Rikolto and agrobiodiversity

Policies and practices to enhance biodiversity and the functioning of agricultural ecosystems

FAO (2010) describes "agricultural biodiversity" as all the components of biological diversity of relevance to food and agriculture and the agro-ecosystem: the variety and variability of animals, plants and micro-organisms, at the genetic, species and ecosystem levels, that sustain the functions, structure and processes of the agro-ecosystem.

Position of Rikolto

Agrobiodiversity plays a crucial role in maintaining and increasing agricultural productivity, while improving sustainability and increasing resilience. Therefore, improved agrobiodiversity (1) allows farmers to better respond to future challenges (e.g. climate change), (2) has higher value for society in terms of ecosystem services provided and (3) has a positive impact on food security. This diversity has been maintained by farmers and communities for millennia and remains a key element of the livelihood strategies of small-scale farmers around the world.

It is a policy imperative to ensure conservation of the genetic diversity of important crops, and to ensure their accessibility for small-scale farmers. Farmers should not become dependent on expensive seeds or planting material from private companies. For small-scale farmers, this independence is important to secure healthy working and living conditions. Policies could enhance this by stimulating research and breeding by institutions that guarantee farmers free access to genetic material. Furthermore, regulations may be needed to guarantee such access.

In line with this, we are reluctant to endorse the development of GMOs (even more so when they are developed by private companies), because huge investment is required to produce a specific seed. In order to cover the investment costs, the seeds are distributed over very large areas, which strongly reduces genetic diversity on agricultural land. Rikolto's broader position on GMOs is presented here.

In-situ use/conservation is an important element contributing to the preservation and dynamics of diversity.

Implications for our work

Rikolto promotes the following agricultural practices that the FAO (2014, pp. 97-98) indicated as being able to improve the biodiversity and functioning of agricultural ecosystems and increase the returns on investment for the neighbourhood in ecosystem services:

- Changing land cover and land use to more structurally complex and species-diverse systems such as agroforestry, mixed crop-livestock systems, intercropping, perennials, forest gardens, etc.;

In **Ecuador and Peru**, Rikolto promotes agroforestry practices for cocoa and coffee production. For example, selecting and planting certain legume species at appropriate times stores nitrogen in the soil for years to come. Another practice involves planting the ideal species of trees in forests naturally designed for that particular area and its climate. In **Vietnam**, Rikolto is coordinating one of the Rainforest Alliance's projects in Asia: "Sustainable Management of Tea Landscapes". Here, small-scale tea farmers are taught practices for managing soil erosion, soil fertility, soil quality, water, biodiversity, weeds, etc. The farms are landscaped by intercropping young tea and by planting hedgerows, shade trees (Indigofera or Cassia) and cover crops.

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Photo: Tim De Weerdt

The soil is also covered with mulch and weeds are efficiently controlled. Newly established compost mounds serve as a natural fertiliser for the farms.

- The use of ecological approaches in tillage, soil fertility and disease, pest and weed control (e.g. trap cropping), integrated pest management, integrated weed management, management of pollination, etc.;

In Nicaragua and Honduras, Rikolto is introducing an Integrated Pest Management (IPM) approach to promote agrobiodiversity. Vegetable, coffee and cocoa plots are redesigned with natural barriers and intercropping. In collaboration with Zamorano, Rikolto is developing online tools and an app for IPM.
In the production of coffee, cocoa and vegetables in **Peru and Ecuador**, Rikolto encourages minimal use of inputs through IPM, fertilisation plans, the implementation of internal control systems on the farms and the use of IT. In **Vietnam**, Rikolto supports small-scale farmers as they implement organic farming practices compliant with the Participatory Guarantee System (PGS) Organic standard for Vietnam. This involves applying organic compost, planting pest-repelling plants and using home-made organic pesticides containing garlic, chilli, ginger and wine.

- The implementation of diversity-enhancing crop and grassland management practices (e.g. diverse crop rotation) such as late and/or staggered mowing, not using synthetic herbicides, the maintenance of wildflower strips and ecological infrastructures (e.g. stone and wood heaps, trees and hedgerows);
- The creation and maintenance of habitat networks that facilitate exchange between populations;
- Longer crop rotations, including nitrogen-fixing species;

Rikolto has introduced agroforestry practices, such as intercropping agricultural crops and trees, on coffee and rice farms in collaboration with WWF **in the Democratic Republic of Congo.** The tree species selected (Grevilea Robusta and Cedrela) have three key attributes: they fix atmospheric nitrogen in the soil, they produce significant biomass and they have a high energy potential (when burned). Local people can get timber from these trees 10 years after planting. In other words, the trees have appreciable economic value and can complement the income earned by farmers. In North Kivu, for example, these tree species are introduced in rain-fed rice plots.

- The coverage of bare ground and other soil protection measures;

Rikolto encourages farmers **in Ecuador and Peru** to adopt four practices that help protect their farmland soil: the use of natural barriers for the benefit of their land, the planting of cover crops, the incorporation of organic matter from recycling crop residues, and crop management of coffee and cocoa in agroforestry systems.
As part of the Rainforest Alliance's project "Sustainable Management of Tea Landscapes" **in Vietnam**, Rikolto supports small-scale tea farmers in applying the Sustainable Agriculture Standard. As part of the standard, farmers must implement a "Soil Erosion Prevention and Control Programme" that counteracts existing and future erosion. New agricultural production sites have to be located in areas with climatic, soil and topographic conditions suitable for a farm's planned intensity of production. Additionally, farms need to have a soil or crop fertilisation programme and to expand their use of vegetative ground cover. Finally, Rikolto also promotes the use of fallow areas.

In general, Rikolto does not encourage the following practices (in line with FAO (2014), pp. 97-98):

- Large areas of monoculture cultivation;
- High external input livestock/aquaculture systems (e.g. stocking densities that exceed the local carrying capacity by a factor of 2 or more);
- Strong reliance on off-farm synthetic inputs for both fertilisers and pesticides and/or complete

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reliance on off-farm feed. (We do recognise that in some locations and for some products, they are essential for increased productivity and more efficient use of agricultural land)

Concerning agricultural production destined for local markets, Rikolto promotes the use of local varieties (native varieties rather than hybrids). In practice, the use of local varieties is not always an option for farmers, as their customers may demand strictly uniform products that can only be obtained from homogeneous seeds (selected hybrids). When Rikolto supports farmers' organisations that sell to "modern markets", it may/will still be necessary to provide homogeneous seeds.

Facts and Figures

Agrobiodiversity increases "resilience" and "ecosystem services":

According to the FAO (2010, p. 51), agricultural production practices/systems need to continue to increase productivity, while improving sustainability and simultaneously responding to future challenges like climate change. There is sufficient evidence that agriculture can meet this challenge. Biodiversity for food and agriculture will play an essential part in this process. Agrobiodiversity contributes to improved soil formation, erosion control, nutrient cycling, pest and disease control, nutrient and water availability, water purification, pollination, regulation of the local and global climate, increased yields and the production of food with better nutritional content. It also contributes to beautiful landscapes (D'haene et al., 2010; FAO, 2014).

Agrobiodiversity at different scales

A broad landscape approach is critical to ensure the effective conservation or improvement of complex ecosystems, including those with agricultural and/or forest components (FAO, 2013, p. 97). Many ecosystem services, such as biological pest control and pollination services, depend on the movement of organisms across the agricultural landscape (FAO, 2013).

An interdisciplinary network of European scientists advocate diversity at all levels of the agricultural system: from soil micro-organisms to plant varieties and cropping systems. This appears to be the only way to ensure the scale of system resilience needed to address many concerns (Østergård et al., 2009).

Food security

In general, the lower the diversity of the food system, the more vulnerable it is to potential threats due to a higher expected impact and a lower resilience against threats. In other words, less diversity means higher risks for food security.

In the past 60 years, 51 out of 52 measured crop commodities increased in geographical distribution. On the one hand, this may be considered to be an improvement from the point of view of food security at local level (on average) (Khoury et al., 2014). On the other hand, national food supplies worldwide became more similar in terms of their composition. There is an increase in homogeneity worldwide and higher interdependence among countries with regard to the availability of and access to these food sources and the genetic resources supporting their production.

- Khoury et al. (2014) estimate that 90% of calories, protein, fat and food weight around the world are provided by 50 crop commodities, composed of 94 crop species.
- The demand for uniformity (e.g. by retailers) or for a superior variety may lead to the prominent use of a single variety where multiple varieties were previously produced and sold on local markets (Van Gossum et al., 2014).
- Loss of diversity occurs at the time of the shift away from country-specific and farmers' varieties towards modern varieties (e.g. Reif et al., 2005; Roussel et al., 2004). This loss might be the major component of genetic erosion, threatening both the sustainability of agricultural production and the raw materials for future plant breeding.
- In the past, genetic uniformity of crops has led to several devastating attacks of pests and diseases (Van de Wouw et al., 2010). Well-known examples are the potato blight epidemic in Ireland in the 1840s, and the corn leaf blight that devastated maize production in the USA

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in the 1970s (Lopez, 1994). Moreover, in terms of world banana production, genetic uniformity has led to the decline of the variety "Gros Michel" and is now threatening the globally spread "Cavendish" variety. The past 150 years have been marked by the declining number and diversity of actors engaged in the collection and management of genetic resources (IAASTD, 2009, pp. 87-98). The increased dominance of large multinational seed companies in breeding is expected to lead to diversity reduction on a global scale if increasingly similar cultivars are released in different regions (Van de Wouw et al., 2010).

- In many countries, NGOs play a very important role at the farm and community level in promoting and supporting the conservation and management of plant genetic resources for food and agriculture (FAO, 2011, p.126; De Boef et al., 2012).

Good practices

Many agricultural practices can improve ecosystem services (D'haene et al., 2010; FAO, 2014). A substantial change in approach is needed, however, to ensure that agricultural biodiversity can fulfil its full potential. One key approach lies in engaging not only consumers, but all stakeholders in the agricultural and food industries. The approaches required will be particularly concerned with supporting small-scale farmers and ensuring effective ecosystem functions and diversity deployment at the landscape level (FAO, 2010).

- Agro-ecological farming practices, e.g. organic farming, enhance agrobiodiversity. A review of 76 studies on organic farming clearly illustrates that species richness across a wide range of taxa tends to be higher on organic than on conventional farms. The main reasons are (1) the prohibition of chemical pesticides and inorganic fertilisers, (2) the sympathetic management of non-crop habitats and field margins and (3) the preservation of mixed farming (Hole et al., 2005).
- Production practices strongly based on external inputs need to be altered (e.g. chemical fertilisers, pesticides, herbicides and water for crop production and artificial feeds, supplements and antibiotics for livestock, and aquaculture production). These are not sustainable, damage the environment, lead to reduced function of essential ecosystem services, result in the loss of biodiversity, and undermine the nutritional and health value of foods (MEA, 2005; FAO, 2009; FAO, 2010).
- Decline in soil fertility and biodiversity are likely to increase the farmers' dependence on high inputs of mineral fertilisers and pesticides to maintain crop yields (Østergård et al., 2009).

Footnotes

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