

Toward autonomous integrated crop-livestock systems: What can we learn from biodynamic farming?

Marion Lebrun^{a, b}, Martin Quantin^b and Cyrille Rigolot^a

^a UMR Territoires, Université Clermont Auvergne, INRAE, VetAgro Sup, AgroParisTech, 63170 Aubière

^b Association Biodynamie Recherche, 5 place de la gare, 68000 Colmar

Abstract:

Integrated crop-livestock systems (ICLS) are promising for agroecology but they have been decreasing in the last decades. Biodynamic farming (BF) is a form of organic agriculture, based on the premise that each farm should aim to become an autonomous ICLS. To understand BF farmers' experiences, 23 semi-structured interviews were conducted in France, in three types of systems: diversified crop-livestock; "wine and livestock" farms; specialized wine production. In addition to common motivations (i.e. decreasing external expenses) and constraints (heavy workload) which can be found in every farming systems, some specific emphases appear in BF farmers' discourses. Particularly, questions of meaning are essential, as BF is also a way of living "*a simple and happy life*". Importantly for farmers, animals are a major source of well-being, and the "atmosphere" they convey is a motivation for itself. In the transitions toward ICLS, specific BF preparations and the moon calendar play an important role, as other more or less common tools, such as animal communication. These tools could inspire innovative solutions and surprising pathways toward ICLS, such as the development of on-farm slaughter. More generally, the strategic role that BF might play in future sustainability transitions opens to stimulating new research questions and perspectives.

Keywords: Organic Farming; Crop-livestock integration; Diversification; Autonomy; Human-Nature relationships; Transition Pathways

Purpose

Integrated crop-livestock systems (ICLS) are considered as a promising option for agroecology (Bonaudo et al., 2014; Ryschawy et al., 2017; Hendrickson, 2020). Interactions between crops and livestock indeed often improve nutrient cycling, soil fertility, resilience and multifunctionality (Moraine et al., 2014). The diversification of production processes is also an important lever to reduce economic risks, and adapt to various hazards (Hendrickson, 2020). Yet, ICLS have been decreasing in the last decades. Specialized farming systems are considered more profitable and easier to manage, and they have often been encouraged by incentive public policies. There is also a lack of attractiveness for keeping animals on the farm (Ryschawy et al., 2017).

Biodynamic farming (BF) is a century old form of organic agriculture, based on a specific conception of life and nature, in which farmers' creativity play a key role (Rigolot and Quantin, 2022). In practice, BF is often characterized by three specific interrelated

principles: 1) the perception of the farm has an “individual organism”; This principle relies on the balance and synergy between plant and animal productions, and on the integration of areas of biodiversity (forest, hedges, wetlands, natural flower bands...). Importantly, the agricultural “organism” is not considered as just a material entity, it also includes socio-cultural, mental and spiritual dimensions (Brock et al., 2019); 2) The use of biodynamic preparations, herbal teas and specific composts. Made from minerals (silica), dungs or medicinal herbs (dandelion, chamomile, nettle, achillea millefolium, oak bark, valerian, horsetail), these preparations are used in small doses as bio stimulating and bio regulating agents in composts, soils and cultivations (Krause et al., 2022); 3) the integration of “cosmic rhythms” in the organization of farming activities (the cycle of the moon and planets in relation to the Earth and the zodiac).

Although BF is controversial in some countries because of its spiritual dimension, it has been shown to be a valuable source of innovation for sustainability (Rigolot, 2023). The basic BF principle of “individual organism” includes the idea of tight interactions between crops and livestock (as in ICLS), combined with higher possible degrees of material and decisional autonomy (Rigolot and Quantin, 2022). The aim of this study is to investigate biodynamic farmers try and/or manage to apply the principle of “individual organism” in practice, given their resources, constraints and specific contexts, and whether general lessons can be drawn to foster the transition of farming systems toward ICLS.

Design/Methodology/Approach

A survey based on semi-structured interviews was conducted in contrasted biodynamic farms in France. According to the Demeter BF international certifying body, there would be between 700 and 1000 biodynamic farms in France, of which around 600 are certified. More than half of certified farms appear as specialized winegrowers, indicating a first gap between the ideal of the agricultural “organism” (an autonomous ICLS) and current BF systems. In order to understand BF transition pathways toward ICLS and diversification, the choice was made to investigate three types of farming systems: diversified crop-livestock farms (n=11); “wine and livestock” farms (n=6); specialized wine production systems (n=6). These farms are diverse (more or less experienced farmers, women and men, individual and collective farms, different agroecological regions covering a large part of the French territory...). The area of diversified crop-livestock farms ranges from 23ha to 100ha. All 11 diversified crop-livestock and the 6 “wine and livestock” farms have at least one herd of ruminants, always combined with other animal species.

A total of 23 semi-structured interviews were conducted to understand farmers’ experience of autonomy and crop-livestock integration, as well as the constraints and levers to diversification. Following a general description of the farm and of its history, the farmers were questioned more specifically about: 1) the integration (or lack of) of an animal presence (domestic and/or wild) on the farm (role, interest, modalities...); 2) their perception of input autonomy (fodder and manure) and decision-making autonomy; 3) the link between the farm and the outside world (consumers, local actors...); 4) their conception of the living world (including potentially a more subtle, immaterial

dimension); 5) the use of specific biodynamic preparations, herbal teas and composts; 6) the use of a lunar calendar (cosmic rhythm). These different topics include classic dimensions of crop-livestock integration (topics 1, 2, 3), and more specific aspects of biodynamic agriculture (which can appear in every topic, but especially in topics 4, 5, 6). All the interviews were recorded and transcribed in full.

The analysis of the interviews is articulated around four axes of analysis, that will be used to structure the presentation of the findings and their practical implications in the two next parts: 1) The perceived advantages of autonomous crop-livestock BF system; 2) The limits to diversification and the internal constraints to the farm; 3) The role of tools in the implementation of the diversification process; 4) External obstacles to diversification in the environment of the farm, which can be related to public policies.

Findings

For biodynamic farmers, the transition toward more diversified ICLS is always related to a question of *meaning* of their activity. From the interviews it appears clearly that biodynamic agriculture is not only a specific way of farming, but also a way of living (“... a simple and happy life”, as a farmer says). The diversification process must therefore be understood from this perspective:

“We always have something to do at the farm. Work is not only about earning money, it is about being part of what we like to do in life. It is intellectually stimulating, and we enjoy seeing things being materialized on the farm. We are satisfied, because we have everything we need here”

In particular, the animals of the farm always seem to play a major role as a source of well-being in the interviews:

“The presence of animals brings a kind of fulfillment in the atmosphere when you are near them, and also in environments where they grazed. Since I’ve had animals, I understand better why organic farmers are so cool, it must be connected to their relations with animals. I can feel this serenity that is being created, animals soothe me. If we can feel that, every being on the farm, plants, they must feel it too... I feel like the physical presence of the animal creates a sense of balance. The people coming here feel good.”

In a similar way to other kinds of farming systems, the economy is often an important motivation to develop a more autonomous crop-livestock system, which enables to decrease external expenses and related financial dept. Some farmers also stress the advantages of ICLS for their decision-making autonomy. For two interviewed farmers having known an intensive and specialized way of farming, the transition toward BF and ICLS is described as an escape from a previous painful moral and psychological situation.

Nevertheless, as in other farming systems, transition toward ICLS in BF has important drawbacks and limits. Interviewed farmers mention heavy workload, low

profitability levels regarding the work provided and the difficulty to transmit a diversified farm. The winegrowers stress the need of specific skills they do not have yet to raise animals on the farm, and the difficulty to hire skilled workers.

When they describe their pathways toward more diversified ICLS, BF farmers mention different types of innovations, more or less common, such as partnerships between BF wine growers and sheep herders. According to most farmers interviewed, the making and use of BF preparations “by their own hands” play a key role in both fertilizer and decision-making autonomy. Depending on the local context, how they perceive the needs of their farms and their own sensitivity, each farmer gives his own priorities to the various types of BF preparations on her/his farm. Often made collectively during “preparation days”, preparations are also important for the exchange of knowledge and practices between peers. The integration of “cosmic rhythms” is made with the help of a moon calendar, specifying the presumed favorable periods for different farming activities. Interestingly, for most farmers, the moon calendar is not seen as an additional constrains, but rather as a resource to organize diversity on the farm. As it is annotated each year, the moon calendar helps farmers to cultivate their own organization and their own remembrance of the place, with actions inscribed in both the past and the present. Moreover, to develop their autonomy for the health of their herds, interviewed farmers are trained for alternative medicines such as acupuncture, osteopathy or homeopathy, often seen as a way to avoid calling veterinarians. For them, raising animals as close as possible to their natural environment enables self-medication. Although health issues such as parasitism may appear, the variety of aromatic and medicinal plants, natural pastures, and every space made available (edges, grazing lands, moors and forests), ensure a diversified diet and treatments that animals take if they need to. Other techniques such as “intuitive interspecies communication” are also instrumental for farmers to develop relationships of care with other living beings on the farms. Particularly, there are as many ways to communicate with animals as there are farmers (speaking aloud, or “through their thoughts”, through the construction of mental images, or thanks to tools such as kinesiology or pendulums. As strange as some of these methods might seem, from a conventional scientific perspective, they do have major consequences for farmers’ decision-making (decisions about slaughter, diets, treatments for animals and plants...).

Practical Implications

In our study, a large part of the motivations, resources and limits to diversification emerging from the interviews with BF farmers mostly confirm the scientific literature already available. For example, economic motivation and workload are essential considerations in the transition toward diversified ICLS (Moraine et al., 2014; Garrett et al., 2020). However, the specific relationship between BF farmers and nature also result in specific motivations, resources and perceived constrains. Particularly, the major role of the animals as a source of well-being for farmers and communities must be highlighted. Importantly, this perception of the animals having a value for themselves can be “trained”, for example through careful observations methods or even intuitive

interspecies communication (Barrett et al., 2021). Furthermore, whatever our opinion might be about the biological effects of BF preparations, the moon calendar, or animal communication (which are beyond the scope of this paper), our study demonstrates that these tools are seen as useful by biodynamic farmers for the development of their autonomy. These tools could inspire innovative solutions for other farmers without necessarily implying the philosophical background of biodynamics. We can think about collective activities (such as during BF preparations' days), new tools to organize a diversified system (such as the moon calendar) or new observation methods (such as animal communication). As regard the dynamic of the transition, our study is consistent with the analysis proposed by Coquil et al. (2014), for who "which tools are used and when they are used depends on what is meaningful to farmers at various stages of the transition"

Biodynamic farmers themselves identify specific obstacles to ICLS development, from their perspective. Particularly, for the farmers interviewed, the slaughter of animals and the fate of males are paramount and recurring notions regarding the development and thriving of autonomous crop-livestock farming systems. This conception is in line with the approach proposed by Porcher (2017), giving prominent importance to animals in the design and management of livestock farming systems. In France, the slaughter of animals must be done in a certified slaughterhouse (for sanitary and environmental reasons), the only exception being for family consumption (which excludes however bovines and equines). Facing this legal reality, BF farmers claim for their responsibility to accompany their animals until their death, and for several of them, to slaughter their own animals. Several farmers are involved in experimental slaughtering projects, at the farm or locally. As regards the fate of males, the current practice is to bring them, as young as possible, to a conventional fattening farm. "Getting rid of the males" is perceived as incoherent by farmers from a BF perspective. For them, finding new practices and value chains is essential to the future of ICLS development. From an economic perspective, interviewed farmers call for evolutions of the socio-economic environment to better compensate for non-market-oriented services (biodiversity, cultural heritage...). They also stress the need for training and support from extension services, confirming previous observations by Aare et al. (2021) with BF farmers in Denmark.

Theoretical Implications

Nowadays, in some countries, academic research on BF has become as controversial as BF itself. In this communication, our approach consists in considering BF knowledge in a comparable way to indigenous knowledge, as part of a broader body of Traditional Ecological Knowledge (TEK) (Rigolot, 2023). According to Albuquerque et al. (2021), TEK and academic knowledge can differ as much as they can coincide, but it is important to move beyond the idea of a simplistic divergence/convergence dichotomy. Instead, these authors propose to see convergences "as evidence for developing more robust decisions", and divergences as opportunities for dialogue and complementarity building (Albuquerque et al, 2021). Our study provides multiple examples of such convergences (economy, labor...) and opportunities for dialogue (on human-nature relationships, for example).

For the study of agroecological transitions, particularly, BF appears as a promising resource to inspire new transition pathways, and to challenge deeply current systems of farming, support and governance. For example, with reference to Toffolini et al. (2019)'s four "ways of acting" for an agroecological transition (i.e. local integration, flexible management, learning dynamics and development of a room for maneuver), from the findings of our study BF could be seen as a possible fifth "way of acting", toward an enhanced connection with the living world. Some policy implications are quite common (need for training, payment of services...) but others are original and thought provoking. Particularly, while these elements have not been identified to date as major aspects for the development of crop-livestock systems, on-farm slaughter and the fate of male animals are essential for BF farmers. More generally, this study illustrates how understanding and sharing a diversity of visions for agroecology (BF among others) can be instrumental to enrich transition pathways in an inclusive way (Pervern et al., 2023). As a next step, transdisciplinary coproduction of knowledge with BF farmers is a stimulating perspective to further inform and activate ambitious transition pathways, as demonstrated in the wine sector by Masson et al., (2021). In the context of a transdisciplinary action-research project in France, Switzerland and Germany, these authors show how the contribution of BF farmers, in collaboration with academic research and other actors has been essential to generate not only scientific breakthroughs, but also tangible changes in practices, discourses, and a substantial decrease of herbicides use in the vineyards (Masson et al., 2021; Madouas et al., 2023). The specific conception of knowledge underlying BF could also inspire new transdisciplinary methodologies for the agroecological transition, involving experiential knowledge and intuition, which could be further explored for a variety of research topics and development goals (animal welfare, food quality...) (Rigolot, 2023).

Acknowledgments: This work is part of the SYNBIOSE project funded by INRAE metaprogramme METABIO. Thanks to farmers for their time and the MABD (Mouvement pour l'Agriculture Biodynamique) and the group Initiative Elevage for the contacts. Thanks to Thibault Gallard (MSH de Clermont-Ferrand, UAR 3550) for the English translation.

References

- Aare, A. K., Egmoose, J., Lund, S., & Hauggaard-Nielsen, H. (2021). Opportunities and barriers in diversified farming and the use of agroecological principles in the Global North—The experiences of Danish biodynamic farmers. *Agroecology and Sustainable Food Systems*, 45(3), 390-416.
- Albuquerque, U. P., Ludwig, D., Feitosa, I. S., de Moura, J. M. B., Gonçalves, P. H. S., da Silva, R. H., ... & Ferreira Junior, W. S. (2021). Integrating traditional ecological knowledge into academic research at local and global scales. *Regional Environmental Change*, 21, 1-11.

- Barrett, M. J., Hinz, V., Wijngaarden, V., & Lovrod, M. (2021). Speaking with other animals through intuitive interspecies communication: Towards cognitive and interspecies justice. *A Research Agenda for Animal Geographies*, Cheltenham and Northampton: Edward Elgar Publishing, 149-65.
- Bonauo, T., Bendahan, A. B., Sabatier, R., Ryschawy, J., Bellon, S., Leger, F., ... & Tichit, M. (2014). Agroecological principles for the redesign of integrated crop–livestock systems. *European Journal of Agronomy*, 57, 43-51.
- Brock, C., Geier, U., Greiner, R., Olbrich-Majer, M., & Fritz, J. (2019). Research in biodynamic food and farming—a review. *Open Agriculture*, 4(1), 743-757.
- Coquil, X., Béguin, P., Dedieu, B. (2014). Transition to self-sufficient mixed crop–dairy farming systems. *Renewable Agriculture and Food Systems*, 29(3), 195-205.
- Garrett, R. D., Ryschawy, J., Bell, L. W., Cortner, O., Ferreira, J., Garik, A. V., ... & Valentim, J. F. (2020). Drivers of decoupling and recoupling of crop and livestock systems at farm and territorial scales. *Ecology and Society*, 25(1), 24.
- Hendrickson, J. R. (2020). Crop-livestock integrated systems for more sustainable agricultural production: A review. *CABI Rev*, 15, 1-11.
- Krause, H. M., Stehle, B., Mayer, J., Mayer, M., Steffens, M., Mäder, P., & Fliessbach, A. (2022). Biological soil quality and soil organic carbon change in biodynamic, organic, and conventional farming systems after 42 years. *Agronomy for Sustainable Development*, 42(6), 117.
- Madouas, M., Henaux, M., Delrieu, V., Jaugey, C., Teillet, E., Perrin, M., ... & Masson, J. E. (2023). Learning, reflexivity, decision-making, and behavioral change for sustainable viticulture associated with participatory action research. *Humanities and Social Sciences Communications*, 10(1), 1-11.
- Masson, J. E., Soustre-Gacougnolle, I., Perrin, M., Schmitt, C., Henaux, M., Jaugey, C., ... & Schermesser, F. (2021). Transdisciplinary participatory-action-research from questions to actionable knowledge for sustainable viticulture development. *Humanities and Social Sciences Communications*, 8(1), 1-9.
- Moraine, M., Duru, M., Nicholas, P., Leterme, P., & Therond, O. (2014). Farming system design for innovative crop-livestock integration in Europe. *Animal*, 8(8), 1204-1217.
- Penvern, S., Lamine, C., Derbez, F., Ollivier, G., Rénier, L., Roche, R., & Tuscano, M. (2023). Addressing the diversity of visions of ecologization in research and in support to agroecological transitions. *Agroecology and Sustainable Food Systems*, 47(9), 1403-1427.
- Porcher, J. (2017). *The ethics of animal labor: A collaborative utopia*. Springer.
- Rigolot, C., Quantin, M. (2022). Biodynamic farming as a resource for sustainability transformations: Potential and challenges. *Agricultural Systems*, 200, 103424.
- Rigolot, C. (2023). Biodynamic farming research and transdisciplinary knowledge co-production: Exploring the synergies. *GAIA-Ecological Perspectives for Science and Society*, 32(4), 353-358.
- Ryschawy, J., Martin, G., Moraine, M., Duru, M., & Therond, O. (2017). Designing crop–livestock integration at different levels: Toward new agroecological models? *Nutrient Cycling in Agroecosystems*, 108, 5-20.

Toffolini, Q., Cardona, A., Casagrande, M., Dedieu, B., Girard, N., & Ollion, E. (2019). Agroecology as farmers' situated ways of acting: a conceptual framework. *Agroecology and Sustainable Food Systems*, 43(5), 514-545.