

with biogenic CH₄ as the prevalent chemical compound. The environmental impact due to AC and EU was split into feeding management and emissions from manure inside the shed and direct on the pasture. For the AC and EC the main polluting compounds were NH₃ in air followed by N₂O in air and PO₄ in water. The component with the highest environmental impact in terms of NRE was crude oil followed by energy produced from natural gas. We could conclude that dairy sheep farming should be systematically monitored to minimize the impact of its activity on environmentally sensitive areas (e.g. national parks) without impairing its competitiveness.

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Environmental impact of insect rearing for food and feed: state of the art and perspectives

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The demand for feed and animal food products is expected to rise sharply until 2050. In addition, livestock production plays a role in the overall anthropogenic impact. Thus, valuable protein alternatives such as edible insects are welcome. Edible insects have an excellent protein value, low feed conversion ratio (FCR) and can be massively reared on low-value substrates. Based on the available literature, this paper is aimed at reviewing the environmental performances of insect rearing and drawing the perspectives for future investigations. To date, few papers focused on the environmental impact of insects farming and used the Life Cycle Assessment (LCA) as standardized methodology. Impacts such as Global Warming Potential (GWP), energy use (EU) and land use (LU) have been estimated for the mealworm meal (MM) production. If compared to some animal food products, the GWP of MM ranges from about a half (pork) to less than a tenth (beef) (Tab. 1), mainly due to the weak climate-relevant emissions of this insect. In addition, the low LU of MM production sounds promising and may be partially explained by the low FCR (2.2) observed for this species. With the exception of beef and pork, the EU of MM is higher than the literature values for the other animal food products due to the rearing facility climate-conditioning. For feed production, housefly larvae grown on organic wastes (including poultry manure) have been studied. The data were obtained from a commercial-exploited testing site. If compared to literature data on fishmeal (FM), housefly larvae meal (HLM)

exhibits a very low impact on climate changes, but is comparable to soybean meal (SBM) production (Table 1). Producing HLM requires less agricultural land than SBM as no dedicated crops are required. The energy demand of HLM production is more than twice the EU for SBM meal, but it is lower than for FM. Even if comparisons between these studies are not easy due to several methodological aspects, edible insects appear more sustainable than other animal products or feedstuffs. However, other environmental indicators (e.g., acidification potential) should be investigated to get a complete understanding of the environmental performance of edible insects as food and feed. The different rearing strategies adopted have a significant effect on the sustainability of the mealworm and housefly rearing cycles. Studies comparing different insect species and/or different rearing strategies should be undertaken.

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The effects of slaughter age and restricted feeding on growth, carcass and meat quality traits of dairy breed lambs

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This experiment aimed to investigate the possibility to raise the carcass weight of lambs of dairy breed and produce low-fat meat by increasing the slaughter age and applying strategies to reduce feeding level. At 35d of age, 70 weaned lambs of Valle del Belice breed were divided into 2 groups and adapted to housing in multiple boxes and experimental diets over a 10-d period. The groups received *ad libitum* pelleted alfalfa hay and concentrates differing in the 20% inclusion of durum wheat bran (0WB, 20WB) used to reduce cost and energy level. After 45d of experiment, both groups were divided into 3 subgroups; 2 of them with 15 lambs were slaughtered at 90d of age (90L), whereas the other 4 subgroups received the same concentrates *ad libitum* (120L) or restricted at 75% of *ad libitum* intake (120R) for 30d until slaughter at 120d of age. Feed intake and live weight of lambs were regularly measured. At slaughter, carcass traits and tissue components of hind leg were recorded. Longissimus dorsi (LD) meat was evaluated for pH, colour, thawing and cooking losses, WB shear force and sensory properties in triangle tests. In both phases, 45-90d and 90-120d of age, the diet did not influence feed intake and growth of lambs fed *ad libitum* (90L and 120L), whereas under feed restriction the lambs fed 20WB showed a reduction in weight gain than 20R lambs fed 0WB (105 vs. 170 g/d, P, ≤ 0.05). In all production systems, the diet did not affect the carcass weight (12.6 vs. 12.4; 14.7 vs. 13.7; 15.6 vs. 14.9 kg for

OWB vs. 20WB in 90L, 120R and 120L), whereas the 20WB diet reduced carcass yield of 120R lambs (52 vs. 56 %, $P \leq 0.01$). The simultaneous feed and energy restriction for 120R lambs fed 20WB diet resulted in the lowest performance. The fat deposition, as perirenal and pelvic fat and adipose tissue of hing leg, increased from 90L to 120R, and to 120L lambs, regardless of diet. The LD traits were affected by the production system, since 90L lambs showed higher water losses, and lower tenderness and red colour than older lambs. At triangle tests, the panellists perceived significantly the differences due to diet for 90L and 120R meat, and the effect of feeding level. Thus, increasing the slaughter age of dairy breed lambs from 90 to 120 d of age lead to the production of heavier carcasses with improvements in meat quality in terms of tenderness and reduced water losses, especially due to a higher but moderate fat content, also when lambs were exposed to a 75% restricted feeding.

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Variation of casein and fatty acids milk contents in Italian Browns Swiss cows

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The interest in functional foods has considerably enlarged and the development of products with particular features for the food market has been encouraged.

The aim of this study was to evaluate the variations of protein, casein, saturated (SFA), unsaturated (UFA), monounsaturated (MUFA) and polyunsaturated (PUFA) fatty acids contents in the milk of two groups of Italian Brown Swiss cows, either conventionally reared in indoor period of housing or consuming pasture during summer. Milk components were obtained from samples collected during the national routine (conventionally reared) and 'extraordinary' (mountain pasture period) milk recording scheme in 2008 and 2013 in herds located near Sondrio. Milk samples were processed with the MilkoScan™ FT6000 (Foss Electric, Hillerød, Denmark) for the identification of milk casein, SFA, UFA, MUFA and PUFA composition. The groups were analyzed separately per year and the environmental factors (pasture/indoor, parity, data of sampling, days in milk, days from col-

lection to analysis) affecting milk protein, casein, and fatty acids contents were included in the GLM and MIXED procedures of SAS 9.3. A total of 778 milk samples were available, including 234 records from indoor and 544 observations from pasture feeding. Pasture intake affected the content of casein (%) and the proportion of fat in milk (g/100g) through its direct effect on energy and protein intake, enhancing milk casein levels (from 2.90 to 3) and reducing the concentration of milk SFA in milk from grazing cows (from 2.32 to 1.88). This study has confirmed in a field study conducted in different locations and time, that in a low input grazing system the total production exhibits a higher true casein content and a minor amount of SFA in milk: pasture intake affects the proportions of fat and casein fractions in milk through their direct effect on energy intake. Additionally, as milk was transformed in cheese, the cheese yield was calculated as 'kg of cheese per 100 kg of milk' resulting to be 10.4 from cows reared indoor resulted 10.4, while this value increased to 12 from milk of pasture based diet cows. The farmers and breeders producing Bitto, "Similar Bitto", and "Latteria" cheeses may disclose to consumer the better nutritional properties of pasture milk (i.e. less SFA) respect to indoor milk to raise awareness of the quality of marketed productions. Acknowledgments: This study was funded by Regione Lombardia projects n705 (BruCa) n. 1328 (LattOmega).

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Food waste valorization: mango peels enhance *in vitro* rumen microbial fermentation

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Mango (*Mangifera indica* L., Anacardiaceae) by-products derived from fruit processing still contain bioactive phytochemicals that could be recovered to develop new functional feed additives or ingredient in ruminant nutrition. This research evaluated the effects of mango peels on rumen microbial fermentation (microbial growth, pH, NH₃-N and volatile fatty acid concentration) by an *in vitro* rumen batch incubator system. Mango peels were tested as raw material and their water, ethanol and heptane extracts and fermented products, at three different concentrations. The *in vitro* batch culture incubation system was carried out with rumen fluid withdrawn from three rumen-fistulated non-lactating dairy cows. The rumen fluid was added in anaerobic condition to a mineral salt buffer, mixed in a bottle warmed at 39°C and standardized at pH 6.8±0.1. One hundred millilitres of solution were placed in glass bottles supplied with a substrate for microbial growth (0.8 g/100 mL alfalfa hay and 0.2 g/100 mL corn meal). The bottles were purged with anaerobic grade N₂/CO₂