Organic Farmers in Europe: motivations and problems for using Conservation agriculture practices. "TILMAN-ORG SESSION"

MARION CASAGRANDE[1], JOSÉPHINE PEIGNÉ[1], CHRISTOPHE DAVID[1], FRANCISCO XAVIER SANS[2],JOSÉ MANUEL BLANCO-MORENO[2], JULIA COOPER[3], KATE GASCOYNE[3] , DANIELE ANTICHI[4], PAOLO BÀRBERI[5] AND FEDERICA BIGONGIALI[5], ANDREAS SURBÖCK[6], ANDREAS KRANZLER[6], ANNELIES BEECKMAN[7], KOEN WILLEKENS[8], ANNE LUIK[9], ELEN PEETSMAN[9], MEIKE GROSSE[10], JUERGEN HEß[10], MAURICE CLERC[11], HANSUELI DIERAUER[11], PAUL MÄDER[11]

Key words: Farmers, conservation agriculture, organic farming, motivations, challenges, principal component analysis

Abstract

Conservation agriculture and organic farming are currently considered as environmentally friendly options for producing food. This study explores the motivations and problems of organic European farmers that apply at least two conservation techniques: (i) no-tillage, (ii) reduced tillage and/or (iii) green manure. We carried out a survey with 159 farmers located in 10 European countries. Data were analysed with a principal component analysis followed by clustering to identify groups of farmers with similar motivations and problems. The most important motivations are related to soil preservation and problems are mainly linked to agronomic conditions and crop management. There are three groups of farmers that share the same type of attitude: "atypical farmers", "soil conservationists" and "agro-technically challenged farmers". Further research may address in priority agronomic problems, such as weed infestation, caused by adoption of conservation agriculture in organic agriculture.

Introduction

Conservation agriculture (CA) and organic farming (OF) are currently considered as agricultural options for producing food while minimizing environmental impacts. Nevertheless they are still rarely combined. Conservation agriculture relies on three main concepts: (1) Minimum soil disturbance due to tillage; (2) Diversified crop rotation and (3) Permanent soil cover with the use of green manure. The objectives of conservation agriculture are to reduce risk of runoff and soil erosion, increase soil water storage and reduce labour and fuel use. Organic farming could benefit from conservation agriculture; however, some specific problems can occur: difficult weed control, limited nitrogen availability, intensive use of machinery. Several review papers provide an overview on management options and challenges of reduced tillage systems in Europe and the United Sates (Peigné et al., 2007; Mäder and Berner; 2011; Carr et al., 2013). But there is little scientific data describing why some organic farmers are applying conservation practices and what type of problems they are faced with. Thus, the objective of this paper is to explore the motivations and problems of European farmers when combining organic farming and conservation practices. To achieve this objective, farmers' perceptions about no-tillage, reduced tillage and green manures have been assessed in a European survey conducted in 10 countries, performed in the project TILMAN-ORG (www.tilman-org.net).

Material and methods

We carried out a survey with 159 farmers located Estonia (17 farmers), Germany (10 farmers), United Kingdom (16 farmers) and Ireland (1 farmer), Belgium (9 farmers), France (31 farmers), Switzerland (19 farmers), Austria (16 farmers), Italy (7 farmers) and Spain (33 farmers). Farmers are applying at least two of the three following conservation agriculture practices:
(i) No-tillage: a conservation tillage practice in which crop is sown directly into soil not tilled since the harvest of the previous crop.

[1] ISARA-Lyon, Université de Lyon, 23 rue Jean Baldassini 69007 Lyon, France, www.isara.fr, eMail: mcasagrande@isara.fr
[2] Agroecosystems Research Group, University of Barcelona, Avda. Diagonal 643, 08028 Barcelona, Spain
[3] UNEW, Nafferton Ecological Farming Group (NEFG), Newcastle University, Nafferton Farm, Stocksfield, NE43 7XD, UK
[4] Centro di Ricerche Agro-ambientali "Enrico Avanzi", Università di Pisa, Via Vecchia di Marina 6, 56122 San Piero a Grado (Pisa), Italy
[5] Institute of Life Sciences, Scuola Superiore Sant'Anna, Piazza Martiri della Libertà 33, 56127 Pisa, Italy
[6] Research Institute of Organic Agriculture (FiBL) Austria, Doblhoffgasse 7/10, A-1010 Wien, Austria
[7] INAGRO, Department of organic crop production, Ieperseweg 87, B-8800 Roeselare, Belgium
[8] Institute for Agricultural and Fisheries Research (ILVO), Plant Sciences Unit, Crop Husbandry and Environment, Burg. Van Gansberghelaan 109, B-9820 Merelbeke, Belgium
[9] Estonian University of Life Sciences, Kreutzwaldi 1, Tartu 51014, Estonia
[10] University of Kassel, Department of Organic Farming and Cropping, Nordbahnhofstr. 1a, 37213 Witzenhausen, Germany
[11] Research Institute of Organic Agriculture (FiBL), Ackerstrasse, CH-5070 Frick, Switzerland

(ii) Reduced tillage: any tillage practice with a depth shallower than the conventional practice and/or a non-inversion method such as chisel ploughing.
(iii) Green manures: any crop that is grown primarily or solely for the purpose of soil protection and improvement including: increasing soil N supply to the subsequent crop, increasing soil organic matter, regulating the populations of pests and diseases, reducing competition from weeds in subsequent crops, and minimizing soil erosion.

A questionnaire with closed-ended questions was filled by farmers. Each farmer assessed with a Likert-scale a list of 12 possible motivations (Tab. 1) and 12 possible problems (Tab. 2) for each conservation practice. Possible motivations and problems encompassed socio-economic, technical, agronomic, environmental and soil conservation topics. We ranked motivations and problems according to their average Likert-scale value. For each conservation practice, we carried out a principal component analysis (PCA) followed by clustering on principal components to identify groups of farmers. Such groups of farmers are sharing the same type of motivations and problems.

Table 1: Tested motivations in the questionnaire for no-tillage (NT), reduced tillage (RT) and green manure (GM) practices

Applicable to NT, RT and GM	Applicable to NT and RT	Applicable to GM
reducing costs	increasing organic matter content in the soil	increasing on-farm nitrogen production
limiting erosion/avoiding soil surface crust formation	enhancing residues mineralization	producing industrial/fuel crops/forage/seeds
improving yields	minimizing environmental impacts	limiting N leaching
technical/innovative challenge		
improving general biodiversity		
improving soil structure		
improving biological soil quality		
advice from network/neighbor		
limiting weeds, pests and diseases		

Table 2: Tested problems in the questionnaire for no-tillage (NT), reduced tillage (RT) and green manure (GM) practices

Applicable to NT, RT and GM	Applicable to NT and RT	Applicable to GM
weed infestation	limited weed control efficiency	weed control
lack of specific technical skills	problem with mixing residues	heterogeneous green manure development
soil structure problems	limited nitrogen supply	competition between crop and GM
increasing labour requirements	limited crop emergence	unfavorable establishment conditions
	limited available information	lack of available N for non-leguminous green manure
	adequacy of machinery	limited biomass of green manure
	not stablecrop yields	cost of seeds
	destroying pasture	destroying the green manure

Results

Reduced tillage and green manure are the two practices that are more often applied than no tillage by the farmers (Fig. 1). Only 26% of the interviewed farmers apply no-till practices. There is a geographical gradient of conservation practices application: more farmers are applying no-till in Southern Europe region whereas green manure is more frequent in the more humid North area (data not shown).

Farmers' main motivations for applying conservation practices are related to soil preservation (improving soil structure, biology, and soil organic matter) and environmental concerns. Agronomic conditions and crop management (weed infestation, destroying of the previous crop) and socio-economic concerns (increasing labour requirements, yield stability) are the most important problems. Organic farmers are thus strongly motivated by soil conservation. Knowler and Bradshaw (2007) show that one of the drivers for adopting conservation practices in conventional farming is the awareness of soil problems. Weed infestation is the first problem for farmers. Indeed, weed control is often considered as a strong technical constraint to the application of conservation practices in organic farming (Berner et al., 2008; Sans et al., 2011). Weed management is a central problem in the case of organic farming because herbicides are not used for controlling weeds. Thus, compared to conventional studies, conventional and organic farmers are both interested in improving soil conservation but organic farmers are facing more technical constraints.

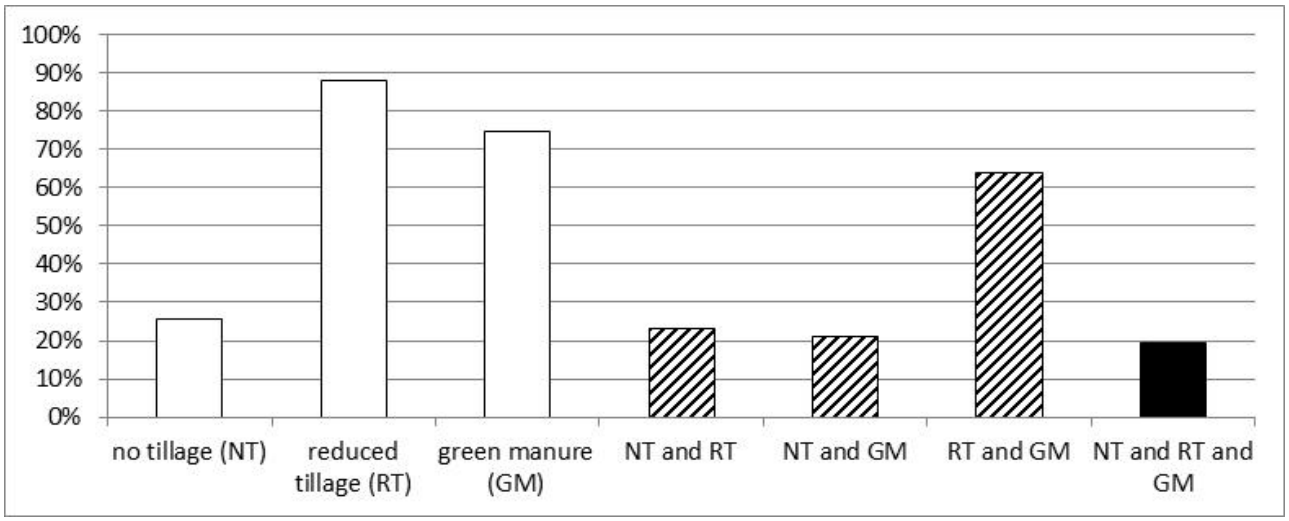

Figure 1. Percentage of farmers using conservation agriculture practices in the survey

Whatever the considered conservation practices, PCA analysis and clustering shows that there are three groups of farmers that share the same type of attitude: "atypical farmers", "soil conservationists" and "agro-technically challenged farmers". "Soil conservationist farmers" expressed strong motivations towards soil preservation. "Agro-technically challenged" farmers expressed that they are facing agronomic problems and challenges. The perception of the problems by farmers differs depending on the groups: "soil conservationists" perceive a small number of problems while "agro-technically challenged" farmers may overestimate the agronomic problems. Although farmers' grouping seems to depend on farm characteristics (such as size and location) we did not identify a clear pattern. Whatever the location of farmers, they could be either "soil conservationists" or "agro-technically challenged", meaning their motivations and problems are more dependent on their environmental attitudes and beliefs than on their farm characteristics or location.

Discussion

This study provides insights on the motivations and problems that European organic farmers are facing when applying conservation practices. The most important motivations are related to soil preservation concerns and problems are mainly linked to agronomic conditions and crop management. According to this study, research may address in priority agronomic problems, such as weed infestation, caused by adoption of conservation agriculture in organic agriculture. Soil benefits due to conservation agriculture should also be studied to strengthen farmers' motivations.

Acknowledgments

This research was carried out within the frame of TILMAN-ORG project (www.tilman-org.net) funded by CORE Organic II Funding Bodies, being partners of the FP7 ERANet (www.coreorganic2.org). The authors thank Monica Stanica-Negrescu, Teatske Bakker, Anne Brogi, Lisa Nilles, Rethy Katalin and the European interviewed farmers.

References

Berner, A, Hildermann, I., Fliesbach, A, Pfiffner, L., Niggli, U., & Mader, P. (2008). Crop yield and soil fertility response to reduced tillage under organic management. Soil and Tillage Research, 101(1-2), 89–96.

Carr, P., Gramig, G., & Liebig, M. (2013). Impacts of Organic Zero Tillage Systems on Crops, Weeds, and Soil Quality. Sustainability, 5(7), 3172–3201.

Knowler, D., & Bradshaw, B. (2007). Farmers' adoption of conservation agriculture: A review and synthesis of recent research. Food Policy, 32(1), 25–48.

Mäder, P., & Berner, A. (2011). Development of reduced tillage systems in organic farming in Europe. Renewable Agriculture and Food Systems, 27(01), 7–11.

Peigné, J., Ball, B. C., Roger-Estrade, J., & David, C. (2007). Is conservation tillage suitable for organic farming? A review. Soil Use and Management, 23(2), 129–144.

Sans, F. X., Berner, A, Armengot, L., & Mäder, P. (2011). Tillage effects on weed communities in an organic winter wheat-sunflower-spelt cropping sequence. *Weed Research*, *51*(4), 413–421.