User-specific Breeding Goals for Brown Swiss and Hinterwälder Cattle in Baden-Wuerttemberg

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Introduction

The Rinderunion Baden-Wuerttemberg e.V. (RBW) represents a unique case among all cattle breeders' associations in Germany: It runs breeding programs for in total 26 breeds including internationally important dairy cattle breeds, four regionally distributed genetic resources at risk of extension and a number of beef cattle breeds. Until now, no systematic approaches have been made to re-evaluate breeding programs including their breeding goals. The present study aims at systematically re-evaluating two breeding programs run by the RBW. The first case study focuses on the evaluation of the Brown Swiss breeding program with regard to future challenges, particularly the use of genomic selection (Hayes et al. (2009)), changes in performance testing (König and Swalve (2009); Thaller (2009)), the integration of traits related to legs and feet (König and Swalve (2006)), robustness traits (Hilgenstock et al. (2006 a-c)) and animal welfare (Nielsen et al. (2005)), as well as with regard to new market developments such as the discontinuation of milk quotas in 2015 (Wolfová et al. (2007)). The second case study includes the Hinterwälder Cattle for which a conservation program is run. It is assumed that the breeding goal for this genetic resource is subject to considerable changes and that non-market traits will be of increasing importance in the future. In a first step, user-specific breeding goals are defined with the participation of the breeders.

Material and methods

Data collection. A letter survey was conducted in July 2009 involving all Brown Swiss (BS) (=787) and Hinterwälder Cattle (HW) (=226) breeders in Baden-Wuerttemberg being members of the RBW. A semi-structured questionnaire was used to elucidate important selection traits for bulls and cows. Breeders' attitude towards the use new technologies (sexed semen, genomic selection and cloned animals) was also evaluated. Information on the vocational education, the type of cultivation and occupation were also collected. A response rate of 27.1% (BS) and 34.5% (HW) could be realized.

Statistical analyses. The FREQ procedure of the statistical package SAS 9.1 (SAS Institute, Cary, NC) was used for frequency analysis of data. Differences were evaluated by chi-square test or Fisher's exact test, when the first test was not valid due to small counts in cells.

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Results and discussion

Dairy cattle production is the principal occupation of most BS breeders (87%) besides fodder (78%) and crop production (56%) and forestry (57%). By contrast, nearly 82% of HW breeders keep HW cattle only as a side occupation, and also other agricultural activities can be considered as side activity. Accordingly, 52% of HW breeders do not have any vocational education, whereas most BS breeders (94%) have at least one agricultural degree. Another main difference is that 92% of BS breeders follow the conventional type of cultivation, whereas nearly 41% of HW breeders are involved in organic production.

The use of cloned animals is clearly refused by BS and HW cattle breeders (93% and 97%, respectively). Also, the attitude towards the use of sexed semen and genomic selection is clearly negative among HW breeders (65% and 72%, respectively). Although sexed semen is available for BS bulls, nearly half of the BS breeders do not use this technology or have a negative attitude toward its use. A possible explanation for this attitude could be that this technology is characterized by higher costs and complexity of operation and lower conception rates as compared to unsexed semen (e.g. DeJarnette et al. (2009); Garner and Seidel (2008)). By contrast, BS breeders tend to be more open with regard to the use of genomic selection: Nearly 46% could imagine using bulls with genomic breeding values, while only 26% stated that they would not use this technology (Figure 1).

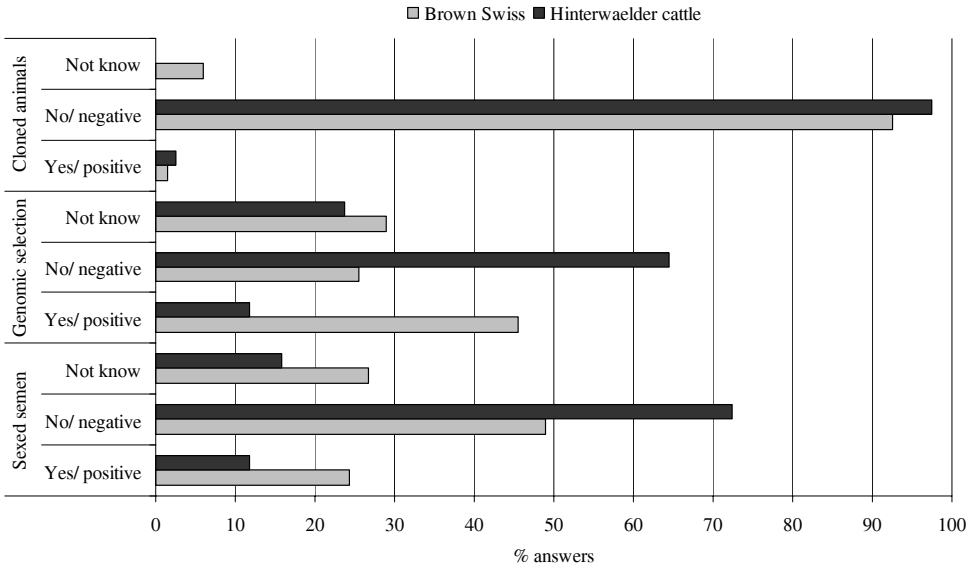

Figure 1: Breeders' attitude towards the use of new technologies

BS breeders stated a variety of different selection traits for their breed (Table 1). There were significant differences between the sexes, the origin of cows and the mating type. The most important traits for selecting BS cattle were milk yield (66.2% of answers), udder conformation and health (44.2%), condition of legs and feet (36.2%), milk contents (34.9%) and milkability (34.6%). Productive life and fertility were more important for selecting female replacement from the own herd (29% and 21%, respectively), while the parentage

tended to be more important when female replacement is bought from outside the farm (19%). The parentage was also more important in selecting natural service bulls than in AI bulls (32% compared to 11%), being the second important selection trait for natural service bulls after milk yield (45%). Breeders' trait preferences are thus consistent with the current breeding goal of the RBW that concentrates on milk yield, high protein contents and a correct udder, besides adaptability, longevity and healthy legs and feet (Weidele (2009); personal communication).

Table 1: Most important selection traits stated by breeders for BS cattle, in %[α]

	Total	Sex		Origin of cow		Mating type	
		Bulls	Cows	Own-bred	Purchase	AI	Natural
Traits	N=550	N=240	N=310	N=198	N=112	N=184	N=56
Milk yield	66.2	60.8[a]	70.3[b]	67.2	75.9	65.8[c]	44.6[d]
Milk contents (fat, protein)	34.9	41.7[c]	29.7[d]	27.3	33.9	46.7[c]	25.0[d]
Condition of legs & feet	36.2	26.7[c]	43.5[d]	42.9	44.6	16.9	17.9
Frame	18.9	17.1	20.3	19.2	22.3	16.9	17.9
Milkability	34.6	30.4	37.7	38.4	36.6	34.8[c]	16.1[d]
Udder conformation & health	44.2	31.3[c]	54.2[d]	54.0	54.5	37.0[c]	12.5[d]
Productive life	22.6	22.1	22.9	28.8[c]	12.5[d]	23.9	16.1
Fertility	14.7	12.9	16.1	21.2[c]	7.1[d]	13.0	12.5
Calving ease	6.0	12.5[c]	1.0[d]	1.5	-	15.8[c]	1.8[d]
Parentage	14.4	15.8	13.2	10.1[a]	18.8[b]	10.9[c]	32.1[d]

[α]Values in the same row (within the same subgroup) with different superscript letters are significantly different at P<0.05 (a,b) or at P<0.01 (c,d) (χ^2 test). Multiple answers were possible (max. 5). Total number of traits stated: Bulls n=26, cows n=30.

Table 2: Most important selection traits stated by breeders for HW cattle, in %[α]

	Total	Sex		Production type		Mating type	
		Bulls	Cows	Suckler	Dairy	Natural	AI
Traits	N=216	N=101	N=115	N=166	N=50	N=57	N=44
Milk yield	18.5	12.9[a]	23.5[b]	12.1[a]	40.0[b]	12.3	13.6
Body size	13.4	9.9	16.5	14.5	10.0	12.3	6.8
Frame	15.7	10.9	20.0	19.9[a]	2.0[b]	15.8	4.6
Exterior	18.1	13.9	21.7	15.1[a]	28.0[b]	15.8	11.4
Color	11.6	10.9	12.1	12.7	8.0	15.8	4.6
Udder conformation & health	19.9	1.0[a]	36.5[b]	20.5	18.0	-	2.3
Condition of feet & claws	10.2	8.9	11.3	9.6	12.0	10.5	6.8
Calving ease	13.4	9.9	16.5	15.6	6.0	5.3	15.9
Muscling	25.5	31.7[a]	20.0[b]	30.1[a]	10.0[b]	35.1	27.3
Character	49.1	38.6[a]	58.3[b]	56.0[a]	26.0[b]	64.9[c]	4.6[d]
Parentage/ Line	28.7	28.7	28.7	25.9	38.0	1.8[c]	63.7[d]
Suckler cow suitability	10.2	2.0[a]	17.4[b]	13.3[a]	-[b]	1.8	2.3

[α]Values in the same row (within the same subgroup) with different superscript letters are significantly different at P<0.05 (a,b) or at P<0.01 (c,d) (χ^2 test or Fisher's exact test if χ^2 test unvalid). Multiple answers were possible (max. 5). Total number of traits stated: Bulls n=43 and cows n=38.

The development of the HW population in Baden-Wuerttemberg is characterized by a trend from dairy cattle production towards suckler cow herds (Wanke (2001)); while in 2005, 55% of all RBW members used HW for dairy production, about 75% of RBW members kept HW in suckler cow herds in 2008 (LKV (2006); RBW (2009)). Accordingly, 75% of all HW

breeders participating in the survey use HW as suckler cows and only 21% still keep HW for milk production. The remaining use HW for both, milk production and as suckler cows. As opposed to BS breeders who mostly use AI (71% using solely AI and 26% of breeders using both, AI and natural service), HW cattle breeders still mainly rely on the use of natural service bulls (53% and 32% using natural service alone or at least partly, respectively). The change in the production type and the still high importance of natural service bulls may explain significant differences in breeders' trait preferences in HW cattle, the character being the most important selection trait for breeders using HW in suckler cow herds and for natural mating bulls (56% and 65%, respectively) (Table 2). Also muscling is an important selection trait in suckler cow herds (30%). By contrast, breeders using HW for dairy production stated milk performance as the most important trait (40%), followed by the parentage (38%). For AI bulls, the parentage is the most important selection criterion (64%).

Conclusions

The current breeding goal of the breeders' association RBW for BS includes all important traits stated by active breeders. From the HW breeders' point of view, the breeding program for their breed has to integrate mainly non-market traits and, depending on the production type, muscling or milk yield. These differences have to be considered when re-formulating the breeding goal for HW in Baden-Wuerttemberg. Further research goes on to differentiate how far stated trait preferences represent actual problems, actual practices and desired changes in traits. Furthermore, reasons are investigated for breeders' attitude towards the use of new technologies and factors identified for their adoption by breeders. After defining user-specific breeding goals, different scenarios for breeding programs for the two cattle breeds will be set-up and genetically and economically evaluated. Advantages and disadvantages of different organizational settings for breeding programs will be elaborated and discussed.

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