

## Sustainability of European maize-based cropping systems: Economic, environmental and social assessment of current and proposed innovative IPM-based systems

V.P. Vasileiadis, A.C. Moonen, M. Sattin\*, S. Otto, X. Pons, P. Kudsk, A. Veres, Z. Dorner, R. van der Weide, E. Marraccini, E. Pelzer, F. Angevin, J. Kiss

European Journal of Agronomy, Volume 48, July 2013, Pages 1-11

Standardised cropping systems with low variability in space and time have led to an over reliance on pesticides but there is strong social and political pressure to reduce their use in European agriculture. Evaluating the sustainability of cropping systems is a complex task due to the conflicting objectives underlying its economic, social and environmental dimensions. Multi-criteria assessment of different Integrated Pest Management (IPM) scenarios and evaluation of the most sustainable options at regional, national and European level is essential. Within the EU Network of Excellence ENDURE, two expert-based surveys were conducted (i.e. interviews), where experts from four European regions (northern region, Denmark and The Netherlands; central-eastern, Tolna and Békés counties in Hungary; south-western, Ebro Valley in Spain; southern, Po Valley in Italy) determined which are the main current maize-based cropping systems (MBCSs) in their region and proposed innovative IPM-based systems. Both rotated and continuous cropping systems were considered in each region. The DEXiPM<sup>®</sup> (DEXi Pest Management) model for arable cropping systems was used to evaluate and compare the economic and environmental sustainability of these systems. The social sustainability was evaluated by adapting indicators of this model to the specificities of maize systems.

The assessments showed that all innovative rotated MBCSs proposed in the four regions can have a higher environmental sustainability than and maintain the same economic sustainability as current rotated systems. These cropping systems are thus acceptable for testing under “real” field conditions. Only the innovative continuous maize system proposed in the central-eastern region was both economically and environmentally more sustainable than the current system. These results show that the adoption of more diversified crop rotations in MBCSs is essential to develop “new” systems that break the life cycle of certain pests, but at the same time, to promote pesticide reduction through the varied crop protection practices implemented in the rotation. Overall, in both rotated and continuous systems, the introduction of innovative tools into IPM strategies can significantly contribute to addressing the EU’s strategic commitment to the sustainable use of pesticides. Nevertheless, DEXiPM<sup>®</sup> identified social weaknesses as the main reasons for lack of implementation of innovative IPM strategies. Although all innovative systems had a positive impact on work safety, according to local expert opinion producers and consumers are not ready to implement them or to accept their higher-priced products, with the exception of consumers in the northern region. These results suggest the need for European and regional policies to encourage the adoption of innovative rotated MBCSs that have positive agronomic and environmental impact through IPM implementation. The major constraints that inhibit this adoption were predominantly related to (1) farmers lack of access to the practical knowledge needed to effectively manage these systems and (2) insufficient consumer awareness and acceptance of product improvements associated with IPM. To overcome these constraints supportive policy environments, well-functioning knowledge management systems (including good farmer support networks) and effective marketing is required. Although this study focussed on MBCSs, these social issues are also largely applicable to other cropping systems. Therefore, policies instituted to fill these “gaps” can be applied to a wide range of cropping systems as well as other regions in Europe.



Weed control by integrating pre-emergence herbicide in band application and hoeing in maize

\* Corresponding author: Maurizio Sattin  
Tel.: +39 049 827 2820; fax: +39 049 827 2818  
E-mail address: [maurizio.sattin@ibaf.cnr.it](mailto:maurizio.sattin@ibaf.cnr.it)  
URL: <http://dx.doi.org/10.1016/j.eja.2013.02.001>



Monitoring of pests using pheromone traps