



Addressing the Feed-Food and Land Use Competition: the Case Study of Piedmontese Beef Farms

Dennis Bonnin¹, Ernesto Tabacco¹, Giorgio Borreani¹

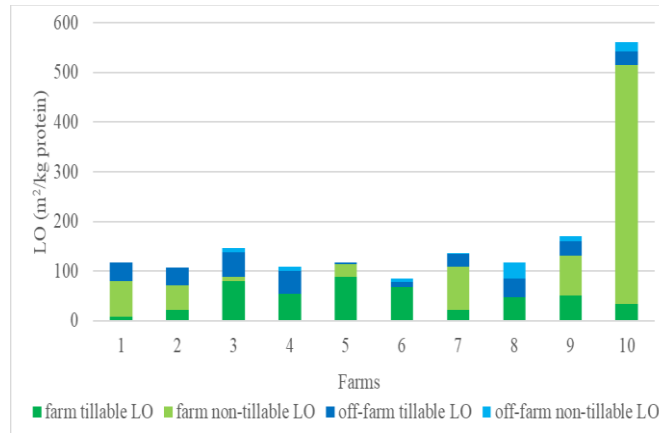
¹ DISAFA, Università degli studi di Torino, IT. Autore corrispondente: dennis.bonnin@unito.it

Introduction

Beef production systems are often criticized for their low conversion efficiency of natural resources into edible food and in particular for their direct competition with humans for the use of human-edible feeds (feed-food competition) and for the indirect occupation of arable land for feed production (arable land use competition).

The aim of this study was to evaluate the feed-food competition and the arable land use competition of beef production in Italy. Piedmontese beef farms were used as a case study.

Composition of the land occupation (LO) of the studied farms



Materials and Methods

- Primary data obtained from 10 whole-cycle Piedmontese beef cattle farms for the period 2016-2019.
- Data covering herd composition, livestock production systems, livestock feed management and productivity, and crop cultivation were collected through on-farm questionnaires, registered data available on the farms and all the farm invoices for the four studied years.
- Evaluation of the feed-food competition using the human-edible feed conversion ratio (HeFCR) proposed by Ertl et al. (2016).
- Assessment of the land competition using the land occupation (LO) indicators proposed by Mosnier et al. (2021) in addition to the land use ratio (LUR) indicator calculated according to van Zanten et al. (2016).
- The functional units considered were one kilogram of liveweight, one kilogram of protein in beef meat and one kilogram of protein in beef meat corrected for the dispensable amino acid score.

Results

- Wide range of variation on the feed-food and land use competition indicators in the studied farms.
- Very high efficiencies of concentrate conversion in some farms (1,3,6).
- The efficiency of converting human-edible protein into meat protein was low and all farms were net consumers of human-edible protein (HEcp and HEcp DIAAS/kg CP >1).
- Total LO was high on all farms, especially for Farm 10.
- Land used was mainly non-tillable land even if farms (3, 4, 5, and 6 showed a high use of tillable land).
- LUR values were for all farms quite above one, implying that the land required to produce 1 kg of beef LW would have yield more huma-digestible protein if directly used to grow human food.

Feed-food competition and land use indicators of the studied farms

Farm	Feed-food competition				Land Use			LUR
	FCR (kg DM conc/kg beef LW)	HE FCR (kg feed/kg meat CP)	HECP FCR (kg HE feed CP /kg meat CP)	HE CP DIAAS FCR (kg HE feed CP DIAAS /kg meat CP DIAAS)	Tillable LO (m²/kg meat CP)	Non-tillable LO (m²/kg meat CP)	Total LO (m²/kg meat CP)	
1	2.96	19.1	3.17	1.49	46.6	70.9	118	1.81
2	4.15	22.5	3.26	1.54	57.7	50.6	108	2.74
3	3.3	25.7	4.09	1.72	129.8	17.0	147	6.68
4	4.57	28.5	3.81	1.55	101.1	8.3	109	4.65
5	5.79	46.2	7.22	4.27	92.6	25.8	118	6.33
6	3.59	28.8	4.22	2.33	79.2	6.2	85	4.56
7	5.17	34.8	6.31	3.90	47.2	88.0	135	2.34
8	7.05	44.8	5.93	2.85	85.0	32.4	117	4.26
9	4.12	32.2	4.47	2.03	80.6	89.4	170	2.70
10	5.12	37.0	4.85	2.35	62.1	499.2	561	3.13
Mean	4.58	32.0	4.73	2.40	78.2	88.8	162	3.92

FCR= Feed Conversion Ratio; LW = Liveweight; DM = Dry Matter; conc = concentrates; HE = Human-edible; CP = crude protein; HEcp = Human-edible crude protein; DIAAS = Digestible Indispensable Amino Acid Score, LO = Land Occupation, LUR = Land Use Ratio according to van Zanten et al., 2016.

Conclusions

The Piedmontese beef production system has shown average values of feed-food and land use competition comparable to those found in other studies. All the studied farms were net consumers of human edible-protein and used significant amounts of arable land, thus showing a high degree of competition for human-edible food and tillable land. The production system should improve its efficiency by increasing the use of forages and by-products that provide little competition with human food and allow for a reduction in the competition for tillable land use.