



ENDURE

European Network for Durable Exploitation of crop protection strategies

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Report about published paper, and Maize Case Study leaflets and the documents delivered to the EIC

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PU Public	PU
PP Restricted to other programme participants (including the Commission Services)	
RE Restricted to a group specified by the consortium (including the Commission Services)	
CO Confidential, only for members of the consortium (including the Commission Services)	

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Glossary

ENDURE	European Network for Durable Exploitation of crop protection strategies
Maize Case Study Guide	formerly called “Endure Leaflet”; includes ‘ready to use’ information for advisors and farmers; available on ENDURE website

Introduction

The final report on the maize Case Study was validated in September 2009: Deliverable “DR3.7, DR1.18 & DR1.19, Final report on the Maize Case Study: Key pests and options to reduce pesticides in eleven European regions”. This report includes a draft version of a scientific paper and drafts for three leaflets. These drafts shall be turned into publications in the 4th JPA in order for achieving broader dissemination of the results, addressing scientist and advisors.

Summary

Using maize as a case study, the most serious weeds, arthropod pests, and fungal diseases were identified as well as classes and amounts of pesticides applied. Data for 11 European maize growing regions were collected from databases, publications and expert estimates.

Three guides from ENDURE’s maize case study team have now been published, offering advisers and extension services useful information about:

- Non-chemical control of corn borers using *Trichogramma* or *Bt* maize,
- Western corn rootworm in Europe: Integrated pest management is the only sustainable solution
- Prevention of ear rots due to *Fusarium Spp.* on maize and mycotoxin accumulation

One peer reviewed paper has been published broaching the issue of pests, pesticide use and alternative options in European maize production:

- Meissle et al, 2010, Pests, pesticide use and alternative options in European maize production: current status and future prospects, Journal of Applied Entomology 134: 357-375.

Teams involved:

	Institute	Country
ACTA	Association de coordination technique agricole	France
AGROS	Agroscope Research Station ART	Switzerland
AU	University of Aarhus	Denmark
CNR	Consiglio Nazionale delle Ricerche	Italy
DAAS	Danish Agricultural Advisory Service	Denmark
IBMA	International Biocontrol Manufacturers Association	
IHAR	Instytut Hodowli i Aklimatyzacji Roslin	Poland
JKI	Julius Kühn-Institut (former BBA)	Germany
SSSUP	Scuola Superiore Sant'Anna (Pisa)	Italy
SZIE	Szent István University	Hungary
UdL	Universitat de Lleida	Spain
WUR/PPO	Wageningen University and Research Centre/ Praktijkonderzoek Plant & Omgeving (Applied Plant Research)	Netherlands

Geographical areas covered:

Totally are eight countries with eleven regions included in this study:

- Spain: Ebro Valley
- Italy: Po Valley
- Hungary: Tolna and Békés County
- Poland: Southwest
- Germany: Southwest
- Denmark: Whole country
- Netherlands: Whole country
- France: Normandie, Grand-Ouest and Southwest

Degree of validation and operability of findings:

Three guides containing 'ready to use' information are presented in the following chapter. They were validated by experts and available on the homepage of ENDURE.

One peer reviewed paper was published in the Journal of Applied Entomology.

Abstracts of paper and guides

The guides contain 'ready to use' information for extension services, advisers and farmers on alternative methods to control key pests in maize. They are disseminated by the ENDURE website under

http://www.endure-network.eu/about_endure/all_the_news/maize_tackling_fusarium_and_mycotoxins

Leaflet 1: Non-chemical control of corn borers using *Trichogramma* or *Bt* maize

Abstracts

Corn borers are widespread and major pest of maize in Europe causing yield losses up to 30%. One alternative to chemical insecticides against the European corn borer is biological control with the egg parasitoid *Trichogramma brassicae*. The small wasps are released on about 150 thousand ha in Europe per year, mainly in France. Egg cards containing the wasps are attached to the maize plants at the beginning of the egg-laying period. Efficacy (more than 75% destroyed pest eggs) and price (35-40 Euros for the first generation) are comparable to chemicals. Genetically engineered maize that produces an insecticidal protein from the bacterium *Bacillus thuringiensis* is another option to control corn borers including the Mediterranean corn borer, which cannot be controlled using insecticides or *Trichogramma*. In Europe, 108 thousand hectares of *Bt* maize were grown in 2008, mainly in Spain. *Bt* maize provides almost 100% protection against all generations of corn borers. No detrimental effects of *Bt* maize on the environment and human and animal health have been reported. *Bt* maize seeds are usually more expensive than conventional seed, but farmers have no extra costs or labour for corn borer control. In conclusion, biological control with *Trichogramma* and *Bt* maize are two efficient and competitive options for corn borer control to reduce the amount of chemicals released into the environment.

http://www.endure-network.eu/about_endure/all_the_news/non_chemical_solutions_to_beat_corn_borers

Leaflet 2: Western Corn Rootworm in Europe: Integrated Pest Management is the Only Sustainable Solution

Abstracts

The western corn rootworm (WCR, *Diabrotica virgifera virgifera* LeConte) was first detected in Europe in 1992, since when it has emerged as a serious pest of maize crops across a large number of countries. This leaflet, the second from ENDURE's Maize Case Study, examines the morphology and biology of WCR, examines the damage it causes and explores the possible control options. WCR can cause economic damage to maize plants at two developmental stages (larvae and adults). Larval feeding can cause significant damage to maize root systems while adults cause damage when feeding in the silks before and during pollination. This leaflet explains the lifecycle of WCR and concludes that the best and safest way to manage WCR larvae is through crop rotation, regardless of geographic and climatic differences or the degree of pest pressure. It explains how WCR should be detected and populations estimated. Where socio-economic factors make crop rotation impossible, insecticides should be applied only after accurate risk estimation. Other non-chemical options are also investigated, including cultural practices designed to enhance maize plant development, hybrid selection, natural enemies and biological control, and transgenic maize hybrids.

http://www.endure-network.eu/about_endure/all_the_news/guide_to_tackling_wcr_now_available

Leaflet 3: Prevention Of Ear Rots Due To *Fusarium Spp.* On Maize And Mycotoxin Accumulation

Abstracts

Red and pink ear rot diseases caused by *Fusarium* spp. occur widely throughout the maize growing regions of the world. Infection appears on the surface of ears at the end of the milky stage or at the beginning of the waxy stage. If the mould is thick, the grains are destroyed. *Fusarium* spp. produce mycotoxins. The most important are deoxynivalenol, nivalenol, zearalenone, fumonisins and moniliformin. They cause immuno-suppression, embryo abortions and deformations, swine enderogenic syndrome, porcine pulmonary oedema, liver cancer in rats and oesophageal cancer in humans. Crop rotation, crop residue management, varietal choice, insect control (including *Bt* maize), and good storage have the highest impact on disease severity and on mycotoxin contamination.

http://www.endure-network.eu/about_endure/all_the_news/maize_tackling_fusarium_and_mycotoxins

Meissle et al, 2010 show the current status and future prospects of pests, pesticide use and alternative options in European maize. For 11 European maize growing regions data were collected from databases, publications and expert estimates. The article revealed that maize production systems show differences in various European regions and is available under:

- Meissle et al, 2010, Pests, pesticide use and alternative options in European maize production: current status and future prospects, Journal of Applied Entomology 134: 357-375.

Political efforts are made in the European Union (EU) to reduce pesticide use and to increase the implementation of integrated pest management (IPM). Within the EU project ENDURE, research priorities on pesticide reduction are defined. Using maize, one of the most important crops in Europe, as case study, we identified the most serious weeds, arthropod pests, and fungal diseases as well as classes and amounts of pesticides applied. Data for 11 European maize growing regions were collected from databases, publications and expert estimates. Silage maize dominates in northern Europe and grain production in central and southern Europe. Crop rotations range from continuous growing of maize over

several years to well-planned rotation systems. Weeds, arthropod pests and fungal diseases cause economic losses in most regions, even though differences exist between northern countries and central and southern Europe. Several weed and arthropod species cause increasing problems, illustrating that the goal of reducing chemical pesticide applications is challenging. Pesticides could potentially be reduced by the choice of varieties including genetically modified hybrids, cultural control including crop rotation, biological control, optimized application techniques for chemicals, and the development of more specific treatments. However, restrictions in the availability of alternative pest control measures, farm organization, and the training and knowledge of farmers need to be overcome before the adoption of environmentally friendly pest control strategies can reduce chemical pesticides in an economically competitive way. The complex of several problems that need to be tackled simultaneously and the link between different control measures demonstrates the need for IPM approaches, where pest control is seen in the context of the cropping system and on a regional scale. Multicriteria assessments and decision support systems combined with pest monitoring programs may help to develop region-specific and sustainable strategies that are harmonized within an EU framework.

http://www.endure-network.eu/about_endure/all_the_news/paper_puts_maize_under_the_spotlight

Documents uploaded to the Endure Information Centre (EIC)

Abstracts of the following documents have been uploaded to the EIC:

N°	Crop	Pests and diseases	Measure	Region	Title	Practicability	Language
1	Maize	Weeds	preventive measures	ES	Noves perspectives en el control de males herbes en panís de cara al 2014 (Catalan)	ready to use	English
			decision support/ control				
			non-chemical control				
			chemical control				
2	Maize	Arthropoda	non-chemical control	ES	Lepidòpters del panís: els canvis en la seva importància relativa són deguts al panís Bt? (Catalan)	experimental	English
		Lepidoptera					
3	Maize	Arthropoda	non-chemical control	ES	El maíz Bt en España: experiencia tras 12 años de cultivo (local language)	experimental	English
		Insecta					
4	Maize	Insecta	non-chemical control	CZ	Experience with BT maize cultivation in the Csech republic 2005 - 2009	experimental	English
		Lepidoptera					
5	Maize	Coleoptera	decision support/ control	HU	Larval injury measured by Iowa 1-6 scale, plant lodging (standing, medium and hard lodged plans	ready to use	English
		Insecta					
6	Maize	Coleoptera	decision support/ control	HU	Determination of economic threshold for silk feeding by western corn rootworm (<i>Diabrotica virgifera virgifera</i> , LeConte) adults in seed corn	experimental	English
		Insecta					
7	Maize		non-chemical control	HU	<i>Diabrotica virgifera virgifera</i> , LeConte, a new sunflower pest from America	experimental	English
			chemical control				
8	Maize	Insecta	chemical control	HU	The correlation of the cotton bollworm (<i>Helicoverpa armigera</i> Hübner) adult abundance measured with pheromone trap to the	ready to use	English
		Lepidoptera					
9	Maize	Insecta	chemical control	HU	actual relevance of insecticide application in commodity maize	experimental	English
		Lepidoptera					
10	Maize	Weeds	decision support/ control	IT	Weed–Corn Competition Parameters in Late-Winter Sowing in Northern Italy	experimental	English
11	Maize	Western corn rootworm	preventive measures		Chemical control of <i>Diabrotica virgifera virgifera</i> leConte	experimental	English
			non-chemical control				
			chemical control				
12	Maize	Arthropoda	decision support/ control	DE	Pests, pesticide use and alternative options in European maize production: current status and future prospects.	experimental	English
		Fungi		DK			
		Weeds		ES			
				FR			
				HU			
				IT			
				NL			
	PL						
13	Maize	Fusarium		CH	Fusarium-Arten und Mykotoxine auf Mais in der Schweiz	experimental	English
14	Maize	Weed Plants	chemical control	IT	Comparison between the use of thermal and hydrothermal time in weed emergence predictive models	experimental	English
			weed control				
15	Maize	Arthropoda	non-chemical control	ES	Bt maize in Spain: 12 years experience of cultivation	experimental	English
		Insecta					
		Lepidoptera					
		Noctuidae					
16	Maize	Arthropoda	non-chemical control	ES	Lepidoptera of maize: are changes in their relative importance due to the growth of Bt maize?	experimental	English
		Insecta					
		Lepidoptera					
		Noctuidae					
17	Maize	Weed Plants	non-chemical control	IT	Options and restrictions to reduce pesticide use for maize	experimental	English
18	Maize	Weed Plants	decision support/ control	ES	Perspective on weed control in maize facing 2014	experimental	English
			non-chemical control				
			chemical control				
19	Maize	Western corn rootworm	decision support/ control	IT	Possible future situation in Italy concerning "Forecast/Warning systems	experimental	English
		Corn moth	Warning systems				
		Weed Plants	Forecast/prognosis systems				
20	Maize	Weed Plants	preventive measures	IT	Weed–Corn Competition Parameters in Late-Winter Sowing in Northern Italy	ready to use	English