Putting Local Communities (Back) at the Heart of Knowledge Production

A Study of a Biostimulant Derived From Fermented Forest Litter

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Background

Fermented forest litter (referred to as '*lifofer*') is a biostimulant used by farmers across several regions in the Global South (Southeast Asia and Latin America) to enhance food crop performance through germination, plant growth, and biological control of certain fungi. It may also serve as a probiotic in animal husbandry, for building sanitation or draining soils. The Institut Méditerranéen de Biodiversité et d'Écologie (IMBE), via its Terre et Humanisme (T&H) network, has championed the reappropriation of lifofer, an agent scarcely recognised by farmers and largely underresearched in France, Europe, and Africa. IMBE has also benefited from farmers' knowledge to adjust its research and better answer the agricultural field's questions about the use of lifofer.

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Description of the Research and System

T&H and IRD first answered calls for projects to set up laboratory research at IMBE and establish an experimental farmer network through T&H, initially located in the Auvergne-Rhône-Alps region, which involved not only farmers but also independent experts in biofertilisation and agronomics as well as a start-up, all drawn from diverse agricultural sectors such as market gardening, large-scale crops (vineyard), and arboriculture. The group has met twice a year since 2021, tasked with developing lifofer (fermented forest litter) application protocols tailored to various crops, establishing metrics to gauge its impact and addressing producers' questions. For example, at the request of this panel of stakeholders, IRD studied how oxygen or the type of forest litter could influence the production of the solid starter culture. Laboratory studies have helped address doubts about preparing the liquid starter culture: addition of whey, fermentation temperature, storage time for the solid starter culture. Thus, through the exchange of knowledge and practices between science and farmers' experiential know-how, this multi-stakeholder network has helped lifofer to be reclaimed, from the field plot to the laboratory analysis of its scientific validity, and improved, to respond to new contexts of use based on the questions raised by local farmers. Thanks to T&H, the use of lifofer has spread, producing reference farmers, fostering a collaborative network that shares findings and inquiries, and organising specialised work groups in fields such as arboriculture, horticulture, and beyond. The lifofer network now covers a good portion of the country. This mode of co-construction facilitates a genuine exchange between experiential knowledge and scientific insight within the laboratory, in intermediary spaces, and directly on the plots themselves. IRD subsequently presented this model to several partners in the Global South, namely the Indio Hatuey experimental station in Cuba, Ki-Zerbo University in Ouagadougou, and the University of Tunis. The proposal was supported by both public actors (France Agrimer, the French embassy in Cuba) and private stakeholders (the Fondation de France).

The Participatory Research Tools Mobilised

The diverse intermediary spaces instituted by T&H were pivotal to the co-construction of this programme. These include communication tools such as creating an online space (Omnispace) where each experimenter/farmer could post their observations and questions, writing the quarterly lifofer newsletter, drafting a guide, taking part in international events (European Agroecology Forum), or organising meetings with potential professional partners (leaders of organic viticulture). Spaces designed to stimulate knowledge co-production within the multi-actor network were also set up, such as targeted seminars on a particular sector (e.g. arboriculture), or focused on lifofer (including the biannual network meetings).

The Results and Effects Achieved Through the Research

These seminars were well-suited to face-to-face interactions, allowing IRD and AMU researchers and the network's experimental farmers to share their expertise and produce new

knowledge together. Network members were guided through the experimental process and introduced to foundational microbiology concepts. These researchers also steered a portion of their work to answer the farmers' questions about using lifofer. In the laboratory (and with T&H's guidance), IMBE mastered the artisanal lifofer production technique, which involves two stages: first, a one-month fermentation produces a solid starter culture; then, during a second week-long step called 'activation', a liquid starter culture is prepared and applied to crops after being properly diluted. Physicochemical, biochemical and microbiological parameters are monitored throughout both fermentations. IMBE demonstrated the strong acidification of the solid starter culture (pH 4), partly due to lactic-acid production (60 mg/g), along with a predominance of lactic bacteria and yeasts. This ensures a healthy product, free from pathogenic microorganisms such as fungi, that can be stored for several years before being activated. It was also demonstrated that strict anaerobiosis is not required; a slight presence of oxygen (microaerophilia) can actually be beneficial. On the other hand, two plant hormones were found in the liquid starter culture: one that boosts the plant's

Preparing the liquid starter culture.

immune system and another that helps it resist water stress. Finally, research carried out at IMBE showed that lifofer improves the germination rate of lettuce, though no difference in subsequent plant growth was observed when compared with a simple 'water' control sample. These studies helped spark collaborative research between IRD, AMU and CIRAD.

TAKEAWAYS

For fellow researchers: stay attuned to the needs of impacted communities, even if this can be challenging because of cultural, linguistic and world-view differences. Researchers need input from farmers who know the local crops, soils and climate. Farmers can have their questions answered through the tools and methods of scientific research. Our experience shows that intermediation spaces are needed. T&H's platform for exchange and discussion around lifofer brought together farmers/testers, consulting firms, businesses and researchers and played a pivotal role in co-producing new knowledge and rapidly spreading this technique and bioproduct across France and several countries in the Global South.

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Photo p. 12: "Phil'eau" workshop to raise awareness among young people in rural areas about environmental issues and water conservation, Saint-Louis, Senegal.

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Photo p. 38-39: "Phil'eau" workshop in an Ameth secondary school, Saint-Louis, Senegal.
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Photo p. 100-101: Coastal erosion at Djogué in the Casamance River estuary after the storm at the end of May 2014.
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