

Soils – the roots of agroecology and family farming

Healthy soils contribute to resilient food production. Soil carbon is a key to healthy soils but, today we see the long-term consequences of agricultural management that has neglected soil carbon – degraded soils, polluted waters, and unprecedented rates of hunger and malnutrition. There are good examples of agroecological practices that were developed by farmers who have long known the importance of soil carbon. Yet, in many cases these practices are being re-learnt, adapted and new practices are being developed to reconnect with the soil and rebuild soil carbon. This issue of Farming Matters explores and celebrates such old and new practices for living soils.

ILEIA Team

"Soils constitute the foundation for agricultural development, essential ecosystem functions and food security and hence are key to sustaining life on Earth." With these words, the General Assembly of the United Nations declared 2015 the International Year of Soils (IYS). This turns our attention to a crucial resource that sustains farming, and life, but which has been very much neglected in dominant agricultural thinking and doing. But reviving soils and building our collective knowledge on soil health can only be effective if carried out in close collaboration with the 500 million farming families who are important custodians of the world's soil. The IYS therefore builds rather seamlessly on the 2014 International Year of Family Farming.

Healthy soils contribute greatly to more resilient farming systems and the livelihoods of farming communities. And soil organic matter is key, and thus the cornerstone for sustainable food production everywhere. Most family farmers have always known this. They have developed successful agroecological strategies to increase organic matter in their soils using fallows, extended fallows, cover crops, green manures,

Photo: Francisco Nogueira



mulch, and the incorporation of these, and crop residues and compost, into their living soils. Traditional and innovative examples of these are presented in this issue of *Farming Matters*.

Healthy soils Soil health, understood as the continued capacity of soil to function as a vital living system, is essential in maintaining plant, animal, and human health. Key to soil health and soil fertility is organic matter. Although this is known, degraded soils worldwide highlight the seriousness of the gap between theory and practice. Sole addition of chemical fertilizers to soils, without also adding organic matter is part of the problem, as also explained by Roland Bunch on page 43. Re-balancing this situation requires renewed emphasis on organic matter, which means current constraints must be overcome – from local shortages of biomass to lost knowledge and oversimplified systems.

Why did we forget about this?

Before the 1940s, organic matter was a key theme at international soil conferences. There is an almost forgotten wealth of knowledge based on very practical research on the value and management of organic matter (see page 32). This was agroecology before the term was coined. But things changed after the Second World War. Organic matter became neglected, and not by accident. The process of artificially producing



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nitrogen was originally developed for the explosives industry, but then the resulting chemical was also applied in agriculture when it was made into ‘fertilizer’. The impact on maize yields was so dramatic that researchers and policy makers became convinced that chemical fertilizer could solve global hunger.

With this new emphasis on chemical fertilizers, world renowned researchers working on soil organic matter were systematically neglected. Scientific journals were no longer interested in publishing their research, and they were no longer invited to international conferences. Subsequently, the importance of soil organic matter also dropped off agricultural curricula and from policy, extension and investment agendas. Under the influence of the economic and

Soil organic matter is ‘black gold’

Soil organic matter is made up of a wide variety of living and dead plant and animal material. In agriculture, this can range from leaf mulch to manure and compost. This ‘black gold’ is a basic building block of soil life that supports plants to grow and thrive. It is important in several ways, mainly by enhancing soil life and increasing the water and nutrient holding capacity. How does that work?

The key component in organic matter is carbon. The process of ‘decay’ of organic matter is in fact a result of it being ‘consumed’ as a food by the multitude of organisms in the soils, who then transfer this carbon into their own tissues or excrete it in other forms. These organisms range from millions of different species of fungi and bacteria, and insects and other arthropods, from the microscopic to larger creatures like earthworms that we know well. This process also causes the breaking down and recombination of a range of

compounds into forms that can be more readily absorbed by plant roots. This forms a part of the process that in soil science is called mineralisation. It is key in nutrient cycling processes that help soils to produce healthy crops. Soil life also forms symbiotic relationships with plant roots, nitrogen is fixed and provided to plants in exchange for sugars, and nutrients such as phosphorus are solubilised for uptake by crops.

Building up soil organic matter also plays a second role: in climate change mitigation. The more carbon that is incorporated in soils, as part of organic matter, the more CO₂ that is fixed. In short, soil organic matter improves soil structure, drainage and aeration; increases water and nutrient storage capacity; increases the activity and number of soil microorganisms and encourages macrofauna, such as earthworms and termites, which loosen soil and improves soil structure even further.

political power of the chemical industry, new crop varieties and production methods that required large quantities of fertilizer were promoted. Slowly then, this belief, pushed by industry, narrowed the view of researchers, education, policy makers and extension staff and became the norm. Chemical fertilizers were so much easier to apply a few bags of fertilizers than the bulky organic matter that also demanded mixed farming. And, the trend towards simplification, away from mixed farming and specialising in either livestock or crops, gave further currency to this narrow approach to soil fertility management. Agroecological methods for building and maintaining a healthy, living and resilient soil were largely forgotten.

The consequences With the use of chemical fertilizers and new varieties, crop yields increased, especially so in some parts of the world. But now, many farmers are experiencing diminishing returns per unit of fertilizer, needing to apply more and more each season (see 'Keeping composting simple' on page 18). This is largely due to the lack of soil organic matter and thus the soil's lost capacity to sustain soil life and retain water and nutrients. Pollution from excess nutrients and eroded soil particles entering waterways are additional long-term consequences of this historical mismanagement.

And, was hunger eliminated, or even reduced, in the process? The total food production per capita increased but there are more hungry and malnourished people today than ever in the history of humanity. This shows that hunger is a distribution problem rather than a production problem. There is food enough for all but it does not reach the poorest, while it's estimated that about one third of all food produced worldwide is lost or wasted.

With the globalisation of our food systems, we are also confronting a growing global imbalance. Nutrients are mined from the soil in one part of the world, and exported in the form of crops to other parts, leading to problems on both sides, as explained by Irene Cardoso on page 28.

So, it is high time that we look in another direction to reverse this situation of soil degradation. We need to look towards practices that will remain affordable and productive for generations to come and that do not demand ever increasing amounts of non-renewable resources.

Soils and agroecology Faced with ever degrading soils many family farmers have devised new or reinvented traditional practices to restore and improve their soils – and with success. Agroecological practices help counter soil degradation and increase farmers' resilience and autonomy. This issue of *Farming Matters* presents the experiences of farmers



Photo: Aspen Edge

who are working successfully, together with others, to improve the health of their soil and their lives.

Farmers have been developing agroecological practices for time immemorial. But, worldwide, and as Rita Uwaka points out on page 9, many farmers and particularly youth may need to re-learn the lost language of the soil. On page 34 Alejandro Bonifacio describes traditional fallow systems that farmers in the southern altiplano of Bolivia are working to preserve.

Jonathon Smith (page 10) describes a growing network of carbon farmers in the UK who are developing and sharing knowledge on healthy soils and, influencing policy makers in the process. Sara Delaney (page 22) shows how experiments with agroecological practices are long-term investments in healthy soils but also in healthy communities.

The agroecological practices presented on these pages are all built from the ground up and based on farmers' knowledge. This cannot be underestimated, and should be valued more by society at large and especially by scientists. Georges Félix (page 14) explains how recommendations to mulch with crop residues often lead to trade-offs between feeding livestock and covering the soil, but that farmers come up with innovative solutions to deal with such dilemmas. Pablo Tiltonell, *Farming Matters'* new columnist for 2015, explains why scientists need to listen to farmers and highlights that healthy soils are teeming with life that we need to better understand.

The experiences presented here provide a taste of encouraging initiatives that are unfolding across the world. This issue of *Farming Matters* shows that careful soil management practices developed over many years offer revealing insights into improving soil health. And the benefits are both local – food security and resilience for farming communities – and global – with contributions to climate change adaptation and mitigation. With agroecology we can build soils for life!