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Participatory organic research in the USA and Italy: Across a continuum of farmer–researcher partnerships

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Abstract

Organic agriculture continues to expand in the USA and in the European Union (EU), particularly in Italy, which had 48,650 organic farms in 2014 compared with 19,474 in the USA. Additionally, EU support for organic research is nearly double than that of the USA. Along with increased support for organic research, the EU organic community has achieved recognition at the European Commission policy level for a dedicated innovation platform, advocating the practice of farmer-first models for participatory research. The US land-grant universities have a long history of on-farm research, primarily through the Extension Service, but the need exists for more inclusive, second-loop, co-research with organic farmers. A survey was conducted of organic farmers and researchers in Italy and in the USA to ascertain the extent of participatory organic research activities and experiences, and explore the vision each group had for the future of co-innovation between organic farmers and researchers. Results indicated that, despite the higher level of organic research support in the EU, the percentage of researchers involved in on-farm/participatory organic research was equivalent in Italy and the USA, presumably due to the more recent emphasis in Italian/EU agricultural research agendas on the importance of farmer knowledge and participation in organic research. Overall, 60% of surveyed organic researchers in both countries cited involvement in on-farm/participatory organic research, with 'farming systems' and 'nutrient/pest management' the main research focus in the USA, compared with 'farming systems' and 'equipment' in Italy. Both countries' researchers expressed their vision of participatory research as helping to improve communication between researchers and farmers, to enable work on relevant research, and to allow farmers to adapt technologies to their own conditions. Organic farmers in Italy completed survey questionnaires as part of a field day activity, leading to more Italian farmers responding to the survey, compared with USA counterparts who were queried via e-mail. Organic farmers in Italy identified 'knowledge-sharing' as a critical value of participatory research, and were conducting on-farm research with less compensation than US farmers. The 'lack of time' was cited as the most important constraint limiting participatory research by Italian and US farmers, although the 'lack of common language' also was rated as potentially impairing full participation. Lessons shared between EU and US organic researchers as a result of this project included methods to institute policies aimed at increasing support for organic research and co-innovations with organic farming communities, and connecting experienced on-farm researchers in the US with Italian colleagues to enhance collaborative activities with organic farmers.

Key words: on-farm research, farmer experiments, innovation in agriculture, extension, farming systems

Introduction

> *'What farmers hear, they may doubt; what they see, they may possibly doubt; but what they do themselves, they cannot doubt.'—Seaman Knapp, Father of U.S. Extension Demonstrations.*

Seaman Knapp (1833–1911) believed that agricultural innovation in the USA arose from good agricultural practices demonstrated *by* farmers *for* the wider farming community (Bailey, 1971). Today, there is a growing recognition that innovation is not a linear process from formal science to farmer adopters, but rather a social process involving a multitude of different actors (De Leener, 2001). Innovation is a dynamic, multi-stakeholder process with obligatory participation of diverse actors (Smits et al., 2010; Benouniche et al., 2014). It is similarly acknowledged that innovation processes can be enhanced by creating more possibilities for actors to interact. According to Pretty (1995), participation is defined as a collective analysis by multiple, interdisciplinary partners, and is essential for any system of learning and completion of a successful project.

Many definitions are used to describe collaborative research innovation. This rich terminology, developed over more than three decades, implies different levels of participation, engagement, protagonism and even fairness, among actors. Experimental operations that include end users have been labeled as participatory action research (McIntyre, 2007; Chevalier and Buckles, 2013), citizen science (Tulloch et al., 2013) or transdisciplinary research (Tress et al., 2005; Mittelstrass, 2011). Pretty (1995) stated that all data are constructed within a particular social and professional context, which can affect the outcome of a specific project. Thus, true participatory research begins with an understanding of the farmer's social and economic situation, and how the research project fits within the context of their farming system, requiring farmers' active involvement in the length of the research project cycle (from defining objectives to co-validating results). Research questions should arise from the farmers themselves, and, ideally, methods to examine the problem should also come from participants (Sriskandarajah et al., 1991).

Progress toward innovation partnerships

Farmers' direct contributions in exploring, improving, adopting and sharing locally adapted farming techniques can provide a crucial incentive in guiding agriculture toward sustainability. In the past 10 yr, there has been a considerable reorientation in science and in practice regarding best methods to accommodate change processes (McIntyre et al., 2009; EC-SCAR, 2013). Networking and cooperation between research and extension services and farmers' groups are increasingly deemed as crucial and promoted by various governmental and NGO groups. As stated in the EC-SCAR report (2013), '(A)genda setting by farmers and food businesses is more important than just more research dissemination.' We therefore advocate a distinction between *science-driven research* and *innovation-driven research* and the latter should gain more cultural and economic investment, as argued by the European Union (EU) scientific committee members.

An enabling environment has to be generated for such cultural, socio-technical and constituency hybridization to occur. A *diálogo de saberes*, or dialogue among different ways of knowing (Leff, 2006), is thus needed, beginning with the recognition, recovery and valorization of local knowledge. Due to the gap between the provision of research results and the application of innovative approaches to farming practice, the idea of a *diálogo de saberes* is partially captured in Europe by the European Innovation Partnership (EIP) strategy (European Commission, 2012), whose added value lies in the idea to build a dynamic platform linking farmers, stakeholders and researchers. The current EU policy thus advocates and invests in the transition to innovation-driven research, by stipulating that actors involved in agriculture find each other in partnerships working on innovations in practice.

Organic farming as an innovative system

Organic farming has a unique position in providing multiple components of sustainability, including innovative farm production methods (Darnhofer, 2014; Moeskops et al., 2014). In both the EU and the USA, the early development of organic farming was mostly based on organic pioneers' experimental capacity without scientific support, since few scientists were part of the early movement (Padel, 2001). Moreover, many valuable local experiences were only partially shared within the organic community and the empirical approach was often the main option for practitioners to solve their problems. Gerber et al. (1996) referred to organic farmers in the pioneering phase as 'active experimenters and practical researchers,' often described as the Organic 1.0 phase (IFOAM, 2015). At a later stage, research institutions and professionals began to devote scientific attention to organic farming systems and innovations as components of sustainability. From a technical perspective, however, tailored solutions beyond input substitutions to meet the needs of organic farmers entering Organic 2.0, where organic production was now codified, only gradually emerged. During this period, private and NGO famer-based organizations, such as AIAB (Italian Association for Organic and Biodynamic Agriculture, Rome) in Italy, and OFRF (Organic Farming Research Foundation, Santa Cruz, CA) in the USA were created to support organic farming research and education needs. In recent times, the organic sector is attracting growing scientific interest, and on-farm innovation maintains a persuasive role as an intrinsic and

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familiar concept in the organic community. The on-going attempt to harmonize organic market opportunities with ecological imperatives is characterized by the concept of Organic 3.0, an international effort with the goal of positioning organic systems as a solution to global problems, including climate change and food security (IFOAM, 2015). Organic research is expected to redefine and fine-tune the guiding principles undergirding organic agriculture along the same direction. The EU has a series of European Technology Platforms (ETP) and the European organic research agenda broadly benefited from the TP Organics leadership, highlighting a more collaborative environment in policy setting. The TP Organics includes farmers, researchers, consumers, civil society organizations and companies involved in the organic value chain—from production to processing and marketing (Moeskops et al., 2014). An important research topic currently within the TP Organics framework is 'eco-functional intensification,' which is defined as more efficient use of natural resources and processes, improved nutrient cycling and innovative agroecological methods for enhancing the diversity and health of soils, improved crop performance and knowledge gain. Eco-functional intensification requires a systemic approach from field to farm and beyond, and builds on stakeholders' knowledge (Halberg et al., 2015). This approach is complementary to the tenets of agroecology first proposed by Altieri (1983), and responds to more recent agroecological visions embracing the whole food system through more inclusive criteria.

Organic research in the EU and the USA

Approximately US$49 billion was spent on food and farming research worldwide in 2012 (Beintema et al., 2012), with <1% of private and public research and development budgets allocated to organic research (Niggli, 2008; Rahmann et al., 2013). However, research in organic farming has increased considerably in recent years. Organic research activity has been greatest in Europe, and EU studies can offer many relevant ideas for US organic farmers. Organic research also has increased in other parts of the world where research is generally carried out in a national context. International coordination and cooperative efforts are increasing, however, in part due to efforts stemming from IFOAM's leadership (IFOAM, 2015).

In 2014, the EU spent US$180 million on organic research, compared with only US$60 million in the USA (Niggli, 2015), which has a comparably sized population. Regarding current policies on the global level, despite a growing interest and emphasis, few institutional documents openly promote participatory research, and those that do are rather recent. In the USA today, organic research is generally based on a state or regional context, with increased national and international coordination and cooperative efforts sorely needed. Research spending for knowledge, techniques and tools that are highly specific to, and in compliance with, organic standards is necessary. Innovation on organic farms is, therefore, still more strongly driven by farmers' own initiatives and less by scientists and farm advisors. This lack of basic and applied research on organic farming systems is a crucial deficit of organic farming and limits development considerably.

European organic research and innovation framework development

Horizon 2020 is the European instrument to promote economic growth across the EU, with agricultural research and innovation funding between 2014 and 2020 almost double that of the previous 7th Framework Program (E.C. 2015). In Horizon 2020, priorities have changed in comparison with earlier EU research programs, as the focus has shifted from research for its own sake to innovation with tangible impacts. A part of the Horizon 2020 program implements a multi-actor approach, aiming at more demand-driven innovation through genuine involvement of various actors all along the project cycle: from participation in the planning and execution of work and experiments, to the dissemination of results, and a possible demonstration phase. The choice of key actors with complementary types of knowledge (scientific and practical) should be reflected in the research consortium and in the description of the project concept, ideally resulting in a broad implementation of project results. This should generate innovative solutions that are more likely to be adopted, owing to the cross-fertilization of ideas between actors, solution co-generation and co-ownership of results. Facilitation/mediation between the different types of actors and involvement of relevant interactive innovation groups operating in the EIP context, such as EIP Operational Groups funded under Rural Development Programs, is strongly recommended. It is noticeable that the Horizon 2020 work programs launched so far required the multi-actor approach in almost all the research topics relevant for organic farming and agroecology.

The EIP-AGRI Focus Group on Organic Farming (May 2014) formulated a number of suggestions and recommendations regarding the implementation of the EIP approach in the organic sector. Five specific topics and four horizontal themes were highlighted: the need for a systems approach; the need to enhance knowledge sharing; the development of resilient systems; and the need for a broad cultural shift to more ecological thinking. Moreover, for an efficient translation of research outcomes into mainstream practical innovation, the EIP Focus Group experts recommended a truly participatory approach, in which the whole innovation process flows from problem identification, to innovation design, generation and validation. A more circular co-production and sharing of knowledge among involved actors was

recognized as crucial, with the organic sector at the vanguard of this movement. Policy and scientific institutions are increasingly acknowledging the diversity of agricultural systems and the variety of transition pathways required to increase sustainability. A crucial characteristic of the new approach to both transition and innovation processes is that they call for actors to interact and mutually learn to strengthen their efforts and to co-produce common goods.

US farmer–researcher partnership development

The terms 'on-farm research' and 'participatory research' have been used in the US since 1988 (Farrington and Martin, 1988) with 'innovation partnerships' only recently entering the vernacular. Although most formal agricultural participatory research began in the context of development projects outside the USA (Pretty, 1995), the USA has a rich history of farmer demonstrations in concert with the land-grant universities (Bailey, 1971). The degree of 'farmer participation' in on-farm demonstrations or trials established by US researchers, however, has been variable, and recent attempts are underway to engage farmers more thoroughly throughout the entire process to encourage co-learning between academic scientists and organic farmers (Vogl et al., 2015). As in business environments, scientists in research institutions have been encouraged to move from 'single-loop learning' (Argyris, 1991) to 'double-loop learning' or understanding 'how' people learn is as critical as 'what' they learn (Pretty, 1995). Farmers at land-grant university field days, for example, have routinely expressed uncertainty about agricultural research results that are derived from small-scale experiment station plots (Delate and DeWitt, 2004). Sewell et al. (2014) have shown that a 'shared inquiry' between farmers and researchers is necessary to 'negotiate understandings and build knowledge' which may derive from disparate sources, compared with typical researcher-controlled experiments. Scientists may utilize different management, technology and production techniques on research stations than what is experienced on-farm, leaving many farmers unable to adopt the entire technology package suggested by the research (Pretty, 1995). True participatory research relies on persistent and critical observation, parallel investigations between and within the team, and open-ended investigations where findings are vetted and challenged (Pretty, 1995). By engaging farmers throughout the project, scientists can systematically extract, evaluate and preserve local farmer knowledge (Niggli, 2015). Because sustainable land use practices have been known to be more knowledge-intensive (Röling and Brouwers, 1999), organic farmers must develop extensive agro-ecosystem knowledge in order to profitably manage their farms without conventional inputs. Emphasizing field diversity and landscape heterogeneity, agroecological approaches are recognized as a sustainable path to reducing undesirable socio-economic and environmental impacts from perturbations such as climate change (Altieri, 2002; de Schutter, 2010).

This paper focuses on the process component of co-innovation, highlighting methodological aspects and barriers to knowledge co-creation, and attempts to identify key common and divergent features among Italian and US panoramas in participatory organic agriculture research. We also sought to ascertain the state of participatory/on-farm organic research in each country. A comparative study, based on pairs of pairs (organic farmers and scientists in Italy and the USA), was set up to help answer these questions. Co-creation of innovation stresses the importance of the three basic constituents of such processes—the context, the content and the process. Here we explore the decision-making *process* farmers and researchers use in determining the value of on-farm/participatory research. As farmers begin to experiment (context and content), innovation of their own farm practices is often an outcome, as farmers are inspired by the connection with researchers in the project (Pretty, 1995).

Materials and Methods

Questionnaire structure

In order to discern the extent of interest and receptivity towards participatory research and co-innovation between organic research and farming communities, a questionnaire was designed by the co-authors with organic farmer input in Rome, Italy, in January 2014. Information about on-farm/participatory experiences and visions of organic farmers and scientists were gathered by two questionnaires, first piloted by members of the two groups of respondents. The questionnaires were written in Italian and in English for each respective country. Both questionnaires were composed of 12 questions: three open-ended questions and nine closed-ended queries. Among these nine questions, two questions were dichotomous questions, where the respondent had two options. The other questions were nominal-polytomous questions, where the respondent had more than two unordered options (Gillham, 2008).

The first two questions were designed to 'warm-up' and classify the respondents. Thus, this section was quite different in the scientists' and the farmers' questionnaires. Question 3 was a typical 'skip' question, so only the respondents (either scientists or farmers) who had experienced participatory research proceeded through the entire questionnaire (Foddy, 1994). Questions 4–11 included 'response mode' questions as the more time-consuming questions. Questions were designed to be similar between the scientists' and the farmers' questionnaires, with the exception of question 7 that dealt with reimbursement to participate in the research and the funding origin, for farmers and scientists, respectively. Question 12 was very broad, aimed to capture individual visions about participatory research: for this reason it was set up as a 'full

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open ended' question (Gillham, 2008). For the purposes of this research, we used the definition of an 'experiment' following Montgomery (2009) who described an experiment as 'a test or series of tests in which purposeful changes are made to the input variables of a process or system' so that observations occur to identify reasons for changes in the output response. Critical components in experimentation would include observing conditions and monitoring results (Sumberg and Okali, 1997).

Participants were asked the following: (1) Identify whether farming is a part-time or full-time operation, and specify the type/types of crops and/or animals included in their operation; (2) Identify if they have or have not participated in on-farm participatory research, and if yes, they were then asked to specify the number of on-farm/participatory research trials and the number of years they have participated; (3) Identify the type and a brief description of innovations that had been researched and type of reimbursement; (4) Identify motivations for engaging in participatory research, as well as what their idea of participatory research includes; (5) Identify any conflicts obstructing successful participatory research; (6) Identify if participatory research should be considered a tool to promote sustainable/organic agricultural policy and/or as an avenue for researchers to extend their role as researchers to extension agents; and (7) Briefly describe their personal vision for on-farm/participatory research.

Questionnaire administration

Questionnaire development, pilot testing, administration and analysis occurred during the months of January to May 2014. In Italy, the questionnaire was administrated to 20 organic farmers in three regions (Lazio, Lombardy and Veneto), according to the 'paper-and-pencil' questionnaire administration model, where the items are presented on paper (Lavrakas, 2008). The questionnaire was filled in as a complementary activity during farmer workshops, field days and other events. The interviewer (Colombo) was present, but did not directly participate in the questionnaire completion, except to answer clarifying questions. Thus, all participating farmers independently completed the questionnaire.

Scientists were contacted through the Italian scientific society for organic farming and biodynamic research (*Rete Italiana per la Ricerca in Agricoltura Biologica e Biodinamica—RIRAB*). The association manages ten Thematic Working Groups (TWG) dealing with different topics, including agronomic practices, energy, biodiversity, animal production and communication. One of RIRAB's goals is to stimulate the most effective cooperation between researchers and experts in the field of organic farming and to promote effective interaction with all stakeholders in the sector, in order to develop new knowledge, encourage interdisciplinary scientific research and technological development and to promote the wider application of results. Approximately 300 scientists in the TWG received the questionnaire through e-mail, along with a short message on survey goals and intentions sent out by a co-author, also member of the RIRAB (Canali).

In the USA, the scientist questionnaire was distributed to 65 researchers recruited through Organic Center scientist lists and through personal contacts of the co-authors. The farmer questionnaire was sent to 200 organic farmers on the Iowa Department of Agriculture and Land Stewardship (IDALS) organic program list. Iowa has an active organic community (fifth largest number of organic farms in the USA) (USDA-NASS, 2011) and farmers were familiar with the co-author (Delate), who has worked with Iowa organic farmers since 1997.

Questionnaire analysis

Questionnaires were received by co-authors and sent to a technician, who numerically coded them to ensure confidentiality of respondents. Quantitative responses (e.g., number of on-farm trials) were directly inputted, while qualitative responses were sorted by topic before data entry. In the case where more than one respondent entered the same or similar additional answers, these were categorized as separate responses (see Table 8). Data were analyzed through Excel™ for means and results were compiled into tables based on the order of questions.

Results and Discussion

Organic researchers

The number of researcher responses was approximately the same in both countries, with 21 researchers in the USA and 23 in Italy completing questionnaires. While there were many similarities between US and Italian on-farm/participatory organic researchers, there were some striking differences (Tables 1–5). The majority of organic researchers in the USA were employed by universities (86% of respondents), while state institutes constituted the largest employer in Italy (66% combined), with only 35% at universities (Table 1). This trend may reflect the history of organic research in academic settings in the USA, where the federal agency, USDA, lagged behind land-grant universities' efforts to meet organic farmers' requests for more organic research (Delate and DeWitt, 2004; Youngberg and Demuth, 2013). In Italy, research in organic food and farming received little attention by institutional scientific bodies until the 1980s, and gradually progressed upon implementation of the EU Council Regulation (EEC) No. 2092/91 on organic production in 1991.

Indeed, the first funded program containing research actions that were supported by the Organic Farming Office of the Italian Ministry of Agriculture, Food, and Forestry (MPAAF–Ministero per le Politiche Agricole, Alimentari e Forestali, 2008) was launched in 1995 and supported research on organic-compliant off-farm inputs

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Table 1. Characteristics of on-farm/participatory researchers—US and Italian organic researchers, 2014.

US researchers						Italian researchers					
Employer of researchers ($n=21$)	Percent of those responding in the affirmative to this question	Area of research ($n=21$)	Percent of those responding in the affirmative to this question	Number of on-farm trials ($n=20$)	Percent of those responding in the affirmative to this question	Employer of researchers ($n=23$)	Percent of those responding in the affirmative to this question	Area of research ($n=23$)	Percent of those responding in the affirmative to this question	Number of on-farm trials ($n=11$)	Percent of those responding in the affirmative to this question
University	86[1]	Grain crops	67	1–5	65	University	35[1]	Grain crops	30	1–5	55
State institute	5	Forage crops	48	6–10	10	State institute	57	Forage crops	9	6–10	9
Federal institute	10	Vegetable crops	57	11–20	15	Federal institute	9	Vegetable crops	39	11–20	18
Private institute	5	Fruit crops	43	>20	10	Private institute	0	Fruit crops	26	>20	18
		Animals	29					Animals	17		
		Other	5					Other	35		

[1] Totals may not add up to 100%, as respondents could check more than one answer in specific questions, or some chose not to respond to that particular question.

to sustain soil fertility and plant protection. Much later (2009), the need for a specific research program at the national level was acknowledged in Italy, and a range of research topics was identified and supported. It was noticeable that the program was primarily aimed ‘to provide support to implement the European regulation at the national level’ rather than to meet organic farmers’ research needs. Italy adopted a National Action Plan on Organic Food and Farming (OFF) research in 2002. This Action Plan was focused on agro-environmental programs, market development, research, and production capacity building. In December 2005, a new National Strategic Plan on OFF was approved; it did not include specific research priorities, but it was used as a reference framework for actions to strengthen the national OFF sector, and, from 2008 to 2010, several organic research actions were funded (Puliga et al., 2006). These actions were aimed at meeting stakeholders’ demands for research and innovation and to provide support to implement the European regulation at a national level (MPAFF Italian regulation MD 13641/2009).

Research focus

There was a nearly equivalent split between grain crops (67%) and vegetable crops (57%) as main areas of concentration for the US researchers, while horticultural crops dominated in Italy (65% combined for vegetables and fruit). The latter trend is reflected in the prevalence of organic horticultural farmers and crops in Italy. Out of 1,387,913 ha, encompassing 48,650 organic farms, 26,093 ha are under horticultural production (SINAB, 2015). As horticultural crops represent the Italian organic agricultural sector with the most value-added crops (SINAB, 2015), the influence of organic horticulturists is noteworthy. At the last US census before this study (2011), there were 1,248,983 ha of total organic cropland, with 59,695 ha of organic vegetables (USDA-ERS, 2015).

Overall, the number of on-farm trials was similar between the USA and Italy, with the majority of researchers in both countries (average of 60%) having conducted 1–5 on-farm trials, experiments, or innovation activities (Table 1). There was a greater number (36%) of Italian researchers reporting on-farm trials at the higher end (11 to 20+ trials) compared with the USA (25%). In examining the number of years of on-farm research, Italian researchers reported a longer history, with 55% having conducted trials for 11 to 20+ years compared with 25% reporting this same period in the USA (Table 2). The majority of US researchers (45%) reported that they had been involved in on-farm research for 6–10 yr. ‘Farming systems’ and ‘nutrient/pest management’ received the highest points for on-farm/participatory research focus in the USA (85 and 65%, respectively), while ‘farming systems’ and ‘equipment’ garnered 50% each in Italy (Table 2). In conversations with organic researchers in Italy, the topic of ‘plant breeding’ or ‘crop selection for

Table 2. Focus of on-farm research, funding sources, and motivations for research—US and Italian organic researchers, 2014.

US researchers								Italian researchers							
Years of on-farm research (*n* = 20)	**Percent[1]**	**Type of research (*n* = 20)**	**Percent**	**Funding sources (*n* = 20)**	**Percent**	**Motivations for on-farm research (*n* = 20)**	**Percent**	**Years of on-farm research (*n* = 9)**	**Percent**	**Type of research (*n* = 10)**	**Percent**	**Funding sources (*n* = 10)**	**Percent**	**Motivations for on-farm research (*n* = 11)**	**Percent**
1–5	30[2]	Farming systems	85[1]	Institute	85	For own information	40	1–5	44	Farming systems	50	Public institution (European Union)	90	For own information	73
6–10	45	Plant breeding	20	University	45	Farmer/Farmer Organization request	40	6–10	11	Plant/animal breeding	30	Italian national funding	50	Farmer/Farmer Organization request	45
11–20	10	Equipment	35	Self-funded	20	Researcher/research institution emphasis	25	11–20	44	Equipment	50	Italian regional funding	80	Researcher/research institution emphasis	36
>20	15	Nutrient/pest management	65	Private association	50	Encouraged by institution	10	>20	11	Nutrient/pest management	30	Private organization	40	Encouraged by institution	0
		Marketing/ processing	20			Specific research funds	50			Marketing/ processing	0	Self funded	30	Specific research funds	18
		Other	10			Other	25					Other	30	Other	9

[1] Percent = Percent of those responding in the affirmative to this question.

[2] Totals may not add up to 100%, as respondents could check more than one answer in specific questions, or some chose not to respond to that particular question.

local conditions' was often repeated as a main participatory research topic, but the questionnaire responses demonstrated only 30% of respondents were working in this area, but this was higher than in the USA (20%).

Funding sources for organic research were similar between countries, with government entities supplying the bulk of the funding. The majority in the USA (85%) receive support from a national agency (USDA) and 90% of Italian respondents receive on-farm organic trial funding from the EU, with 50% citing Italian national agency sources and 80% receiving from regional agencies (Table 2). Considering that the bulk of US universities employing organic researchers are state-funded, 45% of respondents also cited this state source for their organic on-farm/participatory research. Approximately 50% of US researchers received support from private associations, compared with 40% in Italy. The most common private associations funding organic on-farm research in the US are the Organic Farming Research Foundation (OFRF, Santa Cruz, CA) and Ceres Trust (Milwaukee, WI), which provided approximately 1.2% of the entire US organic research budget for organic research in the Midwestern USA. Private funding for organic research is uncommon in Italy, as both Italian researchers and farmers cited no private funds for their activities, although there are some local organizations and farms that support on-farm trials.

Main motivations for conducting on-farm research differed between countries, with 50% of US researchers citing 'specific research funds' while only 18% of Italian researchers cited this motivation (Table 2). Despite the fact that, in the last decade, Italian funding agencies cited involvement of stakeholders in research projects, they did not explicitly require on-farm trials within their grant requirements. This requirement has been incorporated into USDA organic grant requests for proposals (RFP) as a result of stakeholder engagement in the RFP process. The majority of Italian researchers (73%) cited 'for own information' as their main motivator for participatory research, compared with 40% in the USA. While the numbers supporting an '*emphasis* on participatory research by institutions' between the two countries were similar (35 and 36%, in the USA and Italy, respectively), no respondents in Italy cited '*encouragement* for participatory research' by their institution, compared with 10% in the USA. In both locations, 'on-farm organic research' does not appear in any institutional documents. Only recently at Iowa State University, for example, as a result of increased emphasis on stakeholder engagement, are faculty asked to describe their on-farm research in their annual reports.

The results regarding perceptions of on-farm/participatory research were encouraging for both sets of researchers, with 95 and 86%, respectively, in the USA citing 'farmer knowledge' and 'farmers as peers' as key components, and Italian researchers reversing this ranking, placing 'farmers as peers' at 64% versus 'farmer knowledge' at 59% (Table 3). Fifty-two percent of US researchers felt that the concept of 'democratizing research' was essential in on-farm research, while only 32% of Italian researchers cited this idea. Interestingly, both sets of researchers had similar responses to the notion of participatory research as a 'valuable tool to promote organic agricultural policy' (81 and 87% in USA and Italy, respectively). Perhaps because of Italy's lack of history with a visible Extension service, as is seen in the USA, the second response of 'changing researchers to become research-extensionists' through participatory research received acknowledgement by only 39% of Italian researchers compared with 62% in the USA. Regarding constraints limiting participatory research, US researchers placed equal emphasis on 'lack of common language between researchers and farmers' (33%) and 'emphasis on publishing' (33%), while Italian researchers cited 'lack of reward/appreciation' (41%) and 'more time-, resource- and funding-consuming' (36%) as key constraints (Table 3). According to some researchers, they are less willing to meet the demands associated with on-farm research because of the previously described lack of full support for participatory research by their institutions. 'Lack of methodology' was cited almost equally as a constraint by US (28%) and Italian (32%) researchers. This constraint may be remedied by including farmers as co-researchers rather than simply participants with available land for experiments. Limitations of farmers' experiments, however, as cited by Vogl et al. (2015), include precision, reliability, robustness, accuracy, validity or the correct analysis of cause and effect. Okali et al. (1994) noted that if farmer participatory research is to make a significant contribution to the interface between formal and informal research, new conceptual frameworks and methods that permit the description and analysis of local experimentation and information exchange will be required.

It was interesting to contrast the vision statements by US (Table 4) and Italian (Table 5) researchers, with the majority of US researchers (48%) citing participatory research as useful for 'improving farmer involvement', while Italian researchers (69%) discussed the *potential* for participatory research to 'improve communication between farmers and researchers' (Table 5). Both groups cited their vision as including working on 'relevant research' and 'farmers adapting technologies to their own conditions.' While the idea of 'farmer as inventor' was acknowledged by both groups, a quote from an Italian researcher belied the issue of 'farmer take-over' of projects: 'Bucolic visions (i.e. farmers—especially organic ones—are 'always right') should be avoided.' Another Italian researcher cited the idea of participatory research as 'overcoming the disadvantage of not having extension services…as in Northern Europe' (Table 5). The difference between a 'top-down' on-farm research project and true participatory research was acknowledged by a US researcher: 'Participatory research (not the same thing as on-farm research) can provide a valuable avenue to

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Table 3. Key ideas of participatory research, constraints, opinion of participatory research—US and Italian organic researchers, 2014.

US researchers						Italian researchers					
Idea of participatory research includes: ($n = 21$)	**Percent[1]**	**Constraints ($n = 21$)**	**Percent**	**Opinion of participatory research ($n = 21$)**	**Percent**	**Idea of participatory research includes: ($n = 22$)**	**Percent**	**Constraints ($n = 22$)**	**Percent**	**Opinion of participatory research ($n = 23$)**	**Percent**
Farmer knowledge	95[2]	Lack of common language between scientists and farmers	33	Can be a valuable tool to promote sustainable/ organic agricultural policy	81	Farmer knowledge	59	Lack of a common language between scientists and farmers	14	Can be a valuable tool to promote sustainable/ organic agricultural policy	87
Farmers as 'peers'	86	Lack of methodology	28	Can be an avenue to change researcher's roles from pure researcher to researcher/ extensionist	62	Farmers as 'peers'	64	Lack of methodology	32	Can be an avenue to change researcher's roles from pure researcher to researcher/ extensionist	39
Democratizing research	52	Lack of reward/ appreciation	19			Democratizing research	32	Lack of reward/ appreciation	41	Can be a valuable tool to spread on- farm research and to publish results	30
More effective method	38	Emphasis on publishing	33			More effective method	27	More time, resources and funding consuming	36	Other	13
Other	33	Unsuitability of funding	29			Other	9	Institutional lack of belief in benefits of participatory research	14		
		Other	24					Lack of trust by researchers in institutions' belief in benefits of participatory research	27		
								Other	18		

[1] Percent = Percent of those responding in the affirmative to this question.
[2] Totals may not add up to 100%, as respondents could check more than one answer, or some chose not to respond to that particular question.

Table 4. Vision for participatory research—US organic researchers, 2014.

Vision ($n = 21$)	Percent of those responding in the affirmative to this question	Representative quotes
Improve farmer and stakeholder involvement in the development of research questions and projects	48[1]	'In an ideal setup, the research topics and questions would come from the farmers; the research/extension people would design the experiments and secure funding with input from the farmers; the research would be carried out on-farm by the farmers with input and support from the researcher/extensionist; and perhaps more in-depth or technical parallel experiments occurring on the research farm or in the labs. Then the research and extension people would analyze the collected data and communicate the results in publications'
Increase communication and relationships among farmers and researchers	33	'My vision for participatory research is to develop a seamless and integrated relationship between (organic) farming communities and researchers such that the mechanisms behind management practices observed to be successful on organic farms can be validated and explained though a biological lens'
Provide research that is relevant to finding answers to real world problems	29	'For me, on-farm research helps to ensure that my research questions and data collected are relevant and useful to actual farmers. In an applied field like agronomy and horticulture, on-farm research is a kind of informal peer review that lends credibility to a study. If a farmer is willing to implement an experimental strategy on their farm, they must feel the idea is worth exploring'
Address fundamental gaps in knowledge	10	'I think integrated research/extension grant programs-as long as the funding levels are high enough to actually support the numbers of graduate students and personnel needed-are addressing these gaps between farmers, practitioners and researchers by motivating them to work together. I think that researchers know where there may be gaps in fundamental knowledge, but farmer input and skepticism is needed to shape research questions while research is being planned. The biggest barrier I've experienced as a researcher is getting to know who the smartest local farmers are and getting them involved on the front end of research, because it takes a ton of time and involvement to really get to know and trust people, and that works both ways'
Provide development of observation and decision making tools that assist farmers in adapting technologies to their specific conditions	5	'Successful agriculture is about people managing crops, fields, farms, ecosystem services, and animals in integrated systems. Variability from field to field, farm-to-farm and year-to-year is the rule. Participatory research (not the same thing as on-farm research) can provide a valuable avenue to develop observation and decision tools, which help farmers plan and manage their farms. These tools contribute to farmers adapting technologies to their own conditions'

[1] Totals may not add up to 100%, as respondents could check more than one answer, or some chose not to respond to that particular question.

Table 5. Vision for participatory research—Italian organic researchers, 2014.

Vision ($n = 16$)	Percent of those responding in the affirmative to this question	Representative quotes
Improved communication and knowledge transfer among farmers and researchers	69[1]	'Participatory research has the potential to become a new research system-more decentralized (integrating research activities carried out by local and national research institutions) and more oriented to the needs of farmers who have an active role, not only in suggesting issues, but also in finding solutions. An example is participatory breeding: this methodology has recently been used in Italy with positive results, responding to the needs of farmers, while allowing breeding activities in heterogeneous environments and providing improved genetic materials to the end users'
Improved focus on farmers' research needs	25	'Participatory research is an interesting approach as a complement to research on-station (not as a substitute), and as an approach to improve (from both sides: researchers and farmers). Bucolic visions (i.e. 'farmers—especially organic ones—are always right') should be avoided'
Promote participatory research to other stakeholders	25	'The 'real' participatory research starts from the common formulation of research questions. Often, researchers write the research project that is then offered to farmers, asking for their involvement. Therefore, thanks to participatory research, farmers are informed about the possible positive outcomes of research projects from the beginning, and therefore more open to collaborations. In Italy, participatory research can contribute to overcome the disadvantage of not having 'extension services' for innovation and technology transfer as in Northern Europe'
Improve optimization of production process that support sustainable practices	6	'Participatory research can be effective in integrating studies carried out at farm level with those performed at the landscape level. It is particularly effective in pre-competitive, applied research and to perform systemic studies, which can be complementary with a reductionist research. This research can also enhance the trust between researchers and farmers and may help to identify the 'research needs' of farmers and ranchers. Since the control of the experimental factors is more difficult on-farm, appropriate methodologies for on-farm research should be developed'
Developing effective methods for on-farm research	13	'Participatory research allows effective methods for on-farm research'
Allow farmers to recover past knowledge and study old cultivars	6	'Participatory research is particularly useful for the study of old cultivars, recovering the farmer's knowledge accumulated over generations'

[1] Totals may not add up to 100%, as respondents could check more than one answer, or some chose not to respond to that particular question.

develop observation and decision tools, which help farmers plan and manage their farms' (Table 4).

Organic farmers

The smaller sample size of organic farmer responses compared with researchers reflected the difficulty of obtaining farmer input in a timely basis. In Italy, the dedicated survey session within the organic farmer association meeting increased the number of responses compared with the e-mail survey in the USA, leading to 16 farmers completing questionnaires in Italy compared with ten in the USA, despite follow-up telephone calls and e-mails. One of the key US organic farmers, who

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Table 6. Characteristics of organic farmer–researchers and their on-farm research activities—US and Italian organic farmers, 2014.

US farmers								Italian farmers					
Type of farm ($n = 10$)[1]	Percent of those responding in the affirmative to this question	Type of production ($n = 10$)	Percent of those responding in the affirmative to this question	On-farm research partici pation ($n = 10$)	Percent of those responding in the affirmative to this question	Number of on-farm trials ($n = 6$)	Percent of those responding in the affirmative to this question	Type of production ($n = 16$)	Percent of those responding in the affirmative to this question	Awareness of participatory research and purpose ($n = 16$)	Percent of those responding in the affirmative to this question	Number of on-farm trials ($n = 8$)	Percent of those responding in the affirmative to this question
Fulltime	50	Grain crops	60[2]	Have	60	1–5	33	Vegetable crops	81[1]	Yes	94	1–5	100
Part time	50	Forage crops	70	Have not	40	6–10	33	Animals	0	No	6	6–10	0
		Vegetable crops	20			11–20	17	Mixed	19			11–20	0
		Fruit crops	30			>20	17					>20	0
		Animals	30										

[1] Questions asked were: (1) Are you a full-time or part-time farmer (US only); (2) What is raised on your farm; (3) Are you aware of participatory research, or have you ever participated in on-farm research; (4) How many on-farm trials have been conducted on your farm?
[2] Totals may not add up to 100%, as respondents could check more than one answer, or some chose not to respond to that particular question.

Table 7. Focus and length of on-farm research, compensation and funding for on-farm research—US and Italian organic farmers, 2014.

US farmers						Italian farmers					
Type of research ($n = 6$)[1]	Percent of those responding in the affirmative to this question	Years of on-farm research ($n = 6$)	Percent of those responding in the affirmative to this question	Compensation ($n = 6$)	Percent of those responding in the affirmative to this question	Type of research ($n = 10$)	Percent of those responding in the affirmative to this question	Years of on-farm research ($n = 8$)	Percent of those responding in the affirmative to this question	Funding sources ($n = 9$)	Percent of those responding in the affirmative to this question
Farming systems	83[2]	1–5	0	Inputs	66	Farming systems	40[1]	1–5	88	European Union	22
Plant breeding	33	6–10	50	Expertise/ assistance	83	Plant/animal breeding	40	6–10	0	Universities or research institutions	33
Equipment	33	11–20	33	Stipend	83	Equipment	30	11–20	13	Private association	0
Nutrient/pest management	83	>20	17			Nutrient/pest management	30	>20	0	Self-funding	67
Marketing/ processing	33					Marketing/ processing	20				
Other	33										

[1] Questions asked were: (1) What was the focus of the on-farm research; (2) How many years of on-farm research have you conducted; (3) How were you compensated for your involvement in the on-farm research (US only); (4) Funding sources for the on-farm research (Italy only).
[2] Totals may not add up to 100%, as respondents could check more than one answer, or some chose not to respond to that particular question.

had participated in several on-farm trials, told the co-author: 'This is really important, and I am glad you are doing this survey, but I just can't get enough time away from the farm to complete the questionnaire.' Five out of ten farmers in the USA responded they were part-time farmers which may have affected their availability for on-farm research. Six out of ten produced grain and forage crops, while in Italy, 13 out of 16 were involved in vegetable crop production (Table 6). Seven out of ten of the responding US farmers cited involvement in 1–10 on-farm trials, while all the Italian farmers checked 1–5 on-farm trials. Farmers' responses to 'years of on-farm research' matched the number of trials, with US farmers primarily citing 6–10 yr, and Italians citing 1–5 yr (Table 7).

Regarding the most common type of research trial, US farmers cited 'farming systems' and 'nutrient/pest management,' with the Italian farmers citing 'farming systems' and 'plant/animal breeding' as the main foci of research. While there was unanimity between US researchers and farmers regarding on-farm research focus, these results contrast with the Italian researcher responses, where the farmers ranked 'nutrient/pest management' focus ahead of 'equipment,' which was highly ranked by researchers. When US farmers responded to questions of funding for their participation in the on-farm research, the majority cited both 'expertise/assistance' and 'stipend' as the main rewards and 'inputs provided' as secondary benefits. On the Italian side, 11 out of 16 reported projects as 'self-funded' with 9 out of 16 checking EU and University/institutional funding (Table 7). This result may be derived from the requirement in many US grants to compensate farmers for their role in on-farm research, or simply the fact that more Italian organic farmers are engaged in their own research, not necessarily benefiting from outside compensation. While non-linked on-farm research (i.e., no connections with a scientific body) was outside the purview of our study, Vogl et al. (2015) proposed that 'farmers' experiments' are critical to organic farming innovations that can be adapted to changing biological and social conditions, and should be encompassed in future work.

There was a common key rationale motivating participation in on-farm research across US and Italian organic farmer groups: 'to gain information' for themselves (Table 8). This result was in line with observations by Vogl et al. (2015) where Austrian farmers most frequently reported having obtained more knowledge and increased their personal satisfaction, but also eased labor, increased production, gained reputation or increased income as a result of participating in on-farm trials. In Cuba, however, the authors found that increased productivity, increased self-sufficiency and better work efficiency were the most frequently mentioned outcomes (Vogl et al., 2015).

While the US farmers ranked 'researcher request' at a higher position than Italian farmers, it is unclear if this reflects the more recent emphasis on on-farm/participatory research at Italian institutions. Italian farmers divided their responses to the question of their opinion of participatory research into two categories (Table 8): farmer benefits and benefits to society. The majority felt that treating 'farmers as peers' was a key component, along with embracing 'farmer knowledge.' Less highly ranked, but still important, were 'democratizing research' and a 'more effective method of conducting research.' Other comments written by Italian farmers included 'avoiding isolation on the farm' and 'interest in experimentation and publishing results.' These responses comport with findings from Niggli (2015), who found that results from on-farm trials are more efficiently disseminated among other farmers than researcher-led trials.

US farmers again appeared to be more conscious of the need for some form of compensation, as this is now common practice in the USA. Both US and Italian farmers highly ranked participatory research as a 'valuable tool to promote sustainable agriculture.' US farmers were more prone to agree that participatory research can assist researchers in assuming more of an extensionist role—again, an artifact of the more viable US Extension Service.

Constraints affecting participatory research cited by farmers were similar between the USA and Italy, with 'lack of time' receiving the highest points (Table 8), reflecting the reason some farmers were unable to complete their questionnaires. 'Lack of common language' also was rated as critical to both groups of farmers, along with 'lack of reward/incentives.' While some Italian organic farmers we interacted with during the study period appeared to be hesitant to become involved with participatory research, 'lack of trust in institutions' did not rank as high as expected, based on this sentiment.

Corresponding to the low number of responses from farmers, vision statements were also limited (Table 9). As one US farmer stated to the co-author: 'You covered all of my vision ideas in your 'opinion of participatory research' question.' The sentiment from US organic farmers appeared to be: 'This is a better way to address our farm's specific research needs.' One US farmer summarized: 'Participatory on-farm research programs are the first true research for growers that takes the small-standardized research model and applies research to a more diversified ecological area. By getting 'more research boots on the ground,' efficient, new, current, realistic research outcomes can be applied to cultural practices which growers, large or small, can understand.' Italian organic farmers also recognized the benefits of participatory research for improving their farm operations, but more than US farmers, they expressed the benefits accruing to the research community as well. This quote from an Italian organic farmer captures the essence of true participatory research: 'In my view, participatory research enables a shortened time span of innovation and benefits, making them swiftly available to growers; it further allows a greater exchange and debate among stakeholders, making the results more effective and based on farmers' knowledge.'

Table 8. Motivations, constraints and opinions of on-farm/participatory research—US and Italian organic farmers, 2014.

US farmers						Italian farmers					
Motivations for on-farm research (*n* = 6)	**Percent[1]**	**Constraints (*n* = 10)**	**Percent**	**Opinion of participatory research (*n* = 10)**	**Percent**	**Motivations for on-farm research (*n* = 13)**	**Percent**	**Constraints (*n* = 16)**	**Percent**	**Opinion of participatory research (*n* = 15)**	**Percent**	**Opinion of participatory research (*n* = 15)**	**Percent**
Own information	50[2]	Lack of time to fully engage in research	90	Valuable tool to promote sustainable/organic agricultural policy	100	Own information	62	Lack of time to fully engage in research	50	Farmer knowledge	53[1]	Valuable tool to promote sustainable practices and improve enterprise management	93
Researcher/research institution request	83	Lack of reward/ incentives	40	Can be an avenue to change researcher's roles to extensionist	90	Researcher/research institution request	54	Lack of reward/ incentives	44	Farmers as 'peers'	73	Avoid isolation on the farm	40
Farmer/farmer organization request	33	Lack of methodology	40			Farmer/farmer organization request	0	Lack of methodology	31	Democratizing research	40	Interest in experimentation and publishing results	40
Other	0	Lack of common language between scientists and farmers	50			Encouraged by institution	8	Lack of a common language between scientists and farmers	38	More effective method	40	Other	13
		Lack of trust in institutions regarding participatory research	10			Other	8	Lack of trust in institutions regarding participatory research	6	Other	7		
		Unsuitability of funding schemes	30					Institutional lack of belief in benefits of participatory research	0				
								Other	13				

[1] Percent = Percent of those responding in the affirmative to this question.

[2] Totals may not add up to 100%, as respondents could check more than one answer in specific questions, or some chose not to respond to that particular question.

Table 9. Vision for participatory research—US and Italian organic farmers, 2014.

Vision	Percentage of those responding in the affirmative to this question	Representative quotes
US farmers ($n = 4$)		
Increased knowledge base specified to farmers needs and operation	50[1]	'To increase the knowledge base for our part of the industry and provide a better-adjusted diet and animal husbandry program specifically designed for sustainable, organic animal production'
Current and realistic research outcomes can be applied and understood by farmers	25	'Participatory on-farm research programs are the first true research for growers that takes the small standardized research model and applies research to a more diversified ecological area. By getting "more research boots on the ground," efficient new current realistic research outcomes can be applied to cultural practices which growers, large or small, can understand'
Including farmers in the development of research projects and solutions	25	'Farmers get to have a say in what problem or project should be researched'
Research seen as a valuable link between organic farmers and researchers	25	'I have been very active in on-farm research as I see the value of the information to organic farmers. I envision participatory research as a valuable link between organic farmers and scientists'
Italian farmers ($n = 10$)		
Improved communication and knowledge transfer among farmers and researchers	60	'In my view, participatory research enables a shortened time span of innovation and benefits, making them swiftly available to growers; it further allows a greater exchange and debate among stakeholders, making the results more effective and based on farmers' knowledge'
Improved focus on farmers' research needs	30	'Participatory research should be an on-going exchange of information between farmers and researchers; problem resolutions; involving farmers having some interests and concerns'
Promote participatory research to other stakeholders	30	'Research done with scientific methods, with active stakeholder participation (with specific reference to those who contribute to generate value), in needs assessments, identification of variables, research implementation and evaluation of results'
Developing effective methods for on-farm research	30	'Participatory research works if properly done, fully involving growers in all research stages and with thorough recognition of different and complementary roles each play'
The future of research and development based on biodiversity and local production	10	'Participatory research is the future of research and development in farming, in particular, research based on biodiversity and local production'
Other	10	'It shouldn't conflict with farm production design'

[1] Totals may not add up to 100%, as respondents could check more than one answer, or some chose not to respond to that particular question.

The professional and personal rewards derived from co-research must outweigh the additional time and management required with on-farm participatory research for participatory research to become the norm. Pretty (1995) points out that as end users manage decisions and determine how resources are employed, they tend to have a greater stake in maintaining structures and practices. Longevity of co-research projects is often directly correlated to the 'buy-in' of the farmer/farm family on the value of the project related to their own needs, as agency-managed participatory research without actual buy-in from participants can lead to greater alienation and distrust (Pretty, 1995).

Conclusions

While Italy and the USA experienced sustained, vigorous growth in organic production beginning in the 1980s, scientific agricultural institutions in both countries were

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slow to develop support for organic and agroecological research. Organic farmers practiced their own on-farm experimentation to fill this gap, leading to the formation of farmer-based organizations, such as AIAB in Italy and OFRF in the USA, to advance the idea of farmers as researchers with multiple innovations available for scientific exploration. In 2014, we surveyed organic researchers and farmers in Italy and the US to examine the current status of participatory research in bridging the gap between these two groups, and to identify future directions related to enabling policies supporting co-innovations in organic scientific and farming communities.

Overall, US and Italian organic farmers' and researchers' survey responses did not differ in their goals and aspirations for participatory research, although there were a few differences in attitudes toward farmers as full participants (e.g., Italian farmers and US researchers ranked 'farmers as peers' and 'respecting farmer knowledge' higher than Italian researchers). This difference reflects another aspect: trust building is key in such relations and the reluctance for full partnerships on the part of some organic researchers may be derived from frustration during their on-farm/participatory experiences. Various respondents stressed the need to enable a multi-actor and trans-disciplinary innovation, bridging social and technical domains of knowledge, and breaking away from the restriction of individual disciplines.

In the case of US researchers, the tradition of Seaman Knapp's on-farm demonstrations from the early 1900s, and subsequent Extension Service and Experiment Station connections between farmers and scientists at land-grant universities, represented a major structural difference with the Italian experience. In Italy, university researchers are traditionally more disconnected to extension. Many US organic researcher survey respondents cited 'specific funding' for participatory research as a significant motivator for including organic farmers in their research projects, as opposed to simply valuing farmer participation. While a national, farmer-led, organic research association to advance co-research does not yet exist in the USA, on-farm/participatory research continues to be an essential component of grants funded by private organic research foundations, and several federal agency programs in the area of sustainable and organic agriculture. In Italy, organic farming associations traditionally have focused most of their agricultural innovation activities on farmer-led research. This has translated into political efforts, advocating for more resources and institutional priorities aimed at participatory research, and in building on-farm co-innovation opportunities. One example of farmer-led research is the APIOB (Participatory Agroecological Innovation in Organic Horticulture) project, which focuses on co-development of soil and weed management strategies by organic farmers and researchers (FIRAB, 2016).

Conceptual frameworks and recommendations for the development of more participatory approaches have increased since the distribution of this survey. Implementation of the EIP may introduce substantial change in this direction. The EIP implementation represents an occasion to mobilize energies, new ideas, and new methods for including farmers as partners in co-innovation. Recommendations made by both the Technology Platform for organic farming (TPOrganics), officially recognized by the European Commission, and the EIP Focus Group on Organic Farming, as well as the EU Horizon 2020 multi-actor approach, are inspiring Italian organic researchers to increasingly acknowledge the need to include organic farmers in research and innovation initiatives. The Italian setting for agricultural research is under substantial reform, due to two converging forces: changes in the European framework for research and innovation, where more participatory forms of knowledge creation are promoted, and mounting pressures from civil society movements and organizations that advocate for transparent decision-making, open to actors at all levels—including research. A new encompassing Strategic Action Plan for the OFF sector has been recently discussed and negotiated by stakeholders, under the auspices and mandate of the Italian Ministry of Agriculture. The Plan includes a specific action devoted to research in which participatory approaches are clearly indicated as a landmark. Along the same lines, eligibility for funding for innovation under the National Rural Development Program (EC Decision, C2015/8312), stipulates a binding multi-actor agenda. This requires that Operational Groups are set up by plural constituencies, among which economic actors are pivotal, thus implementing part of the EIP strategy in Italy. Progressively, co-innovation is becoming institutionalized and a condition for accessing funds. However, operational indications and tailored methods on how to carry out genuine participatory approaches in organic farming co-research are yet to be defined by agencies, but should contain the parameters previously proposed as minimum requirements for effective co-research.

While prescribing recommendations was not the initial intent of this study, owing, in part, to the flexibility necessary for carrying out the participatory process, results obtained from the survey suggest that the following steps should be fulfilled as minimum requirements for an effective participatory research effort: (1) A collaborative experimentation design, taking into consideration already tested solutions and farmers' know how and explorative potential; (2) Periodic monitoring and observations valuing both researchers' and farmers' viewpoints and angles; (3) Joint data collection and discussion in an iterative manner; (4) Cooperative data elaboration and analysis; (5) Periodic review of the process, including methodological co-evaluation; and (6) Final co-validation of results. For all these steps to occur, appropriate, targeted, equitable and easily accessible funds should be made available, in order to avoid bottlenecks such as lack of commitment or asymmetric rewards among actors.

Results from the survey also support recommendations that US organic researchers could promulgate similar EU initiatives related to innovation partnerships to more fully address the research needs of organic farmers. Working with the Organic Center, a group of US organic farmers and researchers are developing policies for the future use of 'organic check-off' funds, administered by the Organic Trade Association, to facilitate increased participatory organic research (Delate and Shade, 2015).

Finally, knowledge sharing between the two banks of the Atlantic Ocean may provide inspiration for more effective participatory research methods gained from working with experienced on-farm researchers in the USA and co-innovation experts in the EU. In both countries, decentralizing decision-making spaces and getting research closer to farm realities, more responsive to producers, and more receptive of their knowledge within a holistic and agroecological vision is perceived to be the best way forward. Once more genuine efforts are made to support and reward co-research, actors in participatory research will assess its potential and constraints *in vivo* and will then adapt its modus operandi in order to better respond to their needs and aspirations.

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