UMR1213 Herbivores

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Productive, environmental and economic performances of beef cattle farms go hand in hand

The co-assessment of productive, economic and environmental performances of 59 suckler-cattle Charolais farms shows that the farms that optimize their factors of production and make the most efficient use of inputs outperform the others on all three fronts. Large mixed crop-livestock farms are not necessarily the most efficient.

Efforts to assess the environmental performances of beef production systems often culminate in mitigation strategies (de Vries et al., 2010), without factoring in farm economics. The few studies dealing with the joint assessment of the environmental and economic performances are often model-based studies (Veysset et al., 2010, Stehfest et al., 2013). We coordinated a technical-economic survey of 59 Charolais suckler-cattle farms in order to calculate greenhouse gas (GHG) emissions and non-renewable energy (NRE) consumption, for each of these farms, over the years 2010 and 2011. Using real-world data from a farm network enable us to analyze the variability of the results and its determinants. We ran a system-wide analysis to compare the organizational structures, production systems and economic performances of the least GHG-emitting farms against the most GHG-emitting farms.

Mean net GHG emissions amounted to 10.1 kg CO_2e/kg live weight (kglw) with a broad variability (min = 7.3; max = 15.2). GHG emissions were negatively correlated to kg live weight produced per livestock unit (LU), and they were positively correlated to the stocking rate and to the use of nitrogen fertilizers per hectare. Large farms are more GHG-emitting (positive correlations between GHG, farm size and herd size). Degree of specialization also had an impact on GHG emissions, as farms more heavily specialized in beef production (with more grasslands) tended to emit less GHG per kglw.
The amount of NRE consumed to produce one kg of live weight averaged 30.4 MJ (= 17 min; max = 49). This NRE consumption increases with the farm size and decreases with the degree of specialization in beef production. Net GHG emissions and NRE consumption are positively correlated.

Farms with low vs. high GHG emissions	
Energy (MJ / kg live weight)	-36%
Fertilisers (kg N / ha)	-200%
Land use (ha) Herd size (Livestock Unit, **LU**)	-46% -72%
Stocking rate (LU / ha)	-22%
Animal productivity (kglw / LU)	+18%
Income per worker	+29%

Net GHG emissions per kglw were 51% lower on the 25% least-GHG-emitting farms (GHG-) than on the 25% most-GHG-emitting farms (GHG+), at 8.0 versus 12.1 kg CO_2e/kgvv. GHG+ farms were also higher consumers of NRE per kgvv (+36%). GHG+ farms were significantly larger than GHG- farms, had higher labour productivity, were less grass-based (proportion of grass in agricultural area) and had a higher stocking rate (+22%) with a higher nitrogen fertilizer use by ha. The GHG- farms presented systematically better animal performances (live weight production per LU); however, there was no significant between-group difference in amount of concentrate distributed per LU. By getting higher animal productivity without higher charges, and despite having smaller structures, farms that emitted the least GHGs per kgvv ultimately earned higher incomes per worker (29 k€/worker, i.e. +29% or +€8,500/worker). We observed a positive correlation between environmental performances (less GHGs emitted) and economic performances.

It was often the same farms that outperform the others on all three fronts: technical, economic and environmental. They were the farms that optimize their factors of production: concept of overall efficiency of the production system. Large mixed crop-livestock farms are less efficient in the use of inputs. Further researches should explore the relationships between efficiency, economies of scale and economies of scope.

Publication/patent

Veysset P., Lherm M., Bébin D., Roulenc M. Mixed crop-livestock farming systems: a sustainable way to produce beef? Commercial farms results, questions and perspectives. Animal, accepted.
Séminaire ACTA-INRA « Les systèmes de polyculture - élevage dans les territoires », Toulouse, 4-5 juin 2013. Communication et animation d'atelier.

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