# Breeding concepts for organic dairy farms in Brown Swiss and Simmental cattle

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## Introduction

The breeding goal in Brown Swiss (BSW) and Simmental cattle in Germany actually focuses on intensively managed dairy farms. On the other hand organically operating dairy farms often require dairy cows with characteristics different from cows on high producing farms. Breeding for such cows would require an own organic breeding goal and an own organic breeding program.

Investigations of Schmidtko (2007) and Simianer et al. (2007) however showed that a separate organic breeding programme in dairy cattle is not very efficient and economically not profitable. Consequently organic breeding has to be integrated into the conventional breeding program in form of a separate aggregate genotype. Since there is a wide genetic variation within the actual Simmental and Brown Swiss population the supply of appropriate bulls for organic farms should be assured. What are needed are tools to identify suitable animals. Therefore the core of the Bavarian concept of organic dairy breeding is a special organic total merit index (OTMI) that allows selection of appropriate bulls and cows for organic farms.

The organic total merit index for bulls was developed in the end of the 1990's and continuously adjusted to actual scientific knowledge. Results for bulls are published at regular intervals parallel to the conventional total merit index. To improve selection of cows an OTMI is calculated for cows on organic farms since 2009.

## Material and methods

The OTMI is calculated by selection index methodology, using conventional breeding values (Miesenberger et al., 1997). In contrast to the conventional total merit index (CTMI), type traits are included and an additional breeding value "maturity index", is calculated and integrated (Krogmeier et al. 2004).

Since organic farms differ widely in core areas of production (e.g. direct marketing, different guidelines of organic organizations) it is very complex to derive economical weights from an "organic farm model". According to Baumung und Sölkner (1999) an increase of economical weights for fitness traits in the CTMI is a useful way to attain a more organically orientated total merit index. The economic weights of the CTMI were adjusted accordingly.

Table 1 shows breeding values used for the calculation of OTMI and economic weights for aggregated breeding values. Compared with CTMI milk yield is weighted much lower and fitness traits have distinctly higher economical weights.

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**Table 1: Breeding values used in the organic total merit index (OTMI) and their relative economical weight.**

| Complex | Aggregated breeding value (AGBV) | Single breeding Values | Economical weights AGBV | Complex |
|---|---|---|---|---|
| ***Yield*** | **Milk Yield** | • Fat yield (kg)<br>• Protein yield (kg) | 20% ( 25% BSW) | ***35%*** |
| | **Beef yield** | • Net daily gain<br>• Carcass grade<br>• Dressing percentage | 15% (10% BSW) | |
| ***Fitness*** | **Longevity** | • Longevity | 10,8% | ***65%*** |
| | **Persistency and Maturity index** | • Persistency<br>• Maturity index | 10,8% | |
| | **Calving and fertility** | • Maternal fertility<br>• Maternal calving ease<br>• Maternal still birth<br>• Paternal calving ease<br>• Paternal still birth | 27,1% | |
| | **Feet&legs and udder** | • Udder<br>• Feet & legs<br>• Deep heel<br>• Somatic cell score<br>• Milkability | 16,3% | |

## Results and discussion

**Differences between OTMI and CTMI.** The aim of OTMI is the genetic improvement of organic dairy herds with regard to the organic breeding goal. In organic dairy farming it is attempted to reach an economical benefit from long-living, healthy cows with milk yields adapted to the environment. The breeding goals aim at a moderate increase in milk yield and at an improvement in fitness traits. Therefore, economic weights for fitness traits are higher. The relative weight for the whole fitness complex is 65% in OTMI compared to 46% in CTMI. Different weighting leads to different expected genetic progress in important traits (Figure 1).

In Simmental cattle, the genetic gain in milk yield decreases from 398 kg per generation to 283 kg when using OTMI. On the other hand, genetic progress in longevity increases from 2.3 relative breeding value points to 6.5 points per generation. Whereas selection with CTMI leads to a slight decline in maternal fertility and somatic cell score, selection with OTMI is expected to stabilize the genetic level for these traits.

In recent years economic weights in CTMI have shifted towards higher weights for fitness traits, too. This has led to more accordance between OTMI and CTMI. Table 2 represents correlation between both indices.

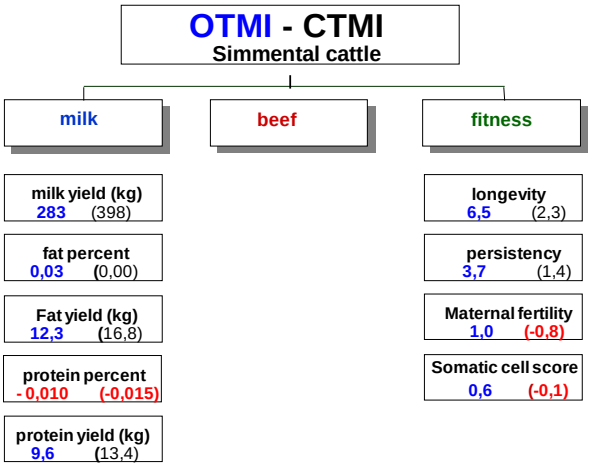


**Figure 1: Expected genetic progress per generation in selected traits (absolute or relative breeding values) using an organic (OTMI) or conventional total merit index (CTMI, in brackets) in Simmental cattle**

**Table 2: Correlations between organic (OTMI) and conventional total merit index (CTMI) and breeding values (BV) for yield and fitness complex**

| | | | Bulls | | |
|---|---|---|---|---|---|
| | **N** | **OTMI** | **CMTI** | **BV yield** | **BV fitness** |
| **OTMI Simmental** | 7514 | 1.00 | 0.92 | 0.76 | 0.80 |
| **Brown Swiss** | 2105 | 1.00 | 0.92 | 0.75 | 0.80 |
| **CTMI Simmental** | 7514 | 0.92 | 1.00 | 0.87 | 0.58 |
| **Brown Swiss** | 2105 | 0.92 | 1.00 | 0.85 | 0.59 |
| | | | **Cows** | | |
| | **N** | **OTMI** | **CMTI** | **BV yield** | **BV fitness** |
| **OTMI Simmental** | 44,254 | 1.00 | 0.88 | 0.73 | 0.75 |
| **Brown Swiss** | 20,360 | 1.00 | 0.90 | 0.76 | 0.79 |
| **CTMI Simmental** | 44,254 | 0.88 | 1.00 | 0.92 | 0.39 |
| **Brown Swiss** | 20,360 | 0.90 | 1.00 | 0.89 | 0.53 |

Correlations between indices for bulls are 0.92 in both breeds and between indices for cows are 0.88 in Simmental and 0.90 in Brown Swiss, respectively. Thus the two distributions show a considerable amount of overlapping. Animals with high breeding values for yield and for fitness traits are ranking high in both top lists. On the other hand, animals with average breeding values for yield traits and superior breeding values for fitness traits are highlighted by the OMTI.

These highlighted animals are not relevant in conventional breeding programs but meet the requirements of organic dairy farms. Selecting for these bulls and cows should lead to a genetic improvement towards the organic breeding goal.

**Publishing of OTMI.** OTMI for bulls and cows is calculated and published in parallel to the results of routine breeding value estimation. Besides OTMI, breeding values for the yield and the fitness complex, for aggregated BV's for "persistency and maturity index", "calving and fertility" and "feet & legs and udder" and for a number of conventional single breeding values are published for bulls. Top lists can be downloaded from the Internet and detailed information can be found in a sire data base. OTMI for cows is provided to organic dairy farms as a part of the annual review of milk yield recording. A web-based data base for cows is in progress.

Another focus of OTMI is to encourage organic dairy farmers to participate actively in breeding work. Conventional breeding values are not considered as useful by many breeders or dairy farmers and selection of bulls is left to AI technicians. In this way OTMI and aggregated breeding values that are especially developed for organic farms should be a good motivation for herd improvement by systematical mating.

## Conclusion

The organic total merit index is an important tool for selection in organic dairy farms. But to provide good information does not automatically mean that the information is used by all farmers. Therefore, future activities should have the aim to establish a "consulting network organic cattle breeding" on the basis of OTMI. The network should encourage farmers to participate actively in breeding on their farms and should educate them in using BV's generally and OTMI in particular. A further step into his direction is the integration of OTMI into a commercial mating program. In an application "organic breeding", OTMI, organic aggregated breeding values as well as conventional breeding values can be used as selection criteria.

OTMI may also help to conserve genes important for organic dairy breeding. Animals that do not fulfill the requirements of intensively managed dairy farms in regard to milk yield but having superior fitness characteristics can be identified and should play a more important role in conventional breeding programs. In this context genomic selection could open up new vistas. The identification of "organic" bulls without an expensive performance testing could motivate AI-stations to offer bulls interesting for organic dairy breeding, perhaps even from matings of bulls and cows with outstanding OTMI.

## References


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