Limits and potential of organic farming towards a more sustainable European agri-food system

Grazia Calabro
University of Messina, Messina, Italy, and
Simone Vieri
University of Rome La Sapienza, Rome, Italy

Received 12 December 2022
Revised 22 February 2023
14 March 2023
Accepted 12 April 2023

Abstract

Purpose – The aim of this paper is to assess whether the current European target to increase the areas under organic farming to 25% by 2030 is attainable and whether the simple increase in areas under organic farming may be sufficient to improve the sustainability of European agriculture.

Design/methodology/approach – The analysis has been carried out through a simple data processing related to areas under organic farming, for the period 2012–2020 (Eurostat database), in order to highlight the trends of areas under organic farming and to verify whether the annual average change rates may be compatible with the stated target.

Findings – The analysis showed that organic farming has a productive weight not corresponding to the amount on the total of the areas under cultivation and a small impact on the total of food consumption. It is a plausible hypothesis, the one that shows the increase in areas under organic farming will engage forms of agriculture and farms that, already, are more sustainable, so the achievement of 25% target will not particularly impact the European potential productive and the less environmental sustainable forms of agriculture.

Originality/value – This paper contributes to the debate, involving scientific community, policy maker and civil society, about the real contribution of organic farming to sustainability, and it will be developed in future research.

Keywords Agriculture, Sustainability, Organic farming, Common agriculture policy

Paper type Research paper

1. Introduction

For some years now, the main references for carrying out every human activity are both the concept of sustainability, understood in its multidimensional sense – economic, social and environment and thence the concept of sustainable development.

Although the principle of sustainability is fully long-time qualified (United Nations, 1987), its adoption at a political level is very recent. In particular, this is due to the decision taken by United Nations General Assembly in 2015. At that date, UN 2030 Agenda (United Nation, 2015) became the universal and mandatory reference for the development and implementation of the Member States policies.

The immediate consequence of this decision was the integration of 2030 Agenda goals into national policies by Member States.

British Food Journal
Vol. 126 No. 1, 2024
pp. 223-236
Emerald Publishing Limited
0007-070X
DOI 10.1108/BFJ-12-2022-1067

To this aim, the European Union (EU) has developed a strategy through the adoption of the *Green New Deal*, involving also the Common Agricultural Policy (CAP).

In particular, it has been established that the aim of the sustainability of European agriculture needs to be reached through the adoption of an action plan called *Farm to Fork (F2F),* which has been defined between 2017 and 2019, and it can be considered the core of the transition plan aimed at achieving the declared objectives of a more sustainable production and consumption patterns.

Through this way, the EU fulfils its obligation to integrate the Sustainable Development Goals (SDGs) into the CAP.

Imbalances and inefficiencies of the current agri-food system are well-known, but they were further highlighted during the coronavirus disease 2019 (COVID-19) pandemic. This has made clearer than ever before the need to re-design and drive them towards sustainability.

The Farm to Fork plan set targets for 2030; among them are 50% reduction in the use of pesticides; 50% reduction in antimicrobials; 20% reduction in fertilizer use and 25% of European agricultural lands need to be converted to organic agriculture by 2030 (European Commission, 2020).

In order to achieve this goal, European Commission issued the Regulation 2018/848 on organic production and labelling of organic products and repealing Council Regulation (EC) No. 834/2007, which entered into force on 1st January 2022 and on March 25, 2021, had presented a specific three-pronged action plan (European Commission, 2021) for the development of organic production:

(1) stimulate demand and ensure consumer trust: The measures proposed in this axis focus on stimulating the demand and the consumption for organic products by increasing the awareness of benefits and consumer trust in the organic logo. Some of the actions to achieve this aim are, for example, promoting organic canteens and increasing the use of green public procurement;

(2) stimulating conversion and reinforcing the entire value chain;

(3) improving the contribution of organic farming to sustainability, focussing more on animals welfare, limiting the use of plastic, water and energy also through investments in research and technology.

In this context, the main problem is that the current CAP monitoring system is unable to allow an efficient intervention monitoring (Scown and Nicholas, 2020), and this, actually, does not allow for a proper assessment on the effectiveness of the actions like the ones stated above. It is also for this reason that the present paper be confined to data analysis relating to areas under organic farming in relation to the stated target of their 25% increase in total by 2030.

The paper can contribute to the debate about the real contribution of organic farming to sustainability. It provides considerations that can be used by scientific communities and policy makers to see what can be done in order to rethink agricultural systems in a more sustainable way. Moreover, it can be useful to civil society to improve its behaviour and in improving one's habits.

The paper is structured in the following way: the second section presents a state of art; then the methodology approach, the results and the discussion are shown. Conclusions are drawn at the end.

2. State of art

For some time, the organic cultivation method is recommended as a possible alternative to the current agro-industrial production system. And that is why, since the second half of the last

century (Oelhaf, 1978), several studies concerning the comparison between conventional and organic farming have been carried out.

Many of the scientific papers were, however, limited to short periods or single aspects (environmental issue, productivity or individual crops), making full understanding of the different compared realities difficulties (Tuomisto *et al.*, 2012).

In this regard, it is believed that only long-term analysis (at least 10 years) may provide credible information about the sustainability of the different production systems.

For example, there is a general concurrence that organic farming gives good results from the environmental point of view but that this is not enough to judge how the organic farming is more sustainable compared to conventional one (Pacini *et al.*, 2003).

In sum, the elements being considered for a right comparison between the different forms of agriculture are manifold (Reganold and Dobermann, 2012).

To this end, in recent years, several studies based on meta-analysis of agricultural systems have been carried out with the aim of examining the main differences between conventional and organic farming: the yields (Seufert and Ramankutty, 2017; Seufert *et al.*, 2012); the effects on biodiversity (Frieben and Köpke, 1998; Bengtsson *et al.*, 2005; Hole *et al.*, 2005); the land use (Foley *et al.*, 2005; Tuck *et al.*, 2014); greenhouse gas emissions (Skinner *et al.*, 2014); the use of fertilizers (Bebber and Richards, 2022) and pesticides (Larsen *et al.*, 2021); the overall environmental impact (Mondelaers *et al.*, 2009; Lee *et al.*, 2015); the quality of products (Rembiałkowska, 2007; Palupi *et al.*, 2012) and the competitiveness of products (Crowder and Reganold, 2015).

It follows a complex overview of what can be found in literature about the main features that differentiate organic from conventional farming, mainly for the purpose of increasing the sustainability of agricultural production processes. For that reason, special attention has been paid to the papers which reported results of meta-analysis studies.

In this respect, three studies have given a great contribution; they compared the results derived from several comparisons leading to a particularly reliable information framework (Seufert and Ramankutty, 2017; Tal, 2018; Benbrook *et al.*, 2021). Thanks to this, at present, it is possible to get important information regarding the main aspects subject to comparison between organic and conventional farming, in particular, yields, environmental issues, economic results and issue pertaining to consume.

Yield is one of the main issues to be compared between organic and conventional agriculture. Several studies show significant differences related to type of crops (Seufert and Ramankutty, 2017), soil and climate conditions (de Ponti *et al.*, 2012), and the agronomic practices (Smith *et al.*, 2007; Ponisio *et al.*, 2015).

Notwithstanding this variability, the comparisons made have, however, demonstrated that the yields of organic farming are, generally, lower than those applying to conventional farming between 20% (Birkhofer *et al.*, 2016) and 34% and less stable over time (−15%) (Knapp and van der Heijden, 2018).

It follows that, regarding, in particular, crops, organic farming needs greater availability of lands than conventional farming for the same output (Barbieri *et al.*, 2021).

However, this is not true in an absolute sense. In fact, as above mentioned, examples of crops for which the organic cultivation method has less impact on yields are not absent.

It is the case, for example, of some permanent crops, fodder crops and legumes (Seufert and Ramankutty, 2017).

In relation to the environmental issues, organic farming has better performance than conventional one, in particular, with regard to the core themes such as the protection of biodiversity, the defence from soil erosion, the preservation of soil fertility and the reduction of environmental pollution.

The protection of biodiversity in organic farmland ecosystem (Tuck *et al.*, 2014) occurs both through general effects attributable to a more varied presence of plant species (Haas

et al., 2001; Rydberg and Milberg, 2000) and animals (Flowerdew, 1997; Brown, 1999; Beecher *et al.*, 2002) and specific effects, such as a greater protection of pollinating insects (Gabriel and Tscharntke, 2007; Andersson *et al.*, 2012).

The defence from soil erosion (Reganold *et al.*, 1987; Auerswald *et al.*, 2003) and the preservation of soil fertility is, mainly, linked to the use of organic materials used as fertilizer, manure in particular (Mäder *et al.*, 2002; Marriott and Wander, 2006; Morrow *et al.*, 2016), that, as it is known, is one of the main characteristics of organic farming compared to conventional one, with great impact on soil structure and, consequently, on its water holding capacity (Burton and Turner, 2003).

Again with a reference to the main environmental themes, some controversial data concern the greenhouse gas emissions and, consequently, the effect on climate changes. In fact, *if on one hand* there is a substantial agreement regarding the increased ability by land cultivated by organic farming to sequester carbon (Leifeld and Fuhrer, 2010; Gattinger *et al.*, 1997) and to cut nitrous oxide emissions due to not using of synthetic nitrogen fertilizers (Lee *et al.*, 2015; Dutra, 2020; El-Beltagi *et al.*, 2022; Connor, 2021), *on the other hand*, there are considerable doubts mainly linked to a possible expansion of organic farming. A possible further expansion of lands cultivated by organic would require an increased use of manure as soil fertilizer (Berry *et al.*, 2002) with inevitable rise in methane emissions (Tal, 2018).

Energy efficiency and water consumption are two other core environmental themes. In terms of energy used per unit area, organic farming is, generally, more energy efficient than the conventional one (Smith *et al.*, 2015). The results are, however, less favourable to organic farming when the amount of energy used is referred to the product unit. In this case, the yields are lower than the conventional farming which, therefore, enjoys a higher capacity to produce net energy (Lynch *et al.*, 2011).

With reference to environmental issues, one of the themes that has contributed the most to emphasize the role of organic farming as the best alternative to conventional agriculture concerns, undoubtedly, is the use of synthetic fertilizers and pesticides. This question directly involves both environmental pollution, the production costs and the quality of products released for consumption (Muller *et al.*, 2017; Meemken and Qaim, 2018).

First of all, it should be remembered that the use of chemicals in the organic farming is not generally prohibited, but it is possible only for some permitted compounds. In this regard, it is not always true that organic farming would lead to a less risk of nitrate leaching water pollution (Kirchmann and Bergström, 2001) or other nutrient such as phosphorus (Heckrath *et al.*, 1995; Stockdale *et al.*, 2002).

Regarding nitrogen, in particular, the risks of environmental pollution vary depending on the source of such nutrient: if the contribution is system legume based, the risk of leaching is lower while it rises if it results from the administration of compost or animal manures (Kirchmann and Bergström, 2001; Korsaeth, 2008). As a result, if theoretically we were witnesses of an increase in organic farming to replace conventional one, in the absence of use of synthetic nitrogen fertilizers, the current production levels could be achieved only through a higher availability of lands and organic fertilizers, in particular of animal origin. This may result in the above-mentioned problems of sustainability (Connor, 2013; Birkhofer *et al.*, 2016; Meemken and Qaim, 2018; Barbieri *et al.*, 2021).

Actually, in relation to water pollution due to phosphorus loss, scientific evidences may not enough demonstrate the greater risk of one farming system than the other (Nelson and Janke, 2007; Seufert and Ramankutty, 2017).

Moreover, regarding the use of pesticides, in general, organic farmers are used to integrate the use of permitted compounds with different cultivation, physical and mechanical practices, aimed at monitoring pests diseases and weeds (Liebman and Davis, 2000; Letourneau and Van Bruggen, 2006). Notwithstanding, the greater attention towards

integrated pest management paid, in the last years, by conventional farmers (Hill and MacRae, 1996; Tomich *et al.*, 2011; Altieri, 2018; Van der Ploeg, 2021; Giagnocavo *et al.*, 2011), to date, they use more frequently pesticides.

The different quantitative and qualitative level of use of pesticides make organic productions more at risk of loss and destruction compared to conventional ones (Van Bruggen and Finckh, 2016; Benbrook *et al.*, 2021).

From the organic farmers' point of view, costs resulting from the greatest product losses can be compensated for lowest costs of crops and highest selling prices of organic products (Seufert *et al.*, 2012; Benbrook *et al.*, 2021). In fact, as it is well known, one of the main reason behind the choice of organic products by consumers derives from the best guarantee in terms of food safety, human health and environmental protection (Siderer *et al.*, 2005; Simoglou and Roditakis, 2022; De Zoysa *et al.*, 2022; Rana and Paul, 2017).

It must be stated, however, that the consumption of organic products is a niche market (Agence Bio, 2020; Tandon *et al.*, 2021) concentrated for more than 80% in North America (44.0%) and Europe (38.3%). In fact, consumers of developed countries paid more attention not only to intrinsic quality of products (Eyinade *et al.*, 2021) but to social, economic and environmental sustainability of their production process (Ladwein and Romero, 2021; De Canio and Martinelli, 2021). Globally, the value of organic products is estimated up to 112 billion dollars (slightly more than 1% of the total value of the global agri-food production) and the world's main market is the United States (40.0% of all), where the consumption of organic products has an incidence of 5.8% (Fibl-IFOAM, 2020). In EU, the maximum impact of total consumption is recorded in Denmark (11.5%); the most economically relevant markets are, in order of importance, the German, the French and the Italian one, where the consumption of organic products are, respectively, 5.1, 4.4 and 4% on the total.

3. Methodology

The possibility to reach the target of 25% of areas under organic farming by 2030 is, currently, difficult to assess, both because the current average incidence of areas under organic farming at European level is a very modest starting point and the high variability of this data between the Member States.

Note in this respect that, between the countries EU 27, only Austria has already achieved the above objective (25.2% already in 2019); among the main agricultural countries, Italy has an incidence of areas cultivated by organic farming which seems consistent with achieving the target (16.6% in 2020 and 17.4% in 2021) while in France, Germany and Spain, the situation is far away from the stated goal. In addition, 8 countries out of 27, including Poland, one of the major producing country, have an incidence of areas under organic farming less than 5%. In such a varied context, it has been considered appropriate to limit the analysis to a simple data processing related to areas under organic farming, for the period 2012–2020, found in the Eurostat database. In particular, the aim of such processing was to highlight the trends of areas under organic farming, in order to verify whether the annual average change rates, in the considered period, may be compatible with the stated target of increasing to 25% by 2030 the incidence of areas under organic farming in EU.

In this regard, two assumptions have been assessed:

(1) the first takes into consideration the changes observed in the period 2012–2020;

(2) the second takes into account the changes observed in the last three years of data availability (2018–2020).

These projections have been attributed both to the areas under organic farming in EU27 and the main four producer countries (Italy, Germany, France and Spain).

4. Results

According to Eurostat (2022), in 2020, in EU 27, areas under organic farming amounted to 14.7 million hectares and accounted for 9.1% of the Utilized Agricultural Area. Countries with the largest extension of organic farming were France (2.5 million hectares); Spain (2.4 million hectares); Italy (2.0 million hectares) and Germany (1.6 million hectares). Out of 57.8% of areas under organic farming in EU was concentrated in these four countries. Among these four countries, Italy had the highest incidence of areas under organic farming (15.9%); while Spain (10.0%), Germany (9.6%) and France (8.7%) were closer to the average value of EU 27.

In the period 2012–2020, the average annual increase in areas under organic farming was 7.0% in EU 27; 18.0% in France; 8.2% in Germany; 9.9% in Italy and 4.8% in Spain. Referring to the last three years of data availability (2018–2020), the annual average increase in areas under organic farming was 4.4% in EU 27; 7.9% in France; 10.1% in Germany; 2.3% in Italy and 2.8% in Spain. It follows that the period 2012–2020, with the exception of Germany, showed a general slowdown of growth of areas under organic farming.

In the period between 2012 and 2020, agricultural areas in EU 27 slightly increased (+0.8%).

Assuming that the same stability can be observed in the period 2020–2030, in order to achieve the target of 25% of areas under organic farming, the average annual growth of areas under organic farming should be in the range of 17.5% in EU 27; 18.7% in France; 16.0 in Germany; 5.6% in Italy and 15.0% in Spain. Under the assumption that, in the period 2020–2030, similar growth rates of areas under organic farming, comparable with those observed in the period 2012–2020 can be replicated, only Italy could be in a position not only to achieve but to exceed (31.9%) the above-mentioned target of 25% of areas under organic farming by 2030. France would approach the target (24.4%), while Germany (17.5%) and Spain (14.8%) would remain very distant from it. The same would happen to EU 27 data (15.4%).

If variations similar to those observed in the three years 2018–2020, occur in the period 2020–2030, neither the countries considered nor the EU 27 would achieve the target. In particular, projection to 2030 of the incidence of areas under organic farming would be 13.1% in EU 27; 15.6% in France; 17.5% in Germany; 19.7% in Italy and 12.8% in Spain.

To get a better idea of what could be the impact on European agriculture resulting from the increase of areas under organic farming, it is necessary to consider both their extension and the way they are used.

In 2020, regarding 14.7 million hectares under organic farming, 6.8 were arable areas (46.2%), 6.2 permanent grasslands (42.2%) and 1.7 permanent crops (11.6%). With regard to arable areas, 34.6% (2.4 million hectares) was planted with cereals, wheat in particular, 0.9 million hectares equal to 38.3% of areas under cereals. Areas under permanent crops consisting for 30.4% of olive groves and 22.6% of vineyards; areas under permanent grass consist of pastures and meadows, mostly used for grazing organic livestock.

The mere observation of data related to the size of organic farming does not provide the detail concerning its weight on the overall amount of European agriculture. According to Eurostat data (2020), in EU 27, agricultural areas amounted to 161.1 million hectares, 98.2 (60.9%) were arable lands; 50.2 (31.5%) permanent grasslands and 12.2 (7.6%) permanent crops. It follows that, in EU in 2020, 6.9% of arable lands, 12.2% of permanent grasslands and 13.9% of permanent crops were under organic farming. This suggests that there are substantial differences between the amount of individual organic crops on the total of corresponding areas and the distribution of the same crops on the total of areas under organic farming.

In fact, it should be considered that arable lands are 46.2% of the areas under organic farming, but they only account for 6.9% on the total of arable lands in EU 27 and the permanent grasslands representing 42.2% of areas under organic farming account for 12.2% on the total of permanent grasslands in EU 27.

Regarding permanent crops, there is a minor gap between the amount of areas under organic farming and the total number of hectares aimed at such crops (11.6 versus 7.6%).

It is worth remembering that, in this regard, among the areas under organic farming, the most widely used are cereals with about 2.4 million hectares (44.6%), wheat in particular (0.9 million hectares, equal to 38.3% of organic cereals); these crops are, however, limited compared to the total of areas under the same crops in EU 27. In fact, in 2020, in EU 27, 52.4 million hectares where planted with cereals and, among these, 22.9 million hectares (43.7%) to wheat. This means that only 4.6% of areas under cereals (3.9% to wheat) were under organic farming. In France, the first European producer of wheat, only less than 150.000 hectares (3.3%) versus a total of 4.5 million hectares were under organic farming. Similar situations can be found in Germany (about 100,000 hectares under organic farming versus 2.8 million hectares to wheat) and Spain (50,000 hectares under organic farming versus 1.9 million hectares of total).

In this framework, values regarding Italy are quite different; notwithstanding they were not very high, however, they affected 11.8% of crops of organic wheat (200.00 hectares) on the total (1.7 million hectares). This means that, at present, the lowest yields characterizing organic farming compared to conventional ones have low impact on the overall cereal productions in the EU.

As stated before, in the period 2012–2020, agricultural areas in EU 27 slightly increased (+0.8%). This variation is the expression of a reduction in arable lands (−0.9%) and an increment in permanent grasslands (+4.5%) and permanent crops (+5.1%).

As a consequence, the distribution of lands to the various destinations was modified. In particular, the amount of arable lands on the total decreased from 62.3% to 61.0% million hectares, while the weight of permanent grasslands and permanent crops increased, respectively, from 30.4% to 31.6% and from 7.3% to 7.6%.

In this framework, always considering the period 2012–2020, areas under organic farming increased from 9.5 to 14.7 million hectares (+54.7%) and their incidence on the total from 5.9% to 9.1%. The said increase of 5.2 million hectares was determined for 50% by the increase of arable lands (2.6 million hectares), by 38.5% by permanent grasslands (2 million hectares) and by 11.5% by permanent crops (0.6 million hectares). It follows that also the amount of single purposes on the corresponding total values had changed. In particular, arable lands increased from 4.2% to 6.9%; permanent grass from 8.6% to 12.3% and permanent crops from 9.9% to 13.7%.

The above shows that the increase in lands under organic farming, in the period 2012–2020, is the result not of the cultivation of new lands but rather of the conversion of existing ones, such an evolution should be expected also for the future.

Assuming that the agricultural areas in EU will register in the period 2023–2030 the same variation observed in the period 2012–2020, and considering that, in the period 2012–2020, the average increase per year of areas under organic farming was 7.3% for arable lands, 5.9% for permanent grasslands and 5.5% for permanent crops, it is to be expected that the new expansion may mainly concern arable lands and permanent grasslands, also because, as above mentioned, they have a lower incidence to the corresponding total areas compared to, for example, permanent crops.

It is clear that the larger the growth of the amount of arable lands areas under organic farming, the stronger the impact on the European productive potential, given that, as said, especially for crops the yields of organic crops are significantly lower than conventional farming.

5. Discussion and findings

Notwithstanding the actions, the EU Commission plans to implement with the new CAP, the achievement of the target of 25% of areas under organic farming by 2030 seems, at present to

be difficult to fulfil. In fact, it would require an increase of about 26 million hectares of areas under organic farming compared to the 14.7 million hectares reported in 2020.

In EU, in the period 2012–2020, about 1.8 million Euro per year were allocated to organic farming (European Commission, 2020). This commitment will certainly be reinforced by the CAP 2023–2027, which provides that 25% of direct aid to farmers, and 35% of rural development funding must be dedicated to agro-environmental measures, which, only partly, concern organic farming. In this regard, it should be noted that, given the great differences in the Member States, at present, it is not possible to quantify the financial commitment which will actually be aimed at organic farming and then its effect on its development at European level cannot even be hypothesized. For this purpose, it should be noted that the EU Commission, which is now difficult to build all the indicators needed to monitor the planned measures (Scown and Nicholas, 2020), has foreseen to carry out a midterm review of the action plan for the development of organic production in 2024 (European Commission, 2021).

The high incidence, on the total areas under organic farming of pasture and meadow areas (42.2%), in itself, shows that, in EU, organic farming has a productive weight not corresponding to the amount on the total of the areas under cultivation; as well as the market share of organic products on the total of food consumption is extremely small (Fibl-IFOAM, 2020). It follows that, it is impossible that, in the event of introduction of a 25% of areas under organic farming target by 2030, should correspond an equivalent weight of organic products of overall of agricultural production and food consumption of Europeans. In this regard, it should be considered that such a rise in the organic production on the total would require a much wider spread of areas under organic farming (Barbieri *et al.*, 2021), due to the yields less than the conventional farming (Birkhofer *et al.*, 2016; Knapp and van der Heijden, 2018) and the highest risk of product loss for the non-use of pesticides (Van Bruggen and Finckh, 2016; Benbrook *et al.*, 2021).

As said, the effect of this could be the negative impact on the overall sustainability of European agriculture, as it would require the cultivation of new lands and the unavoidable use of natural animal fertilizers (manure) in order to ensure the supply of nitrogen compatible with the organic method (Connor, 2013; Birkhofer *et al.*, 2016 Meemken and Qaim, 2018; Barbieri *et al.*, 2021).

It is therefore to be expected that the increment of areas under organic farming, in Europe, will mainly involve crops less affected by loss of productivity after conversion to organic farming method and farms which are unable to practice commercial farming due to their dimension and location, or engaged in secondary activities, such as farm holiday (Calabrò and Vieri, 2014).

It should be thus possible to increase the impact of areas under organic farming on the total and, at the same time, not to negatively affect the current product potential of European agriculture.

This evolution, as well as possible, is also to be considered desirable, given that a reduction in the current production level would inevitably lead to an increase in food prices and in inflation tax (Wesseler, 2022).

The hypothesis that the possible increase of the areas under organic farming can relate to both forms of agriculture and farms that, in the transition to the organic method, have less to lose in terms of productivity, also seems to be supported by other considerations. It would particularly refer to what had happened with the previous implemented agri-environmental measures within CAP; it is expected that farmers dealing with less environmental problems will join the measures (Vieri, 2012).

Equally, very modest was the impact of the green measures that have characterized the CAP 2014–2022 (Louhichi *et al.*, 2017).

This means that farmers in inland areas, practising less intensive forms of agriculture without strong commercial orientation, may be better off adhering to the agri-environmental

measures, thus reducing costs of productive factors and receiving Community aids in return which actually makes up for the lack of production.

Although the target of increase areas under organic farming seems to be achievable through their diffusion between more sustainable crops and farms, it will be, however, difficult that these forms of agriculture can reach a meaningful contribution to the other CAP 2023–2027 targets, such as the 50% reduction in use of chemicals, sales of antimicrobial and soil nutrient loss; as well as the reduction of 20% in synthetic fertilizers consumption.

It is evident that if the increment in areas under organic farming involves low intensive forms of agriculture, the said targets will be achieved through agro-industrial activities such as livestock and monoculture farming. In this regard, it should be useful to integrate the measures under the new CAP with a serious food education programme aimed at reducing the consumption of animal origin products that, as it is well known, is one of the main driver in order to achieve important environmental benefits in terms of land use, water consumption and greenhouses gas emissions (Ranganathan *et al.*, 2016; Clark *et al.*, 2020).

6. Conclusions

The aim of this paper is to reflect on the effectiveness of the 25% target of areas under organic farming by 2030.

The established obligation to all the UN Member States to integrate the Sustainable Development Goals in their policies has had important consequences on the definition of Community policies for the period 2021–2027. CAP was, in this field, one of the most affected policy; its content has been significantly revised in order to encourage the adoption of more sustainable behaviour by farmers. One of the hardest target for this purpose is to forecast that 25% of European agricultural lands have grown using organic farming method. The achievement of this target, in the event of conversion of the most mainstream intensive form of agriculture, may result in a reduction of European productive potential that would be offset through an increase in agricultural lands, thus creating new sustainability issues. The most plausible hypothesis is therefore the one that shows the increase in areas under organic farming will engage forms of agriculture and farms that, already today, are more sustainable, so that the achievement of 25% target will not particularly impact the European potential productive and, thus, not even on the less environmental sustainable forms of agriculture. It follows that, in order to increase the sustainability of European agriculture, it is not enough to focus on the increase of areas under organic farming.

This paper contributes to the ongoing debate about the sustainability of agri-food system. The analysis carried out has highlighted how the organic farming alone cannot tackle some important food sustainability issues. The conclusions highlight the need to explore alternatives aimed at driving the agri-food systems towards sustainability. This topic will be developed in further studies and future research.

References

Agence Bio (2020), *L'agriculture Bio dans le Monde*, Agence Bio, Montreuil (F).

Altieri, M.A. (2018), *Agroecology: The Science of Sustainable Agriculture*, CRC Press, New York.

Andersson, G.K., Rundlof, M. and Smith, H.G. (2012), "Organic farming improves pollination success in strawberries", *PLoS One*, Vol. 7, e31599.

Auerswald, K., Kainz, M. and Fiener, P. (2003), "Soil erosion potential of organic versus conventional farming evaluated by USLE modelling of cropping statistics for agricultural districts in Bavaria", *Soil Use and Management*, Vol. 19, pp. 305-311.

Barbieri, P., Pellerin, S., Seufert, V., Smith, L., Ramankutty, N. and Nesme, T. (2021), "Global option space for organic agriculture is delimited by nitrogen availability", *Nature Food*, Vol. 2 No. 5, pp. 363-372.

Bebber, D.P. and Richards, V.R. (2022), "A meta-analysis of the effect of organic and mineral fertilizers on soil microbial diversity", *Applied Soil Ecology*, Vol. 175, 104450.

Beecher, N.A., Johnson, R.J., Brandle, J.R., Case, R.M. and Young, L.J. (2002), "Agroecology of birds in organic and nonorganic farmland", *Conservation Biology*, Vol. 16, pp. 1620-1631.

Benbrook, C., Kegley, S. and Baker, B. (2021), "Organic farming lessens reliance on pesticides and promotes public health by lowering dietary risks", *Agronomy*, Vol. 11 No. 7, p. 1266.

Bengtsson, J., Ahnström, J. and Weibull, A.C. (2005), "The effects of organic agriculture on biodiversity and abundance: a meta-analysis", *Journal of Applied Ecology*, Vol. 42 No. 2, pp. 261-269.

Berry, P.M., Sylvester-Bradley, R., Philipps, L., Hatch, D.J., Cuttle, S.P., Rayns, F.W. and Gosling, P. (2002), "Is the productivity of organic farms restricted by the supply of available nitrogen?", *Soil Use and Management*, Vol. 18, pp. 248-255.

Birkhofer, K., Smith, H.G. and Rundlöf, M. (2016), *Environmental Impacts of Organic Farming*, ELS; John Wiley & Sons, Ltd., Chichester, UK.

Brown, R.W. (1999), "Margin/field interfaces and small mammals", *Aspects of Applied Biology*, Vol. 54, pp. 203-210.

Burton, C.H. and Turner, C. (2003), *Manure Management: Treatment Strategies for Sustainable Agriculture*, 2nd ed., Llister and Durling, Bedford, UK.

Calabrò, G. and Vieri, S. (2014), "The environmental certification of tourism: a tool to enhance the unicity of a territory", *Quality Access to Success*, Vol. 15 No. S5, pp. 44-55.

Clark, M., Macdiarmid, J., Jones, A.D., Ranganathan, J., Herrero, M. and Fanzo, J. (2020), "The role of healthy diets in environmentally sustainable food systems", *Food and Nutrition Bulletin*, Vol. 41 No. 2_suppl, pp. 31-58.

Connor, D.J. (2013), "Organically grown crops do not a cropping system make and nor can organic agriculture nearly feed the world", *Field Crops Research*, Vol. 144 No. 20, pp. 145-147.

Connor, D.J. (2021), "What is the real productivity of organic farming systems?", *Outlook on Agriculture*, Vol. 50, pp. 125-129.

Crowder, D.W. and Reganold, J.P. (2015), "Financial competitiveness of organic agriculture on a global scale", *Proceedings of the National Academy of Sciences of the United States of America*, Vol. 112, pp. 7611-7616.

De Canio, F. and Martinelli, E. (2021), "EU quality label vs organic food products: a multigroup structural equation modeling to assess consumers' intention to buy in light of sustainable motives", *Food Research International*, Vol. 139, 109846.

de Ponti, T., Rijk, B. and van Ittersum, M.K. (2012), "The crop yield gap between organic and conventional agriculture", *Agricultural Systems*, Vol. 108, pp. 1-9.

De Zoysa and Waisundara, V.Y. (2022), "Benefits and risks of organic food", *Ensuring Global Food Safety*, Academic Press, Cambridge, Massachusetts, pp. 197-212.

Dutra, J.C.V. (2020), "Nitrous oxide (N2O) emissions from organic crops", *Journal of Agronomy and Agricultural Sciences*, Vol. 3 No. 018, pp. 1-3.

El-Beltagi, H.S., Hashem, F.A., Maze, M., Shalaby, T.A., Shehata, W.F. and Taha, N.M. (2022), "Control of gas emissions (N2O and CO2) associated with applied different rates of nitrogen and their influences on growth, productivity, and physio-biochemical attributes of green bean plants grown under different irrigation methods", *Agronomy*, Vol. 12 No. 249.

European Commission (2020), *Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions a Farm to Fork Strategy for a Fair, Healthy and Environmentally-Friendly Food System*, COM (2020) 381

final, Brussels, May 20 2020. [online] available at: https://eur-lex.europa.eu/resource.html?uri=cellar:ebb94528-8d5b-11eb-b85c 01aa75ed71a1.0001.02/DOC_1&format=PDF (accessed 23 January 2023).

European Parliament, Council of the European Union (2018), "Regulation (EU) 2018/848 on organic production and labelling of organic products and repealing Council Regulation (EC) No 834/2007", Brussels, *Official Journal of the European Union L 150/1*, June 14, 2018.

European Commission (2021), *Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions on an Action Plan for the Development of Organic Production*, COM (2021) 141 final, Brussels, March, 25 2021. [online] available at: https://eur-lex.europa.eu/resource.html?uri=cellar:ebb94528-8d5b-11eb-b85c-01aa75ed71a1.0001.02/DOC_1&format=PDF (accessed 23 January 2023).

EUROSTAT (2020), Available at: https://ec.europa.eu/eurostat/web/agriculture/data/database (accessed 30 January 2023).

Eyinade, G.A., Mushunje, A. and Yusuf, S.F.G. (2021), "The willingness to consume organic food: a review", *Food and Agricultural Immunology*, Vol. 32 No. 1, pp. 78-104.

Fibl-IFOAM (2020), The World of organic agriculture 2020. Frick (CH)Fi:bl, 2021.

Flowerdew, J.R.M. (1997), "Biodiversity in agricultural habitats", in Kirkwood, R.C. (Ed.), *Biodiversity and Conservation in Agriculture*, British Crop Protection Council, Brighton, UK, pp. 25-40.

Foley, J.A., Defries, R., Asner, G.P., Barford, C., Bonan, G., Carpenter, S.R., Chapin, F.S., Coe, M.T., Daily, G.C. and Gibbs, H.K. (2005), "Global consequences of land use", *Science*, Vol. 309, pp. 570-574.

Frieben, B. and Köpke, U. (1998), "Effects of farming systems on biodiversity. Organic farming in land use systems", *Proceedings of the First ENOF, The European Network for Scientific Research Co-ordination in Organic Farming. Workshop*, Bonn, Germany, 8-9 December 1995, pp. 11-21.

Gabriel, D. and Tscharntke, T. (2007), "Insect pollinated plants benefit from organic farming", *Agriculture, Ecosystems and Environment*, Vol. 118, pp. 43-48.

Gattinger, A., Muller, A., Haeni, M., Skinner, C., Fliessbach, A., Buchmann, N., Mäder, P., Stolze, M. and Gerhardt, R.-A. (1997), "A comparative analysis of the effects of organic and conventional farming systems on soil structure", *Biological Agriculture and Horticulture*, Vol. 14, pp. 139-157.

Giagnocavo, C., de Cara-García, M., González, M., Juan, M., Marín-Guirao, J.I., Mehrabi, S., Tiziano, G., David, P. and Paoletti Maurizio, G. (2011), "Environmental impact of different agricultural management practices: conventional vs. Organic agriculture", *Critical Review in Plant Science*, Vol. 30 Nos 1-2, pp. 95-124.

Haas, G., Wetterich, F. and Köpke, U. (2001), "Comparing intensive, extensities and organic grassland farming in southern Germany by process life cycle assessment", *Agriculture, Ecosystems and Environment*, Vol. 83, pp. 43-53.

Heckrath, G., Brookes, P.C., Poulton, P.R. and Goulding, K.W.T. (1995), "Phosphorus leaching from soils containing different phosphorus concentrations in the Broadbalk experiment", *Journal of Environmental Quality*, Vol. 24 No. 5, pp. 904-910.

Hill, S.B. and MacRae, R.J. (1996), "Conceptual framework for the transition from conventional to sustainable agriculture", *Journal of Sustainable Agriculture*, Vol. 7, pp. 81-87.

Hole, D.G., Perkins, A.J., Wilson, J.D., Alexander, I.H., Grice, P.V. and Evans, A.D. (2005), "Does organic farming benefit biodiversity?", *Biological Conservation*, Vol. 122, pp. 113-130.

Kirchmann, H. and Bergström, L. (2001), "Do organic farming practices reduce nitrate leaching?", *Communications in Soil Science and Plant Analysis*, Vol. 32, pp. 997-1028.

Knapp, S. and van der Heijden, M.G. (2018), "A global meta-analysis of yield stability in organic and conservation agriculture", *Nature Communications*, Vol. 9 No. 1, pp. 1-9.

Korsaeth, A. (2008), "Relations between nitrogen leaching and food productivity in organic and conventional cropping systems in a long-term field study", *Agriculture, Ecosystems and Environment*, Vol. 127, pp. 177-188.

Ladwein, R. and Romero, A.M.S. (2021), "The role of trust in the relationship between consumers, producers and retailers of organic food: a sector-based approach", *Journal of Retailing and Consumer Services*, Vol. 60, 102508.

Larsen, A.E., Claire Powers, L. and McComb, S. (2021), "Identifying and characterizing pesticide use on 9,000 fields of organic agriculture", *Nature Communications*, Vol. 12 No. 1, pp. 1-12.

Lee, K.S., Choe, Y.C. and Park, S.H. (2015), "Measuring the environmental effects of organic farming: a meta-analysis of structural variables in empirical research", *Journal of Environmental Management*, Vol. 162, pp. 263-274.

Leifeld, J. and Fuhrer, J. (2010), "Organic farming and soil carbon sequestration: what do we really know about the benefits?", *AMBIO*, Vol. 39, pp. 585-599.

Letourneau, N. and Van Bruggen, A.H.C. (2006), "Crop protection in organic agriculture", in Kristiansen, P., Taji, A. and Renagold, J. (Eds), *Organic Agriculture. A Global Perspective*, CSIRO Publishing, Collingwood (Australia), pp. 93-121.

Liebman, M. and Davis, V.M. (2000), "Integration of Soil, Crop and Weed Management in Low-External-Input Farming Systems", *WEED RESEARCH-OXFORD-*, Vol. 40, pp. 27-47.

Louhichi, K., Ciaian, P., Espinosa, M., Colen, L., Perni, A. and Gomez y Paloma, S. (2017), "Does the crop diversification measure impact EU farmers' decisions? An assessment using an Individual Farm Model for CAP Analysis (IFM-CAP)", *Land Use Policy*, Vol. 66, pp. 250-264.

Lynch, D.H., MacRae, R. and Marti, R.C. (2011), "The Carbon and global warming potential impacts of organic farming: does it have a significant role in an energy constrained world?", *Sustainability*, Vol. 3, pp. 322-362.

Mäder, P., Fliessbach, A., Dubois, D., Gunst, L., Fried, P. and Niggli, U. (2002), "Soil fertility and biodiversity in organic farming", *Science*, Vol. 296, pp. 1694-1697.

Marriott, E.E. and Wander, M.M. (2006), "Total and labile soil organic matter in organic and conventional farming systems", *Soil Science Society of America Journal*, Vol. 70, pp. 950-959.

Meemken, E.M. and Qaim, M. (2018), "Organic agriculture, food security, and the environment", *Annual Review of Resource Economics*, Vol. 10, pp. 39-63.

Mondelaers, K., Aertsens, J. and Van Huylenbroeck, G. (2009), "A meta-analysis of the differences in environmental impacts between organic and conventional farming", *British Food Journal*, Vol. 111 No. 10, pp. 1098-1119.

Morrow, J.G., Huggins, D.R., Carpenter-Boggs, L.A. and Reganold, J.P. (2016), "Evaluating measures to assess soil health in long-term agroecosystem trials", *Soil Science Society of America Journal*, Vol. 80, pp. 450-462.

Muller, A., Schader, C., El-Hage Scialabba, N., Brüggemann, J., Isensee, A., Erb, K.-H., Smith, P., Peter, K., Leiber, F., Stolze, M. and Niggli, U. (2017), "Strategies for feeding the world more sustainably with organic agriculture", *Nature Communication*, Vol. 8 No. 1290, pp. 1-13.

Nelson, N.O. and Janke, R.R. (2007), "Phosphorus sources and management in organic production systems", *Hort Technology*, Vol. 17, pp. 442-454.

Oelhaf, R.C. (1978), *Organic Agriculture: Economic and Ecological Comparisons with Conventional Methods*, Halsted Press, Montclair, NJ, USA.

Pacini, C., Wossink, A., Giesen, G., Vazzana, C. and Huirne, R. (2003), "Evaluation of sustainability of organic, integrated and conventional farming systems: a farm and field-scale analysis", *Agriculture, Ecosystems and Environment*, Vol. 95, pp. 273-288.

Palupi, E., Jayanegara, A., Ploeger, A. and Kahl, J. (2012), "Comparison of nutritional quality between conventional and organic dairy products: a meta-analysis", *Journal of the Science of Food and Agriculture*, Vol. 92 No. 14, pp. 2774-2781.

Ponisio, L.C., M'Gonigle, L.K., Mace, K.C., Palomino, J., de Valpine, P. and Kremen, C. (2015), "Diversification practices reduce organic to conventional yield gap", *Proceedings of the Royal Society B: Biological Sciences*, Vol. 282, 20141396.

Rana, J. and Paul, J. (2017), "Consumer behavior and purchase intention for organic food: a review and research agenda", *Journal of Retailing and Consumer Services*, Vol. 38, pp. 157-165.

Ranganathan, J., Vennard, D., Waite, R., Dumas, P., Lipinski, B., Searchinger, T.I.M. and Globagri-Wrr, M.A. (2016), *Shifting Diets for a Sustainable Food Future*, World Resources Institute, Washington, DC.

Reganold, J.P. and Dobermann, A. (2012), "Comparing apples with oranges", *Nature*, Vol. 485, pp. 176-177.

Reganold, J.P., Elliott, L.F. and Unger, Y.L. (1987), "Long-term effects of organic and conventional farming on soil erosion", *Nature*, Vol. 330, pp. 370-372.

Rembiałkowska, E. (2007), "Quality of plant products from organic agriculture", *Journal of the Science of Food and Agriculture*, Vol. 87 No. 15, pp. 2757-2762.

Rydberg, N.T. and Milberg, P. (2000), "A survey of weeds in organic farming in Sweden", *Biological Agriculture and Horticulture*, Vol. 18, pp. 175-185.

Scown, M. and Nicholas, K. (2020), "European agricultural policy requires a stronger performance framework to achieve Sustainable Development Goals", *Global Sustainability*, Vol. 3, p. E11.

Seufert, V. and Ramankutty, N. (2017), "Many shades of gray—the context-dependent performance of organic agriculture", *Science Advances*, Vol. 3 No. 3, e1602638.

Seufert, V., Ramankutty, N. and Foley, J.A. (2012), "Comparing the yields of organic and conventional agriculture", *Nature*, Vol. 485, pp. 229-232.

Siderer, Y., Maquet, A. and Anklam, E. (2005), "Need for research to support consumer confidence in the growing organic food market", *Trends in Food Science and Technology*, Vol. 16 No. 8, pp. 332-343.

Simoglou, K.B. and Roditakis, E. (2022), "Consumers' benefit—risk perception on pesticides and food safety—a survey in Greece", *Agriculture*, Vol. 12 No. 2, p. 192.

Skinner, C., Gattinger, A., Muller, A., Mäder, P., Fließbach, A., Stolze, M. and Niggli, U. (2014), "Greenhouse gas fluxes from agricultural soils under organic and non-organic management—a global meta-analysis", *Science of the Total Environment*, Vol. 468, pp. 553-563.

Smith, R.G., Menalled, F.D. and Robertson, G.P. (2007), "Temporal yield variability under conventional and alternative management systems", *Agronomy Journal*, Vol. 99, pp. 1629-1634.

Smith, L., Williams, A. and Pearce, B. (2015), "The energy efficiency of organic agriculture: a review", *Renewable Agriculture and Food Systems*, Vol. 30 No. 3, pp. 208-301.

Stockdale, E.A., Shepherd, M.A., Fortune, S. and Cuttle, S.P. (2002), "Soil fertility in organic farming systems–fundamentally different?", *Soil Use and Management*, Vol. 18, pp. 301-308.

Tal, A. (2018), "Making conventional agriculture environmentally friendly: moving beyond the glorification of organic agriculture and the demonization of conventional agriculture", *Sustainability*, Vol. 10 No. 4, p. 1078.

Tandon, A., Jabeen, F., Talwar, S., Sakashita, M. and Dhir, A. (2021), "Facilitators and inhibitors of organic food buying behavior", *Food Quality and Preference*, Vol. 88, 104077.

Tomich, T.P., Brodt, S., Ferris, H., Galt, R., Horwath, W.R., Kebreab, E., Leveau, J.H.J., Liptzin, D., Lubell, M., Merel, P., Michelmore, R., Rosenstock, T., Scow, K., Six, J., Williams, N. and Yang, L. (2011), "Agroecology: a review from a global-change perspective", *Annual Review of Environment and Resources*, Vol. 36, pp. 193-222.

Tuck, S.L., Winqvist, C., Mota, F., Ahnström, J., Turnbull, L.A. and Bengtsson, J. (2014), "Land-use intensity and the effects of organic farming on biodiversity: a hierarchical meta-analysis", *Journal of Applied Ecology*, Vol. 51 No. 3, pp. 746-755.

Tuomisto, H.L., Hodge, I.D., Riordan, P. and Macdonald, D.W. (2012), "Does organic farming reduce environmental impacts? A meta-analysis of European research", *Journal of Environmental Management*, Vol. 112, pp. 309-320.

United Nations (1987), *Our Common Future*, United Nations, New York.

United Nations (2015), "Transforming our world: the 2030 agenda for sustainable development [online]", available at: https://www.un.org/ga/search/view_doc.asp?symbol=A/RES/70/1&Lang=E (accessed 23 January 2023).

Van Bruggen, A.H.C. and Finckh, M.R. (2016), "Plant diseases and management approaches in organic farming systems", *Annual Review of Phytopathology*, Vol. 54, pp. 25-54.

Van Der Ploeg, J.D. (2021), "The political economy of agroecology", *The Journal of Peasant Studies*, Vol. 48 No. 2, pp. 274-297.

Vieri, S. (2012), "Common agricultural policy (CAP) and measures for environment protection and conservation: contrasts, balances and new methods of development for the future", *International Journal of Environment and Health*, Vol. 6:1, pp. 48-62.

Wesseler, J. (2022), "The EU's farm-to-fork strategy: an assessment from the perspective of agricultural economics", *Applied Economic Perspectives and Policy*, Vol. 44 No. 4, pp. 1826-1843.

Further reading

Crisol-Martínez, E. (2022), "Reconnecting farmers with nature through agroecological transitions: interacting niches and experimentation and the role of agricultural knowledge and innovation systems", *Agriculture*, Vol. 12 No. 2, p. 137.

Smith, P., Scialabba, N.E.-H. and Niggli, U. (2012), "Enhanced top soil carbon stocks under organic farming", *Proceedings of the National Academy of Sciences of the United States of America*, Vol. 109, pp. 18226-18231.

Corresponding author
Grazia Calabro can be contacted at: calabrogr@unime.it