

Small-scale farmers and climate change – Opportunities and barriers to community engagement

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Summary

The agricultural sector has been particularly under pressure in recent years to provide not only food, animal feed and energy crops, but also to be a key player in environmental conservation and biodiversity, and more recently in the provision of ecosystem services. Therefore, farmers are not only responsible for producing food for society, but also have to preserve the environment, improve waste recycling, prevent air, soil and water pollution and provide a habitat for flora and fauna, all for the benefit of society. Furthermore, small-scale farming has to face financial constraints that may also adversely affect the successful implementation of good agricultural practices. Small-scale farmers often feel isolated and consider researchers and policy makers distant from their farming realities; they tend to rely on local communities, interest groups or networks of influence in order to help them cope with innovation, policy changes and most recently, the impact of climate change. However, translational research can help in this respect by valuing farmers' knowledge and providing guidance and advice to small-scale farmers on how to implement management practices that are not only proven to mitigate the effects of climate change on agricultural production but build on their own experiences and expertise.

Key words: Small-scale farming, greenhouse gases, translational research, farmer engagement, sustainable farming systems

Introduction

The impact of the agricultural sector in terms greenhouse gas (GHG) emissions is estimated around 9% of the total GHG emissions in the United Kingdom (DEFRA, 2012). Emissions include 32% of methane (CH₄) primarily from ruminant digestion processes and the production and use of manure and slurry, 61% of nitrous oxide (N₂O) primarily from fertilisers use, and less than 10% of carbon dioxide (CO₂) primarily from energy used for fuel and heating. Under the Climate Change Act of 2008, the UK aims at reducing GHG emissions by 80% from the 1990 baseline by 2050 (United Kingdom Parliament, 2008). Quantitative scientific literature provides useful strategies to reduce GHG emissions from livestock farms, such as optimizing diets (Arriaga *et al.*, 2010), improving feed conversion efficiency (Waghorn *et al.*, 2006), improving housing management (Misselbrook *et al.*, 2006), adopting specific manure storage and treatment conditions (Chadwick *et al.*, 2011), shorter rotational grazing pattern (Flechard *et al.*, 2007) and optimum soil and effluent management (Eckard *et al.*, 2010). However, farmers are under multiple pressures from the government, markets and consumers, to improve production, business competitiveness and promote environmental conservation (DEFRA, 2007; Natural England, 2011).

In order to evaluate the potential for adoption of new policies to incentivise emissions reduction, studies need to understand farmers' perceptions of climate change and in particular, farmers' decision-making process. Networks of influence build social and cultural capital among small-scale farmers (Klerkx *et al.*, 2012; Oreszczyn *et al.*, 2010). Participatory action research with consistent, transparent communication between researchers and farmers can help creating long-standing relationships that can lead to improving the sustainability of farm management practices (Mapfumo *et al.*, 2010; Pretty & Buck, 2002). This study represents a classic example of translational research with the aim to engage with farmers and promote the benefits of on-farm innovation in order to mitigate GHG emissions. By focusing on practical solutions and by enabling farmers to be co-researchers in the study, the approach promotes knowledge transfer and knowledge sharing, in a multi-level stakeholder environment.

Materials and Methods

Rapid Farm Practices Appraisal tool

The Rapid Farm Practices Appraisal (RFPA) tool was created for the purpose of the study. Farm practices were divided in five categories, i.e. dietary management, livestock housing, manure storage and treatment, grazing and pasture management and manure application to field. The tool consisted of scoring sheets and decision trees for each category, linked to a booklet of guidelines to reduce GHG emissions. Practices featured in the tool were selected from acknowledged quantitative scientific literature on GHG emission from livestock farming systems. Practices were assigned scores based on their mitigation potential.

Farm visits

A pilot set of 14 small-scale livestock farmers across the South West and West Midlands regions was visited twice over 6–9 months. During the first visit, the RFPA tool was used to assess farm management impact in terms of expected GHG emissions mitigation potential. A report was subsequently compiled and presented to each farmer. The report detailed the results of the assessment and proposed solutions to improve practices in order to reduce emissions. During the second visit, the RFPA tool was run again to assess the impact of any changes in farm management.

Farmers' interviews

Qualitative scientific literature on farmer engagement and decision-making was used to select a list of 17 factors that may influence decisions regarding farm management. During the second visit, semi-constructed interviews were used to identify the greatest opportunities and barriers to on-farm innovation and farmer engagement. Feedback on methodological approach was also gathered.

Farmers' focus group meeting

Farmers were invited to a focus group meeting to share their experiences with the project. The meeting included workshops and discussion groups on topics selected by the farmers, i.e. livestock diet, grazing and pasture management, and manure management.

Results

Farm assessments

Over the two rounds of farm assessments in spring and autumn 2012, 50% of the farmers adopted changes in farm practices (Fig. 1). Results from the RFPA tool show the potential improvement in GHG emissions mitigation (Fig. 2).

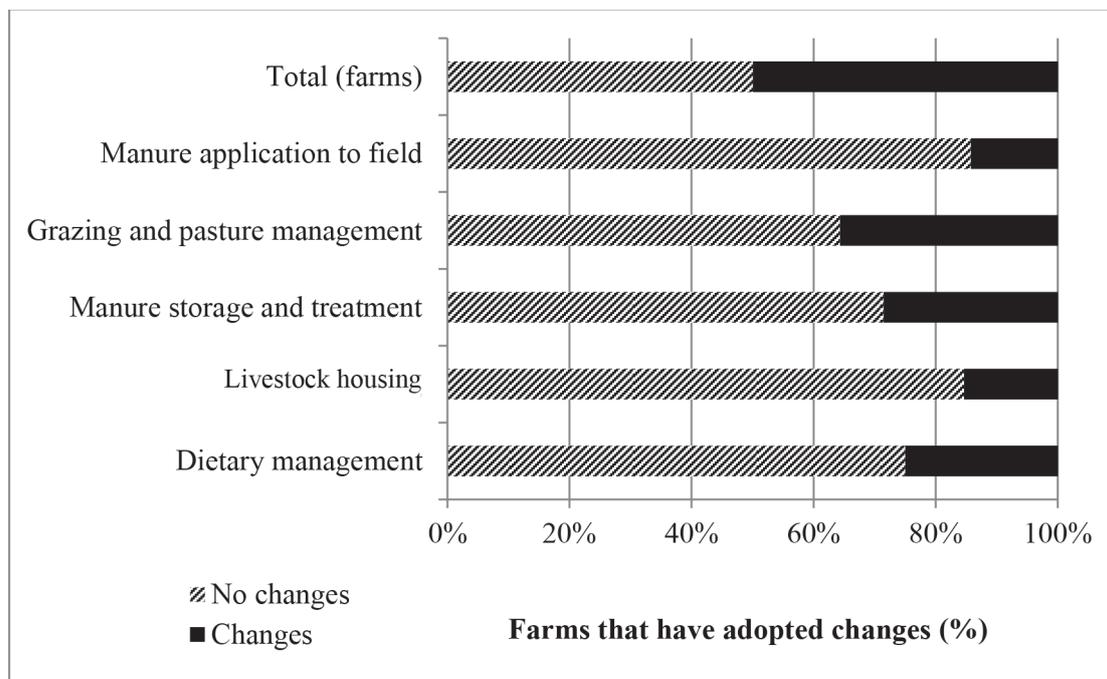


Fig. 1. Percentage of adoption of changes in farm practices and breakdown of changes by practice sector.

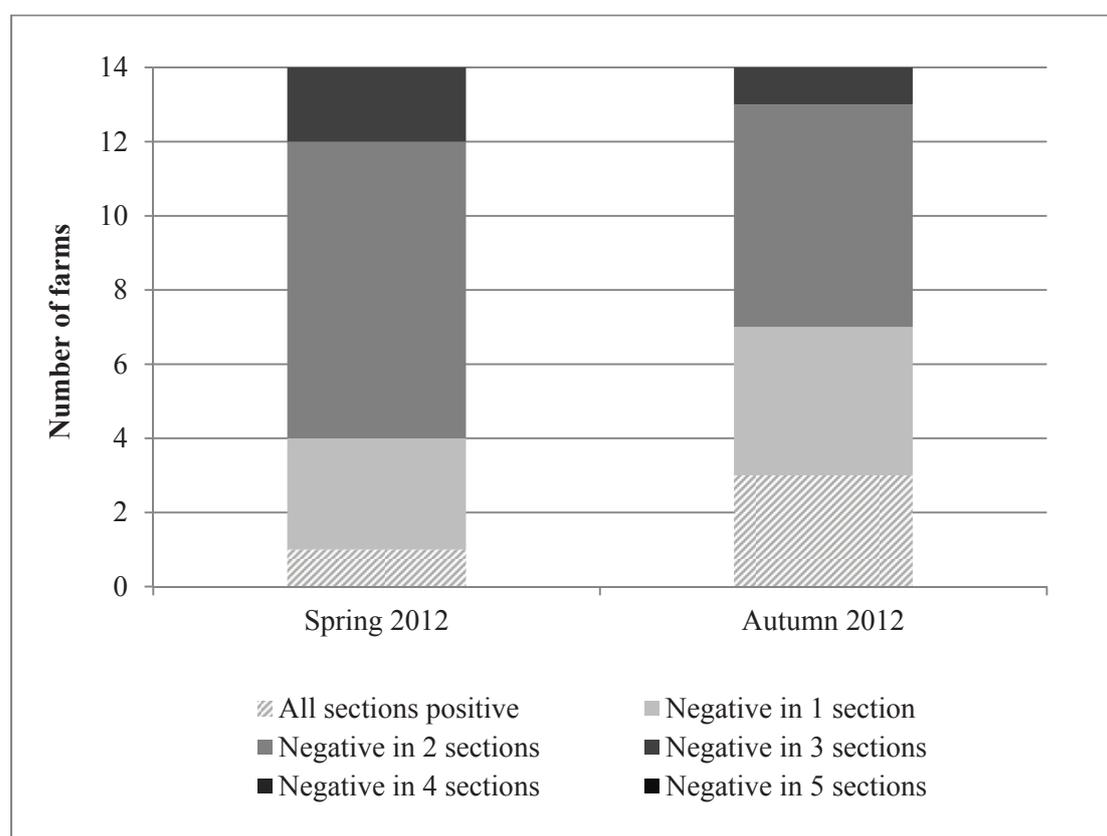


Fig. 2. Improvement of RFPA tool results over two consecutive farm assessments. Positive RFPA results identify GHG emissions mitigation in action; negative RFPA results identify lack of mitigation.

Farmer engagement

The pilot set included 14 farmers. All farms participated in the two rounds of farm management assessments; 50% of farmers adopted changes; 100% of farmers accepted to be interviewed on decision-making; 85.71% farmers showed interest in the focus group meeting; 50% could attend the meeting and 35.71% of farmers maintained contact with the organiser in order to give their

contribution via email or phone, and receive feedback on the event.

Farmer decision-making

The majority of farmers stated that regular face-to-face communication with an adviser had a positive impact on their acceptance of recommendations (Table 1). Farmers also appreciated clear scientific advice from reputable institutions and user-friendly GHG assessment tools, and were influenced by their interest in environmental matters. However, between 52% and 70% of farmers expressed negative comments on government action, bureaucracy and limited budgets that hinder long-term management plans.

Table 1. *Factors with the greatest impact on farmers' decision-making*

Impact	Factor	Percentage
Positive	Trust in source of recommendations, i.e. individual	93
	Interest in conservation and environmental matters	67
	Trust in source of recommendations, i.e. institution	66
	User-friendliness of assessment tools	57
	Community support and/or engagement	50
Negative	Financial constraints, i.e. limited budget	70
	Trust in official reports, i.e. government	63
	Support in integrating environmental schemes and GHG emissions reduction	53
	Bureaucracy linked to obtaining grants	51
	Trust in scientific basis	51
	Reluctance to change, e.g. current management is viable	50
Neutral	Budget management support, i.e. farm accounting	79
	Labour force availability	66
	Cost of agricultural consultants	60
	Interest in renewable energies	57

Discussion

Barriers to on-farm innovation

The greatest obstacle to improving farm practices in order to reduce GHG emissions is the financial burden of implementing changes, followed by lack of trust in government action and scepticism over scientific basis of GHG mitigation. Small-scale farmers face difficult challenges in balancing investments and outcomes. Practices that were recommended most often included improvements in livestock housing, manure storage and treatment. Such improvements can be expensive, but do not reflect directly on farm incomes in terms of live weight gain or milk production. The inability to make long-term management plans is in part due to limited budgets and confusion over sources of information regarding GHG emissions mitigation. The results are in accordance with the findings of Jones *et al.* (2013) and Emery & Franks (2012) regarding the lack of flexibility of agricultural policies to match realities varying in size and farming system. Although often relying on government subsidies, farmers remained critical of government action and the motivations behind agricultural policy innovations. Farmers preferred practical solutions, obtained through a less fragmented and privatised advisory service, engaging in consistent face-to-face interaction with agricultural advisers, in accordance with the findings of Islam *et al.* (2013) and Rydberg *et al.* (2008). Therefore, it is reasonable to assume that lack of trust in scientific basis

behind the benefits of GHG emissions mitigation could be linked to the confusion around the sources of information. Further research would be needed to identify specific correlations between sources of information and adoption of on-farm innovative solutions to reduce GHG emissions.

Opportunities for engagement

The three main drivers to on-farm innovation were regular communication with an adviser, promoting farmers' interest in environmental issues, including GHG emissions mitigation, and links to reputable sources of information on climate change.

Farmers showed interest in GHG mitigation, in particular aspects regarding grazing and pasture management, and carbon sequestration. All farmers appreciated the simplified, yet versatile structure of the RFPA tool, providing clear and practical advice to reduce GHG emissions. Only two farmers didn't show interest in the focus group meeting, whilst all participated in the other stages of the study, in some cases even acting as delegates for farmers groups outside of the study. This is in accordance with the findings of McKenzie (2011) regarding drivers to on-farm innovation and it reinforces the importance of social networks (Bodin & Crona, 2009), participatory multi-level stakeholder interaction (Wheeler *et al.*, 2013) and clear and transparent communication with competent advisers (Mugnier *et al.*, 2012) in promoting sustainable environmental management.

The RFPA tool, combined with two-way communication with farmers, proved to be a successful approach in promoting on-farm innovation in order to reduce GHG emissions from small-scale livestock farms. Further research is needed to include economic assessment of the benefits of GHG emissions mitigation, while continuing engagement with farmers as co-researchers in participatory translational research activities.

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