WORLD CONGRESS ON AGROFORESTRY
DELHI - 2014

Vigyan Bhavan & Kempinski Ambience

10 - 14 February 2014 Delhi, India

Coffee and climate change: the importance of systems thinking

Coffee and climate change: the importance of systems thinking

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Studies around the world have shown that climate change will have a massive negative impact on coffee production. East-Africa will not be the exception. In this study, we want to show how a systems approach in agricultural research is necessary in order to adapt coffee systems sustainably to climate change. To develop sustainable climate-smart practices, it is not only necessary to consider processes at the plot level, but also need to take into consideration the adoption drivers and trade-offs at household, landscape and institutional levels. We will illustrate this by studies on coffee systems in Uganda. In Uganda, coffee is one of the largest export products, generating some 20%-30% of the foreign exchange earnings. Robusta accounts for about 70-80% and Arabica 20-30% of the export volumes of Uganda. To understand broadly the extend to which climate change will have an impact on Arabica and Robusta growing regions in Uganda, maps depicting the suitability changes of Arabica and Robusta due to climate change were developed using the MAXENT approach. This allowed us to focus on regions that were most in need of adaptation measures. In these areas, data was collected at field and household level by conducting surveys. At field level, data analysis showed that climate change did not only have on the crop physiology but also on the pest and disease dynamics. Furthermore, by measuring yields and pests and disease incidence along an altitude gradient, future production and pest/disease trends could be predicted following the climate analogue principle. We found that some pests and diseases are likely to expand strongly in the future, but effects will be source and site specific. Farmer interviews confirmed findings concluded from field measurements. Farmers but also other coffee stakeholders largely put shade forward as a good adaptation measure. The selection of the shade type and shade density is a function of managing the competition for light, water and nutrients on the one hand and accounting for the benefits generated by the shade plants on the other hand. Competition can be reduced by applying nutrient inputs

or irrigation. For this purpose, we developed site-specific fertilizer recommendations. Shade plants can also affect the incidence of specific pests and diseases. We observed that the incidence of Black Coffee Twig Borer would increase significantly under shade, particularly under Albezia spp, much higher incidence rates of twig borer damage was recorded. Although farmers recognize the constraints and opportunities of using shade as an adaptation strategy in their coffee systems, they explained the lack of access to existing knowledge but also to input markets that made it impossible for them to successfully adopt shade as a sustainable innovation. Furthermore, adopting new technologies like shade requires household members to prioritize their resource investments. Shade plants like bananas can provide food and income benefits in the short term (<1.5 years), whereas most shade trees would take 3-5 years before providing any benefits. Meanwhile, most private and public organizations are recommending this tree species through uncoordinated initiatives without taking into consideration that certain tree species can increase pest and disease incidence. Our work shows there is a strong need for an integrated approach to climate change adaptation, requiring improved understanding and linking of drivers and actors at household and institutional level.

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