Differences in preferences for breeding traits between organic and conventional dairy producers in Sweden

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A B S T R A C T

Development of sustainable breeding goals for dairy production has to consider the producers’ preferences which are likely to differ between production systems. The number of dairy producers with herds certified according to the standards of organic production has increased during the last decades. Traditionally, organic producers use animals selected in conventional production systems but the traits important in organic herds have been suggested to differ due to the different production conditions. The aim of this study was to assess what traits Swedish organic and conventional dairy producers consider to be important for the cows in their herds, and the relative importance of traits in the two production systems.

An advanced web questionnaire with an underlying selection index was developed. The selection index was not shown to the respondents but it enabled them to weight traits against each other based on the genetic progress obtained. The questionnaire also included questions about what traits the producers intuitively considered important for the cows in their herds and how they ranked 15 given production and functional traits. The questionnaire was answered by 468 Swedish dairy producers of which 122 had a certified organic herd and 346 had a conventional herd.

The results of this study show that the trait longevity was ranked first by both organic and conventional Swedish dairy producers. However, the ranking differed to some extent between the production systems for other traits, e.g. mastitis resistance and milk production. Swedish producers with organic herds tended to desire a higher genetic gain in disease resistance, including mastitis and parasite resistance, compared with producers with conventional herds. The results also reflect a somewhat lower interest in milk production level among producers with organic production. However, as the traits most important for Swedish producers with organic herds are already considered in the current Nordic breeding goal they can continue the use of this animal material.

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1. Introduction

The development of sustainable breeding goals for dairy production has to consider the producers’ preferences because they have unique insight into what characteristics are important for the cows in their herds. Differences in production environments, markets and values among producers influence their preferences, and we argue that this needs to be considered by breeding organizations when estimating economic weights for selection traits. Breeding goals in the developed world have become broader, i.e. including both production traits and functional traits such as health and fertility. However, these breeding goals target a broadly defined group of producers where sub groups of
organic and conventional dairy producers (e.g. producers from different countries or regions, or organic producers) might have different preferences regarding breeding traits.

In current breeding goals the relative importance of different traits is determined by their economic weights, but there are important aspects of dairy production that are difficult to measure in monetary terms, e.g. animal welfare and environmental impact. Considering this, strategies to weight traits that also consider non-economic values are under development. For example, it has been shown that animal health and welfare could be improved, using such non-market weights, but at the cost of lower progress in production traits (Gourdine et al., 2010; Nielsen et al., 2006). The value of traits, both economic and non-economic and thus the desired gain of the traits, are likely to differ between production systems due to different production conditions. Hence, the knowledge about dairy producers’ preferences considering goal traits in different production systems is insufficient.

The interest in organic products and thus the production is increasing in Sweden (KRAV, 2013) and in Europe (Eurobarometer, 2010). Organic production aims for a sustainable use of resources, balance between plant and animal production on farm level, and a high animal welfare (IFOAM, 2012). In Sweden, more than 10% of the dairy herds are certified by the national certification organization for organic agriculture, KRAV, and this figure has constantly increased the last decades. The production environment of these herds differs from that in conventional herds in five main aspects: (1) large proportion homegrown feed, (2) roughage-based feed rations, (3) loose-housing systems, (4) pasture and outdoor access (except during winter), and (5) limited use of antibiotics and anthelmintics (KRAV, 2012).

Traditionally, organic producers use the same animal material as conventional producers i.e. animals bred for high profitability in a conventional production environment (Nauta, 2001). It is, however, likely that different values among organic producers, together with different production conditions, make the breeding preferences different in organic production than in conventional production. For example functional traits, such as reproduction, health and longevity, have been suggested to be of higher importance in organic herds (Bapst, 2001; Pryce et al., 2004). However, reports from scientific studies about breeding objectives in organic production have been scarce.

The overall aim of this study was to compare Swedish organic and conventional dairy producers’ preferences concerning cow breeding traits. The specific aims were to investigate (1) what traits organic and conventional dairy producers intuitively think are important in cows in their herds (2) how organic and conventional dairy producers rank various traits against each other, and (3) what genetic gain organic and conventional dairy producers prefer for various traits.

2. Material and methods

A web questionnaire about traits relative importance for cows in dairy production was developed and tested on a group of producers and animal keepers. Then, dairy producers with e-mail addresses registered in either the Swedish Dairy Association’s or the Swedish organic certification organization KRAV’s database were invited to answer a web questionnaire about traits important for cows in dairy production. Invitations were sent to 1481 producers, i.e. one-fourth of all dairy producers in Sweden. The invitation was followed by two reminders with approximately two weeks interval, and the questionnaire was open from February 23 until March 30 2012. The aim of the questionnaire, expressed in the invitation, was to assess traits of importance for sustainable dairy production. Our specific interest in organic production was not mentioned. The invitation included a farm-specific link to the questionnaire that anyone with access to the e-mail account could use. The respondents could enter the questionnaire several times as long as they had not submitted it. Once the respondent had finished and submitted his/her answer, the farm-specific link to the questionnaire was closed.

2.1. Web-based questionnaire

The questionnaire developed consisted of four steps:

1. The producer states what traits they intuitively consider important (what immediate came up in their minds) in their herd.
2. The producer ranks 15 given traits against each other.
3. The producer weighs traits against each other given the estimated genetic gain (based on selection index theory).
4. The producer answers general questions about him/herself and the herd he/she works in.

We estimate that it took between 15 min and 45 min to answer the questionnaire.

2.1.1. Part 1

In the first part of the questionnaire the respondent was asked to state what traits he/she intuitively considered most important in the herd. The question was: What traits do you consider important for the cows in your herd? The respondents used their own words to describe the traits in 10 separate textboxes. The characters described were later transformed into 24 binary trait classes (mentioned/not mentioned) that included all information given by the respondents. The reason for using open-ended questions in the first part of the questionnaire was to enrich the data and allow the respondents to express interest for all possible traits without being influenced by the questionnaire outline (Foddy, 1993).

2.1.2. Part 2

In the second part the respondents were asked to rank 15 given traits against each other, from most important (1) to least important (15). This task was formulated as follows: Please rank the traits in the list below. The headline was followed by a short explanatory text. The traits (Table 1) were chosen so that they represented both production traits and functional traits important for profitability, animal welfare and the environment. Traditional and potential future breeding traits were included and
all traits had to be considered before continuing to part 3. The order in which the traits were presented to the producers was random and varied between respondents to prevent bias.

2.1.3. Part 3

The five traits that each respondent had given the highest rank in part 2 were presented to the respondent again in part 3, i.e. different traits were shown to different respondents. The task was formulated as follows: How should traits be weighted in a genetic evaluation to give the genetic gain you want to see in your herd? The headline was followed by a short explanatory text and an instruction video. The video showed the general procedure and was not expected to influence the respondents’ choices. The five traits were weighted by the respondents (the weights had to sum up to 100) and the estimated genetic gain was shown for each trait. It was possible for the respondent to repeat the procedure, i.e. put new weights for the traits, if the genetic gain was not satisfactory. This procedure could be repeated indefinitely. It was, however, not possible to go back to the previous step and redo the ranking in order to obtain a new

### Table 1

Fifteen given traits ranked by the producers in part 2 of the questionnaire (here in alphabetic order). Traits included in the current breeding goal for Swedish Holstein and Swedish Red are marked (not mentioned in the questionnaire).

| Trait Description given to the producers |
|------------------------------------------|
| Increased average daily gain (g/day)              |
| More cows with normal calvings (percent of the herd) |
| Better classification (the EURO scale converted to a numerical scale, 1 (P-) to 15 (E+)) were 15 is the best |
| More cows without feet and leg problems (percent of the herd) |
| More cows that do not need to be treated for diseases, except mastitis (percent of the herd) |
| More milk (kg ECM) produced per MJ ME in the feed |
| More cows become pregnant at first insemination (percent of the herd) |
| The ratio between milk produced in late lactation (day 280) and early in lactation (day 60) is increased |
| Longer period between first calving and culling (percent of the herd) |
| More cows that do not need to be treated for mastitis (percent of the herd) |
| More milk (kg ECM) per gram methane that the cows produce |
| Higher milk production (kg energy corrected milk (ECM) per 305 days lactation |
| More cows without gastrointestinal parasite infections (percent of the herd) |
| Increased ability to eat roughage (kg DM/day) |
| Calmer cows (scale from 1 (nervous/aggressive) to 9 (calm/friendly)) |

### Table 2

Genetic and phenotypic parameters used in the selection index. Heritabilities on the diagonal, genetic correlations above the diagonal and phenotypic correlations below the diagonal. Phenotypic variances ($\sigma^2_p$) are shown in a separate column.

| Traits | ADG | CE | CARC | F&L | HLTH | FCNV | FERT | LCRV | LONG | MAST | CH4P | ECM | PARA | RINT | TEMP | $\sigma^2_p$ |
|--------|-----|----|------|-----|------|------|------|------|------|------|------|-----|------|------|------|---------|
| ADG    | 0.35| 0  | 0.3  | 0   | 0.1  | 0.3  | 0    | 0.1  | 0.4  | 0.2  | 0.1  | 0   | 0.3  | 0    | 1603  |
| CE     | 0   | 0.95| 0.2  | 0.2  | 0.4  | 0    | 0.4  | 0    | 0    | 0.2  | 0    | 0.1 | 0.1  | 0    | 3.06  |
| CARC   | 0.3 | 0   | 0.2  | 0.2  | 0    | 0    | 0.1  | 0    | 0    | 0.1  | 0    | 0.2 | 0.1  | 0.1  | 1.11  |
| F&L    | 0   | 0   | 0.05 | 0.4  | 0    | 0.3  | 0.2  | 0.2  | 0.2  | 0.3  | 0    | 0.4  | 0    | 0.1  | 0.001 |
| HLTH   | 0.1 | 0.2 | 0    | 0.4  | 0    | 0.2  | 0    | 0.2  | 0.2  | 0.3  | 0    | 0.4  | 0    | 0    | 6.13  |
| FCNV   | 0   | 0   | 0    | 0    | 0.35 | 0    | 0.1  | 0.1  | 0    | 0.2  | 0    | 0.5  | 0    | 0.3  | 0.001 |
| FERT   | 0   | 0   | 0    | 0    | 0    | 0.05 | 0.2  | 0.2  | 0.3  | 0    | 0.3  | 0    | 0    | 0.1  | 0.001 |
| LCRV   | 0   | 0   | 0    | 0    | 0    | 0    | 0.3  | 0.2  | 0.2  | 0    | 0    | 0.1  | 0    | 0.4  | 0    | 0.001 |
| LONG   | 0   | 0   | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0.35 | 0    | 0.1  | 0    | 0.00025 |
| MAST   | 0   | 0   | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 12.67 |
| CH4P   | 0   | 0   | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0.2  | 0    | 0.00025 |
| ECM    | 0   | 0   | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 724201 |
| PARA   | 0   | 0   | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 9.0   |
| RINT   | 0   | 0.1 | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0.3  | 0    | 0.35 | 0.785 |
| TEMP   | 0   | 0   | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0.1  | 0.35 | 0.35  |

* Ahlman et al. (2011), Carlén et al. (2004), Cassandro et al. (2010), Dickson et al. (1970), Gasbarre et al. (2001), Haile-Mariam et al. (2003), Hansen Axelsson (2013), Harder et al. (2006), Hickey et al. (2007), Hoekstra et al. (1994), Interbull (2008), Jakobsen et al. (2002), Jakobsen et al. (2003), Kadarmideen et al. (2000), Koening et al. (2005), Korver (1988), López de Maturana et al. (2007), Luo et al. (1999), Morris (2007), Muir (2004), Mäntysaari et al. (2002), Oltenacu and Broom (2010), Powell and VanRaden (2003), Roosström et al. (2001), Sander Nielsen et al. (1997), Simianer et al. (1991), Strangberg (1991), Sundberg et al. (2010), Swedish Dairy Association (2008), Søndergaard et al. (2002), Van Arendonk et al. (1991), Van Raden et al. (2004), Van Veldhuizen et al. (1991), Vukačinović et al. (1995), Weller and Ezra (2008).

* See Table 1 for abbreviations.
combination of traits to weigh. The weights and genetic gains given in the last run were registered, together with the correlated genetic response in the traits not shown to the respondent (traits ranked 6–15 in part 2).

The genetic gain presented was calculated based on selection index theory. The information was based on 150 daughters (half sibs) for each sire, with only one measurement per trait. The intensity of selection was 1.755. Because of large variation in phenotypic variance between various traits, standardized values (phenotypic variation divided by genetic variation) were used in the calculations. The standardized genetic gain was then transformed back to the original unit before being shown to the respondents.

The genetic and phenotypic parameters used were based on literature (Table 2). Estimates from Swedish studies or from studies performed under similar production conditions (breeds, environment, etc.) were prioritized. The heritabilities were considered to be high (0.35), medium (0.2) or low (0.05) and the genetic and phenotypic correlations were rounded to the first decimal place. For some traits genetic and/or phenotypic correlations could not be found. In those cases, the parameters used were based on genetic parameters for similar traits and the biology of the traits. This approach was necessary as a limitation to well known traits was not in line with the aim of this study. Thus, the genetic gains presented in part 3 were approximations, but within a realistic range and therefore considered useful for the respondent when deciding what weights should be given to different traits.

2.1.4. Part 4

In the last part of the questionnaire the respondent were asked about their production system (i.e. conventional or organic), herd characteristics (e.g. herd size, breed composition, housing system, production level), and questions about themselves (e.g. sex and age).

2.2. Statistical analysis

The statistical analyses were performed with the SAS package, version 9.2 (SAS Institute, Inc. 2011). Descriptive statistics were analysed using procedure MEANS and procedure FREQ. Associations between herd characteristics and proportion of respondents intuitively mentioning different traits were analysed with generalised linear models; procedure GLIMMIX. Associations between herd characteristics and genetic gain given by respondents were analysed with general linear models; procedure GLM. The following model was used in both analyses

\[ y = \text{production system} + \text{herd size} + \text{housing system} + \text{breed} + \text{production level} + \text{gender} + \text{birth year} + \text{residual} \]

where the response variable ‘y’ is whether or not the respondent intuitively mentioned each specific trait (mentioned/not mentioned, i.e. 0/1 variable), or genetic gain for each specific trait (continuous variable), and the explanatory factors: production system (2 classes: Conventional or Organic), herd size (5 classes: <50, 50–74, 75–99, 100–149, ≥150 number of cows), housing system (3 classes: loose housed, loose housed with robot, or tied stall), breed (4 classes: mainly Swedish Holstein cows, mainly Swedish Red cows, equal proportion Swedish Holstein and Swedish Red cows, other breed or no information), production level (4 classes: <8500 kg, 8500–9499 kg, 9500–10,499 kg, ≥10,500 kg ECM per cow per year on average), and gender of the respondent (2 classes: female or male) were included as fixed class effects. Birth year of the respondent was included in the model as a continuous covariate.

Residuals of all dependent variables were examined for normal distribution using PROC UNIVARIATE, considering Shapiro–Wilks test for normality and a normal probability plot.

3. Results

The number of producers that started to fill in the questionnaire was 772 (49% of the invited) and 468 of these finished and thereby got their answers registered (32% of the invited). Of these, most were conventional producers (N=346) and the rest were producers with certified organic production (N=122). The proportion of organic dairy producers answering the questionnaire was higher than the proportion of conventional dairy producers. All organic producers, except two, had their production certified according to the national organic standards by KRAV. The non-KRAV organic herds were certified according to the EU standards. The number of

| Number of respondents | All | Conventional | Organic |
|-----------------------|-----|--------------|---------|
| Production system     |     |              |         |
| Swedish Red           | 156 | 114          | 42      |
| Swedish Holstein      | 163 | 128          | 35      |
| Swedish Red and Holstein | 71  | 51           | 20      |
| Other breed or missing value | 78  | 53           | 25      |
| Herd size (number of cows) |     |              |         |
| <50                   | 135 | 95           | 40      |
| 50–74                 | 127 | 92           | 35      |
| 75–99                 | 70  | 50           | 20      |
| 100–149               | 75  | 60           | 15      |
| ≥150                  | 57  | 47           | 10      |
| Production level      |     |              |         |
| <8500                 | 68  | 28           | 40      |
| 8500–9499             | 139 | 91           | 48      |
| 9500–10,499           | 163 | 137          | 26      |
| ≥10,500               | 87  | 81           | 6       |
| Calving interval (month) |     |              |         |
| <12.5                 | 134 | 93           | 41      |
| 12.5–12.9             | 129 | 92           | 37      |
| 13.0–13.4             | 98  | 75           | 23      |
| ≥13.5                 | 81  | 65           | 16      |
| Housing               |     |              |         |
| Loose housed          | 105 | 80           | 25      |
| Loose housed with robot | 180 | 124          | 56      |
| Tied stall            | 171 | 135          | 36      |
| Sex of respondent     |     |              |         |
| Female                | 178 | 132          | 46      |
| Male                  | 285 | 211          | 74      |
respondents per class of herd characteristics is shown in Table 3.

3.1. Part 1

The intuitively chosen traits most often mentioned by the producers (Fig. 1) were cow behaviour towards other cows and humans (71% of the respondents), feet and leg health (70%) and udder conformation (66%). Two different types of cow behaviour was identified; the cow’s manners towards humans and the cow’s interactions with other cows, where the former was mentioned more frequently. Regarding udder conformation the function of the udder seemed to be most important; it should be easy to put the milking machine on. Also milkability, i.e. milk flow, was a trait of importance for many producers (34%), as well as udder health (38%), general health (36%) and fertility (44%). Milk production was mentioned by 51% of the producers.

![Fig. 1. The probability that conventional and organic producers intuitively mention traits as important for cows in dairy production.](image)

![Fig. 2. Mean ranking of 15 traits for cows in conventional and organic dairy production, 1 = most important, 15 = least important. The traits are listed according to rank in organic production.](image)
In general, organic and conventional producers seemed to stress the same traits. However, the organic producers more often mentioned meat production, feed intake and conversion, general and udder health, fertility and calving ability, compared with conventional producers. In conventional production, on the other hand, feet and leg health, cow behaviour and the amount of fat and protein in the milk were more commonly mentioned. Analysis of these intuitively mentioned traits, classed into 24 binomial traits (mentioned/not mentioned) showed that the number of producers intuitively mentioning fertility, body size and staying clean was significantly higher in organic production ($p = < 0.01$). Moreover the number of producers intuitively mentioning udder health and lactation curve tended to be higher in among producers with organic herds ($p = 0.06$ and $p = 0.05$, respectively), whereas behaviour (against humans and cows together) tended to be more likely to be mentioned by producers with conventional herds ($p = 0.07$).

### 3.2. Part 2

Among the 15 given traits longevity had the highest mean rank and methane production the lowest mean rank in both conventional and organic production (Fig. 2). Re-ranking was observed for most other traits but the magnitude was generally small. The largest differences in rank between conventional and organic production were found for resistance to mastitis and parasites, which both had a higher mean rank in organic production. Moreover roughage intake had a higher mean rank in organic production, whereas milk production had a higher rank in conventional production. In general, the traits could be divided into three groups; high ranked, medium ranked, and low ranked traits based on the visual impression of Fig. 2. The same traits were found in the same rank group in both production systems.

### 3.3. Part 3

Narrowing down to the 5 highest ranked traits by each respondent, production system was the herd characteristic most associated with desired genetic gain, i.e. with significant effect on the largest number of traits. The level of genetic change that the respondents with organic and conventional herds would like to see on average was significantly different for two traits; carcass classification and resistance to parasites (Table 4). The least square means (LSM) estimated for genetic change in these traits were $-0.03$ points per generation for carcass classification and $0.41\%$ of the herd not infected per generation for parasite resistance for organic producers and $-0.05$ points and $0.34\%$, respectively, for conventional producers. The desired genetic gain in resistance to mastitis and other diseases tended to be higher among producers with organic production, who desired $0.57\%$ and $0.26\%$ more cows not treated, respectively. Corresponding figures for producers with conventional production were $0.50\%$ and $0.21\%$. Producers with organic production also tended to desire higher genetic gain in longevity (2.0 months) than producers with conventional production (1.7 months). The average desired genetic change in milk production tended, on the other hand, to be higher among producers with conventional production, (25 kg ECM), compared to producers in organic herds (−59 kg ECM).

Production level significantly affected the desired genetic gain in methane production and cow temperament, indicating that producers in the group with an average milk production $<8500$ kg milk per cow and year desired lower improvement in methane efficiency (kg ECM/g methane) and faster improvement in cow temperament (favoring calm cows) compared with producers in groups with average milk production $>8500$ kg milk per year.

Producer characteristics also significantly affected the desired genetic gain in some traits. The interest in longevity, lactation curve and parasite resistance declined with increased age of the respondent, whereas the interest in temperament increased with age of the respondent. Gender only significantly affected the desired genetic change in methane production that was on average higher for female than male respondents.

| Trait                  | Unit       | Conventional LSM | Conventional SE | Organic LSM | Organic SE | p-Value |
|------------------------|------------|------------------|-----------------|-------------|------------|---------|
| Beef production        | g/day      | 9.8              | 0.3             | 10.2        | 0.4        | 0.43    |
| Calving ability        | % of herd  | 0.17             | 0.01            | 0.19        | 0.01       | 0.20    |
| Carcass classification | points     | −0.05            | 0.00            | −0.03       | 0.01       | 0.00    |
| Feet and leg health    | % of herd  | 0.35             | 0.02            | 0.36        | 0.03       | 0.87    |
| Disease resistance     | % of herd  | 0.21             | 0.01            | 0.26        | 0.02       | 0.06    |
| Feed conversion        | g/MJ ME    | 2.16             | 0.26            | 2.05        | 0.41       | 0.81    |
| Fertility              | % of herd  | 0.41             | 0.02            | 0.45        | 0.03       | 0.24    |
| Lactation curve        | A ratio    | 0.89             | 0.16            | 1.16        | 0.26       | 0.34    |
| Longevity              | Months     | 1.7              | 0.1             | 2.0         | 0.1        | 0.09    |
| Mastitis resistance    | % of herd  | 0.50             | 0.02            | 0.57        | 0.03       | 0.06    |
| Methane production     | g ECM/g CH₄| 3.9              | 0.2             | 3.4         | 0.2        | 0.10    |
| Milk production        | kg ECM     | 25.2             | 23.8            | −59.0       | 37.5       | 0.05    |
| Parasite resistance    | % of herd  | 0.34             | 0.02            | 0.41        | 0.03       | 0.02    |
| Roughage intake        | kg DM/day  | 0.21             | 0.01            | 0.22        | 0.02       | 0.68    |
| Temperament            | Points     | 0.05             | 0.01            | 0.03        | 0.01       | 0.23    |
4. Discussion

This study showed that production system, i.e. organic or conventional, was the herd character that had most influence on Swedish producers’ preferences considering dairy cow traits. However, the traits considered most important in organic dairy production are included in the current Nordic breeding goal, which is developed for conventional production. The relative importance of alternative traits, such as parasite resistance and methane production, was generally considered to be low. This may partly be due to tradition and that the producers can not relate to these traits as much as to the traits included in current breeding goal. They may also be unaware of the influence of alternative traits on herd profitability.

The relative importance of traits differed slightly between the production systems. Organic dairy producers tended to prefer health traits, i.e. mastitis resistance, parasite resistance and overall disease resistance (i.e. not treated for diseases related to reproduction, metabolism and feet and leg problems) more than conventional producers, despite similar health status in the two production systems (Fall et al., 2008; Hamilton et al., 2002). Increased genetic gain in disease traits can be achieved at the expense of milk production. The organic producers tended to not value milk production as high as conventional producers, which was a result of correlated response and increased genetic gain in milk production was seen among organic producers on average (p=0.048), which is in line with the fact that the mean production level is lower in organic herds (Reksen et al., 1999; Sato et al., 2005; Valle et al., 2007). Besides a lower yield caused by a lower concentrate allowance, this finding could be an indication that organic producers accept a lower milk yield in order to reduce the disease frequency. However, these results are influenced by the questionnaire design, which only allowed the respondents to weigh the five traits ranked highest in the previous part. This limitation was chosen because a higher number of traits would have been difficult for the respondents to consider in the weighting process. Producers that gave milk production a lower rank than 5 did not have the opportunity to see the correlated response in that trait, i.e. the cost of their choices. This applies to 48% of the producers with organic herds and 32% of the producers with conventional herds. An increased genetic gain in milk production was seen among producers that had ranked this specific trait 1–5, whereas producers that had given milk production lower rank (6–15) chose weights than resulted in a reduced genetic gain. This value was a result of correlated response and should not be interpreted as their breeding goal, but it does reflect a lower interest in milk production among producers with organic production compared to those with conventional production.

The differences seen between producers with organic and conventional production may partly be due to the higher price for organically produced milk, which may allow a lower production level. The slightly higher interest in health traits and lower interest in milk production seen in organic production may also indicate that the values and sentiments of organic producers differ from conventional producers, and that they are in line with the ideology of organic farming, which is based on ethical considerations regarding, e.g. animal health and welfare (IFOAM, 2012). The interest in breeding for functional traits has been suggested to be higher in organic production than in conventional production for both economic and ethical reasons (Pryce et al., 2004). However, other traits that have been suggested to be more important in organic production, such as longevity, fertility, feed intake and feed conversion (Hörning, 2006; Pryce et al., 2004) do not seem to be more important for organic producers than for conventional producers in Sweden. This may partly be explained by the long tradition of broad breeding goals in Sweden, making all producers aware of the advantages of functional traits. Similar preferences regarding breeding goal may also partly be due to small differences in production environments between organic and conventional herds in Sweden, due to a strict animal welfare law, compared to many other countries (Sundberg et al., 2010).

The impact of ruminants on climate change has been highlighted since the FAO report “Livestock’s long shadow” was published in 2006 (Steinfeld et al., 2006). Reducing the emissions per unit of product by decreasing the amount methane produced, e.g. by breeding (de Haas et al., 2011), or by combining dairy and beef production more (Cederberg and Stadig, 2003) has been suggested. Due to one of the aims of organic production, i.e. reducing environmental impact, we expected higher interest in beef production traits and methane production among organic producers, but no such trends were identified in this study. Methane production was not considered an important trait by any of the groups, probably because there is no direct cost associated with this trait on farm level. However, it is possible that they consider the environmental aspects of the production through traditional productivity traits: milk yield, feed conversion, fertility, etc., which may contribute to decreased methane emissions per produced unit of milk and meat.

Breeding for beef production traits were not important for either organic or conventional producers even though it is common practice to raise dairy bull calves for slaughter in Sweden. Low economic advantage of dual purpose animals under Swedish production conditions is a probable explanation. Both producers with organic and conventional production accepted a decreased genetic gain in carcass classification. These results were, however, mainly due to correlated responses to other traits, because only 1% of the respondents had considered the trait to be one of the five highest ranked traits and thereby had the possibility to put weight on the trait.

The results discussed above were based on the answers of approximately one tenth of the Swedish dairy producers. The response rate was 32% which was lower than expected. The number of producers answering the questionnaire was nevertheless acceptable for the purpose of this study. Several reasons for a relatively low response rate could be identified. The lists of e-mail addresses obtained from external organizations were not well updated. Some addresses were therefore wrong and in some cases producers informed us that they had ended their dairy production. Therefore, the true number of invited producers is unknown. Among the producers starting to fill in the questionnaire 61% finalized it. We regard the questionnaire to be more advanced and challenging than...
ordinary web-based questionnaires and the respondents’ interest in breeding was probably important for completion. The answers recorded are thus considered to reflect the view of producers concerned about breeding issues. These producers probably contribute most to the genetic progress by selecting bulls and contribute with bull mothers. Therefore the quality of the data was considered high.

The method chosen in this study, i.e. an advanced web questionnaire including selection index theory, was chosen to allow the respondents to express what traits they feel are relevant and important to consider, to allow ranking of traits, and to assess the relative importance of traits. A traditional questionnaire combined with e.g. a conjoint analysis was discussed but found to not fulfill our requirements. The genetic change would not have been considered and the number of traits included would had been limited. Moreover, in the web questionnaire, the number of traits weighted was limited to five to make the weighing process feasible for the respondents, but the correlated response for all 15 traits was recorded.

The proportion of organic dairy producers answering the questionnaire was higher than the proportion of conventional dairy producers. This indicates that the way the questionnaire was presented in the invitation letter, i.e. development of breeding strategies for sustainable dairy production, attracted organic producers more. It could also indicate that organic producers are less satisfied with the current breeding strategy, which has been developed for the conventional production system, than the conventional producers. This interpretation is strengthened by the fact that crossbreeding and local breeds are more common in organic production than in conventional production in Sweden (Sundberg et al., 2009).

The results of this study indicate that in general the same traits are important in organic and conventional dairy production. These results, together with the results from previous studies showing no genotype by environment interactions of importance between Swedish organic and conventional dairy production, i.e. the same genes are important in both production systems (Ahlman et al., 2011; Sundberg et al., 2010), indicate that a common breeding program is appropriate. However, the differences in attitudes and sentiments between Swedish organic and conventional producers, especially regarding disease resistance and milk production, should be considered if the proportion of organic producers continues to increase. Estimation of two total merit indexes for bulls, one based on the weights of traits in conventional production and one based on the corresponding weights of traits in organic production, would make it easier for organic producers to identify the bulls best suited for their herds. It is important to emphasize that these results represent the conditions in Sweden. Compared to many other countries, the differences in production environment for the cow between organic and conventional production are relatively small in Sweden. The main reasons for this are that regardless of production system, all cows in Sweden are required to graze during the vegetative season (Ministry for Rural Affairs, 1988), the use of antibiotics is generally low (European Medicines Agency, 2013) and the proportion of roughage in the diet is relatively high due to good climate and light conditions for production of high nutrient roughage in the Nordic countries. In other situations, with larger or different discrepancies between organic and conventional production environments, a specialized breeding program for organic production may be appropriate.

In our questionnaire study the preferences of producers regarding dairy cow traits have been assessed, but the study does not explain the underlying values and sentiments of the respondents. In order to understand how dairy producers see these traits, focus group interviews will be performed.

5. Conclusion

This study indicates that Swedish organic dairy producers have somewhat different breeding objectives to Swedish conventional producers. Producers with organic herds tend to want a higher genetic gain in disease resistance, including mastitis and parasite resistance, at the expense of milk production, compared to producers with conventional production. However, the traits most important for producers with organic herds, e.g. disease resistance and longevity, are considered in the current breeding goal and a continued use of this animal material seems to be appropriate for organic dairy producers.

Conflict of interest statement

None.

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