of an animal in Ireland from birth to death or export. With an increasing number of the activities in cattle breeding becoming electronically based, the opportunity was now available to create a fully integrated national cattle breeding database with minimum manual recording and no duplication of recording activities or data storage. The overall design of the system is outlined in Figure 4.

The information relating to all breeding animals is now stored on this central cattle breeding database. The registration of a calf, whether pedigree or non-pedigree, is initiated by the completion of an event record. This can be undertaken by the breeder on paper using a standard event recording sheet, or by email from the farm computer. This single event satisfies the legal requirement of identification and registration and the herd book requirements of registering a calf. The distinction between pedigree and non-pedigree animals is achieved by simply inserting a name for the animal. All animals are now identified in the system by their National Identity Number (NID) as assigned by the Department of Agriculture. As it is a legal requirement that all movements, exports and deaths of animals must be notified to the Department of Agriculture, a lot of basic information is now available which can be used to derive important economic traits such as longevity. By agreement with the Department of Agriculture, all members of ICBF can have all of this movement and mortality information synchronized automatically to the cattle breeding database once notified. This has provided great opportunities for expanding the level of data capture, as the location of every animal at all stages of its life is now known. It also provides the basic information needed to implement efficient data capture in the field based on electronic technology such as the PDA handheld.



There are, in addition to the Department of Agriculture databases, a number of other sources of information available which can provide useful data to the cattle breeding database as detailed in Figure 4. These include AI centers, commercial sales yards, and slaughter plants.

5 Event Recording of Data

Through the use of an event recording data capture recording sheet, the opportunity is provided for recording a variety of genetically important activities in the herd in addition to the legally required birth notification. These include:

- Insemination details and/or ‘Bull in’ ‘Bull out’ dates;
- Calving ease at time of birth notification;
- Multiple keeper recorded weights through the life of the animal;
- All health events;
- Pregnancy diagnosis for management reports;
- Weaning details and culling decisions,
- Disposal and death details.

The commercially available farm computer systems are also adapted to email this information to the cattle breeding database. The experience to date with this event recording single point of entry concept has been most satisfactory.

6 A new genetic evaluation system for use in beef cattle breeding in Ireland

Following the review, the strategy adopted in respect of animal evaluation was to develop a genetic evaluation system, which would:

- Be simple to use at farm level;
- Allow all breeding animals to be compared across breed;
- Account for the full impact of matings in the succeeding generations where appropriate;
- Provide comprehensive breeding values for specialist breeders with individual requirements;
- Report breeding values in an overall index and sub-index format using EUROS (€'s) as the comparative measure;
- Use all available data;
- Produce a rapid turnaround of evaluations, ideally every week.

7 The Approach

Following detailed consultations with the industry, a new genetic evaluation system was designed and a contract was entered into for its development and implementation. The core of the system is the generation of the following four sub-indices:

- Calving
- Weaned calf production
- Beef production
- Maternal/Reproductive

8 Calving Index

The calving sub-index for each beef bull provides for two situations, reflecting the bulls use on dairy cows and on beef cows. This is necessary as the economic consequences of a difficult calving on a dairy mating are much more serious than on a beef mating where the quality of the calf is relatively more important.

Table 1 Calving Subindex

Trait	Relative importance Dairy	Relative importance Beef
Calving Difficulty Direct (% Serious Difficulty)	-4.9	-2.7
Gestation Length (Days)	-5.3	-0.5
Calf Mortality (% dead)	-1.1	-1.3

The calving sub-index includes calving difficulty direct (CD), gestation length (GL) and calf mortality (Mort). Table 1 shows the relative importance of the component traits based on Irish production costs and market returns as measured by the genetic standard deviation times the economic weight.

The relative importance of the traits in percentage terms for the dairy index are 43%, 47% and 10% for CD, GL and Mort respectively. The corresponding values for beef are 60%, 11% and 29% respectively.

Calving difficulty is significantly more important in the beef calving index than gestation length. Calving difficulty is economically more important in dairy herds than in beef suckler herds. Gestation length is substantially more important in dairy herds, because of the need in Ireland for optimal management of cheap seasonal feed on dairy farms.

9 Weaned calf production Sub-index

The weaned calf production sub-index shown in Table 2 includes weaning weight and calf quality. This index was considered necessary as there is a major trade in weaned animals to European markets and animals slaughtered do not reflect the same price differential for conformation quality as is found in the market for weaned calves. Calf quality is a prediction trait derived from linear scores and carcass conformation scores. The relative importance is 42% and 58% for Weaning Weight and Calf Quality respectively.

Table 2 Weaned calf production Sub-index

Trait	Relative importance
Weaning Weight direct (kg)	19.4
Calf Quality (% high quality)	26.4

10 Beef Production Sub-index

The traits included in the Beef Production sub-index are shown in Table 3. An interesting feature of this index is the ability to apply separate weightings to component cut weighs. Currently these are based on dissection analysis. However Ireland has recently introduced mechanical grading as a carcass classification tool. A feature of the system is its ability to generate component cut yield data. This aspect of the index development is currently still evolving.

Table 3 Beef Production Subindex

Trait	Relative importance
Weaning weight direct (kg)	2.1
Dry Matter Intake (kg)	-13.5
Carcass Weight (kg)	21.8
Loin Cut Weight (kg)	2.6
Hind Quarter Cut Weight (kg)	2.5
Other Cuts (kg)	1.9
Carcass Conformation	3.7
Carcass Fat score	-1.8

11 Maternal Sub-index

The maternal or reproductive sub-index, which includes survival, calving interval, maternal calving difficulty, maternal weaning weight and cull cow value traits in its determination, are shown in Table 4. Calving interval and survival are significant contributors to this index.

12 Overall Beef Merit Index

For most breeders, the sub-indices will be the focus for consideration. An overall beef merit index will also be generated. This will be constructed based on:

- Proportion of animals sold at weaning for live export (P_E) (currently 0.16)
- Proportion retained for slaughter in Ireland (P_S) (currently 0.68)
- Proportion sold or retained as replacement females (P_R) (currently 0.16)

Table 4 Maternal Subindex

Trait	Relative importance
Cow survival	6.3
Calving Interval	-3.6
Calving Difficulty Maternal (% serious)	-9.9
Weaning Weight Maternal (kg)	4.4
Cull Cow Carcass Weight	-1.3

Thus the TOTAL BEEF MERIT INDEX is:

P_e(Weaning Index)+P_s(Beef Index)+(P_e+P_s)Beef Calving Index+P_r(Maternal Index)

or

TBMI=0.16 x (WCSI)+0.68 x (PSI)+0.84 x (BCSI)+0.16(RSI)

These new beef breeding indices are currently being implemented for beef AI bulls. It is planned to expand the use of these indices to all breeding animals by the end of 2005.

13 Economic Values

The generation of economic weights for traits requires the combination of the economic value of a unit change in a trait for each expression, multiplied by a factor, which reflects the number of expressions of the genes of a bull for the trait per calf born, all discounted forward. Discounted genetic expression coefficients are used to achieve this, as described by Amer et al 2001.

Discounted genetic expression coefficients account for the delay in, and frequency of expression of, various categories of traits. For example, maternal traits are only expressed in replacement females, but the expression of many of the traits are repeated annually through the productive life of the cow. Other traits are expressed in all calves born (e.g. calving ease), while others are only expressed in slaughtered animals after a delay of several years. The number of discounted genetic expressions of a sire's genes are shown in the accompanying table.

Trait	Discounted Genetic Expression Coefficients
Terminal	
Birth	0.50
Weaning	0.43
Slaughter	0.39

14 A revised Economic Breeding Index for dairy cattle

As part of the overall review of cattle breeding, the economic breeding index (EBI) for dairy cattle has undergone a number of updates as the results of the necessary research and development work became available. The findings here may have interest for dual purpose breeds such as the Simmental/Fleckvieh. In 2002 the first revised EBI based on the traits, milk yield, fat yield, protein yield, calving interval and survival was published. Prior to that, calving interval and survival were not included. It was recognized that the omission of calving interval and survival did not reflect the true economic realities to the dairy farmer. Based on the ongoing development work on beef, it was apparent that significant improvement in dairy farm profitability could be achieved if calving performance (i.e. gestation length, calving difficulty and calf mortality) and beef performance traits (i.e. carcass weight, carcass conformation and carcass fat score) were included in the overall Economic Breeding Index for dairy cattle.

In including these new traits it was important to accurately determine the economic value of each. This involved detailed consultation with the industry to establish real costs and returns in dairy production. The economic value for a 1% change in the proportion of cows requiring severe calving assistance or worse was -€3.35, when the costs of reduced milk production and impaired reproduction were included. It dropped to -€1.31 when these were excluded. The economic value of gestation length (day) was found to be -€7.09 reflecting the importance of having cows calve when low cost grass could be efficiently utilised. The economic value of calf mortality was found to be -€1.94 for every 1% change in calf mortality. The economic values of calf carcass weight, conformation score and fat score were €1.22, €5.24 and -€8.19 respectively. Table 5 details the relative importance of each trait in the various sub-indices.

Table 5 Relative importance of component traits in the Dairy Economic Breeding index

Trait	Relative Importance			Sub-index
	Base EBI	Base EBI with Calving	Base EBI with Calving and Beef	
Milk (kg)	-17%	-14%	-14%	**Production**
Fat (kg)	12%	11%	10%	
Protein (kg)	32%	29%	28%	
Calving interval (day)	-22%	-20%	-19%	**Fertility**
Survival (%)	18%	16%	16%	
Direct Calving Difficulty (%)		-4%	-3%	**Calving**
Maternal Calving Difficulty (%)		-1%	-1%	
Gestation Length (Day)		-3%	-3%	
Direct Calving Mortality		-1%	-1%	
Cull Cow Carcass Weight (kg)			0.20%	**Beef Cull Cow**
Calf Carcass Weight (kg)			3%	**Beef Calf**
Calf Carcass Conformation			1%	
Calf Carcass Fat Score			-1%	

In Table 6 details of the change in emphasis as calving and beef traits are sequentially introduced into the base Economic Breeding Index are shown.

Table 6 Relative emphasis of the Sub-indices in the Dairy EBI's in Table 5

Sub-index	Base EBI	Base EBI with Calving	Base EBI with Calving and Beef
Production	60%	55%	52%
Fertility	40%	37%	35%
Calving		11%	8%
Beef Cull Cow			0%
Beef Calf			5%

Table 7 summarises the relative emphasis of traits within the various sub-indices. Protein contributes most to the variation in the production index while calving interval is most influential in the fertility index. Both direct calving difficulty and gestation length have a large effect on the calving sub-index while surplus calf carcass weight has the strongest influence on the beef sub-index value of an animal.

Table 7 Relative importance of Traits within each sub-index				
Trait Sub-index	**Production**	**Fertility**	**Calving**	**Beef**
Milk (kg)	27%			
Fat (kg)	20%			
Protein (kg)	54%			
Calving interval (day)		55%		
Survival (%)		45%		
Direct Calving Difficulty (%)			41%	
Maternal Calving Difficulty (%)			10%	
Gestation Length (Day)			37%	
Direct Calving Mortality			12%	
Cull Cow Carcass Weight (kg)				4%
Calf Carcass Weight (kg)				62%
Calf Carcass Conformation				15%
Calf Carcass Fat Score				19%

15 Selection on Sub-indices

Table 8 summarises the impact of selection on each sub-index on genetic response after 10 years assuming a genetic response of 0.89 genetic SD after 10 years.

Table 8 Expected genetic gain in animal merit € after ten years of selection on alternative sub-indices				
Trait / Index	**Production**	**Fertility**	**Calving**	**Beef**
EBI Base	27.5	30.89	11.95	5.57
EBI Calving	27.77	33.22	22.62	4.72
EBI Beef	29.7	28.66	11.04	13.58
EBI Calving + Beef	29.97	31	21.72	12.72
Production Index	43.15	-16.75	1.15	12.04
Fertility Index	-15.66	47.63	10.79	-6.47
Calving Index	0.28	2.34	10.68	-0.85
Beef Index	2.2	-2.23	-0.9	8.01
Milk Kg	173.67	-218.1	-50.72	113.01
Fat Kg	8.04	-5.11	-0.46	2.26
Protein Kg	9.6	-4.43	-0.18	3.3
Calving Interval Day	1.69	-4.27	-1	0.69

As expected, selection on each sub-index maximises gain for that respective index. Selection on production results in a large reduction in the fertility index which is attributed to an increase in the calving interval and a reduction in survival. This is consistent with internationally found antagonistic correlations for the milk and fertility traits. Selection on fertility alone has a significant negative effect on beef performance while selection on calving performance reduces carcass weight, improves fertility and has minimal effect on milk. Selection on the beef index reduces calving performance and increases the production index. The response therefore to selection in milk production is expected to increase with the inclusion of calving and beef performance in the EBI. This is attributed mainly to the positive correlations observed between beef performance and milk production and the positive economic weight attributed to beef performance. It is important to note that these findings are based on the population of dairy bulls tested in Ireland.

It is now planned to introduce the extended EBI which will include calving and beef traits. It is estimated that this will result in an increased return of €1.6 million per year to dairy farmers. Failure to do so would reduce the genetic gain for overall profitability by 3% per annum.

16 Possible strategies for Simmental/Fleckvieh

The Simmental/Fleckvieh, if it is to remain a dual-purpose breed will need to continue to improve beef and dairy traits concurrently. Endeavoring to agree and then sustain two alternative breeding strategies within one breed is fraught with difficulties. It may become difficult to administer within the herdbook in terms of reaching agreement and then, on how the herdbook is maintained. Will it be necessary to have two sections in the herdbook and if so where will animals, the result of matings between selected dairy and beef strains be recorded?

This question has arisen in Ireland. The issue has been resolved by asking how the needs of the cattle industry are best served. This led to the identification of a series of traits followed by a number of sub-indices based on these, which commercial cattle breeders can use whether they are in dairy or beef production. The genetic evaluation system was then designed to identify the breeding value of all animals for the different sub-indices. Breeders and farmers are free to make economic breeding decisions that best serve their particular needs. In Ireland for example it is expected that some degree of specialization will evolve as a result of the generation of these sub-indices, in conjunction with the general trends in the industry after decoupling. Some producers may specialise in producing replacement breeding females based on the maternal sub-indices, while other pedigree breeders will concentrate on producing terminal sires for use in beef production, for which only direct calving ease in addition to beef production indices will be important. The introduction of two breeding objectives for one breed can only result ultimately in two distinct sub-breeds.

17 Acknowledgements

The findings described in this paper are derived from research conducted by the staff of ICBF in conjunction with consultants Dr Peter Amer from Abacus Biotech Limited in New Zeeland and Dr Roel F Veerkamp from the Animal Sciences Group in Leystad in the Netherlands.

18 References:

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Introduction of “Fleckvieh Austria”

The consortium of Austrian cattle breeders is pleased to present the farming structure of Austria, focusing on the biggest and most important breed – Austrian Simmental Fleckvieh. Approximately 18,000 farms belong to the federation of Austrian Fleckvieh breeders, which consists of 11 member associations and supervises the breeding programme of 250,000 Fleckvieh cows. Within the Austrian Fleckvieh population, the paid emphasise of cattle characteristics is very wide ranging. On the one hand the focus can be laid on the production of milk or on producing beef. The breed Fleckvieh can satisfy both and this is the big advantage for the farmers. The stable constancy of 80 % of Fleckvieh in Austria reinforces the given statement.

In cooperation with Germany, the aim of the breeding programme was defined as the economic total breeding value milk + beef + fitness. By means of the breeding program “Fleckvieh Austria” it is the common aim to realise the given ambitions and to guarantee a substantial annual progress.

The assessment of the annual key aspects of activity works in close cooperation with the consortium of Austrian cattle breeders (Arbeitsgemeinschaft der österreichischen Rinderzücher), the breeding-data (ZuchtData), the genetic base Austria consisting of 6 stations for artificial insemination (Genetic Austria), the University for Agriculture (Universität für Bodenkultur), the responsible persons for developing the common breeding value estimation for Austria and Germany, the governmental department for agriculture, forestry, environment and water management, the Federal States and the National Agriculture Associations (Landwirtschaftskammern). After professional and financial decision making, the key aspects are corporately realized The result of the implemented measures is evaluated and published in the form of an annual breeding program analysis.

This approach has implicated a visible acceleration of the breeding process for “Fleckvieh Austria”, what is represented in the following reports and results.

Ing. Richard Pichler
General Manager

FLECKVIEH AUSTRIA – FIT FOR FUTURE

Richard Pichler, Federation of Austrian Simmental Fleckvieh Cattle Breeders

1 The economic importance of cattle stock keeping

Owing to the natural production conditions cattle husbandry finds favourable preconditions in Austria and therefore plays an important part in agriculture. The production of breeding cattle and productive livestock as well as milk production takes place predominantly in grassland areas, in the mountains and the lowlands of the Alps, whereas the production of fattening cattle/feeder cattle/feeding cattle is to be found in the climatically favoured areas with silo maize cultivation in the foothills of the Alps and in the eastern and southern plains and hilly countryside.

About 45 % of the total production value in cattle husbandry come from milk, calf and cattle production. In Austria cattle husbandry is generally structured in very small units. Therefore only 30 % of all farms are run by full-time farmers, 70 % in part-time farming or as small sidelines. About 2.1 million cattle, of which 550,000 are milk cows and 250,000 are suckler cows are kept in 90,000 farms. That is to say that the average farm keeps approximately 23 cattle or fewer than 10 cows. About two thirds of all milk cows are subject to milk performance recording.

In Austria dual purpose breeds play an extremely important role. 79 % of all cattle belong to the Simmental breed. Apart from that there are 9.2 % Brown Swiss, 5.2 % Holstein, 2.3 % Pinzgau Cattle, 0.7 % Tyrolean Grey and 3.7 % beef breeds. From this it becomes obvious that Simmental is by far the most dominant breed in Austria.

2 Origin, historical development and spreading of the Austrian Simmental Fleckvieh

The origin of a methodical breeding of Simmental Fleckvieh in Austria is to be found in the middle of the 19th century. At that time the first original Simmental bulls were imported from Switzerland. They were used for crossbreeding with the indigenous cattle, which were traditional in the various provinces. In 1894 the first Austrian Simmental Fleckvieh breeding association was founded. Since this time the carrying out of performance recording, the introduction of herd-books and the active breeding of Simmental Fleckvieh has been improved and intensified in all Austria. In all Austrian provinces breeders' associations were gradually set up. They took over the keeping of herd-books and have organised breeding cattle auction sales for the respective region. Already in the year 1927 the first breeding cattle exports of Austrian Simmental Fleckvieh to Russia could take place.

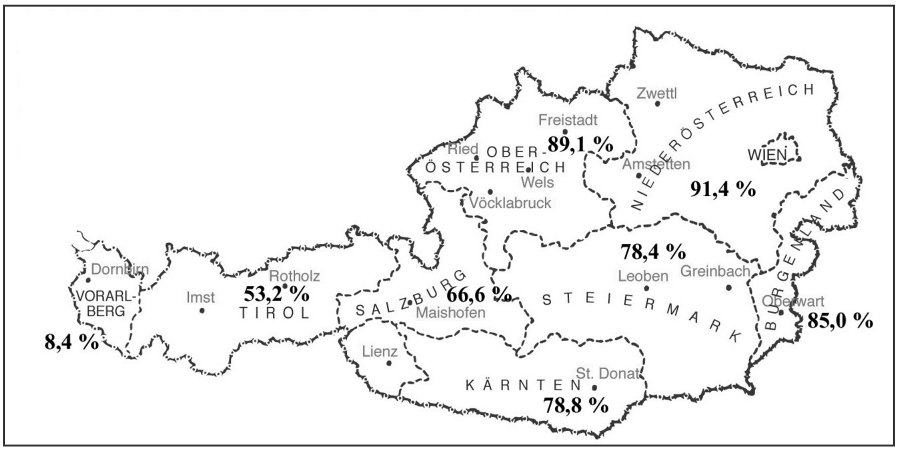
The Austrian Simmental Fleckvieh breeding suffered serious setbacks through the impact of World War I and II. Moreover, precious breeding material was lost in the course of making the population free of bovine tuberculosis, bovine brucellosis and bovine leucosis. In spite of these setbacks the breeding of Austrian Simmental Fleckvieh has improved tremendously from 1950 until now both in terms of quantity and quality.

At present the total Simmental Fleckvieh population is 1.72 million cattle. Austria, with an almost 80 % share of the breed, is the country that is richest in Simmental Fleckvieh globally.

Table 1: Development of the share of the Simmental Fleckvieh breed in Austria from 1925 to 2004

1925	1947	1954	1964	1974	1984	1995	2004
30 %	36,3 %	40 %	53,9 %	71,1 %	78,6 %	81,3 %	79,5 %

Figure 1: Distribution of Simmental Fleckvieh cattle in the Austrian provinces and auction halls



The breeding region of the Austrian Simmental Fleckvieh reaches from the high Alpine regions with the grazing of the high-lying Alpine meadows over the foothills of the Alps to the Pannonic lowlands. Owing to the climatic and economic differences this involves it is necessary that in a common breeding program the specific geographically determined circumstances are taken into consideration.

Whereas in the mountain and grassland regions a high recording density predominates, the percentage of animals subject to performance recording is lower in the low-lying areas. As far as the performance level is concerned the situation is exactly the reverse, which is not least connected to the intensity and quality of the feed basis. For any comparison of performance the fact that 72.5 % of all Simmental Fleckvieh breeders are mountain farmers and therefore have to breed and produce under highly difficult conditions must not be neglected.

3 The organisation of the Austrian Simmental Fleckvieh breeding

In Austria the subsidizing of livestock breeding in the 9 provinces is regulated by provincial laws. In order to establish a standardized policy concerning various measures transgressing provincial borders the individual cattle breeds kept in Austria have been united to cattle breed work groups. Within the work groups joint decisions for breeding programs, advertizing and the international presentation of a breed are taken. The Austrian Federation of Simmental Fleckvieh Breeders (Arbeitsgemeinschaft Österreichischer Fleckviehzüchter – AGÖF) consists of 11 Simmental Fleckvieh breeding associations.

Tabel 2: Member associations of the AGÖF (2004)

Association	Abbreviation	Breeding herds	Herd-book cows	Insemination density %
Burgenländischer Fleckviehzuchtverband	BF	227	3.559	98,8
Kärntner Rinderzuchtverband	KRZV	1.113	13.130	90,5
NÖ. Genetik Rinderzuchtverband	Nö.Gen.	4.036	64.161	98,8
Fleckviehzuchtverband Inn- und Hausruckviertel	FIH	1.924	36.235	96,0
Rinderzuchtverband Oberösterreich	RZO	2.442	39.925	95,4
Rinderzuchtverband Vöcklabruck	RZV	501	8.825	98,0
Rinderzuchtverband Salzburg	RZS	1.601	15.915	88,8
Verein der Fleckviehzüchter Salzburgs	VFS	158	3.381	91,7
Rinderzucht Steiermark	RZ Stmk	2.778	35.869	92,8
Tiroler Fleckviehzuchtverband	TF	2.843	29.193	87,3
Verein der Vorarlberger Fleckviehzüchter	VVF	62	358	92,9
Fleckvieh Austria		**17.685**	**250.551**	**94,6**

4 Population size and performance level

The Austrian Simmental Fleckvieh population with performance recording and herd-book breeding comprised **250,551 herd-book cows in 17,685 farms** with an average herd size of 14.2 cows in 2004. At an insemination rate of 94.6 % this results in an active breeding population of 237,000 Simmental Fleckvieh cows.

4.1 Milk performance

The milk performance of the cows in the herd-book cattle farms was 6357-4,21-268-3,44-219-487 in the recording year 2004. Compared to 2003 the increase in performance amounted to remarkable 155 kg milk and 13 kg fat and protein. The cows achieved 5776-4,23-244-3,44-199-443 in the first lactation and improved by 153 kg milk and 14 kg fat and protein. The genetic trends based on the cow breeding values show that concerning the cohorts of 1988 – 2001 a breeding progress of 72 kg milk per year on average, and for the cohorts of 1995 – 2001 an average of even 98 kg milk could be achieved.

With the bulls the genetic trends have developed likewise favourably. In spite of a considerable improvement concerning the milk performance, the fitness and beef performance have on the whole been able to be held.

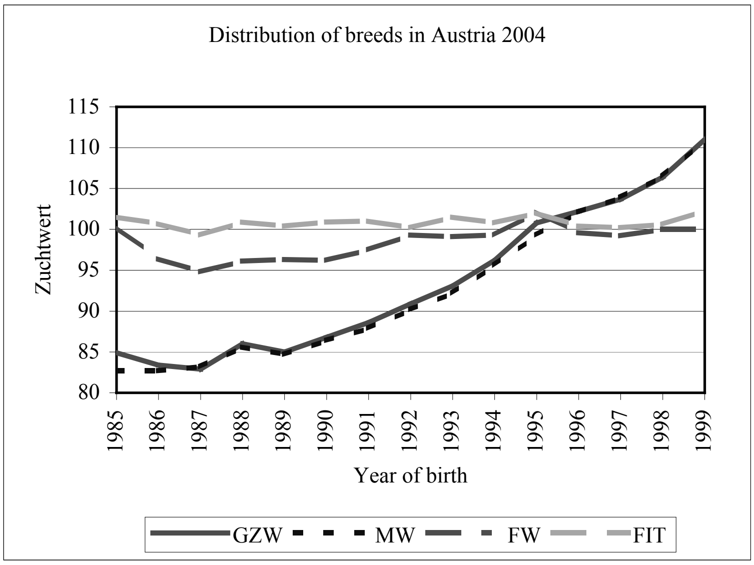


Figure 2: Development of partial breeding values of bulls (cohorts 1985 – 1999)

Table 3: Most productive cows 2004

Name	L.	M-Kg	F %	E %	FEKg	Vater	Besitzer	Verband
HERZDAME	3	14.944	5,84	3,65	1.418,0	HORB	PIRIBAUER JOSEF	NÖ. Genetik
LUZI	3	14.517	5,58	3,62	1.335,3	RESS	RADLER ALOISIA UND JOHANN	RZO
EVA	5	15.228	4,72	3,60	1.266,4	MALF	MAYER SIEGFRIED	RZStmk
NENA	6	16.268	4,35	3,36	1.254,3	HAMIR	HOLZER KAROLINE UND GERHARD	RZO
LILLI	4	14.983	5,19	3,18	1.253,8	RUMSI	KIRCHNER ANTONIA	NÖ. Genetik
ZARINA	5	13.929	5,10	3,60	1.211,9	HARY	RADLER ALOISIA UND JOHANN	RZO
HERA	2	12.931	5,60	3,70	1.203,6	WEINOX	PIRIBAUER JOSEF	NÖ. Genetik
LORENA	6	12.852	5,40	3,79	1.180,7	DISKONT	HANDLER FRANZ	NÖ. Genetik
DORONA	8	13.159	4,96	3,92	1.168,8	MORELLO	STEINER FRANZ	TF
PRINZESSIN	4	14.538	4,56	3,45	1.164,0	HORB	STEINER FRANZ	TF

Table 4: Most productive first-calf cows 2004

Name	M- Kg	F %	E %	FEKg	Vater	Besitzer	Verband
ZERA	13.187	4,85	3,93	1.158,3	WEINOX	PIRIBAUER JOSEF	NÖ. Genetik
ANKA	10.305	5,88	4,13	1.031,4	RUMBA	RADLER ALOISIA UND JOHANN	RZO
GOLDI	12.451	4,61	3,52	1.012,9	MALUS	RADLER ALOISIA UND JOHANN	RZO
HEIKE	11.420	4,80	3,86	989,2	HORWART	PIRIBAUER JOSEF	NÖ. Genetik
SINDI	10.293	5,20	4,00	946,7	EGO	NINAUS VERONIKA	RZStmk
WESPE	9.123	6,31	3,90	931,5	RUMBA	WIMMESBERGER ROSA	FIH
GOIDL	10.399	5,29	3,62	927,5	INDUVI	BERNSTEINER HERMANN	RZS
HALI	10.335	5,00	3,96	925,3	DOLLAR	EIDLER VERONIKA UND ANDREAS	NÖ. Genetik
PARADIES	11.764	4,21	3,48	905,7	ROLO	BURGSTALLER MARIA UND ALFRED	NÖ. Genetik
BELLAMARIA	10.576	4,96	3,52	896,3	ZASTER	HARTL THERESIA	FIH

4.2 Beef performance

In order to improve the trait of beef performance in the breeding process several performance recording systems are applied.

At the 3 own performance recording stations Rosenau, Kalsdorf and Kleßheim 1,418 g daily gain were achieved with altogether 132 recorded young bulls on the 420th day of their life. In 2004 680 herd-book bulls were licensed at the auction sales. They showed a daily performance gain of 1,372 g, an average wither height of 138 cm and a chest girth of 202 cm at an average age of 463 days.

The results of the survey of slaughterhouse data were a net gain of 672 g and a cutting yield of 56.4 % for the Simmental Fleckvieh for 19,588 carcasses. 97 % of the carcasses could be classified a grade E, U and R according to the 5-grade EUROP trade class system. The 10-year comparison shows an increase of 58 g in daily gains coinciding with a significant improvement of the trade class distribution.

Table 5: Most productive herds 2004

	Betrieb	Verband	Kühe	M- kg	F %	E %	FE Kg
1	RADLER ALOISIA UND JOHANN	RZO	16,7	11.209	5,31	3,72	1.013
2	PIRIBAUER JOSEF	NÖ. Genetik	17,4	10.992	4,84	3,71	940
3	HOLZER KAROLINE UND GERHARD	RZO	19,1	11.254	4,14	3,75	888
4	MAYER SIEGFRIED	RZStmk	29,5	11.322	4,11	3,67	880
5	GRUBER JOSEF	RZS	11,2	11.742	4,17	3,30	877
6	WINKLEHNER ANNA MARIA	RZO	22,5	10.885	4,36	3,64	870
7	STROHMAYER HERMINE	NÖ. Genetik	16,7	11.187	4,16	3,59	866
8	GLAS CAECILIA UND ALOIS	FIH	10,2	10.751	4,40	3,62	862
9	ZOCHLING EVA UND FRANZ	NÖ. Genetik	58,5	10.602	4,60	3,52	861
10	BRUNNER PETER	RZStmk	6,9	10.791	4,25	3,70	858

Carcass classification for beef

E **excellent**	**Extra ordinary muscle abundance**	
U **very good**	**Very good muscle abundance**	**97 % of the carcasses**
R **good**	**Good muscle abundance**	
O **quite poor**	**Average muscle abundance**	
P **poor**	**Poor muscle abundance**	

Figure 3: Chart of the classification of cattle carcasses

The beef performance recording for Simmental Fleckvieh in suckler herds is carried out by means of weighing the calves and standardizing the weight for the 200th and 365th day of life.

Table 6: Results of suckler cow husbandry (2004)

			200 Tage		365 Tage	
	Anzahl	Geburtsgewicht	Gewicht	Tageszunahme	Gewicht	Tageszunahme
♂	2.054	44 kg	274,1 kg	1.154 g	365,1 kg	882,2 g
♀	2.625	41 kg	244,0 kg	1.015 g	333,1 kg	799,0 g

4.3 Fitness

Regarding the fitness traits the productive life independent of performance, the somatic cell count as parameter for udder health, the calving interval as a measure of fertility, the calving ease and the still-birth rate are important (Table 7).

Table 7: Comparison of the fitness traits of productive life, somatic cell count, calving interval, calving ease, still-birth rate and milking speed 2004

Trait	Simmental Fleckvieh	Braunvieh	Holstein
Productive life of all cows (years)	3,56	3,75	3,21
Somatic cell count in the first lactation	120.820	156.726	173.243
Somatic cell count in the first lactation	191.919	240.937	265.869
Calving interval of all cows (days)	396,9	417,0	420,8
Normal calving ease (%)	96,0	96,9	96,8
Still-birth rate (%)	3,7	4,6	6,3
Milking speed in the first lactation (kg/min)	2,10	2,11	2,31

4.4 Milkability/ Milking speed

For this important trait single tests with first-calf cows and lactocorder tests with bulldams are made. The average milking speed per minute of first-calf cows is excellent at 2.10 kg. Comparatively, the average milking speed per minute has been continuously increasing in the recent 20 years (illustration 4).

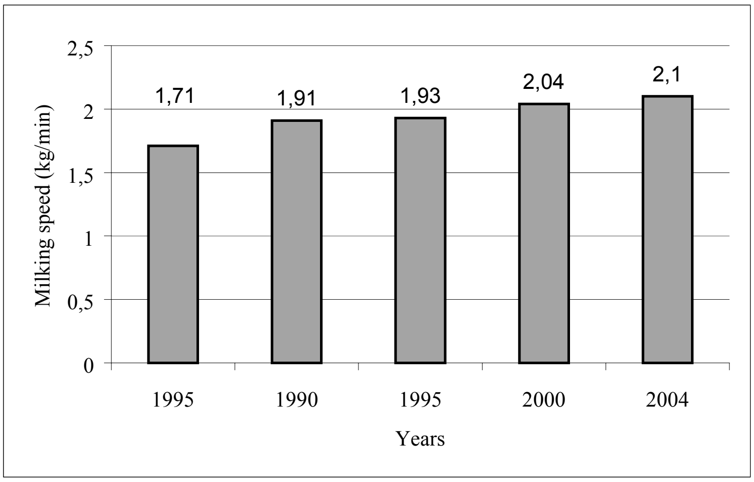


Figure 4: Development of the average milking speed per minute of first-calf cows from 1995 – 2004

4.5 Type

Of special interest are the main traits of frame, muscularity, feet & legs and udder. Approximately 50 % of the daughters that were tested are described linearly. In 2004 the average rump height of these young cows was 142.4 cm, hip width 53.8 cm, trunk depth 78.5 cm and rump length 53.2 cm.

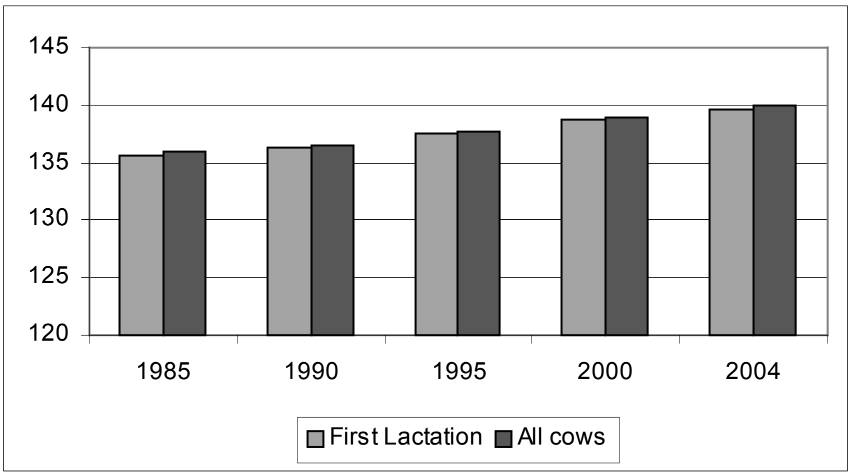


Figure 5: Development of wither height (cm) of young cows in the first lactation and all cows from 1985 - 2004 (exterieur evaluation)

5 Breeding aim

The current breeding aim was decided upon in 1998. It says that the improvement of the economic efficiency of the milk and beef production under the given economic and natural conditions is aimed at. The breeding aim is defined as the total economic breeding value:

The complexes milk : beef : fitness are economically weighted in the proportion 39 : 16 : 45. This weighting in the breeding value leads to a natural breeding progress of 81 % for milk, 9 % for beef and 10 % for fitness.

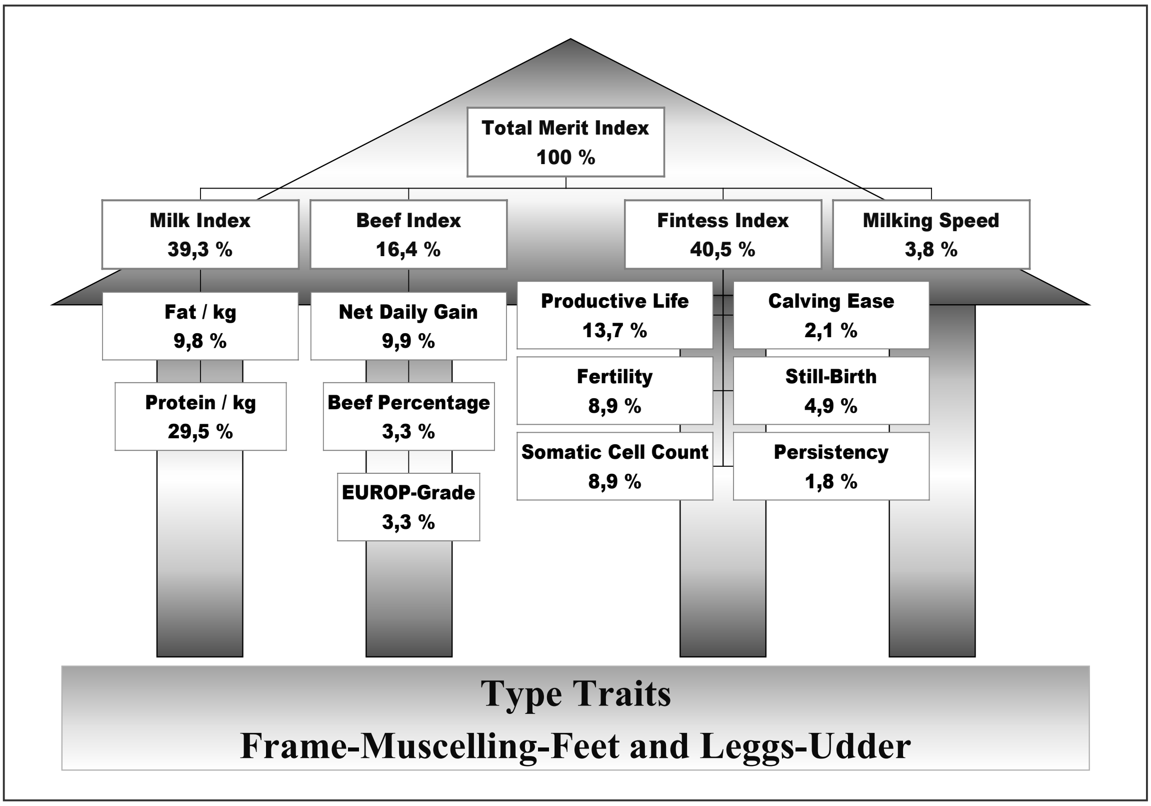


Figure 6: The total economic breeding value of Simmental Fleckvieh

5.1 Verbal definition of the breeding aim for Fleckvieh Austria

The mature cows should have a wither height of 138 – 145 cm, a weight of approximately 700 – 750 kg, a correct format, first-class udders, high performance security (guarantee?) and lactation records of at least 6,000 kg in the first lactation and more than 7,000 kg in the further lactations. Regarding the ingredients more than 4 % of fat and 3.4 % of protein are aimed at. In cattle farms with good herd management the average performance should be more than 8,000 kg of milk.

The male calves have to be suitable for quality cattle fattening and achieve a daily weight gain of 1,300 g as well as a killing out percentage of 56 – 60 %. For the fully grown bulls a good muscularity, a wither height of 155 – 160 cm and a weight of 1,100 – 1,200 kg together with a correct format is desired. Extreme performance and extreme measurements are explicitly avoided.

The requirements for Simmental Fleckvieh in suckler cow keeping are fulfilled by means of a high milk yield, outstanding daily weight gains, excellent beef quality and, above all, also fitness.

5.2 Beef Simmental Fleckvieh breeding

In Austrian suckler cow husbandry Simmental Fleckvieh represents the most important dam breed. Therefore a suitable range of bulls has to be provided both for pure breeding and commercial crossbreeding. In order to produce highly muscular calves Simmental Fleckvieh insemination bulls that have a highly positive commercial crossbreeding value are recommended. This breeding value is weighted in the proportion 70 : 30 = beef : fitness.

6 Breeding program

In the course of a scientific research project at the Vienna University for Agriculture (Universität für Bodenkultur, Wien) the breeding program “FLECKVIEH AUSTRIA” was developed. In 2000 it was resolved by the Work Group of Austrian Simmental Fleckvieh Breeders. The procedure of the program is depicted in the following chart (illustration 7).

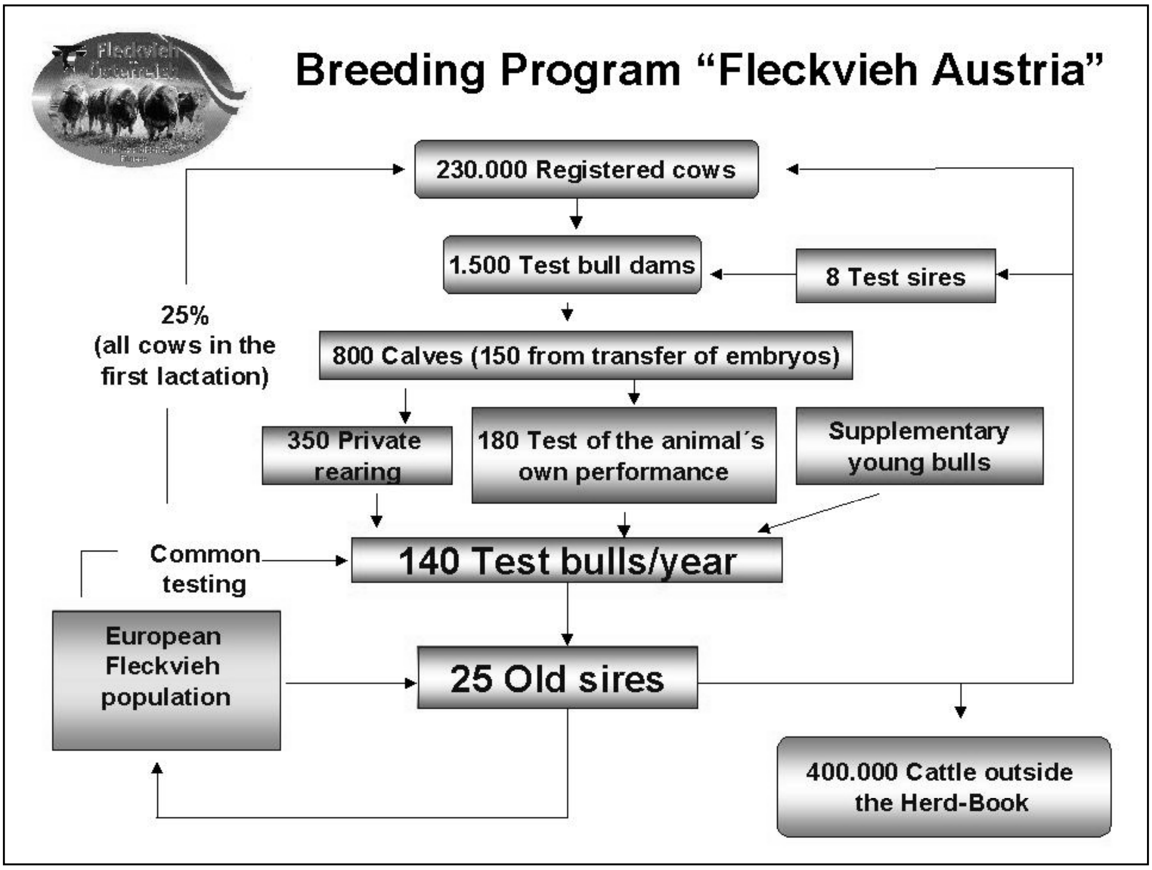


Figure 7: Scheme of the Breeding programme Fleckvieh Austria

6.1 Testbulldams

Taking all the 250,550 herd-book cows into account approximately 1,500 (0.7 %) testbulldams are selected according to strict criteria. In 2004 the average performance of testbulldams was 8780-4,33-3,58-693, the total merit index was 118.7 and the milk index was 117.8.

The testbulldams are selectively mated with the testsires selected by the Control Committee or used via embryo transfer.

Table 8: Bulldams with at least 3 sons in artificial insemination

Bulldams	Bloodline	Sons in artificial insemination	Breeder
SOMA AT 375.222.332	Romulus x Brand	Amstetten, Uran, Steffen, Harro, Zanda, Stoer, Zarsom	Eliabeth Litzllachner, Amstetten
ZAMBA AT 191.064.233	Romen x Moras	Wastl, Windhag, Wald, Weinbar, Rumen, Volt	Karl Grundböck, Wald
GRANDI AT 502.595.532	Hartl x Meteor	Horny, Hort, Zobel, Retl, Palast, Zartl	Karl Grundböck, Wald
ORA AT 580.037.946	Horwein x Haxitus	Rumenik, Ramazoti, Rainer, Storm, Rubens, Run	Maria Gutenthaler, Gutau
GRANADA AT 009.699.633	Half x Präfekt	Malf, Stralf, Handa, Ralf, Reproff	Karl Grundböck, Wald
WONE AT 332.628.962	Malf x Dirteck	Harlekin, Haralf, Rum, Horito, Henry	Johann Derler, Piregg
KATJA AT 560.343.257	Haxala x Patron	Rubi, Rubin, Wenko, Rektor, Wesir	Ernst Hartl, Breiningsham
MANI AT 716.471.133	Streitl x Hasel	Romek, Dipmann, Maestro, Dipan, Zelt	Willibald Öhlzelt, Gr.Reinprechts

6.2 Testbull sires

Each year 8 – 10 proven sires are selected from the tested bulls of the Austrian Simmental Fleckvieh breeding and 4 – 6 more from abroad, which are used in selective mating. This selection is practiced by the Control Committee of Fleckvieh Austria after each breeding value estimation (4 times a year).

6.3 Testbulls

About 800 bullcalves stemming from selective matings are reared by the breeders or own performance test stations respectively. Each year 140 testbulls, which are partly tested together with other European Simmental Fleckvieh populations, are selected. The pre-estimated total merit index of a testbull has to exceed 120 points. Concerning the exterieur of the testbulls minimal requirements are 7 points for frame, 6 for muscularity and 7 for shape. 25 % of all inseminations, which are most frequently practiced with cows in the first lactation, should be carried out with a testbull. The testsires that achieved most testbulls in 2004 are Randy (22), Rumba (15), Ralbit (13) and Repuls (12).

Table 9: Current Sires in the Breeding Programme (August 2005)

Nummer	Name	V / MV	GZW	MW	FW	FIT
DE 0934492505	WINNIPEG	WESPE / ROMEN	146	132	120	129
DE 0932627221	RAINER	RADAU / HORWEIN	142	142	120	100
DE 0934586859	VANSTEIN	RANDY / MALF	133	129	118	102
DE 0932878499	HULOCK	HUCKI / HORB	133	125	129	104
DE 0811017046	ROMSEL	ROMEN / HAXPAT	130	123	103	117
AT 388887842	HERBERT	HERON / CAVEMAN	128	130	99	104
AT 810248934	WARAN	WEINOX / MALF	128	125	116	101
AT 671844642	HERICH	HERON / STRICH	128	125	102	111
DE 0934225983	MORIS	MORROR / ERFURT	125	123	90	111
DE 0811448217	ALEON	STROVANNA / MORWEL	124	130	90	100
AT 809838334	WEINBAR	HORWEIN / ROMEN	124	116	106	118
DE 0933752613	BOSPOR	BOSS / RENOLD	123	122	92	111
AT 553777534	HAN ET	HORWART / RENNER	120	120	97	105
AT 114384834	SAMI	SALUS / HAXA	119	123	80	107

6.4 Selection of proven Sires

At a selection precision of about 1: 6 approximately 25 tested and selected bulls are to be expected yearly. The results of the breeding value estimation have to fulfil the required minimum values and securities in all performance, fitness, exterieur and milkabilty traits. The total merit index has to be at least 106.

6.5 Embryo transfer in the breeding program FLECKVIEH AUSTRIA

The embryo transfer is of increasing importance in the breeding program FLECKVIEH AUSTRIA. Some of the tested and selected bulldams and heifers stemming from selective mating are used via embryo transfer (ET) in order to on the one hand reproduce reliable first-class cows, and young genetic material of the future on the other hand. Of the about 150 – 160 testbulls of the breeding program FLECKVIEH AUSTRIA approximately 15 % have been produced by means of embryo transfer.

At the moment scientific research programs that investigate the use of marker-assisted selection (MAS) in Simmental Fleckvieh breeding are subsidized.

Altogether approximately 200 – 250 Simmental Fleckvieh cows are used via embryo transfer (ET) in Austria yearly. On average 6 suitable embryos occur per rinsing, which makes about 1,200 – 1,500 per year. Apart from the use of embryo transfer in the breeding program FLECKVIEH AUSTRIA the export of embryos especially in faraway importing countries is becoming more and more important.

7 Breeding value estimation

The breeding value estimation is carried out in cooperation with Germany with all breeds and for all traits. It takes place 4 times a year, which is to say that the information is published each February, May, August and November. Since May 2005 all breeding values have been related to a flexible basis. The relative breeding values have been adjusted to a variation/dispersion(?) of 12 points due to the true genetic standard deviation. Generally breeding values higher than 100 are desirable in breeding, although there are exceptions concerning the exterieur breeding values.

Table 10: Most frequently used AI sires in 2004

Rank	Name	Number	birth	Breed	Number of inseminations	Zuchtwerte				
						GZW	MW	Mkg	F%	E%
1	REHARD	AT 416.908.233	1997	FL	19264	114	111	952	-0,37	-0,23
2	RESS	AT 348.995.433	1996	FL	17519	128	122	939	-0,21	0,00
3	REPTEIT	DE 09 32059928	1998	FL	14126	125	127	1230	-0,04	-0,12
4	DIONIS	AT 447.242.233	1997	FL	12570	129	120	1004	-0,27	-0,06
5	RUMBA	AT 623.710.746	1995	FL	10189	131	120	496	0,03	0,19
6	PLUS	AT 698.392.246	1997	FL	8412	113	110	394	-0,02	-0,01
7	HONDA	AT 364.620.333	1996	FL	7919	121	120	539	0,15	0,1
8	POLDI	DE 09 13325437	1996	FL	7608	123	119	982	-0,04	-0,15
9	SIEGI	AT 150.067.934	1998	FL	7040	114	117	390	0,12	0,15
10	RALWAX	AT 540.810.911	1998	FL	6988	120	106	-100	0,32	0,13
11	REBELL	DE 08 10918322	1998	FL	6984	110	118	940	-0,10	-0,13
12	LEO	AT 927.146.534	1998	FL	6947	117	124	1138	-0,15	-0,09
13	ZEPELIN	AT 140.623.411	1998	FL	6163	113	111	925	-0,33	-0,22
14	MALHAX	AT 153.674.133	1994	FL	5936	122	117	471	0,11	0,1
15	EGO	DE 06 60970481	1998	FL	5924	117	123	693	0,17	0,07
16	HOFER	AT 498.149.944	1994	FL	5830	115	112	637	-0,06	-0,11
17	EMIR	DE 09 31852499	1998	FL	5804	117	115	600	0,01	-0,02
18	WEINOLD	DE 09 33663105	1999	FL	5415	143	138	1246	0,19	0,06
19	PONGO	AT 672.818.146	1997	FL	4907	110	114	330	0,40	-0,01
20	ROCKET	AT 378.211.733	1996	FL	4664	120	116	527	0,26	-0,02

Table 11: Excerpt of the top list of total breeding values (August 2005)

Rank	Number	Name	Sire/MV	GZW	MW	FW	FIT	R	B	F	E
1	DE 09 33663105	WEINOLD	WEINOX / RENOLD	143	138	110	110	106	83	114	120
2	AT 841.069.834	WAL	WAXIN / MALF	136	130	109	114	106	105	119	107
3	AT 623.710.746	RUMBA	RALBO / HARKO	131	120	120	112	120	117	94	108
4	AT 833.343.333	RENE	ROMEN / MORN	130	124	112	109	106	111	96	95
5	AT 446.573.411	REMBRANDT	REPORT / TARTARS	129	126	107	106	103	85	107	114
6	DE 09 32878729	WEBAL	WEINOX / BALHAN	129	126	98	108	109	87	122	117
7	AT 447.242.233	DIONIS	DIDI / MORAS	129	120	121	106	104	105	107	113
8	AT 453.113.733	DINO	DIDI / RADI	129	120	111	112	119	95	103	106
9	AT 940.866.434	HICKER	HARDI / MALF	129	112	131	115	108	114	104	115
10	AT 388.887.842	HERBERT	HERON / CAVEMAN	128	130	99	104	98	95	114	131

7.1 Total breeding value/total merit index

The total economic breeding value (Miesenberger, 1997) is calculated from the partial breeding values of the individual traits taking the economic importance, securities and genetic correlations into account.

7.2 Milk

For the traits milk, fat and protein yield the test day model is used. The breeding values for milk, fat and protein kilograms are summarized with an economic weighting of 0 : 1 : 4. The results of the breeding value estimation are used in the INTERBULL BREEDING VALUE ESTIMATION. Exclusively the INTERBULL breeding value is published. At the moment 10 countries take part in the INTERBULL BREEDING VALUE ESTIMATION for Simmental: Fleckvieh Germany, France, Ireland, Italy, the Netherlands, Austria, Switzerland, Slovenia, the Czech Republic and Hungary.

7.3 Beef

A multiple trait BLUP animal model is used. The data are derived from undirected field tests as well as from test centres for the animal's own performance and weighing at auction sales. The partial breeding values of net gain, beef percentage and the EUROP trade class are summarized according to the proportion of 60 : 20 : 20 as beef value.

7.4 Fitness

Fitness traits rate tremendously highly in Austria. There are breeding value estimations for productive life, persistency, fertility, calving ease, still-birth rate, somatic cell count and milkability. Economically most important are productive life, fertility and somatic cell count.

7.5 Exterior

The breeding value estimation for exterior (type) traits is carried out by means of an animal model using data from the linear scoring of daughters of at least 20 daughters per tested animal. The main traits comprise frame, muscularity, feet & legs and udder. For further 19 traits breeding values are recorded.

7.6 Milkability/ Milking speed

This is again a BLUP animal model, in which the influence of the farm and yearly effects as well as calving intervals are taken into account. In Austria the average milking speed per minute of single tests of first-calf cows is used.

7.7 Breeding value estimation for commercial crossing

This breeding value estimation, which has been practiced since May 2000, takes the traits beef performance and fitness in a proportion of 70 : 30 into account. The individual traits are weighted as follows:

Daily (weight) gain	27,5 %	70 %
Cutting yield:	27,5 %	
Trade class:	15,0 %	
Pateneral fertility	7,5 %	30 %
Patneral calving ease	10,0 %	
Paternal still-birth rate	12,5 %	

Table 12: Top list ranking commercial crossing breeding values (breeding value estimation August 2005)

Rank	Number	Name	Sire	GKZ	FW	NTZ	FLA	HKL	TGZ	AUS
1	AT 558.838.942	WAMS	WAX / MALF	127	125	117	113	121	107	126
2	AT 355.747.362	RADLO	RADIUS / MORELLO	124	129	129	104	110	120	113
3	AT 447.242.233	DIONIS	DIDI / MORAS	124	121	123	97	107	123	110
4	AT 784.503.334	HARUM	HARRO / RUMSI	121	123	121	104	115	111	110
5	AT 778.096.111	EGBERT	EGOL / LOTUS	120	123	119	108	117	111	111
6	AT 435.276.733	DIETER	DIDI / HORWEIN	120	122	119	105	115	115	117
7	AT 577.455.642	ENNO	EGOL / HORWEIN	118	123	120	103	117	117	98
8	AT 569.850.471	MUFTI	MALF / DIRAN	116	127	125	105	113	114	103

8 The Development of FLECKVIEH AUSTRIA 1985 – 2005

In 1985 Austria organized the 17^{th} European congress (of Simmental Fleckvieh). Therefore it is interesting to note how Simmental breeding and the prices of breeding cattle have developed during these 20 years can be seen in table 13.

9 Health status

The high health status of Austrian cattle breeding, which has been held for many years, is valued as especially precious. As officially accredited Austria's cattle population is free of bovine tuberculosis, brucellosis, leucosis and IBR/IPV. Also concerning BSE (bovine spongiform encephalopathy/mad cow disease) the strictest security standards are applied. On the basis of a nationwide BVD law it is ensured that no virus vector is released into the animal traffic. The new Law on the Prevention of Cruelty to Animals ensures that the regulations for welfare oriented animal husbandry are kept to.

10 Marketing and export

The production of high-quality genetic material by the Simmental Fleckvieh breeding is an extraordinary production alternative for the Austrian Simmental Fleckvieh breeders, which is therefore frequently taken. At more than 120 auction sales in the various regions organized in breeders' organisations and in organized farm-gate sales approximately

Table 13: Key features of Austrian Simmental Fleckvieh breeding 1985 / 2004

	1985	**2004**	**+/-**
Number of Simmental breeders	17.466	17.685	+219
Number of herd-book cows	187.543	250.551	+63.088
Milk (kg), fat (%), protein (%) yield	4533-4,12-3,27	6.357-4,21-3,44	+1.824 +0,09 +0,17
Daily gains – auction sale (g)	1290 g	1378	+88
Best-performing cow	BORA 9.628-873	HERZDAME 14.944-1.418	+ 5.316 +545
Insemination density (%)	71,2	94,6	+ 23,4
Prices of bulls (at auction sales) (€)	2.125,--	2.236,--	+ 111,--
Prices of cows (at auction sales) (€)	1.501,--	1.350,--	- 151,--
Prices of cow heifers (at auction sales) (€)	1.529,--	1.407,--	- 122,--

30,000 breeding cattle, ranging from calf to mature cow, are marketed yearly. In order to be licensed to market their cattle the breeders have to fulfil numerous conditions. These are comprehensive guarantee regulations, legal veterinary regulations and strict licensing and evaluation criteria. Thus the buyers are guaranteed to purchase impeccable quality.

Special attention is paid to Simmental Fleckvieh calves for quality veal and beef production. Approximately 60,000 Simmental Fleckvieh calves are sold via the breeding associations yearly.

35 % of the breeding cattle are exported each year. Whereas Italy is traditionally predominant as importing country at the auction sales, up to now 45 countries could be supplied with Simmental Fleckvieh from Austria globally by means of farm-gate exports.

Table 14: Sales of Simmental Fleckvieh Austria 2004

Auction sales	20.801 Stück
Farm-gate sales	9.315 Stück
Total	30.116 Stück

Since 2002 the export of cattle semen and embryos has been carried out by GENETIC AUSTRIA, which is the union of all 6 Austrian insemination stations.

11 Final remarks

The Austrian Simmental Fleckvieh breeders have been doing successful breeding work for many years. By means of the broad variance of Simmental, Fleckvieh from specializing in milk or beef to combiing both, the cattle farms can successfully practice all forms of intensive as well as extensive production.

Apart from this high-quality genetic material in the form of breeding cattle, semen and embryos for the worldwide export are produced by the Austrian Simmental Fleckvieh breeders, their breeding associations and insemination stations.

The Austrian Simmental Fleckvieh breeders are convinced that they will be able to meet also the future requirements of the international market extremely well with the Simmental Fleckvieh breed. **FLECKVIEH AUSTRIA IS FIT FOR THE FUTURE.**

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ZAR - Austrian Cattle Breeders' Federation

ZAR - Austrian Cattle Breeders' Federation, with headquarters in Vienna, is an association that area of activity stretches throughout the nation of Austria. The association was founded 1954 and its aim is to represent the interests of Austrian cattle breeders and further the efforts and execution of measures designed to improve both local cattle-breeding as well as their validity nationally and internationally.

ZAR represents the interests of 27.429 breeders with about 372.000 herd book cows.

Since foundation of ZAR its major tasks like disease control and standardization and harmonisation of performance recording have been advanced and extended.

Today the tasks of ZAR cover:

- Quality and performance control
- Processing performance data
- Breeding evaluation (jointly with ZuchtData)
- Representation of cattle-breeding interests and related interested in this agricultural sector
- Comment and evaluation of proposed legislation at the federal, national and EC level (animal protection, animal health services, and relevant agropolitical decisions).

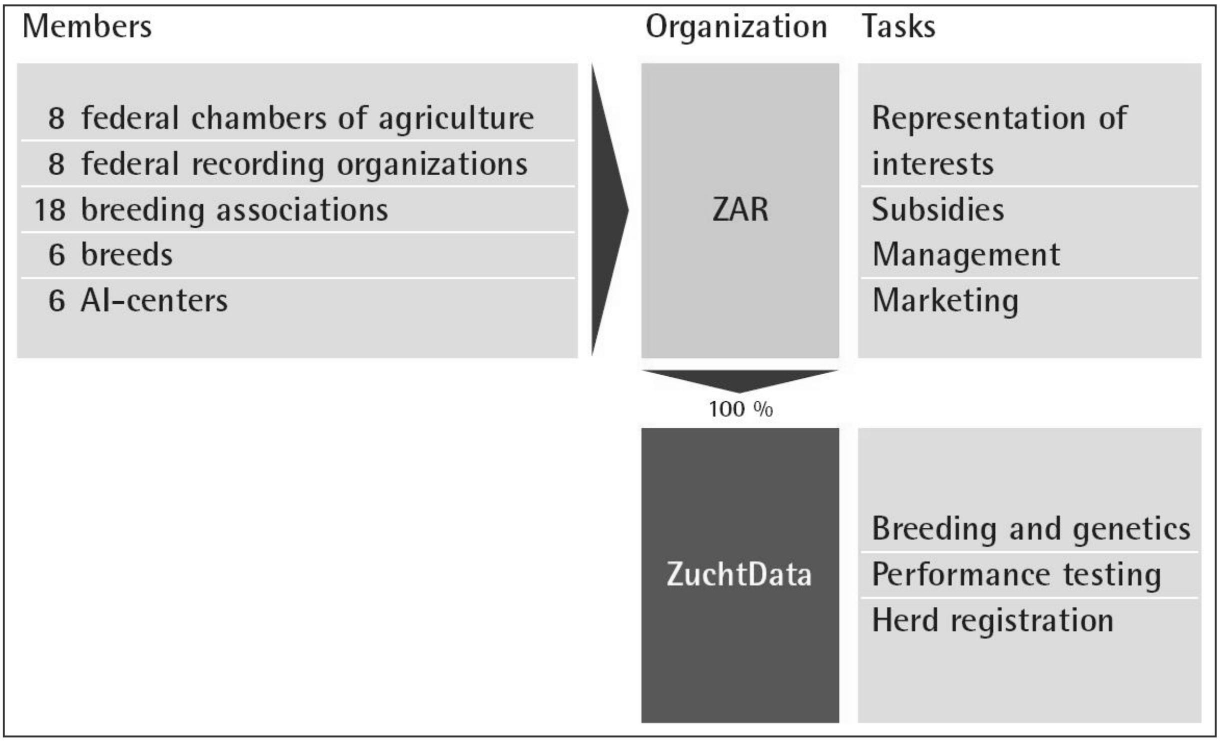
Intensive contacts with similar organizations worldwide and memberships within the European head organization like (Interbull, ICAR, COPA-COGECA, Babroc etc.) are maintained by ZAR.

At the national level, there is intensive and ongoing cooperation with the Ministry of Agriculture, the Chamber of Agriculture, Agrarmarkt-Austria, University of Vienna and other national organizations.

Nowadays, ZAR is the nerve center of Austrian Cattle Breeding on a national and international level.

By means of the cattle data bank of Agrarmarkt-Austria, animal transport is monitored and documented systematically. After introduction of the new EU-wide "Animal Identification Decree 820/97", all newborn calves became marked with two ear tags

The tasks of the ZAR are coordinated in five working, one control, and six breeding committees.



ZuchtData

The processing of all performance and identification control data is done by ZuchtData in close cooperation with the Agricultural and Forestry Data-Collection Center.

Pedigrees and performance data are guaranteed by the registered breeding associations.

Areas of Activity:

- Breeding and genetics
- Performance testing
- Herd registration

For breeding and genetics the operational and technical implementation and development is realized jointly with data processing centers in Germany.

Further, the provision of data for breeding programs, including controlling, consulting, and analysis of the breeding programs is provided. These breeding programs have been developed jointly with the University of Vienna and the breeding associations which are continuously provided with updated information according to the given conditions.

In the areas of performance testing and Herd registration, ZuchtData provides maintenance and the further development of the central data bank with RDV- (Rinderdatenverbund) software and reports. The main purpose is to manage the data of selected performance and herd data.

Milk performance data recording is carried out according to the AT and Lactation-period (ICAR) methods. A wide range of fitness data are recording within these tests.

Beef performance data recording is done as an individual test in a test station as well as individual and progeny tests in the field.

Additionally important is the training, courses, and advisory services provided for functionaries and employees of the member organizations by ZuchtData.