Re-conversion to organic farming, between organic rules and agro-food chain referential : how to fit out the organic fattening referential ?

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***Abstract* - In the Belgian context, characterized by a strong referential of lean and tender Belgian Blue cattle meat, we explain how the organic principles and rules are translated in practices and we highlight the tensions emerging when the re-conversion to organic frame takes place in agro-food chain. From this starting point, we explain how we have defined, in the context of a research-action following the introduction of "intermittent consumer concept", an experimentation to explore 'how organic conversion can question the basic concepts of the conventional referential ?'.**
In this experiment, four feeding strategies, to say two concentrate levels (65 and 55 %) crossed with two diets distribution strategies, are compared in terms of animal performances. The results highlight the absence of concentrate impact while diet distribution strategy plays a significant role on animal performances and intake. An important result lies in the observation of a determinant impact of animal learning to such unusual feeding practices.
For the organic cattle meat food chain, the main output lies in the demonstration that it is possible to reduce bull fattening scheme intensity to be closer to organic rules while conserving the control of the performances. However, what is the advantage to pursuit bulls fattening, at the limit of organic rules, instead of more extensive alternatives like heifers, steers ...?

Introduction

This research starts following the identification of some tensions related to the distance existing between organic rules and agro-food chain implicit or explicit obligations in terms of product characteristics. Among these rules, the norm (ANN.I.B.4.7.) is difficult to reach for biofarmers who fatten their bulls for the market . It stipulates the obligation to use, as soon as possible, grazing or at least 60 % of rough fodder on a dry matter basis, in the daily diet. In practice, bull fattening is based on concentrates at a higher rate than the accepted 40 %, especially during the last 6 months before slaughter. However, such discrepancy between organic rules and farmer practices, even if important for the organic system sustainability and credibility, is not discussed between the different actors of the organic cattle meat agro-food chain

Now, consumers focus groups led to the definition of different consumer profiles: exclusive consumers susceptible to product certification and intermittent consumers susceptible to product differentiation. This new intermittent consumer concept, as a more pertinent way for organic market development, led to the definition of some questions: 'Is it possible to fatten bulls in accordance with organic rules and consumers perception of such production mode, i.e. with more forage produced on farm? Does this slower fattening mode lead to a different meat?' To answer two hypotheses are tested in the experimental scheme. First one: from a zootechnical and economical point of view, the maximal concentration of the diet is not the optimal one's. Second one: feeding modalities, i.e. in two sequenced meals or in a single non sequenced meal, have an impact on the diet valorisation and on animal welfare during fattening phase. That hypothesis was that, through ruminal fermentation stabilisation, a sequenced distribution of the diet, beginning by the fibrous forage, would have allowed a better nutriments valorisation. This strategy focuses on diet valorisation efficiency instead of animal performances maximisation.

Material and Methods

Two levels of diets energy density were defined : first to reach 80 % of concentrates during the finishing phase (HC), to ensure an Average Daily Gain (ADG) of 1.3 kg and to produce young bulls to slaughter at 700 kg liveweight, second to peak at a level of 60 % of concentrates during the finishing phase (LC), to ensure an ADG of 1.1 kg and to produce older bulls to slaughter at 800 kg liveweight. They were crossed with two feedstuff distribution schemes : sequenced (S) or non sequenced diets (NS). This led to four combinations: 'S-HC', 'S-LC', 'NS-HC' and 'NS-LC'.

S diets were organised in two meals per days in the ratio 40/60, on a dry matter basis, distributed at 8.30 am and 4.30 pm. Each meal was sequenced according to the following distribution : fibrous hay (20 % of the diet) first, 45 minutes later concentrates, and 10 minutes later pre-wilted silage. If 80 % of the fibrous hay was not ingested within 45 minutes, concentrates and silage were not distributed. The rest of the morning diet being removed at 12 am. In the NS diet, concentrates were distributed at 9 am with a permanent access to forages.

Four groups of 6 fifteen months old (473 ± 72 days), liveweight (446 ± 37 kg) bulls from the Limousin breed

bulls were submitted to the 4 defined diet combinations. To define their performances, animal were weighted monthly while intake was quantified daily, at the group scale and was characterised through a weekly analysis of the proposed diet and refusals. As intake measured was different from these proposed, especially in the 'S-HC' and 'S-LC' groups, we start our analysis by the definition and the comparison of the real metabolisable energy content (UFV kg^{-1} in the french system) of the different diets.
The trial period runs from the 8 of November till the 15 of April, corresponding to slaughter date of the first animals in the 'NS-HC' group.
The model used to test the effect of the 'concentrate level' and 'distribution scheme' on diet characteristics, is a crossed - fixed two-ways ANOVA integrating the factors 'diet' (fixed – 4 levels) and 'time' (fixed – 5 levels), corresponding to the intervals separating two consecutive weighing. The statistical model used to analyse animal ADG was a crossed - mixed two-ways ANOVA integrating factors 'diet' (fixed – 4 levels) and 'breeder' (random – 5 levels). Contrasts were also used to test the specific effect of the 'concentrate level' and 'distribution scheme' factors while multiple means comparisons were performed with the Student-Newman-Keuls method (SAS 1989).

Results

ANOVA 2 performs on the metabolisable energy content highlights an impact of both the 'time' ($F(4,72) = 21.6$; $p < 0.001$) and the 'diet' ($F(3,72) = 12.8$; $p < 0.001$) factors. While the interaction is marginally significant ($F(12,72) = 1.9$; $p = 0.056$). The multiple means comparison identifies three groups in term of metabolisable energy content: 'NS-HC' (0.95 UFV kg^{-1}) > 'S-HC' (0.90) = 'NS-LC' (0.88) > 'S-LC' (0.84). Both 'concentrate level' ($F(1,72) = 25.7$; $p < 0.001$) and 'distribution scheme' ($F(1,72) = 12.7$; $p < 0.001$) have a significant impact on this parameter.
As underlined by the lack of interaction ($F(12,4) = 1.2$; $p < 0.463$), whatever the 'Breeder', the 'Diet' factor has a very highly significant effect on bulls ADG ($F(1,72) = 12.7$; $p < 0.001$). This effect is exclusively due to the 'distribution scheme' ($F(1,12) = 35.6$; $p < 0.001$), that has a strong impact on the level of metabolisable energy intake ($F(1,12) = 30{,}9$; $p < 0.001$), and not to the 'concentrate level' ($F(1,12) = 1.6$; $p = 0.234$), that, nevertheless, has a significant impact on the level of metabolisable energy intake in the NS modalities ($F(1,12) = 7.6$; $p = 0.018$) (table 1). No difference was observed for the carcass characteristics, classified, whatever the diet, in the U+ level, from the SEUROP scale, with a fattening level of 2, on the 1 to 5 scale.

Table 1 : Results of the multiple means comparison (Student Newman Keuls) performed on the ADG and on the intake levels observed for the four diets, from November till April. The means quoted with different letters are significantly different.

Diets	**Concentrates** (% DM)	**ADG** (kg day-1)		**Energy** (UFV 100kg $liveweight^{-1}$)	
NS-HC	69	1.411	A	1.789	A
S-HC	62	1.102	B	1.477	B C
NS-LC	58	1.351	A	1.603	B
S-LC	48	0.977	B	1.383	C

Discussion and Conclusions

According to the results, sequenced diets, instead to increase diet use efficiency, had reduced it : 6.8 UFV and 8.3 UFV were needed par kg of liveweight gain, respectively for the NS and S diets. This could be explained by the negative animal reaction in relation to such feeding practice. Indeed, animal behaviour has led to the persistency of the learning period. During this period S-HC and S-LC bulls were forced to drop some meals as long as they did not eat their hay fraction. This led to a significant reduction of the dry matter intake, in quantity and in quality. More especially the metabolisable energy content was reduces because the drop fraction was always the concentrate one. Such extended learning phase had led to significantly lower levels of animal performances together with lower apparent feed efficiency. This last parameter has been linked to the use of a higher proportion of the metabolisable energy to cover maintenance requirements under a low intake period. So, the observed marginally significant effect of the 'distribution scheme' on the feed efficiency indices disappeared once we only take into account, the fraction of the metabolisable energy valorised to increase animal weight ($F(1,12) = 0.27$; $p = 0.612$). These different considerations underline that the low performances observed under sequenced meals are linked to the low level of intake more than to a low feed use efficiency. This demonstrates the importance of learning phases when there are important modifications of the breeding conditions.
In the NS diets, there is a significant increase of the level of metabolisable energy intake, following a 11 % increase of the concentrate fraction, that is not correlated to an increase of animal performances. This underlines, under the trial conditions, that the maximum level of concentrate is not the optimal one's and open some evolution possibilities to conciliate organic rules and organic beef agro-food chain expectation without negative impact neither in term of animal performances nor of carcass quality.

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