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Conflict of goals? Animal welfare and greenhouse gas emissions in Swiss beef production systems of different intensity

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Abstract. The case study analysed and discussed the trade-offs between reduction of greenhouse gas emissions and animal welfare in Swiss beef production. The aim was to find out whether there are significant differences in the levels of animal welfare between single farms and different production systems and to which extent animal welfare can be improved under the given circumstances. Therefore, an On-farm Welfare Assessment scheme was designed and applied. Furthermore differences in the climate impact of beef production on the single farms and production systems were calculated and evaluated with a Life Cycle Assessment approach. The comparison of the production systems showed huge differences in animal welfare, but only small differences in the climate impact, which was up to 50% due to methane emissions from enteric fermentation. Farms of the same production system hardly differ in these issues. Some factors like the cattle's movement area and free roaming on pastures achieve bigger improvements in animal welfare than negative impacts on the GHG emissions. For these reasons and for further ecological, economical and physiological aspects beef production should base on high quality forage and pasture.

Keywords. Animal welfare – Greenhouse gas emissions – Beef production – Pasture – On-farm Welfare Assessment – Product Carbon Footprint.

Conflit d'objectifs ? Bien-être animal et émissions de gaz à effets de serre dans différents systèmes de production de bœufs en Suisse

Résumé. *Dans cette étude de cas, les possibilités d'optimisation entre la réduction des émissions de gaz à effet de serre et le bien-être animal dans la production de bœuf en Suisse ont été analysées et discutées. Le but était de vérifier s'il existe des différences significatives de niveaux de bien-être des animaux entre les fermes individuelles et les différents systèmes de production et jusqu'à quel point il est possible d'améliorer le bien-être des animaux dans les conditions données. Un plan d'évaluation du bien-être dans les fermes a été développé et appliqué à cet effet. Les différences au niveau des impacts environnementaux de la production de bœuf dans les fermes individuelles et avec les différents systèmes de production ont été calculées et évaluées avec un modèle d'analyse du bilan écologique. La comparaison des systèmes de production a fait ressortir de grandes différences au niveau du bien-être des animaux, mais seulement de petites différences concernant l'impact sur le climat pour lequel le méthane contribue à 50%. Quasi aucune différence d'émissions n'est constatée entre les fermes qui ont le même système de production. Certains facteurs, comme la surface de mouvement ou le déplacement du bétail en pâturage libre, obtiennent d'avantage d'améliorations du bien-être des animaux que d'impacts négatifs sur les émissions de gaz à effet de serre. Pour ces raisons et pour d'autres aspects environnementaux, économiques et physiologiques, la production de bœuf devrait être basée sur du fourrage ainsi que de la pâture de haute qualité.*

Mots-clés. *Bien-être animal – Gaz à effet de serre – Production de bœuf. – Patures – Evaluation – Empreinte de carbonne.*

I – Introduction

Climate change has become an important issue in agriculture and concerning politics. Avoiding greenhouse gas (GHG) emissions and the reduction of emissions per produced unit are main topics (Alig *et al*., 2012; BLW, 2011). Aspects of animal welfare are often neglected in this context. The case study analysed and discussed the trade-offs between reduction of GHG emissions and animal welfare in Swiss beef production systems of different intensity. The aim was to find out whether there were differences in the levels of animal welfare between the single farms and the different production systems and to which extend animal welfare could be improved under the given circumstances. Furthermore differences in the climate impact of beef production on the single farms and production systems were evaluated. Conflicts of goals and synergies between climate protection and animal welfare were pointed out. Relevant measures were discussed with regard to their implementation in agricultural practices.

II – Methods

Investigations and discussions of different definitions of animal welfare lead to an own appropriate On-farm Welfare Assessment scheme to collect and to evaluate data on chosen farms. Three beef production systems of different intensity were examined: “Qualitätsmanagement Schweizer Fleisch” (QM) is characterized by a short and intensive fattening period of bulls based on concentrate feeding and indoor housing. “TerraSuisse” (TS) practices short and intensive fattening of bulls also based on concentrate feed, but offers more space and different areas in the indoor housing and an additional outdoor yard. “Bio-Weide-Beef” (BWB) typically practices long and extensive fattening of steers and heifers raised on a forage based diet on pastures, at least in summer. Three Swiss farms of each production system were evaluated using specifically defined and weighted indicators of the following welfare parameters: moving behaviour, social behaviour, resting and sleeping behaviour, feeding behaviour, animal comfort, health and hygiene (Sambraus, 1978; Bartussek, 1996; Sundrum, 2007; Welfare Quality®, 2009; Rütz, 2010).

Global warming potential (GWP) was calculated per kilogram of beef yield at farm gate using a farm model based on a Life Cycle (LCA) Assessment approach (Schader *et al*., 2012). The farm model consists of a plant model and a livestock model which both allow implementation of farm specific data. Soil-born nitrous oxide emissions were calculated using a model that differentiates between nitrogen from organic and mineral fertilizers (Meier *et al*., 2012). Thereby the climate impact of the dung of browsing cattle could be modelled more precisely. Animal welfare and climate impact were specifically assessed and modelled for nine farms.

III – Results

The comparison of production systems showed huge differences in animal welfare, but only small differences in the climate impact. Farms of the same production system hardly differed in these issues. The low number of farms assessed within this case study did not allow for a statistical testing. Distinct differences are indicated by not overlapping double standard deviations (Alig *et al.*, 2012).

Related to an optimal farm with 100% animal welfare, QM farms offered 16%, TS farms 53% and BWB farms 76% overall animal welfare, calculated by the mean of single welfare criteria. Thereby distinct differences in animal welfare between the three production systems were shown, although mainly slight differences between the single welfare criteria occurred. This can be seen in Fig. 1.

The GWP of QM beef was 9.5, TS beef 10.8 and BWB 11.5 kg CO_2-eq kg per live weight at the end of fattening. No distinct differences existed as shown in Fig. 2. In all production systems methane

(CH_4) from enteric fermentation accounted for about 50% of the total GHG emissions. Furthermore the duration of the fattening period accounted most for the climate impact of beef production. An analysis of the climate impact of one fattening unit per year revealed 30% less emissions by the extensive farms compared with the intensive systems: For QM farms we calculated on average 4,976, for TS farms 5,412 and for BWB farms 3,673 kg CO_2-eq per fattening unit and year.

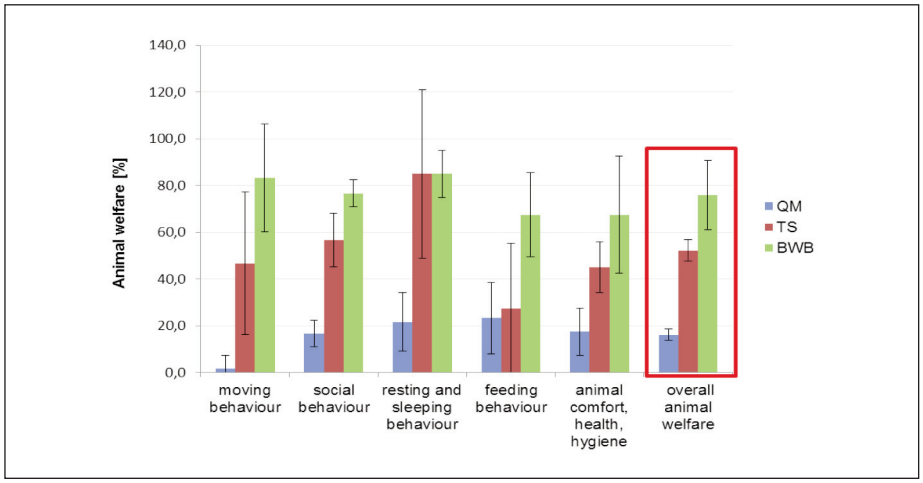

Fig. 1. Animal Welfare related to optimal farm divided in welfare criteria and production systems. The double standard deviation implied significant differences in the overall animal welfare between the three production systems.

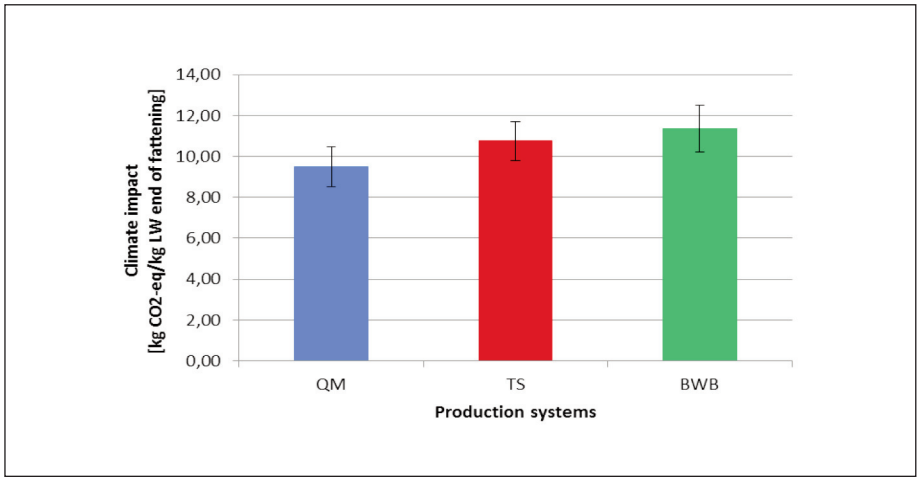

Fig. 2. Global warming potential of the three beef production systems. The double standard deviation did not imply distinct differences.

IV – Discussion

Based on the current findings it appears important and possible to establish and support synergies between animal welfare and GHG reduction measures. Some factors like the size of the cattle's exercise area, pasture and litter achieved large improvements in animal welfare but only small negative impacts on the GHG emissions. Furthermore, pastures provide important synergies like carbon sequestration, mitigation of N_2O emissions, use of grassland and animal welfare (Bartussek, 1996; Bischofberger and Battinger, 2011; BLW, 2011).

A shorter fattening period with high daily weight gains of animals fed on a concentrate-based diet results apparently in the lowest GWP per kg live weight. However, the forage based fattening system resulted in only slightly higher GWP per kg live weight showing no clear trade-off between animal welfare and GHG emissions. In addition, for different ecological, economical and physiological reasons the use of concentrates in livestock feeding shall be reduced and replaced by forage. This measure has gained importance because the assumption of higher CH_4 emissions as a result of roughage feeding had been disproven (Hindrichsen *et al*., 2006 – Klevenhusen *et al*., 2010).

V – Conclusions

The case study revealed potential synergies between animal welfare and climate protection. These synergies should be established and supported. Extensive pasture-based systems as practiced on BWB farms offer best requirements for synergies. Often mentioned conflicts of goals got relativised considering the distinct differences in animal welfare and the slight differences in climate impact between the three production systems. Housing systems which don't offer outdoor yards, litter and pasture can only be supported for economic, but not necessarily for ecological reasons. According to the high percentage of CH_4 in total GHG emissions and its limited reduction potential the most efficient way to mitigate the climate impact of beef production is a short fattening period with high daily weight gains based on forage. In order to support these goals pasture management, roughage production and conservation, nutritive requirements and values and breeding schemes have to be focused on (Spengler Neff, 2011).

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