

# Sheep productivity in the tropics: Finding the limits by a meta-analytic approach.

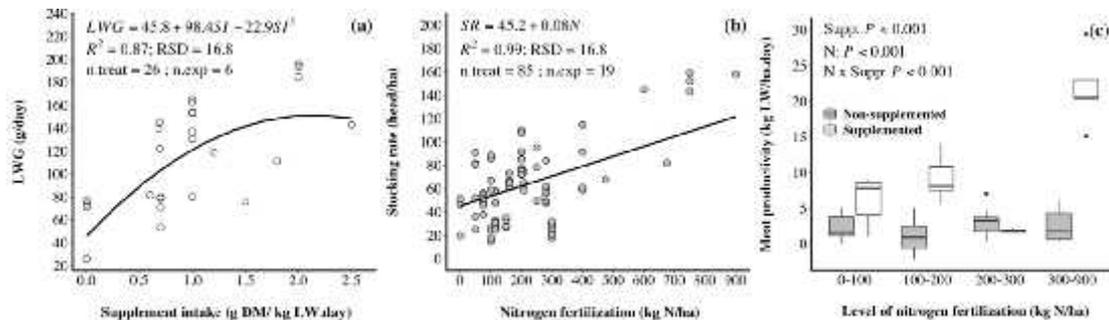
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Small ruminants are an important resource for improving the livelihood of smallholder farmers in tropical livestock systems. However, there is a lack of information in regards to the potential of meat productivity (i.e. kg of liveweight produced per area) of growing sheep in such systems, especially when grazing tropical pastures. The aim of this study was to describe the potential of these systems, and identify and quantify the impact of the main factors associated with the two components of meat productivity: average liveweight gain (LWG) per head and number of animals per area. This was achieved by conducting a meta-analysis of published data of post-weaning sheep growth during the wet-season in tropical climates. The empirical data from published studies were collated in a database with the following parameters: stocking rates, grazing method, fertilizer application, grazing time, pasture biomass, pasture species, pasture nutritive value, type of supplementation, level of supplementation, nutritive value of the supplement, animal genotype, sex, initial and final liveweight, liveweight gain and faecal egg count. For this analysis only grazing studies on growing animals which described stocking rate at LWG were selected. The dataset was coded following the recommendations provided by Sauviant *et al.* (2008) and weighted based on the number of observations. As there was interest in investigating the effects of these management strategies on meat productivity, data were categorised according to the level of nitrogen fertilization and the use or not of supplements. All analyses were performed by specifying a linear mixed effect regression model with study included as a random effect and candidate risk factors included as fixed effects. A backward-step model building process was adopted. The final model that only contained statistically significant main effect terms and, based on Akaike information criterion and conditional and marginal  $R^2$ , considered to best fit the data was selected.

Data from fifteen studies representing seventy treatments contributed to this analysis. The average meat productivity per hectare was 4.7 kg LW/ha.day and ranged from -1.9 up to 29.4 kg LW/ha.day. The level of supplement intake was found to be the main factor associated with LWG through a quadratic relationship. Based on this equation (Figure 1a), the predicted maximum LWG of 151.6g/day was likely to be achieved when supplementing sheep at 2.1 g DM/kg LW.day and in contrast a minimum of 45.8g/day when sheep were not supplemented. A linear association existed between stocking rate and increasing levels of nitrogen fertilization (Figure 1b). In grazing systems where nitrogen fertilizer was not utilised, the mean stocking rate was 39.5 head/ha and increased by 0.1 units per additional kg of nitrogen up to a maximum of 129.5 head/ha when applying 900 kg of N/ha.



**Figure 1.** Effect of supplement intake (Supp) on liveweight gain (LWG) (a), relationship between nitrogen fertilization rate (N) and stocking rate (b) and meat productivity of supplemented and non-supplemented sheep under different levels of nitrogen fertilization (c).

An interaction existed between nitrogen fertilization and supplementation (Figure 1c) with meat productivity increasing with increasing levels of nitrogen fertilisation when sheep were supplemented. However, this association was not observed for non-supplemented sheep. It is possible that high stocking rates, obtained by nitrogen fertilization, would lead to a greater pasture gastrointestinal nematode (GIN) contamination decreasing the LWG of non-supplemented sheep. Supplemented sheep demonstrate a greater resistance and resilience to GIN, and therefore productivity, due to higher nutrient intake when compared to non-supplemented ones (Ceï, *et al* 2018). In tropical grazing systems, the use of supplements and fertilizers have a great potential to increase meat productivity of sheep, however animal performance may be compromised at high stocking rates when GIN burden is not properly addressed.

## References

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Sauviant, D., P. Schmidely, J. J. Daudin and N. R. St-Pierre (2008). *Animal* **2**(8): 1203-1214