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110% of Ross specification tended to decrease feed, energy, and protein efficiencies (quadratic, $p = .06$) and pre-slaughtered weight (quadratic, $p = .10$) whereas increased serum uric acid concentration (quadratic, $p = .05$). Increasing Lys levels decreased serum P concentration (linear, $p = .02$) and immune response against NDV after the first vaccination (linear, $p = .09$) whereas increasing Met levels tended to increase serum concentration of cholesterol linked to high density lipoproteins (linear, $p = .09$). Met \times Lys interaction were observed on serum glucose ($p = .01$) and ALP (tendency, $p = .06$), relative weights of rectum ($p = .02$), liver ($p = .02$), and bursa of Fabricius (tendency, $p = .06$). Results showed that optimal growth performance, blood serum parameters, immune responses, and carcass traits can be achieved if Met and Lys requirements of Ross 308 broilers are satisfied according to the Ross recommendations. Levels of Met and Lys higher than NRC specifications (approximately +10% on average over grower and finisher periods for Met and over starter, grower, and finisher periods for Lys) could be necessary for comparable results.

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Efficiency of *in vivo* ear flap NIR scan in the detection of differences related to diet or pregnancy status in young rabbit does

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The aim was to determine whether *in vivo* spectroscopy of the ear flap was able to detect the diet-related differences and pregnancy status, with its prognostic in forward or backward perspective.

Methods. Young grey Carmagnola rabbit does in groups of eight were fed diets enriched with: linseed at 5% (A); linseed at 5% and hazelnut skins at 1.5% (B); palm oil at 1.8% (C); and a standard diet (D), respectively. After the zero-point (P0) before A.I. a second point (P1) was fixed at d 21. A smart-NIR device (SCIO, 740-1030 nm) was used.

Chemometric analyses of the 331-point spectra were performed by using WinISI 1.5, without math pretreatment. Modified Partial Least Squares method was fitted to dummy binary variables. Outliers were identified once and excluded when $t > 2.0$. R^2 coefficient in cross-validation was retained as reference parameter. In parallel, for binary categorical discrimination, the proprietary software SCiO lab based on AKA (Also Known As) confusion matrix was used. Results. The NIR spectra were able to clearly perceive changes from a standard pre-experiment D diet to the A, B and C diets, with R^2 around 0.60, while the value was lower for diet D (0.29). This first outcome is favorable for the repeatability of the method and for a discernment of nutritional factors. Prognostic of gestation in backward mode (scan at P1) was significant with mild NIR relationship (0.35), not suitable for practical uses, while in forward mode prediction (scan at P0) result was poor (0.20). The feeding treatments with different fatty acid profiles were instead more accurately perceived in the NIR spectra, especially for the C group, which was discriminated from the A and B groups with a R^2 value of 0.71, which corresponds to a 75% reclassification as AKA. Interestingly, the antioxidant compound of the B diet was enhanced for a non-pregnant status (0.85 *vs* 0.12 when pregnant) and this could indicate the presence of interactions between growth and pregnancy requirements, as assessed from skin variations. Conclusions. At the present state of knowledge, the miniaturized NIR device looks promising, mainly for the assessment of body fat composition. As far as the feeding experiment is concerned, it should be pointed out that it is rare to obtain model R^2 values as high as those obtained during this preliminary work for a classic design, even multivariate ones, without extreme diets. The skin is an unbiased mirror of health and nutritional status of rabbits.

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Effects of arbuscular mycorrhizal fungi and low fertilizer supply on forage quality, milk traits and profitability

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The combined effect of arbuscular mycorrhizal fungi and low fertilizer supply on crop yield, *in vitro* rumen degradability of DM (IVDMD) and NDF (IVNDFD), and milk traits was

assessed. Seeds of maize (*Zea mays* L.) and sorghum (*Sorghum vulgare* Pers.) were inoculated with a commercial product based on *Glomus* spp. and were sown in an irrigated plain buffalo farm (maize) and a dryland hill dairy farm (sorghum). The treatments (C control, E experimental) were the following: MC (not inoculated maize seeds, fertilization: N 250 kg ha⁻¹, P 100 kg ha⁻¹), ME (inoculated maize seeds, fertilization: N 125 kg ha⁻¹), SC (not inoculated sorghum seeds, fertilization: N 120 kg ha⁻¹, P 50 kg ha⁻¹), SE (inoculated sorghum seeds, fertilization: N 60 kg ha⁻¹). For each treatment, 2 plots, 1.5 ha each, were arranged. The forages were harvested as silages, and were used in 2 feeding trials carried out on 32 lactating cows (sorghum) or 40 buffaloes (maize). After 10 d of adaptation to diet, for 6 d milk traits (yield and chemical composition) of each animal were measured, along with determination of dry matter intake (DMI). Data were analyzed using ANOVA for repeated measures, with treatment as factor. A significant improvement ($p < .05$) of biomass yield (Mg ha⁻¹) was found for both experimental maize (76.3 vs 65.7, respectively for ME and MC) and sorghum (46.3 vs 36.1 respectively for SE and SC). SE silage resulted in less ($p < .05$) NDF (39.8 vs 42.0% DM) and more ($p < .05$) crude protein (11.7 vs 9.7) content, but no significant differences between ME and MC could be detected for chemical composition. In similarity, IVDMD was significantly ($p < .05$) higher in SE compared to SC (72.2 vs 70.1), whereas no differences were observed among MC and ME ($p > .05$). For both forages, experimental treatments did not influence IVNDFD ($p > .05$) as well as DMI and milk traits of both buffaloes and cows. The economic benefit analysis showed that experimental managements improved the crop profitability due to increased salable products and to reduced costs of fertilizers. Finally, energy efficiency was improved in experimental crops as a consequence of both reduction of energy inputs from fertilizers and the reduction of energy outputs. Results indicate that combining mycorrhizal inoculation with low rate of fertilizers may help to increase eco-efficiency and profitability in forage production without affecting the feed quality and the livestock productivity.

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Proximate composition and microbiological characterization of fresh mealworms (*Tenebrio molitor* L.)

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The increasing demand for high-quality proteins requests intensive farming of meat and milk animals, thus leading to a strong environmental impact. The exploitation of edible insects as a valuable large-scale, animal-based commodity, can represent a valid alternative due to their richness in high-quality proteins, good lipids, micronutrients, B-group vitamins and fibre. Moreover, insects are very efficient in transforming vegetable into animal biomass compared to ruminants, converting their feeding substrate into proteins of high biological value. In this study, laboratory-reared fresh mealworms larvae, wheatmeal used as feeding substrate and frass (excrements with substrate residues) were analysed for moisture, protein, fat, fibre, Nitrogen Free Extract – NFE, ash, and for microbial counts, according to official methods. For larvae also the energy value was estimated with the Atwater coefficients.

The chemical composition of larvae (% DM) showed protein values 3-4 fold the limit (10g/100g) for labelling a food as "high source of protein". Differently from meat, a modest content of crude fibre was also measured, thus resulting in a potential positive effect in human digestion when mealworms are used as food. Energy content was in agreement with recent values reported in scientific literature, even though the observed slight differences on proximate composition of larvae may be ascribed to the modest protein level of wheatmeal. Regarding microbiological analyses, in wheatmeal a mean (\pm s.d.) load of 5.5 ± 0.4 log colony forming units (cfu)/g was discovered for total mesophilic aerobes (TMA), while viable counts for *Enterobacteriaceae* (ENT) were below detection limit (1 log cfu/g). In fresh larvae the counts of TMA and ENT showed means of 8.3 ± 0.3 and 6.7 ± 0.8 log

Table: Chemical composition (min-max) of wheatmeal, mealworms and their frass (% DM)

	Wheatmeal	<i>T. molitor</i> larvae	Frass
Moisture %	11.00-11.28	60.16-63.86	12.36-13.30
Protein %	15.55-15.62	39.03-44.09	17.81-21.80
Fat %	3.19-3.35	33.96-35.36	1.02-1.86
Fibre %	8.75-9.08	5.76-6.57	17.77-20.67
NFE %	66.77-67.03	11.81-17.40	46.47-51.66
Ash %	5.32-5.34	3.57-4.04	10.52-11.08
Energy kcal/100 g	Not Determined	529-536	Not Determined