Performance of veal calves of different genotypes raised on contrasted multi-species grasslands

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Abstract

Pasture-based veal production may offer an option of raising male calves from dairy herds that is ethically justifiable and combines potential benefits in terms of resource efficiency and ecosystem services when compared to conventional indoor systems. This study evaluated the performance of 72 veal calves from three genotypes: Brown Swiss, Limousin × Brown Swiss, and Swiss Fleckvieh, raised across four environments: a control group housed indoors and three grazing systems—intensive grasslands, permanent grasslands, and alpine grasslands. Significant differences were observed in performance metrics based on production system and genotype. Carcass weights differed significantly among farms, with the indoor housed calves yielding the heaviest carcasses with 102 ± 9.4 kg compared to the grazing animals with values of 92 ± 9.4 kg for the intensive, 85 ± 13.2 kg for permanent and 92 ± 10.3 kg for alpine grassland. Average daily weight gain (ADG) also varied notably by location, with indoor calves achieving the highest ADG and calves at permanent grasslands the lowest ADG values. Genotype effects on meat quality were significant, with Swiss Fleckvieh calves exhibiting darker and more tender meat. These findings underscore the influence of production systems and genotype on growth and meat quality traits in veal production.

Keywords: dairy beef calves, meat quality, organic, pasture-based, resource efficiency

Introduction

There are challenging issues of raising male calves from dairy herds, which can be difficult to solve satisfactorily in conventional indoor systems. Alternative finishing systems, such as pasture-based veal production, may offer a solution to raise these animals in a way that is ethically justifiable and possibly combining promising benefits in terms of resource efficiency and animal welfare (Webb *et al.*, 2023). This study aims to investigate the feasibility of finishing pure dairy breed (Brown Swiss), dual-purpose (Swiss Fleckvieh), or meat-crossed (Limousin x Brown Swiss) male calves on contrasted multi-species grasslands from the age of three to six months. By exploring genotype-specific performance and grazing system interactions, the study seeks to contribute valuable insights into the viability of these alternative finishing systems for understanding sustainability effects when rearing male dairy calves on multi-species grasslands.

Materials and methods

In the trial, 72 male dairy beef calves of three different genotypes (Brown Swiss (BS), Limousin × Brown Swiss (LB), Swiss Fleckvieh (SF)) were evaluated in four different production systems. In each production system, six animals of each breed were raised. The calves were finished in Switzerland either indoors as a control group, or in three grazing systems. All animals were selected at the age of 34 ± 9 days and raised under similar conditions. At the age of 3 months, the calves were transferred to the four different production systems to be finished and slaughtered at the age of 180 days. All animals received *ad libitum* access to hay and 3 litres of milk replacer per day in the first month of the trial. Animals on

Table 1. Mean and standard deviation of the grass quality, botanical composition and pasture characteristics of the three grazing systems.

Variable	Intensive		Alpine		Permanent	
	n	Mean ± SD	*n*	Mean ± SD	*n*	Mean ± SD
Average height (mm)	6	114 ± 35.1	8	76 ± 10.6	7	104 ± 25.7
Mean of pasture area per paddock (ha)	6	0.32 ± 0.15	8	0.27 ± 0.13	7	0.45 ± 0.25
Mean pasture access time (h/day)	54	11.3 ± 3.88	86	9.1 ± 2.4	79	10.4 ± 4.0
Dry matter (g/kg)	44	220 ± 40.1	51	294 ± 58.2	46	229 ± 57.1
Crude protein (g/kg DM)	44	159.3 ± 26.3	53	143.9 ± 19.11	49	151.7 ± 26.26
Ash (g/kg DM)	44	10.7 ± 0.99	53	7.2 ± 0.98	49	8.5 ± 1.2
Neutral detergent fibre (g/kg DM)	44	468.1 ± 61.3	53	406.1 ± 54.42	49	427.1 ± 59.22
Acid detergent fibre (g/kg DM)	44	309.3 ± 36.9	53	269.6 ± 28.81	49	298 ± 35.03
Net energy for growth (MJ NEV)	44	5.5 ± 0.65	53	6.1 ± 0.37	49	5.8 ± 0.56
Grasses (Mean % of five 1-m^2 quadrats)	8	74.2 ± 5	9	58.4 ± 8.7	9	61.8 ± 13.6
Legumes (Mean % of five 1-m^2 quadrats)	8	17.3 ± 7.2	9	6.3 ± 3.3	9	17 ± 9.7
Forbes (Mean % of five 1-m^2 quadrats)	8	8.5 ± 5.4	9	35.3 ± 9.2	9	21.5 ± 5.7

DM, dry matter; NEV, net energy value.

grazing systems had a similar supplemental feeding strategy with 0.5 kg/day of lucerne and 1.3 kg/day of maize pellets during the 3-month finishing period and 0.5 kg/day of concentrate per calf in the last 4 weeks of finishing. The indoor calves received slightly more intensive supplemental feeding of 1 kg/day of lucerne and 2 kg/day of maize pellets during the 3-month finishing period, 1.3 kg/day of concentrate per calf in the last 6 weeks of finishing and 4 kg fresh matter per day of fresh grass silage in the last month of finishing. Paddocks were changed every second week and the grass quality and the botanical composition were monitored with five 1 m^2 quadrats cut at 4 cm sward height, pre- and post-grazing. The grass was dried for at least 48 hours at 40°C, ground and later analysed by an in-house calibration on a Buchi NIRflex N-500 via near-infrared reflectance spectroscopy (NIRS) for the quality parameters. Descriptive parameters for classifying the multi-species grasslands and pasture management are presented in Table 1. Grass height and area of each newly grazed paddock were measured at the start of grazing using a rising plate meter.

Animals were weighed at the beginning and end of the trial and were slaughtered at the age of 180 ± 9 days. Carcass weight, tenderness and meat colour were assessed. Significant differences among production systems and breeds were tested via Kruskal-Wallis and Dunn's pairwise comparison.

Results and discussion

For the meat characteristics, the production systems had a significant effect on the carcass weight, resulting in a higher carcass weight for the indoor housed animals with a mean weight of 102 ± 9.4 kg compared to the grazing animals with values of 92 ± 9.4 kg for the intensive, 85 ± 13.2 kg for permanent grassland and 92 ± 10.3 kg for alpine grassland. Among the grazing systems and between genotypes, there were no significant differences. Tenderness was highest in the indoor system and in SF calves. In Figure 1, the ADG is presented. With regard to production systems, it reflects the results for carcass weight. The lowest ADG was found on the permanent grassland site. This may be related to a lower energy content of the grass or other production factors. For the genotype, there was no significant difference detected, but the numerical difference with an ADG of 0.83 ± 0.23 kg/day for SF calves, compared to 0.76 ± 0.21 kg/day for LS and 0.75 ± 0.26 kg/day for BS demonstrates a tendency that SF calves are more suited for finishing on grasslands compared to the other breeds. The results indicate that LB are not as suited to extensive fattening systems with a high grass-based diet. This tendency of

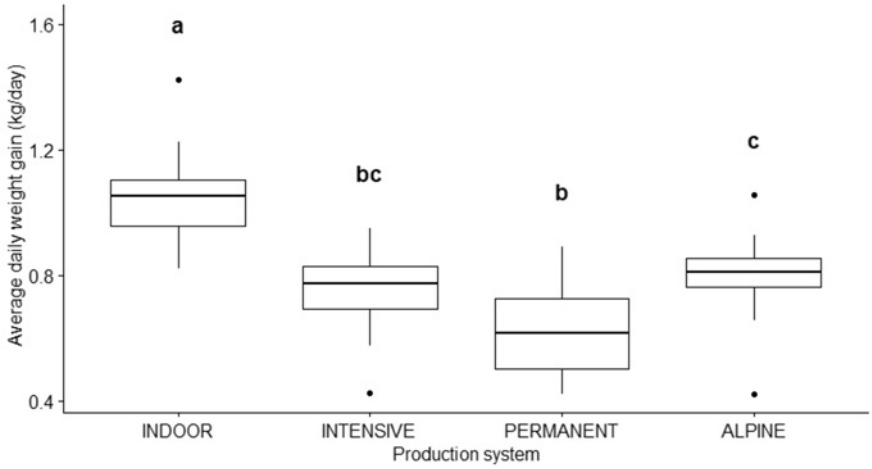

Figure 1. Boxplots of average daily weight gain per production system with significant differences based on Dunn's test.

the SF calves is also demonstrated in a significantly darker meat colour at slaughtering with L-values of 42.7 ± 1.34 and 43.6 ± 1.08 for LS or 43.7 ± 1.47 for BS, respectively. The production system did not significantly influence the meat colour, although this could have been expected for grazing animals (Priolo *et al.*, 2001). The results demonstrate that there is a potential to successfully finish veal calves on multi-species grasslands by accepting lower ADG than indoor housed animals and that there might even be a chance for dual-purpose breeds to outperform crossed meat-dairy genotypes.

Conclusion

The study found significant differences in production systems, with indoor finished veal calves having higher carcass weights. No differences for higher carcass weights were observed among the three grazing systems. In contrast to this, calves on permanent grasslands exhibited significant lower ADG than calves on alpine grassland systems and indoor raised calves. Swiss Fleckvieh calves tended to perform better on multi-species grasslands than meat-focused crossbreds or pure dairy breeds.

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