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“Bridging the gap between increasing knowledge and decreasing resources”

Can Science Contribute to Smallholder Management of Complex Systems? Lessons from Agroecological Intensification of Multi-Strata Coffee with Banana

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Abstract

Banana intercropped in multi-strata coffee agroforestry, a technology developed by farmers, offers multiple livelihood benefits – a monthly income, a shade component easy to establish and manage, and food security. More than a million smallholder households associate bananas in their coffee fields, in spite of countervailing technical recommendations. Between 2009–2013, with financing from GIZ, scientists and groups of farmer experimenters in seven zones of Honduras, Nicaragua, Costa Rica and Peru collaborated to develop approaches to improve the productivity and value of banana as part of the agroecological intensification of their shaded coffee. Growers and scientists diagnosed the structure and function of the tree-bananas-coffee association, providing the basis for a work agenda which was implemented over three experimentation cycles. Five agroecosystem-based decision tools to intensification resulted – optimisation of light resource partitioning among trees, banana and coffee; macronutrient input-output analysis, including nitrogen contribution of leguminous trees; banana bunch, stem and mat management; landscape, farm and plot management of *Fusarium* wilt to reduce impact on Gros Michel, the preferred market banana; and strategies for increased banana prices and margins. The process of prototype development bringing together seven grower groups, advanced institute and local banana and coffee scientists and German and Latin American students was analysed to identify lessons for the contribution of science to farm household management of the complex field and farm coffee agroforestry-based agroecosystem. First, iterative, adaptive learning approaches should focus on first-generation prototypes which guide improved decision making while also building capacity for the ongoing generation of more dynamic, improved prototypes. Second, complementary frameworks drawn from agroecosystems, gender- and generational-based livelihoods, and small business should be integrated into the experimentation process. Third, analysis should be grounded in linkages between farm decision-making and neighbouring farms, the local territory and the institutional and innovation

system. Fourth, stakeholder participatory processes should be enriched with results of formal studies, conceptual and quantitative model building and visioning exercises. Finally, complexity should be addressed through scenario building under variable and uncertain futures resulting from different combinations of climate change, prices for commodities, energy and inputs and investments in social capital, governance and innovation.

Keywords: Agroecological intensification, banana, coffee agroforestry, complex systems, participatory experimentation