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Modelling Interventions to Transform Cassava-based Production Systems through Applying Agroecological Principles: a Study from Zambia

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Abstract

The question of whether food system. based on agroecological principles can nourish the world is becoming increasingly relevant. There is no doubt that conventional system. reach their limits and that systems dependent on external inputs are hardly practicable for developing countries. Moreover, dependence on a few varieties affects agrobiodiversity and reinforces the problem of vulnerability and risks in times of climate change. Sub-Saharan Africa in particular, the focal point of global hunger, needs a pathway to food sovereignty. We apply our analysis to Zambia, which suffers from alarming hunger levels. Our study is based on a research project funded by the Federal Ministry of Food and Agriculture. We developed a mathematical programming model representing a four-hectare demonstration farm implemented in a remote village in northern Zambia. Objectives of the study are (1) to investigate the economic value of the diversified agricultural system, (2) to assess the nutritional contribution of the improved food system and (3) to identify limiting factors and options for transforming the cassava-dominated production towards an agroecological system. The model consists of four components: crop production, livestock, fish farming and forestry. Components represent different project interventions, and the mathematical model captures linkages existing on the demonstration farm. The model covers a time period of 10 years, and the objective function maximises the system's net production value subject to limited availability of the production factors labour, land and capital. Our analysis is based on 250 household surveys, six interviews with local government officials and farmer feedbacks on project investments. Preliminary results show that (1) net production values from the diversified system are continuously increasing. Initially, cattle keeping is the main contributor, which over time is replaced by rising returns from the tree nursery. (2) Nutritional values through the integration of fish farming, vegetable and fruit production improve significantly. (3) Rising marginal values for limiting factors reveal the contribution of investments in system improvements. The model requires interdisciplinary and transdisciplinary research. However, reliable cooperation between farmers, local decision-makers and scientists is crucial for sound planning to support the transition to an agroecological system and its adoption.

Keywords: Agricultural Transition, Demonstration Farm, Diversification, Mathematical Planning Model, Sustainable Food System

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