Tropentag, September 10-12, 2025, hybrid conference

"Reconcile land system changes
with planetary health"

Agroecological performance of smallholder dairy farms in central Mexico

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Abstract

Our aim was to conduct a multidimensional assessment of agroecological performance of smallholder dairy systems of Mexico and their contributions to food systems sustainability. The survey portion (steps 1 and 2) of the FAO Tool for Agroecological Performance Evaluation (TAPE) was administered to 60 smallholders from the municipality of Aculco, State of Mexico selected through non-probabilistic snowball sampling. The 10 agroecological elements (AE) of TAPE step 1 survey results were subjected to a factor analysis and a cluster analysis that allowed us to create a typology of farm types (groups). The characteristics of each group in regard to the 10 AE, the 10 core criteria of performance (TAPE step 2 variables linked to multiple sustainable development goals) and a set of 15 variables that characterised the household, the farm and its biological diversity (plants, animals, and trees) were compared using non-parametric statistics (Kruskal-Wallis or Games-Howell post-hoc tests) with significance declared at $p < 0.05$. Three factors captured 64.8 % of the variance revealing positive associations for Efficiency, Diversity, Synergy and Recycling (Factor 1), for Culture-&-food traditions, Circular-&-solidarity-economy and Human-&-social values (Factor 2), and for Resilience, Co-creation-&-sharing-of-knowledge, and Responsible governance (Factor 3). Land (2.45 ha), lactating cows (4.25 heads), household characteristics and biological diversity did not differ among the four groups of farms identified by the cluster analysis. However daily milk production per cow (14 vs. 10 kg) and per farm (80 vs. 39 kg) were greater in group 1 (n=12) than the other 3 groups (n=48). All 10 AE were greater in group 1 than either one, two or all three other groups. However, no correlations were detected between milk production performance of the cows or the herd with an aggregate measure of the farm's agroecological performance. In contrast, farms in group 1 had greater scores for indicators of economic performance (income, added values), human health (dietary diversity), youth employment and soil health compared to farms of other groups. This study suggested that greater cow milk performance in smallholder systems, although not correlated with the AE, had positive association with desirable socio-economic, environmental, and human health outcomes.

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Keywords: Factor analysis, food system, México, small-scale dairy, sustainability