RESEARCH PROGRAM ON Water, Land and Ecosystems

CGIAR

Led by: IWMI International Water Management Institute

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Highlights

- Growing different varieties of the same crop together consistently shows decreased variance* of pest and disease damage
- Using diversity as a pest control method is an economically viable option for smallholder farmers
- Using less chemical inputs benefits the environment and public health, and may improve other ecosystem services such as pollination

Using agricultural biodiversity for pest and disease management

Overview of an ecosystem service approach

Pests and diseases are part of any ecosystem. In agricultural ecosystems, farmers can use different methods to control pests and diseases and cope with their effects on crops. Besides using pesticides and other chemical inputs, many farmers use other more ecological methods such as creating physical barriers or introducing natural enemies to their farms. To date, however, little research has been done on understanding the role that agricultural biodiversity could play in pest and disease management.

Since 2007, Bioversity International and partners have been working with farmers in China, Ecuador, Morocco and Uganda, to see whether and how using diversity within a crop, can add value to the array of pest management options that already exist. The research focuses on six crops: banana, barley, common bean, faba bean, maize and rice, and looks specifically at pests and diseases that affect these crops in the given countries. In order to identify the different resistance that varieties of these crops have to specific pests and diseases, scientists conducted focus groups, household surveys and field observations, alongside trials in research stations and greenhouses. In Uganda, for example, more than 60 varieties of common bean grown by farmers were observed and documented for their resistance to diseases such as Angular Leaf Spot, Anthracnose and pests such as bean fly. Scientists are currently experimenting with different mixtures of these varieties to see if certain combinations prove to be more effective in controlling pests and diseases. Awareness raising materials have also been developed and shared with farmers and extension workers.

*Low variance refers to a low spread of pest and disease damage index within a community.

Findings – Diversity ↑ Damage ↓

An important result consistent across countries and crops, is that growing more varieties of the same crop within the farm, leads to a decreased variance of pest and disease damage. This means that even though certain pests and diseases might affect crops on a farm, overall, the risk of having a severe infection or pest outbreak is lower, e.g. they might just have a few spots, lesions or bites. These results suggest that crop genetic diversity has the potential to curb epidemics and outbreaks to save farmers from high yield losses. It also demonstrates an overall more resilient system, where crops are unlikely to suffer significant damage when and if a new pest or disease comes around.

Agricultural biodiversity is an economically viable and accessible option for smallholder farmers who may not be able to afford chemical inputs. Other knock-on benefits to using less pesticide include better public and environmental health, and hence the better delivery of other ecosystem services such as pollination. Using diversity for pest and disease management also encourages farmers to maintain local diversity on their farms, an important source of genetic material that could be used for breeding resistant varieties in the future.

It is important to note that farmers need to proactively manage their crops and varieties to safeguard against pest and diseases. Diversity should be used as a complementary tool to other methods, such as seed cleaning, selective breeding and increasing distance between plants, so that this ecosystem service can be put to its best use.

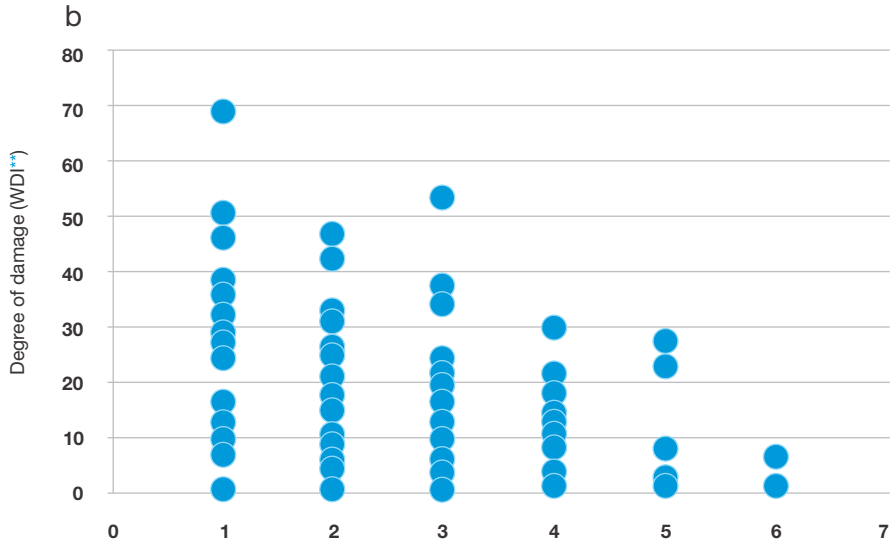

Fig.1 Relationship between the number of varieties being grown in a plot and the degree of damage from Anthracnose fungi, Uganda. (Adapted from J.W. Mutumba et at., 2012)

Main partners

Bioversity International

Yunnan Agricultural University

Instituto Nacional Autónomo de Investigaciones Agropecuarias

Institute of Agronomy and Veterinary Medicine Hassan II

National Agricultural Research Organization

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References and links

Mulumba J.W., Nankya, R., Adokorach, J., Kiwuka, C., Fadda, C., De Santis, P. and Jarvis, D.I. (2012) A risk-minimizing argument for traditional crop varietal diversity use to reduce pest and disease damage in agricultural ecosystems of Uganda. Agriculture, Ecosystems & Environment Vol. 157: pp.70-86.

Jarvis, D.I., Padoch, C. and Cooper, H.D. (2007) Managing Biodiversity in Agricultural Ecosystems. New York: Columbia University Press.

Platform for Agrobiodiversity Research. (2010) "Crop Biodiversity: To Reduce Pest and Disease Damage." http://agrobiodiversityplatform.org/cropbiodiversity/

**Weight Damage Index