Diversified farming systems for improved sustainability of agriculture: potentialities and challenges

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MIX-ENABLE

CORE organic
Diversified farming systems

• “We refer to a farming system as “diversified” when it intentionally includes functional biodiversity at multiple spatial and/or temporal scales, through practices developed via traditional and/or agroecological scientific knowledge. Farmers manage this functional biodiversity to generate critical ecosystem services to agriculture” (Kremen et al., 2012)
Diversified farming systems to solve the problems of modern agriculture

To Specialize or Diversify: Agricultural Diversity and Poverty Dynamics in Ethiopia

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Summary. — Recent agricultural development policies have begun to shift focus from the promotion of a few staple crops toward encouraging crop diversity. The belief is that crop diversification is an effective strategy for dealing with a variety of issues, including poverty alleviation. However, there is a lack of empirical evidence to justify these positions. We contribute to filling this research gap by providing quantitative evidence on the impact of diversity in crop cultivation on household poverty. Using household panel data from Ethiopia, we develop a diversity index to measure the effect of crop diversity on poverty status. To control for endogeneity and selection bias resulting from unobserved heterogeneity, we utilize a recently developed parametric method for estimating dynamic binary response models with endogenous contemporaneous regressors. Our results provide evidence that households which grow a diverse set of crops are less likely to be poor than households that specialize in their crop production. Additionally, crop diversity reduces the probability that a non-poor household will fall into poverty and the probability that a poor household will remain in poverty. We conclude that crop diversification is a viable way to deal with the exigencies of being poor.

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Key words — crop diversity, poverty, control function approach, dynamic binary response models, rural Ethiopia

The role of agricultural biochange: towards an analyti

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Multi-species livestock farming (MSLF)

- Keeping two or more animal species or breeds (e.g. dairy cattle and beef cattle) simultaneously on the same farm is a diversification option that has received little attention to date.

- Most studies of MSLF are
  - partial (e.g. deal only with grazing management)
  - focus on specific dimensions of farm sustainability (e.g. parasite management)
  - and address low organizational levels (i.e. within the farm)

- Holistic assessment of potential benefits of MSLF for farm sustainability is lacking
Objectives

• We synthesized potential benefits and limitations of MSLF for farm sustainability from existing literature and listed research challenges related to it.

Source: TECA, FAO
Benefits and limitations for farm sustainability

No empirical study
It may imply a higher total workload and management complexity for the farmer (Kingwell, 2011)
Yet the actual workload per worker may not increase if diversification is accompanied by reorganization of work and/or by improved management of production processes (Darnhofer et al., 2010; Hostiou, 2013).

Dietary overlap between sheep and cattle remains low unless forage availability becomes too low (Walker, 1994)
Herbage-use efficiency increased: herbage intake was 9-10 t DM/ha when co-grazing heifers and sows vs. 5.7-8.8 t DM/ha when mono-grazing (Sehested et al., 2004)

A way to mitigate risks (Bowman and Zilberman, 2013) that can both increase mean profit and decrease profit variability (Diakite et al., 2019)
Farmers may perform less well when managing more complex systems

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Achievement of potential benefits very much depends on the management practices implemented e.g.
- An appropriate stocking rate at grazing
- A relevant combination of livestock species

ADG per ha in mixed grazing was higher by 28.6% compared with sheep alone and by 25.1% compared with cattle alone (d’Alexis et al., 2014)

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Characterize better farm management in MSLF

- The management dimension is often poorly understood
- This is a central dimension for scaling-up MSLF
Explore further the complementarity of livestock species

- Maladaptiveness of some species combinations ➔ dietary overlap, parasite susceptibility or disease transfer among species
- Systems analysis of usual combinations (e.g. cattle-sheep) are lacking
- Some species combinations remain largely ignored, mainly those of ruminants and monogastrics

Adapted from Hinsinger et al. (2011)
Assess and explain the sustainability of MSLF

- A holistic assessment is essential to develop consistent recommendations for improving MSLF
- Sustainability assessment methods are already available in the literature: SAFA (FAO, 2013), IDEA (Zham et al., 2008; 2019) and RISE (HAFL, 2014)...
- Most of these methods build on assumptions about farm sustainability and practices
- These assumptions need to be reconsidered, since it is currently unknown whether they apply to MSLF
- Modeling developments are needed to simulate different livestock species in one farming system, especially species previously overlooked (e.g. goats, broilers).
Characterize conditions for success of and obstacles to MSLF

- Lock-ins occur when relationships among environments, organizations, technologies, knowledge and values create strong interdependencies among stakeholders in a sector (Kallis and Norgaard, 2010).
- Lock-ins apply at all levels of agricultural products, from production to consumption.
- Characterizing conditions for success of and obstacles to multi-species livestock farming is a precondition to its wider development.
- Socio-technical analysis will identify stakeholders active along the value chain, their respective objectives, work habits and constraints.
- Increasing understanding should help prioritize actions and organize them into pathways toward diversification of livestock farms.
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