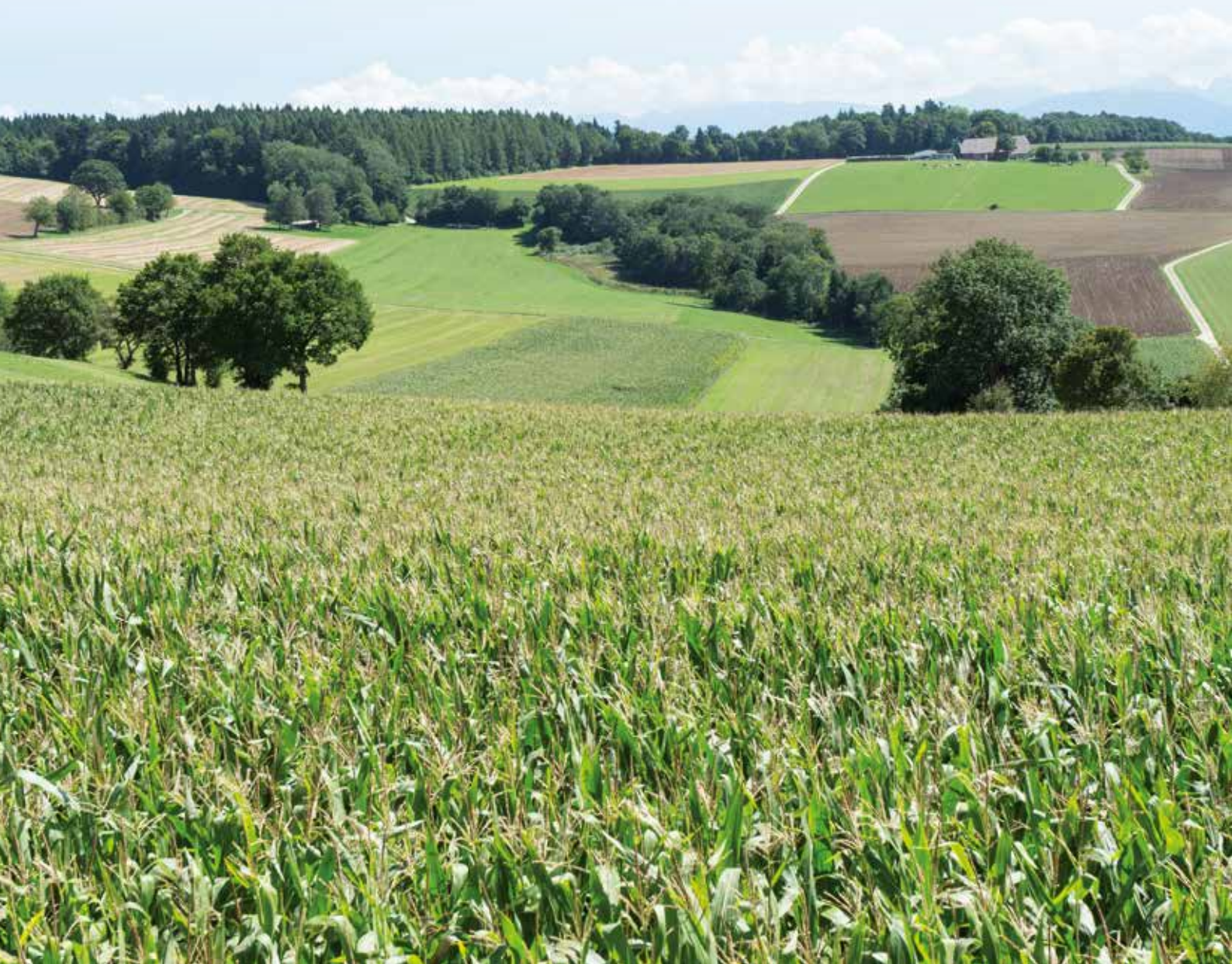
ESA2018

XV[e] European Society for Agronomy Congress

August 27-31, 2018 - Geneva, Switzerland

www.esa-congress-2018.ch

ABSTRACT BOOK



INNOVATIVE CROPPING AND FARMING SYSTEMS FOR HIGH QUALITY FOOD PRODUCTION SYSTEMS

CICG, GENEVA SWITZERLAND
27 - 31 AUGUST 2018

Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

Département fédéral de l'économie,
de la formation et de la recherche DEFR
Agroscope

Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

Swiss Confederation

Federal Department of Economic Affairs
Education and Research EAER
Federal Office for Agriculture FOAG

ETH
Eidgenössische Technische Hochschule Zürich
Ecole polytechnique fédérale de Zurich
Politecnico federale di Zurigo

FiBL

SGPW SSA

PS-7.1-05

A Comparison of Major Arable Production Systems: An Agronomic, Environmental and Ecological Evaluation

Marcel van der Heijden[1], Raphael Wittwer[2], Werner Jossi[2], Ulrich Prechsl[2], Thomas Nemecek[2], Klaus Schläppi[2], Emily O. Hagen[2], Thomas Keller[2], Florian Walder[2], Lucie Büchi[2], Raphaël Charles[3], Tino Colombi[2], Julia Hess[2], Juliane Hirte[2], Jochen Mayer[2], Viviana Loiaza[4], Engil Pujol-Pereira[4], Jo Six[4], Francesca Dennert[4], Monika Maurhofer[4], Steffen Seitz[5]

[1]Agroscope, Univ. Zürich, Switzerland, [2]Agroscope, Switzerland, [3]FIBL, Switzerland, [4]ETH Zürich, Switzerland, [5]University Tübingen, Germany

Abstract: One of the primary challenges of our time is develop sustainable farming systems that can feed the world with minimal environmental impact. Some studies argue that organic farming systems are best because these have minimal impact on the environment and are positive for biodiversity. Others argue that no-tillage systems are better because such systems save energy and preserve soil structure and quality. A third group argues that conventional farming systems are best because yield per hectare is highest. However, so far, systematic comparisons of major arable production systems are rare and often it is difficult to compare the advantages and disadvantages of farming systems in a systematic way due to differences in soil/site characteristics and management. Here we present data of the Swiss Farming Systems and Tillage Experiment (FAST), a long term experiment where the main European arable production systems (organic and conventional farming, reduced tillage and no tillage, each system with different cover crop treatments) are being compared using a factorial replicated design. A multidisciplinary team of researchers from various disciplines and organizations analysed this experiment.

We show the advantages and disadvantages of the various production systems and present data on plant yield, life cycle analysis, global warming potential, soil quality, plant root microbiomes and above and below ground biodiversity. Our results demonstrate that: i) plant yield was highest in the conventional systems, ii) soil biodiversity and above ground diversity tended to be higher in organic production systems, iii) soil erosion was lowest in the absence of tillage and in organic production systems, iv) the positive effects of cover crops were highest in organic production systems and increased with reduced land use intensity, v) the global warming potential of organic farming systems was lower compared to conventional systems, and vi) root and plant microbiome varied between the farming systems with the occurrence of indicator species that were specific for individual farming practices. In a next step we compared the results of this experiment with observations from a large farmers network (60 fields) in Switzerland (see abstract by Büchi et al.) where organic, conventional and conservation agriculture were compared. The results of our trial (e.g. yield and environmental performance of the different farming systems) were largely in agreement with those observed in the farmers network. Overall, our results indicate that no farming system is best and the choice of the “best” production system depends on economic, ecological and environmental priorities.

Keywords: production systems, organic agriculture, conservation agriculture, yield, biodiversity