POLICY BRIEF

Farm-level enablers and barriers to the uptake of Sustainable Farming Practices

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Farmers across seven different countries who took part in on-farm participatory trials as part of the SolACE project were asked about enablers and barriers to adopting sustainable farming practices. Participants shared their views on trialled innovations to improve water and nutrient use efficiency, highlighting the following:

Enablers:
- Increasing profits, productivity and quality
- Soil suitability, health and climate change resilience
- Knowledge exchange and information availability
- Regulation and restriction

Barriers:
- Risk and cost-benefit balance
- Biotic stressors
- Resource and information restrictions

Introduction

Although there is considerable interest and effort to increase the uptake of sustainable agriculture practices to improve Water Use Efficiency (WUE) and Nutrient Use Efficiency (NUE), adoption of sustainable practices remains low in the UK and Europe (Lahmar, 2010; Merante et al., 2017; Alskaf et al., 2020). Research into factors influencing farmer decision-making regarding sustainable practices can be broadly summarised into the following themed factors:

- **Environmental/biophysical factors:** suitability for specific environmental conditions (e.g. soil type, climate, topography)
- **Economic/financial/market factors:** examples include market prices, profitability, upfront costs, labour costs, and opportunity costs
- **Informational and technical factors:** farmer knowledge, awareness and accessibility to information, relevant skills
- **Agronomic factors:** relate to suitability to overall management, for example, does the practice fit with the current planting/harvesting regime
- **Psychological factors:** examples include attitudes toward sustainable agriculture, perceptions of risk
- **Sociocultural factors:** norms within communities, trust in information sources (advisors, policymakers, research etc.)
- **Policy factors:** existence and efficacy of motivating or limiting legislations or regulations

Each of these factors can serve as enablers and/or barriers to uptake, though they are usually multifaceted and work together to encourage or deter the adoption of sustainable farming practices.

This policy brief summarises the main enablers and barriers identified by farmers participating in on-farm trials of sustainable farming practices to consider what farmers already engaging in sustainable agriculture view as key incentives and detractors.

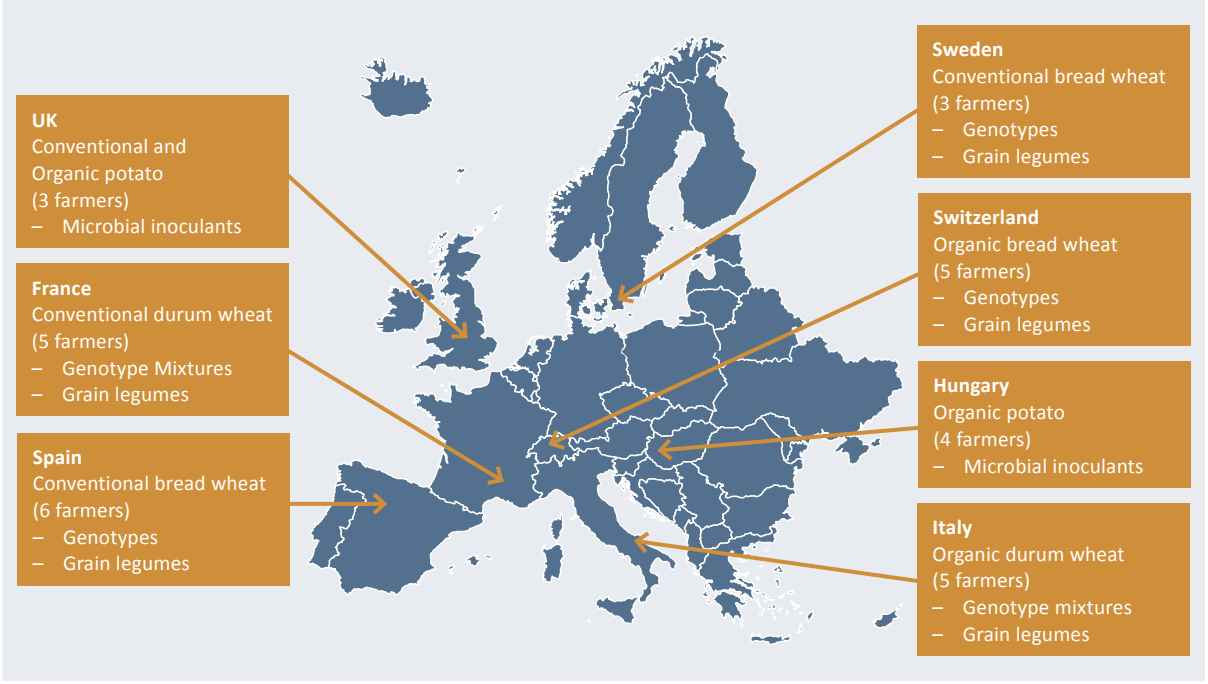
Approach

The project Solutions for improving Agroecosystem and Crop Efficiency for water and nutrient use (SolACE) aimed to identify farm-level enablers and barriers to the uptake of sustainable farming practices to improve WUE and NUE[1] focusing on the following practices:

1. Genotype mixtures, novel varieties and hybrids
2. Microbial inoculants/biostimulants
3. Grain legumes as beneficial pre-crops in rotation
4. Reduced or zero tillage[2]
5. Decision Support Tool (DST)[2]
6. Improved controlled or slow-release fertilisers

Farmers in seven different partner countries (France, Hungary, Italy, Spain, Sweden, Switzerland and the UK) participated in on-farm trials of these innovations in organic and conventional potato, durum wheat and bread wheat systems from 2018–2021 (Figure 1). The main innovations tested on farms were genotype mixtures or new genotypes and grain legumes in rotation in durum wheat and bread wheat systems and microbial inoculants in potato systems. A total of 29 farmers completed questionnaires and participated in network meetings to share their experiences of using and trialing sustainable farming innovations, including perceived barriers and enablers to using innovations. Additionally, semi-structured interviews took place with farmers participating in the SolACE trials in France (2 farmers) and the UK (3 farmers) during and at completion of the trials and were supplemented with notes and observations from meetings and conversations collected by SolACE network leads. Quantitative data were analysed in Excel to produce descriptive figures and qualitative data was analysed by thematic analysis in Nvivo (version 12).

Figure 1. Location, trial cropping systems and number of farmers completing questionnaires as part of the SolACE participatory farmer networks.



1 The SolACE project also produced a policy brief on policy-level enablers and barriers to the uptake of sustainable farming practices, which is available through the project Zenodo community here: zenodo.org/record/4983434#.Yw9tpRzMKUk

2 Tillage practices and decision support tools were used by some farmer networks, but were not trialled consistently within cropping networks. Improved fertilisers were not trialled by any participants. All of these practices were discussed with farmers participating in the SolACE project as potential innovations to trial and farmer perceptions of these innovations were included in questionnaires and interviews.

Enablers to Sustainable Farming Practices

The main factors enabling farmers to try sustainable farming innovations selected by participants in questionnaires were agronomic, technical and economic, with policy enablers representing the least common factors (Figure 2). Agronomic and economic factors represented nearly 50 % of selected reasons for trying innovations at baseline, while final questionnaires indicated that technical factors were the most commonly selected reasons at 26 % of responses.

Thematic analysis of farmer interviews, farmer network lead summaries and long-form responses on questionnaires identified the main enabler theme as economic, followed by social and agronomic themes while policy-based themes were the least commonly cited (Table 1). Though there were similarities in the influence of economic and agronomic themes from quantitative and qualitative data, the thematic analysis highlighted more social themes and illuminated some specific incentives for farmer decision-making.

Figure 2. The percentage of different enabler themes represented by responses from SolACE farmer participant questionnaires at the start (Baseline) and at completion (Final) of the on-farm trials (ENVIRON = environmental).

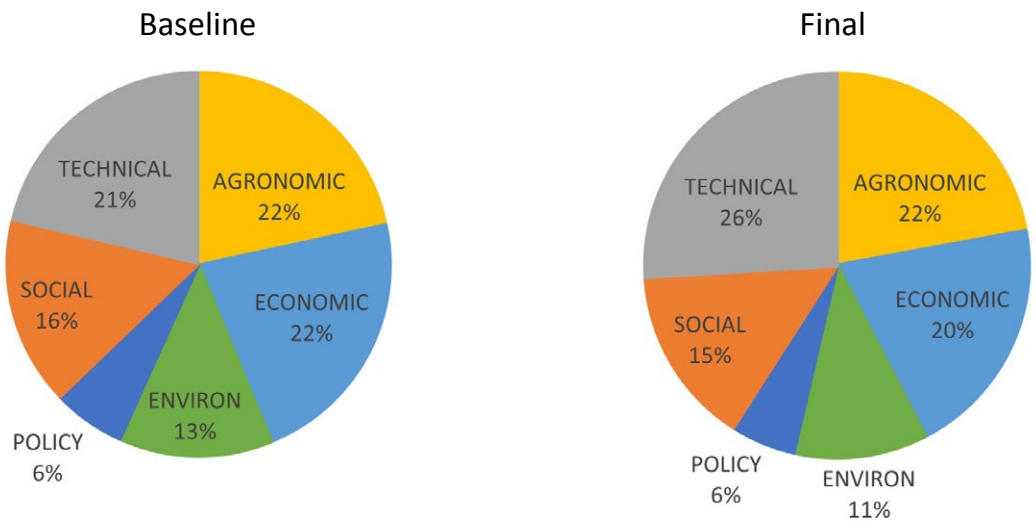


Table 1. Summary of themes and key reasons enabling uptake of sustainable farming practices from interviews (France and UK), farmer network lead summaries (Switzerland) and long text responses from questionnaires identified in thematic analysis.

Theme	Coverage	Key Reasons
Agronomic	22 %	Improve soil quality, crop productivity, crop quality and drought resistance
Economic	29 %	Increase profits, reduce fertilizer use and a market for produce exists
Environment	9 %	Increase climate change resilience and soil biodiversity
Policy	8 %	Restriction of chemical use
Social	23 %	Motivated to share knowledge, try new things and by other farmers
Technical	10 %	Availability of data/information and hearing from other farmers

"Farmers have a very tight budget, so at the end of the day it's going to be money, and if it doesn't cost very much, if it's cheap and has a good effect and that's obviously going to encourage farmers."
UK Potato Farmer

Increasing profits, productivity and quality

SolACE farmers clearly expressed a desire to increase profits as the main economic reason for using sustainable farming practices, and this was closely tied to reduced costs and increasing productivity. Besides wanting to use practices and products that are not too expensive, trial participants were also very keen to reduce fertiliser inputs while retaining yield. While interest in improving productivity was expressed for farmers trying all of the innovations used in the SolACE project, reducing fertiliser use was a particular incentive for using grain legumes in rotation and DSTs.

Although this was not elicited by quantitative questionnaires, interviews and long-form answers allowed farmers to express an interest in crop quality as a component of productivity. Individual farmers characterised the relationship between quantity and quality differently, as some viewed them as equal evidence of strong performance, while others emphasised the importance of quality and consistency over yield increases.

"Increasing yields is not really the aim, but quality and security of production are more important."
Hungary potato farmer

Soil suitability, health and climate change resilience

A farming practice's suitability for local soil conditions and potential to improve soil health were main agronomic incentives for adopting sustainable farming innovations. Farmers reflected that a lot of the wider agricultural discussion of sustainable farming practices is currently driven by soil health. They also discussed soil health in conjunction with improved climate change resilience, especially toward improving soil structure for drought resistance and overall soil biodiversity. Farmers who trialed microbial inoculants and practiced reduced/no-tillage particularly emphasised their interest in these practices due to potential soil benefits.

"The trendy thing at the minute is to build soil health, generally. If we can specify that exactly where we need to in a certain part of the field, right around the crop we're growing then it's got to help I think."
UK potato farmer

"Farmers are very good at talking and very good at exchanging information. You know, I get a lot of information from other farmers. I have regular meetings with other farmers, so I think your routes to markets of the inoculant will be the physical statistical information, farmers like myself who are persuaded that it's the right thing to do."
UK potato farmer

Knowledge exchange and information availability

The main social reasons farmers cited for wanting to try sustainable farming innovations were wanting to share knowledge with others and a general interest in experimenting and trying new things. Trial participants also acknowledged that knowing other farmers who already use farming innovations can incentivise further uptake. These social enablers also tie into the technical benefit of available information and data, especially if this information is easily accessible to farmers who can then share with others.

"It feels reassuring to be part of such a program. That would be a personal and psychological incentive that goes along such an experiment. Not being alone when taking decision is one valuable thing."
France durum wheat farmer

Regulation and restriction

Although policy enablers made up the smallest percentage of farmer-selected enablers for adopting sustainable farming innovations, farmers did acknowledge that one of the main incentives for changing their practices was due to restrictions on their use of chemical inputs. Potato farmers in the UK specifically noted that they are interested in trialling non-chemical alternatives, such as microbial inoculants, because legal restrictions of pesticides are forcing them to change their practices. Farmers in France also acknowledged that farming in a Nitrate Vulnerable Zone (NVZ) also encouraged them to improve NUE, which they were able to do using a DST.

Barriers to Sustainable Farming Practices

Farmers were less likely to complete the questionnaire section about barriers to trying SolACE innovations, resulting in fewer overall quantitative responses. The main factors acting as barriers to try sustainable farming innovations were economic, while environmental barriers were the least commonly selected factors (Figure 3). The main difference in responses from the baseline to final questionnaires indicates that more economic barriers were selected at the completion of the trials (48 %) compared with the number selected at the start of the trials (34 %).

Thematic analysis of farmer interviews, farmer network lead summaries and long-form responses on questionnaires identified the main barrier theme as overwhelmingly economic, followed by agronomic themes while environmental themes were the least commonly cited (Table 2). The quantitative and qualitative data from farmers both emphasised economic themes, while thematic analysis elicited more agronomic incentives and clarified the range of potential economic barriers.

Figure 3. The percentage of different barrier themes represented by responses from SolACE farmer participant questionnaires at the start (Baseline) and at completion (Final) of the on-farm trials. (ENVIRON=environmental)

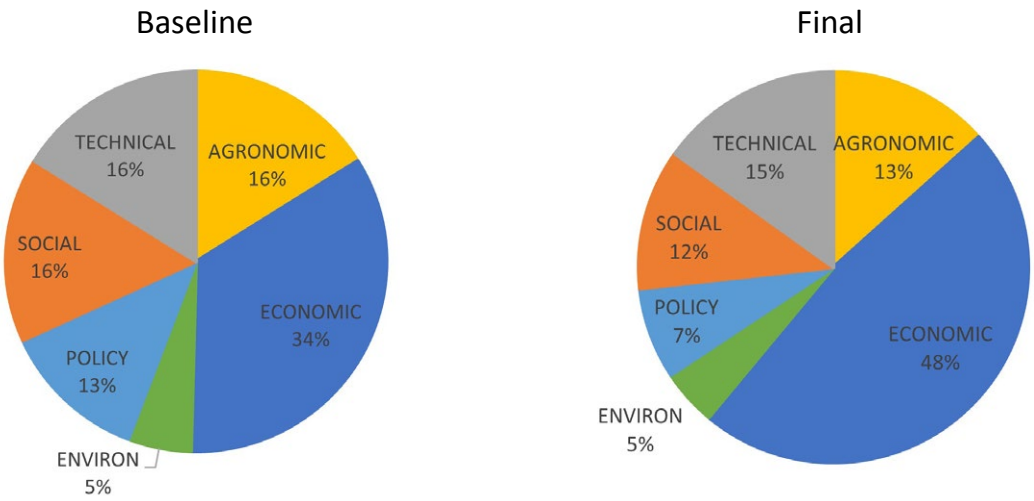


Table 2. Summary of themes and key reasons preventing uptake of sustainable farming practices from interviews (France and UK), farmer network lead summaries (Switzerland) and long text responses from questionnaires identified in thematic analysis.

Theme	Coverage	Key Reasons
Agronomic	24 %	Weeds, pests and disease pressure and unsuitability for soils
Economic	54 %	Cost of product, time to see benefit, lack of machinery and time saving
Environment	2 %	Climate change
Policy	5 %	Local extension service not able to help
Social	7 %	Competition between farmers
Technical	8 %	Lack of understanding/knowledge

Risk and cost-benefit balance

Just as increased profits incentivise farmers, the risks of losing money is the main detractor for farmers trying sustainable farming practices. Particularly early on in the SolACE project, participant farmers were concerned about the cost of the product/practices they were using and whether or not the results would prove enough financial benefit to justify the risk of trying something new. Farmers also expressed a concern that they would not experience financial benefits early enough in the process to achieve a cost-benefit balance , based on current market prices for produce and up-front costs of applying innovative practices.

"The main problem is the price of the crop, cereals are not really interesting regarding price so the cost of tool will be an important thing to discuss as could be the main point that farmers will watch sadly."
France durum wheat farmer

"If they were going to provide it to me free of charge, I'd consider using it again, but I'm not going to use something that's going to cost me money and if I can't justify the risk."
UK potato farmer

"I am not convinced by no tillage and mechanical control of weeds."
Italy durum wheat farmer

Biotic stressors

The key agronomic barriers to sustainable farming practices elicited by qualitative data from interviews, farmer network meetings and long-form responses to questionnaires were biotic stressors, particularly concerns over non-chemical weed and disease control. Organic farmers in particular were wary of utilising no-till and without sufficient weed control options, and conventional farmers in Spain also noted that no-till has an over-reliance on chemical weed control, questioning its relevance to sustainability. Disease control was a concern for organic farmers in Switzerland regarding growing grain legumes and balancing the health of their rotation with the desire for nitrogen fixation.

"They must have a break of 8 years until they can grow peas again on a plot (to prevent diseases)."
Switzerland bread wheat farmer network lead

Resource and information restrictions

"If a farmer has a good planter and irrigation technology, it could be better, but I have to innovate mine."
Hungary potato farmer

At the end of the SolACE trials, farmers selected lack of machinery and time as main economic barriers to utilising innovations, as the experience of the trials seemed to emphasise the restrictions imposed by not having specific equipment and time to set it up. And just as access to information enables farmer uptake of sustainable practices, lack of understanding of innovations and access to knowledge and resource support from local government agronomy services were identified as barriers. An organic potato farmer in the UK lamented the limited information available from the UK's main agriculture advisory service about organic varieties with blight resistance and farmers in Spain remarked that a general lack of knowledge about benefits prevented farmers from wanting to try sustainable practices.

"One of the difficulties with a lot of the heritage varieties is because they're off the AHDB list and not on anyone else's list, don't get blight scores."
UK potato farmer

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Imprint

Publisher:
Newcastle University
Newcastle, UK
Phone: +44 (0)191 208 6000
www.ncl.ac.uk

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Permalink: zenodo.org/record/7247955

The project SolACE – "Solutions for improving Agroecosystem and Crop Efficiency for water and nutrient use" is supported by the European Union's HORIZON 2020 research and innovation programme under the Grant Agreement no 727247, and by the Swiss State Secretariat for Education, Research and Innovation (SERI) under contract number 17.00094. The opinions expressed and arguments employed herein do not necessarily reflect the official views of the EC and the Swiss government. Neither the European Commission/SERI nor any person acting behalf of the Commission/SERI is responsible for the use which might be made of the information provided on this policy brief.

SolACE: This policy brief was elaborated in the SolACE project. The project is running from May 2017 to September 2022. The goal of SolACE (Solutions for improving Agroecosystem and Crop Efficiency for water and nutrient use) is to help European agriculture face major challenges, notably increased rainfall variability and reduced use of N and P fertilizers.

www.solace-eu.net

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 727247 (SolACE)

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