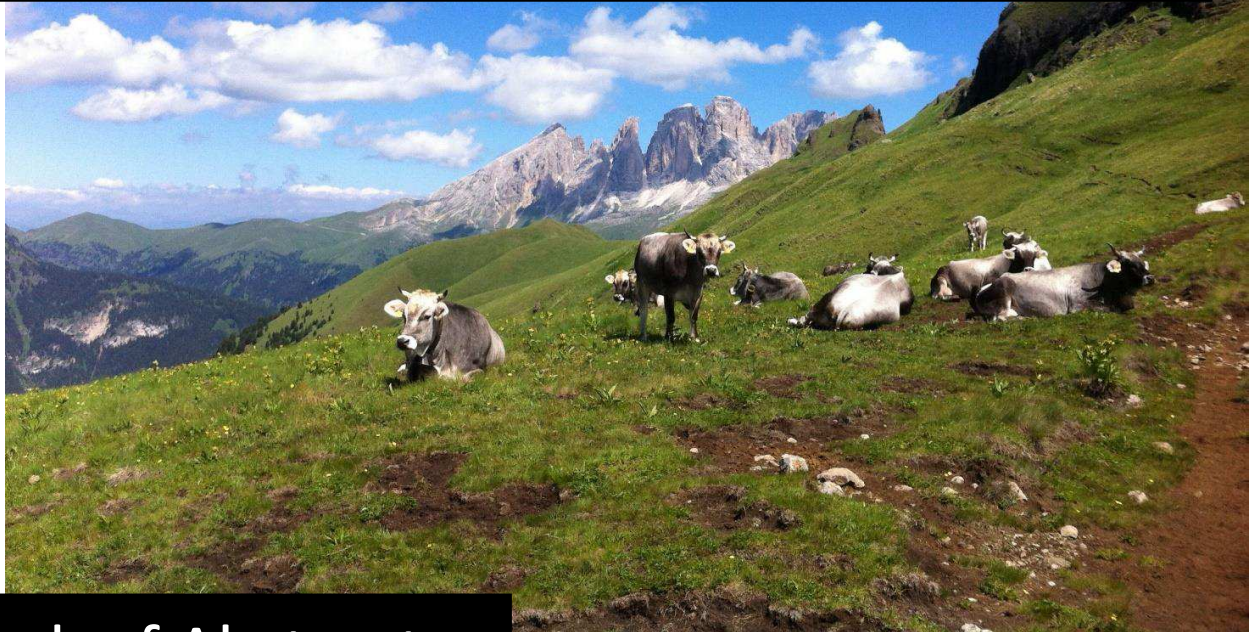


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Advanced opportunities to develop a circular economy model for mountain livestock farming

Bona Daniela¹, Silvestri Silvia², Grandi Luca³

Fondazione E. Mach, San Michele a/A, Italy^{1,2,3}

The studies conducted in the last years at FEM Biomass Lab have deeply investigated the analytical quality of cattle manure aimed at a better exploitation of their energy and agronomical potential value. Cattle livestock waste have a good content of lignocellulosic fibre, mainly cellulose and hemicellulose, not completely degraded by rumen digestion, overall ranged between 43–62% DM, depending on both animal feed and husbandry. The studies exploited lignocellulosic fraction of manure by (i) bioethanol production, (ii) biomethane production and (iii) the integration of both (Bona et al., 2017). Bioethanol production were obtained by pretreatment of the manure, hydrolysis of cellulose and hemicellulose and the fermentation of pentose and hexose sugars obtained. Biomethane production were assessed by BMP (BioMethane Potential) tests. A final assessment of the agronomical properties was carried out on processes residue. Data were analysed using ANOVA and multiple pairwise comparison with Tukey's tests (HSD) at $\alpha=0.05$ level of significance, using STATISTICA software (Statsoft Inc., Tulsa, OK, USA). The bioethanol production was 68 mg/g DM, obtained after saccharification of 292.69 mg/g DM of cellulose content and 219.49 mg/g DM of hemicellulose (saccharification yield 41.22%) and fermentation of sugar. The integration of bioethanol process and biomethane from distillation waste leads to 72.95 mg/g DM of CH₄ production too, generating a net energy balance of 1.28 MJ/kg. The preliminary comparison of wet and dry anaerobic digestion technologies highlighted no significantly differences on CH₄ yield, by exploiting about 42% of cellulose content and 45% of hemicellulose residual. The proper exploitation of livestock waste could play a crucial role in the development of a circular economy system in mountain areas, achieving energy and biofertilizers production on one side and the reduction of greenhouse gas emissions on the other one.