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FEED AUTONOMY IN ORGANIC CATTLE FARMING SYSTEMS: A TECHNICAL AND ECONOMIC ASSESSMENT

Anne-Michelle Faux* [1], Didier Stilmant[1], Mary Guillaume[2], Virginie Decruyenaere[3]
[1]Agriculture and Natural environment, Walloon Agricultural Research Centre, Libramont, [2]Agriculture and Natural environment, [3]Production and Sectors, Walloon Agricultural Research Centre, Gembloux, Belgium

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Abstract: Increasing the level of feed autonomy (FA) is usually considered as a prerequisite for conversion of cattle farms to organic farming. This study aimed at generating references for organic dairy and beef cattle production through a technical and economic assessment of FA in commercial farms. Data were collected in 2014 and 2015 on 11 farms located in distinct agricultural regions of Wallonia, Belgium. Dry matter production, animal performances and all cash in- and outflows were recorded. Economic efficiency (EE) was computed as the share of the gross margin, i.e., the gross product (GP) minus the total feed and transformation costs, in the GP. The average level of FA was 94±6%. Total feed costs, including feed production and purchases, were negatively related with FA. Farms with FA ≥ 90% but one had an EE > 65%, suggesting that a 90% level of FA is necessary, but not sufficient, to be economically efficient in organic cattle farming. Three production systems with EE > 65% were finally described based on the observed crop rotations and levels of production.

Introduction: Feed autonomy relates to the ability of a farm to produce livestock from its own feeding resources (Lebacq et al. 2015). It is the ratio between self-produced feed and consumed feed, including both self-produced and purchased feed. Whether due to the European regulation constraints, to the high price of organic feeds, or to reduce the environmental impact of the production system (Lebacq et al. 2015) or to improve the final product's quality (Duru et al. 2017), by increasing the share of grazing in animals' feed in particular, organic cattle production systems are expected to consider feed autonomy.

Increasing the level of feed autonomy requires properly managing the feed production capacity and animal performances to maximize *in fine* the economic profitability. Self-produced feeds include grazed grass, stored fodders from permanent grasslands, temporary grasslands and/or immature crops, and grains from cereal and protein crops. Given their high protein and energy requirements dairy cows and young fattening bulls are the most challenging categories to feed with self-produced resources.

Considering the above, the present study aimed at generating references to support transition to organic farming. Two main objective were pursued: (i) initiating a detailed characterization of fodders and concentrates produced under organic conditions (species composition of sown mixtures, nutritional value, yield), and (ii) determining the level of feed autonomy in organic cattle farms in Wallonia and its relationship with the economic performances and underlying technical characteristics. The present paper focuses on the second objective.

Material and methods: Data were collected in 2014 and 2015 in 6 dairy and 5 beef farms located in distinct agricultural conditions of Wallonia. Out of the beef farms, two were breeders-fatteners and three were breeders only.

Feed production, including grazed grass, stored fodders and grains, was characterized in terms of quantity and quality. Dry matter (DM) production from grazed pastures was estimated using grazing calendars. For beef farms, the annual liveweight (LW) production was calculated over the whole herd by taking into account livestock variations and by estimating the weight of each animal using a growth model parameterized on breed-respective data collected in the farms themselves and in the experimental station of the CRA-W. All cash in- and outflows were recorded.

Economic performance was characterized by the economic efficiency (EE), computed as follows:

EE (%) = (GP - (Feed production and purchase costs + Transformation costs))/GP

where GP is the gross product without subsidies, including all cattle-related incomes (sales of milk, processed milk, live cattle, breeding bulls, meat). Feed production costs included seeds, fertilizers and amendments, storage of fodder, fuels and lubricants, maintenance of equipment and machinery, work by third parties, and, if any, the fees related to cooperatives for the use of agricultural equipment. Transformation costs included the variable costs associated with transformation.

Results: Monitored farms had 71.6±23.4 ha of organic certified agricultural area. Dairy farms had 60±22 dairy cows in addition to 12±6 suckler cows. Suckler farms had 48±12 suckler cows.

The overall yield, calculated over the whole feed production, was 5818±1046 kg DM per ha. Grazed grass accounted for 49±7% of the total self-produced DM, stored fodders for 43±7% and grains for 12±7%. The annual milk production was 5334±650 litres per cow. In beef farms, the annual LW production per cow was 480±76 kg for breeders-fatteners (289±36 per LU) and 209±70 kg for breeders only (150±36 per LU). The stocking rate was 1.2±0.2 LU ha^{-1}. It was positively correlated with the overall yield (p <0.01). The level of feed autonomy (FA) was 94±6%.

Economic performances could be characterized for 9 out of the 11 farms. Total feed costs, including feed production and purchases, were 459±173 € LU^{-1} in dairy farms and 277±71 in beef farms. They decreased significantly with FA (Fig. 1A). Transformation costs were found in one dairy farm (D3). They were low compared to the total considered costs (i.e., feed and transformation), accounting for 1.5% of the total costs in 2014 (start year of transformation) and for 5.6% in 2015. Farms with EE higher than 65% had a FA level higher than 90% (Fig. 1B). However, not all farms with FA higher than 90% were economically efficient at the 65% level. EE in farm B5 was low due to high fuel and machinery maintenance costs in 2014 and to a lower number of animal sales in 2015. Moreover, EE closed to 80% were achieved by farms with levels of FA ranging between 90 and 100% (Fig. 1B). These observations suggest that achieving a 90% level of FA is necessary but not sufficient to be economically efficient in organic cattle farming, while beyond 90% of FA increasing FA is not necessarily economically efficient.

Fig. 1. Relationship between total feed costs per LU and FA (A) and between EE and FA (B) (6 dairy and 3 beef farms).

Three production systems were described based on the technical characteristics of the farms with EE higher than 65%.

Production system I: mixed crop-livestock systems with a relatively high production level (farms D1, D4, B1 and B3, with mean EE of 83, 66, 77 and 72%, respectively). Crops included temporary grasslands, grain crops, and possibly immature cereal-protein crops, in addition to permanent grasslands. FA levels were high (94 to 99%) and associated with relatively high production levels (5800 and 6500 milk litres cow^{-1} $year^{-1}$; presence of a fattening activity in beef farms). Overall yields in farms D1 and B1, located in the silty region of Wallonia, were high (7.5 and 7.0 tDM ha^{-1}), allowing for higher stocking rates (1.4 and 1.7 LU ha^{-1}). They were lower in farms D4 and B3, located in the Ardenne (5.4 and 4.3 tDM ha^{-1}; 1.1 and 0.9 LU ha^{-1}, respectively).

Production system II: grassland systems with a relatively high production level (farms D5 and D6, with mean EE of 81 and 79%, respectively). These farms had only permanent grasslands. Although slightly lower than in System I, FA levels (90 and 93%) and production levels (5500 and 5000 milk litres cow^{-1} $year^{-1}$) remained relatively high. Overall yields (6.3 and 5.8 tDM ha^{-1}) and stocking rates (1.2 and 1.1 LU ha^{-1}) were closed to the global averages *(cfr supra)*.

Production system III: mixed crop-livestock systems with a relatively low production level (farm D2, with EE of 67%). Crop rotation was similar to farms D1 and B1. Production level was relatively low (4000 milk litres cow^{-1} $year^{-1}$), associated with high FA (99%). Feed purchases included mineral and vitamin supplements only. Overall yield was 6.1 tDM ha^{-1}, and stocking rate was 1.4 LU ha^{-1}. More than a standard crop rotation, this system was characterized by the objective of producing in complete FA.

Discussion: The monitored farms had characteristics of organic cattle farms. Stocking rates were below the 2 LU ha^{-1} allowed in organic farming. Dairy production was in the same magnitude as the organic group described by Lebacq et al. (2015; 5473 litres cow^{-1} $year^{-1}$). The LW production per LU for breeders-fatteners was close to that reported by Veysset et al. (2011; 300 kg LW LU^{-1} on average regardless the production system).

Although high levels of mass FA can be achieved by cattle farms (88% on average in France; Devun et al. 2014), the level of FA in organic farms appeared to be even higher. The share of grazed grass in the total self-produced DM was typical of grass-based, not including maize, systems (Devun et al. 2014).

A decreasing effect of FA on the total feed cost was found. Economic advantages of self-producing animal's feed have been demonstrated, associated with the use of fewer inputs and high quality fodders (Lebacq et al. 2015; PROTECOW 2018).

This study finally highlighted the importance of adapting the herd size and performances to the feed production capacity to achieve a level of FA between 90 and 100%. The feeding strategy to be adopted, and resulting level of FA, depends, in particular, on the potential of the farm to produce grain crops. In this respect, simulations could help to adapt animal performances to the feed production capacity while maximising the economic profitability.

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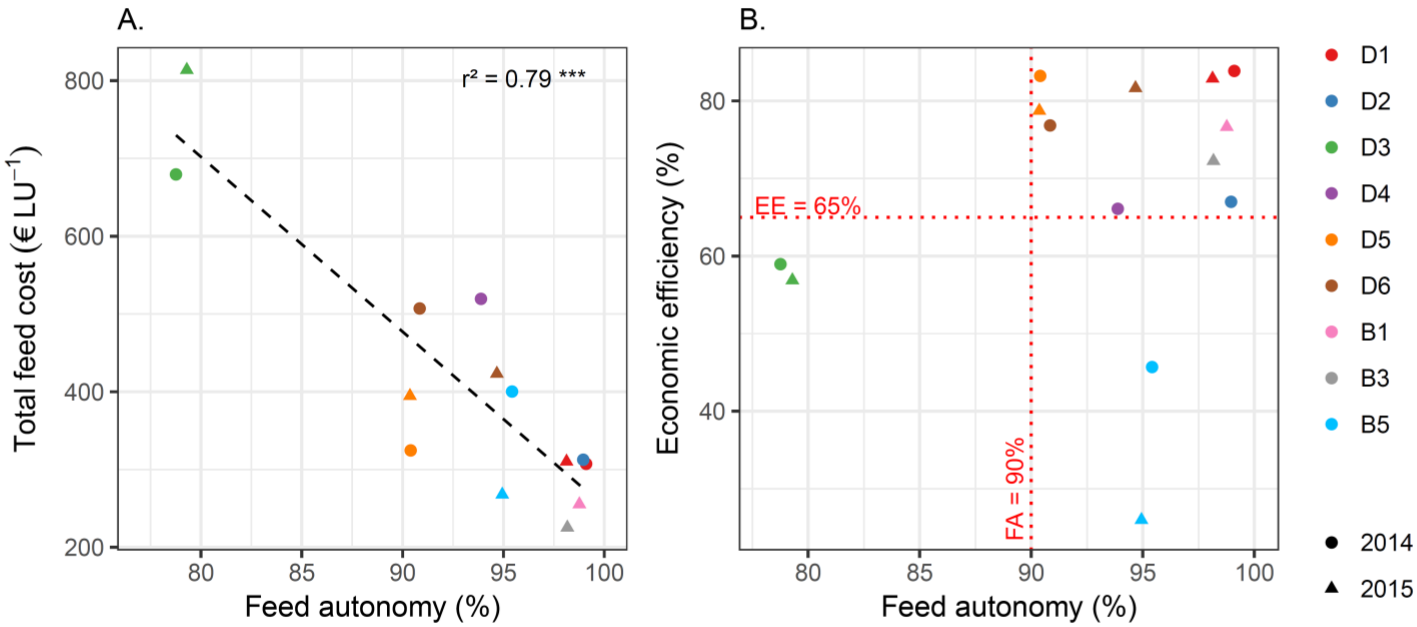
Image:



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