Contributions of agricultural research to organic farming in Southern countries

Concept note - 2015

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Foreword

This joint concept note is based on the creation of a think-tank at CIRAD on organic farming in Southern countries. It sums up the current thoughts of this group in complementarity with the institutional positions of CIRAD regarding agroecology and ecological intensification, with which organic farming shares various concepts and approaches.

Summary

Organic farming is mainly qualified using definitions governed by international norms and standards. Yet, in Southern countries, such farming can entail various production realities, and diverse opportunities for innovations and interactions between stakeholders. This overview, based on the publications and current work of CIRAD researchers, proposes to take stock of the research trajectories on this subject and of the main limiting factors that structure the corresponding research fronts.

Keywords: Organic farming – Agricultural research - Development – Agroecology - Agrobiology

[1] CIRAD: UMR Innovation, [2]UMR MOISA, [3]UPR HORTSYS, [4] UPR Systèmes de pérennes [5] UPR AIDA, [6]UMR QUALISUD, [7]UMR AGAP , [8]DGDRS.

Introduction

In Southern countries, which demarcate the geographical scope of CIRAD's agricultural research, organic farming covers a diversity of technical realities and social and economic models of production, marketing and consumption that are visible and institutionalized to varying degrees.

The most visible form is organic farming that complies with standards controlled by third-party certification and which mainly concerns products traded on international markets, such as cocoa, coffee, cotton, quinoa, rice, dessert banana, mango and pineapple, or products intended for the national markets of Southern countries, but taking long distribution channels (François et al, 2005).

Another type of organic farming that is less visible but more present involves a set of agricultural situations using very little or no chemical fertilizers and pesticides[2]. These situations are based on agricultural realities that have existed for millennia, whose balances and evolutions bring into play localized ecological and social factors. Non-certified organic farming involves numerous situations that are often found in agroecological systems used by family farming, which can also be considered in terms of agrobiology[3]. Although not certified in terms of international standards, it sometimes brings into play certain forms of so-called "participatory" certification, occasionally supervised by national (or regional) standards, and which mainly concern the domestic markets of the producing country.

This note, which was drafted based on the main work published by CIRAD on organic farming in Southern countries, proposes an overview of the different research activities. The first section defines how market specification polarises some of the research work that accompanies organic farming. The second part of the note identifies the main factors limiting the development of organic farming and describes the main research fronts currently existing on this subject.

1: Research trajectories related to organic farming in Southern countries

Public agricultural research makes multiple contributions to the analysis of organic farming in the South. Those contributions are made by public research and cooperation organizations dedicated to agriculture[4]. They work within different partnership configurations within Southern countries, in relation with national research centres, universities, and sometimes firms.

[2] Some authors use the term *"organic by default"*. This term is particularly controversial because it implicitly assumes an agricultural model using synthetic chemicals to be a normal situation of reference.

[3] The term agrobiology was used, for example, in Silguy C. *L'agriculture biologique.* Que sais je? PUF 1991

[4] CIRAD, IRD, IAM or sometimes international centres: IITA, ICIPE, ICRISAT.

A distinction can be made between these contributions according to the markets of organic products (international and domestic) which are concerned and to the governing stakeholder systems and existing certification institutions (third party, participatory).

1.1. A trajectory geared towards supplies to domestic markets

Domestic food product markets are mainly local (urban and rural). They involve agricultural production which directly threatens the health of consumers (Moustier et al. 2006) and producers through an intensive/poor use of chemical inputs that causes pollution of resources (water, soil), without these negative externalities being taken into account by market mechanisms. These situations are all the more problematic in that they concern institutional contexts:

- of a failure of health information (hence warning) systems regarding pesticide residues, the levels of pest outbreaks in crops, the health status of products and recommendations for limiting risks to human (producer and consumer) and animal health.
- of a failure of public or societal organizations in taking charge of or revealing the price paid by populations in terms of public health.

In these contexts, participatory stakeholder networks emerge, based on short distribution channels to secure urban supplies of healthy products for consumers. These short channels rely on links of confidence between the different stakeholders (consumers, producers, researchers, local and international NGOs, agricultural technicians, etc.). They may lead to the introduction of participatory guarantee systems, which organize the control of organic farming production based on the information, knowledge and learning that can be drummed up locally.

Such situations are mainly multiplying in emerging countries and in Latin America (Mexico, Brazil, Argentina, etc.), where accelerated industrialization, including that of agriculture, is generating an increasing mediatisation of information about the health-related pollution of food products. These changes are particularly being brought about by structuring of the social networks that are enabling the digital revolution.

More discreetly, these situations also exist and are developing in less advanced countries, or countries with intermediate incomes. They mainly occur there in urban farming or places characterized by strong competition for the use of water and soil resources. They lead to the subject of health safety in food supply channels being highlighted by informed populations, usually corresponding to the most fortunate (high income) social categories.

In the above-mentioned contexts (emerging countries and less advanced countries) ensuring food safety mainly involves participatory certification of the organic nature of products, or rather their healthy nature for consumers in phytosanitary terms. This consists of different processes:

- In some cases, it concerns places of provenance in order to rule out low-lying contaminated periurban areas for example, or zones with intensive use of phytosanitary products.

- In other cases, certification regards physical markets dedicated to trade in healthy products subjected to collective surveillance.

- In other cases still, it focuses more on the quality of the resources used for production (quality of irrigation water, soil) than on the actual products. The guarantee of quality is then based on proximity between producers and consumers within the framework of direct supply channels. In other words the guarantee is then based on relations of confidence institutionalized by the nature of the transactions.

The standards brought into play in these participatory certification processes take into account (or may take into account) other development challenges whose nature may be identity-related (preservation of ancestral techniques, an inheritance or cultural heritage), social (child labour, gender criteria, employee working conditions) environmental (protection of ecosystems, of biodiversity), or political (food sovereignty stakes) specific to the different contexts. For the most part, these elements do not figure in the standards used by organic farming certified by third parties intended for exports to Northern markets.

The contribution made by research to analysing these situations may operate in a complementary manner between the agricultural and technological sciences, and the human and social sciences.

The research contributions made by the agricultural and technological sciences are organized around two main complementary issues:

- The production of knowledge, information and methods for characterizing and assessing the realities encountered in the field (Martin et al. 2010; Silvie et al. 2010) from a risk situation viewpoint in environmental and public health terms (Jannoyer et al. 2007; de Bon et al. 2014).
  Moreover, this work may involve both conventional agriculture (uncovering hidden costs) and agriculture using local organic resources but whose poorly controlled quality induces the potential use of dangerous chemical waste (e.g. organic fertilizers derived from the recycling of urban waste).

- The designing and improvement of cropping systems based on agronomic experiments incorporating the principles of agroecology and the development of new ecological intensification practices with stakeholders, in order to reduce pesticide use for example: insect-proof netting, use of biopesticides, sanitizing or repellent plants, use of organic fertilizers (De Bon 2010, Blanchard et al. 2013), installation of ant nests (*Oecophylla longinoda*) in mango, citrus and cashew plantations (Vayssières et al., 2009). These crop management procedures based on agroecological principles propose some novel situations that reduce the use (or impact) of chemical inputs in conventional agriculture.
  These solutions sometimes lead to substitutions between chemical molecules, such as:

- in conservation agriculture where pesticide reduction may go hand in hand with an increased use of herbicides,
- in other cases, where a shift can be seen in "field" pesticide use towards post-harvest treatments due to "technical dead-ends". For instance, limiting fungicides may lead to the development of toxigenic moulds for which biological control still remains to be invented and validated.

The diversity of the trade-offs made when choosing technical solutions depending on the constraints in the supply chains and the requirements of producers may alternatively contribute to the objective of an ecological transition of the production function in conventional agriculture, or bring out needs for knowledge and innovations that contribute to organic farming.

The research contribution made by the human and social sciences takes on two main aspects:

- The first accompanies the proposals made by agricultural research (Fernandes et al. 2009). It is then a matter of specifying the conditions for socio-economic adoption on different scales (farmer uptake, entrepreneurial dynamics within supply chains and territories) or assessing the impacts of new practices.

- The second aspect of knowledge production concerns collective and institutional actions that galvanize other sources of innovations brought by local communities, or entrepreneurial dynamics. It is a matter of analysing interactions between stakeholders at local level and strengthening collective organizational capacities leading to socio-technical transitions towards agroecology or organic farming (Goulet & Hernandez, 2011). It is also a matter of looking into participatory certification systems, analysing the diversity of forms from one country or region to another, and the economic and social effects of their implementation (Lemeilleur, 2014). Lastly, research also concerns the conditions and dynamics of the debates taking place in different countries regarding the farming models to be developed and promoted, and public policies in this field (role in encouraging and discouraging socio-technical transitions). Studying the dynamics of the debates surrounding organic farming therefore means analysing the determining factors of agricultural policies in general, and the backing they procure for organic farming in particular.

1.2. *A trajectory geared towards supplies to the international market*

Two situations occur in which the place and role of research vary.

The first situation is linked to commitments (partnership, contractual) with national firms, such as for cotton, or international firms, as for cocoa (Ruf et al., 2013), banana (Guillermet et al., 2014). This contractualization implicates agricultural research in the development of crop management sequences, production models or in assisting in the standardization process to accompany the establishment of these operators on the international organic produce market.

This is sometimes done with European importers (private sector) in lucrative ecological niches, as in the case of dried mango in West Africa, for which the “organic farming” label opens up markets and creates market value (notably in Germany, the Netherlands and the UK).

A second situation in Europe involves various entrepreneurs (African diaspora, importers, processors) who seize the opportunities offered by the European market, which is expanding for tropical organic products. It calls less for research than it does for resources related to i) social networks for supplying distribution channels in the North with African products, ii) European certified product markets. Through organic certification, some products usually consumed locally (butter fruit, plantain banana, yam, cassava) can then be earmarked for export.

In some cases, certification focuses on the raw material incorporated into very high added-value products in the cosmetic or food industries (dietary supplements, shea butter, acerola). These markets are usually structured upstream by the regulations and standards of the importing countries: EU, USA, Japan. There is little involvement of research in their definition.

This emergence process for certified organic farming in Southern countries via export markets to Northern countries brings into play research in the social sciences to analyse the consequences of these voluntary standards and of third-party certification from both an economic viewpoint (Daviron and Vagneron. 2011) and a social and political viewpoint (Loconto and Fouilleux, 2013; Fouilleux and Loconto, 2014). This work particularly sheds light on the “conventionalization” mechanisms and processes that typify the evolution of organic farming in recent decades.

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These two research trajectories polarized by the markets for organic farming products obviously hybridize. The on-going international debates focusing on the different possible types of farming (competition between candidate agricultural models for sustainable farming) and on the possible public policies in this field are an ideal forum for transversality and are stimulating for such hybridizations.

2. Factors limiting agrobiology in the South and research fronts

Several limiting factors are an obstacle to the extension or recognition of organic farming in Southern countries.

As regards organic farming for supplies to local markets, the following can be considered as limiting factors:

- marketing conditions for atomized production of heterogeneous quality
- economic risks linked to the testing of new crop management sequences and techniques

- health risks
- the dominant focus of public policies on productivist objectives.

For certified organic farming geared towards exports:

- standards poorly adapted to the reality faced by producers in Southern countries
- the high cost of certification compared to the added-value achieved
- uncertainty surrounding the reliability of inspections
- dependence on outside aid to fund third-party certification.

Agricultural research in its broad sense (including the human and social sciences involved in this field) seeks, as a priority, to lessen these constraints.

The interest shown by a large number of stakeholders, be they scientists, producers, exporters and importers, processing companies, or consumers, in developing organic farming in Southern countries leads to its consequences being assessed for food security and poverty alleviation objectives on different scales. Moreover, this question is shared by other technological trajectories such as the ecological intensification of family farming in the South (Affholder et al., 2014). Such research may have an "intentional" dimension (in direct relation to organic farming) or a "non-intentional" dimension.

2.1. "Intentional" research on organic farming

This type of research is undertaken in projects dedicated to organic farming (Mazorra et al., 2013; Fernandes et al., 2011). Such projects respond to societal demands (contractualization, calls from local government or civil society). The work focuses on knowledge production, developing new techniques, creating new inputs, capacity building. It comprises four complementary lines of research.

A first line of research on knowledge revealing positive externalities

This involves characterizing how this agriculture affects management of the environment (biodiversity, climate, water pollution, soil protection) in the farming systems of Southern countries. This work explores ecosystems potential and seeks to increasing agricultural and environmental efficiency without using or by limiting the use of synthetic inputs (Malézieux, 2012; Ratnadass and Barzman, 2014). It generates scientific and technical knowledge about the ability of organic farming to take up the development challenges and to produce ecosystem services in relation to biodiversity (Jagoret et al. 2014), surface water and groundwater protection, or erosion control.

This work is carried out in contexts of development precarity, tropical climates and weak institutions, which characterize many Southern countries. This line of research also involves agronomy experiments on new inputs (varieties, biopesticides, other) arising from the search for local know-how and knowledge.

A second line of research on the organizations/institutions that determine the innovation processes linked to organic farming situations

This work, in economics, analyses how food crop farming polarized by self-sufficiency can become competitive in supplying urban markets without necessarily changing the production model (Temple et al. 2014). It notably focuses on innovation and research systems that generate cognitive and informational resources and the experimenting capacities needed to enable greater use of locally produced inputs (Temple et al., 2015). The health quality of those inputs may, in its turn, raise food safety issues that impose specific research work.

A third line of research on the "objectivization" of organic farming systems

The ability of organic farming to meet food security and environmental challenges at the same time (Kahane et al. 2013) fuels some controversies. The work under way is targeted at helping to reduce those uncertainties by producing information and knowledge on biophysical, ecological, technical, economic and social parameterization (Martin et al., 2010; Silvie et al., 2010). It contributes to analysing both the effects on the environment (not always as hoped for), on the living standards of those involved in these systems, and on human and animal health.

On a farm scale for example, the processes are complex and raise numerous questions about:

- the advantages in terms of innovation autonomy in relation to the inputs used (Brévault et al 2014)
- effects related to productivity
- labour constraints and the induced production costs (including certification) and their impacts on income.

A fourth line of research on organic farming definition processes and its political recognition

This work seeks to understand how the stakeholders involved in the debates surrounding organic farming discuss this type of production and how that connects up with wider debates on the future of farming in the countries involved. It seeks to analyse the positions of the actors present (producers, local and international NGOs, scientists and experts, ministerial staff, etc.) and their ability (financial, discursive, institutional resources, etc.) to make their arguments heard in the debate and ultimately influence the public policies implemented. These debates may concern national policies or bilateral or international cooperation policies in the fields of agricultural, food, research or even the environment (Fouilleux, 2015).

2.2. Non-intentional research in its relation with organic farming

Paradoxically, this involves research that demonstrates the health risks that might arise from products derived from traditional farming systems using few synthetic inputs, or that reveals the negative health externalities of conventional farming using chemical inputs. These externalities then become elements that bring out the positive contributions of organic farming which, by definition, does not use that type of inputs.

Assessing the risks associated with mycotoxins (Galindo and Montet, 2014) which contaminate (or which may contaminate) products on local markets, such as maize and groundnut, makes it possible to target the limitations that might be encountered by organic farming crop management procedures in relation to health safety.

In other examples, these risks block access to the international markets for products from Southern countries (Rafflegeau et al. 2015). They often justify the use of synthetic pesticide in the food supply chains, mainly at the post-harvest stages, to facilitate product transportation and storage.

In a symmetrical manner, work qualifying the negative externalities linked to synthetic inputs in conventional farming contributes, for its part, to uncovering the "hidden costs" for that type of farming and the corresponding advantages that organic farming production methods potentially offer for:

- the quality of the natural resources used in agriculture (soil, water)
- biodiversity, human health (Jondreville et al., 2014).

Conclusion

Tying all this work together is instrumental in gradually transforming the technological paradigms that guide agricultural research. It attains recognition of the innovation potential offered by the agrobiological realities in Southern countries, while qualifying limitations and situations that make it necessary to combine the complementarities of different technical systems.

The coordination existing "within" and "between" agricultural research organizations, the pooling of knowledge and information, the optimum use of complementarities within those organizations and their interconnection with local producer organizations, public research centres in the countries involved, along with universities, private firms and NGOs would, however, be worth strengthening.

Yet, organic farming is still not a priority for national or regional public innovation policies. It is not widely acknowledged in the agricultural research organizations of both Northern and Southern countries, except for, sometimes, a "niche of experiments and new inventions". It is also considered as an opportunity for capturing certain highly lucrative markets undergoing rather localized expansion in industrialized countries. Living in a more polluted environment, consumers there can see representations of the health risks, and to a lesser extent, the environmental risks linked to their food, which leads them to agree to pay more for products that call for more work and are therefore sometimes more expensive. These representations may be linked to situations of greater pollution, more effective information systems, or greater society awareness for reducing health safety risks, related to a rise in income levels.

In addition, increasing calls for greater productive efficiency in farming in quantitative terms, linked to the urbanization of lifestyles, the globalization of national and international markets, and growing demand from the globalized industrial sector (agrifood, energy, construction) are

not a context conducive to the identification of the “organic farming” issue in research programmes.

Assessing the agronomic (quantities, product quality), environmental and, more generally, sustainability performance of organic farming also comes up against another difficulty. It means applying a standard to practices that can be extremely diverse and which are consequently not enough to form a uniform farming system.

Exposing the issues associated with organic farming in agricultural research implies specific incentive actions to reduce the disincentives identified. The first action could be to identify the challenges arising from the recognition of organic farming “in the South”: Which market for which type of products and consumers, what trade-offs between the different restrictive functionalities encountered by organic farming, on what geographical scales and time horizons? How does if differ from the ecological intensification model which is defined according to the principle of reconciling the “ecological” imperative of environmental conservation and ensuring high production per unit of area and time? How can this diversity of production methods be reasoned, but especially how can they be made to complement each other in research programmes?

Ensuring consistency between the needs for productive, environmental and social (public health, employment) efficiency means more effectively gearing/guiding research towards studies on the innovation processes offered by agrobiology. Ensuring that consistency conjures up the public good function of agriculture and the need of a funding structure for agricultural research that is adapted to the production of that public good.

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