EC/JRC research on global aspects of GM adoption and agricultural benefits of GM in Europe

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"Risk Assessment of GMOs for Human Health and the environment"
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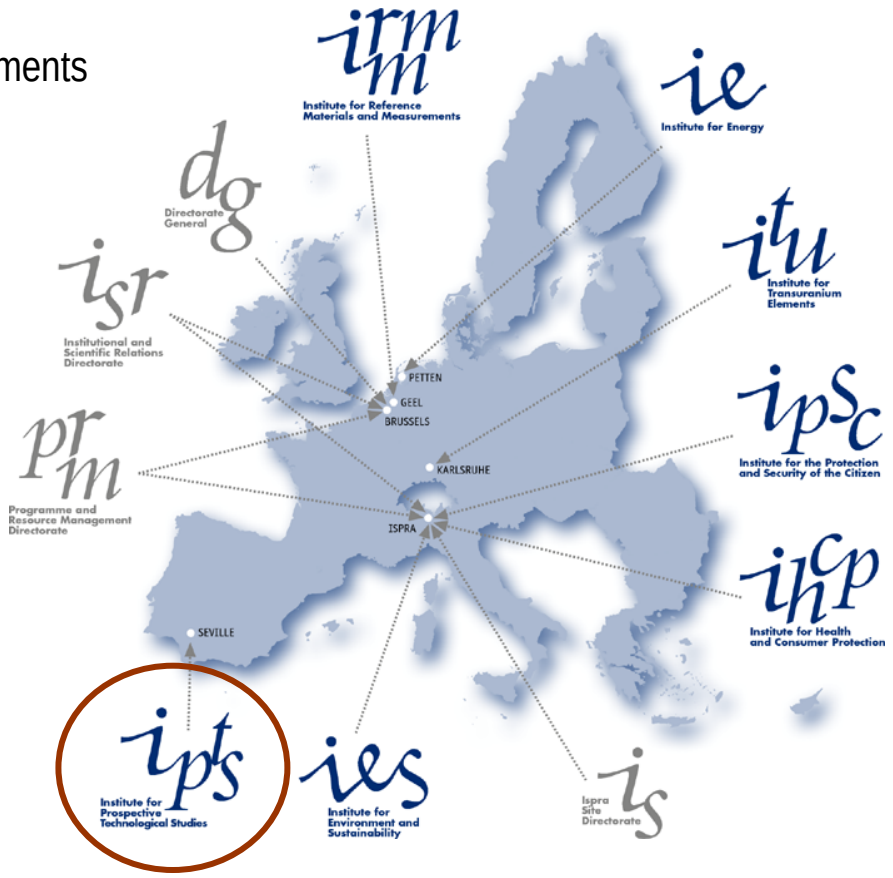
IRMM – Geel, Belgium
- Institute for Reference Materials and Measurements

IE – Petten, The Netherlands
-Institute for Energy

ITU – Karlsruhe, Germany
- Institute for Transuranium elements

IPSC - IHCP - IES – Ispra, Italy
- Institute for the Protection and the Security of the Citizen
- Institute for Health and Consumer Protection
- Institute for Environment and Sustainability

IPTS – Seville, Spain
- Institute for Prospective Technological Studies



Total staff > 2600 people, IPTS 180 people

Outline of the presentation

1. The EU-FP6 SIGMEA project
2. *Ex post* analysis: adoption and impacts of Bt maize in Spain
3. *Ex ante* analysis: adoption and possible impacts of HT maize and HT oilseed rape in Europe
4. Concluding remarks

The SIGMEA project

- ***« Sustainable introduction of GM crops into European Agriculture » EU* FP6 STREP project (2004-2008)**
- WP5: adoption by EU farmers, agronomic and socio-economic impacts

http://www.inra.fr/sigmea

Global adoption-share of GM varieties in main crops (2008)

Soybean	**HT**	**70 %**	**66 M ha**
Cotton	**Bt/HT**	**46 %**	**15 M ha**
Maize	**HT/Bt**	**24 %**	**37 M ha**
Oilseed rape	**HT**	**20 %**	**6 M ha**
Sugarbeet	**HT**		

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Bt maize: the technology, adoption and impacts

Bt maize: the technology

Resistant to maize borers (ECB / MCB)

Maize borers are not efficiently controlled by conventional insecticides

Some farmers assume yield losses (no treatments)

Hypothesis: Bt maize increases yields in areas affected by maize borers, and may reduce insecticide use

Increase of farm earnings? Will depend mainly on additional GM seed costs

Evolution Bt maize in Spain

1998: two hybrids containing Bt 176, 20000 ha, 5% adoption rate

2008: over 50 hybrids containing MON810

79000 ha (2008) 20% adoption rate

100% of GM maize grain sold to animal feeding industry
10 years experience, empirical evidence

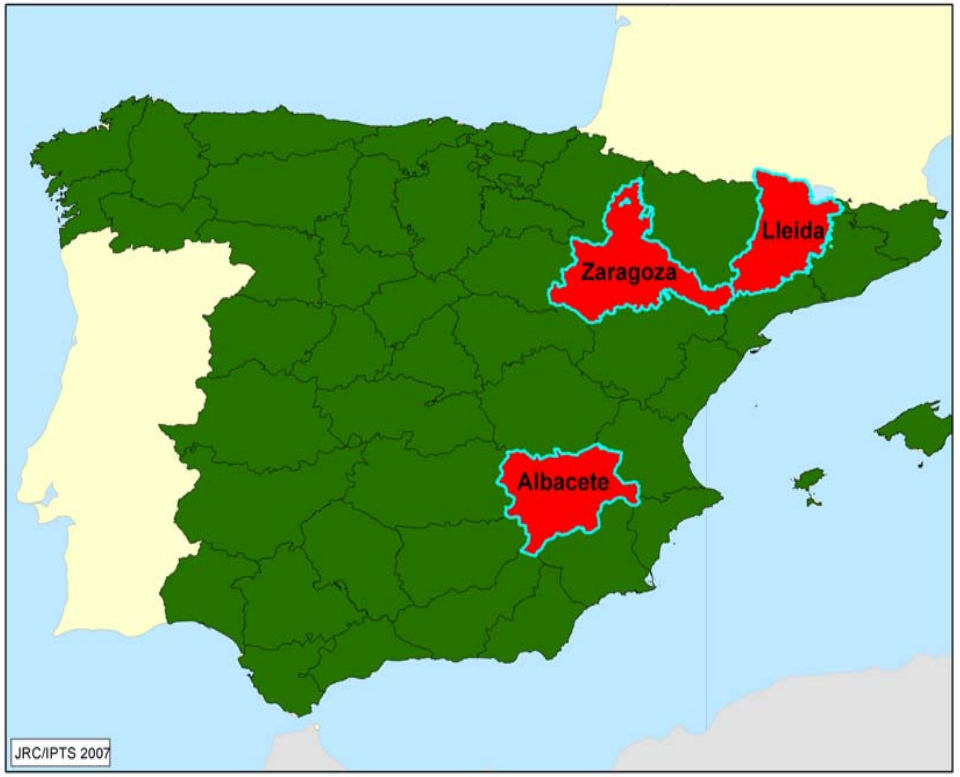
Field work (2005): surveying commercial farmers for 2002-2004 data

Regions with high presence of Bt maize

2005 adoption rates

- Aragon (31%)
- Cataluña (43%)
- Castilla- la Mancha (16%)

ZARAGOZA, LLEIDA y ALBACETE

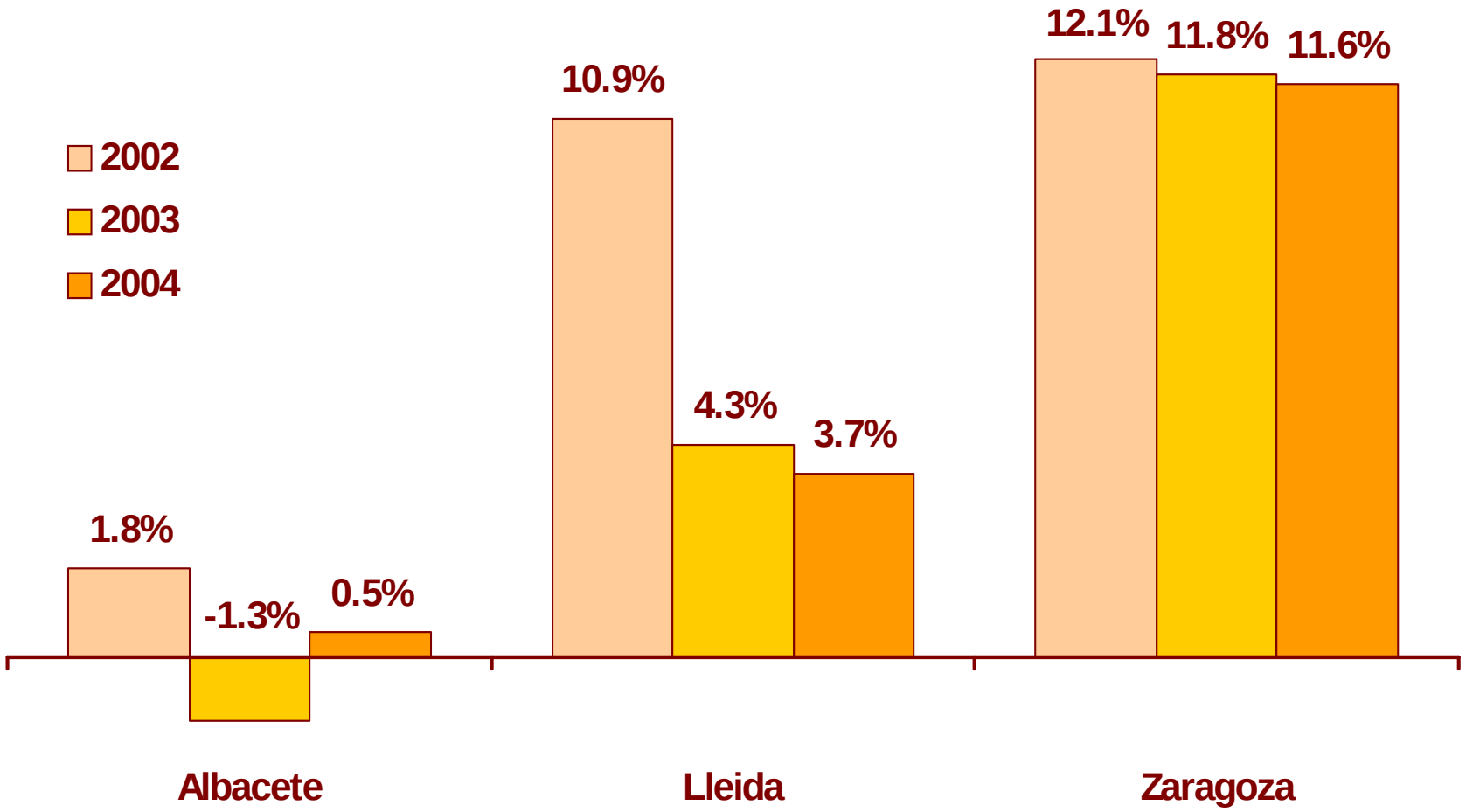


Types of farmers identified

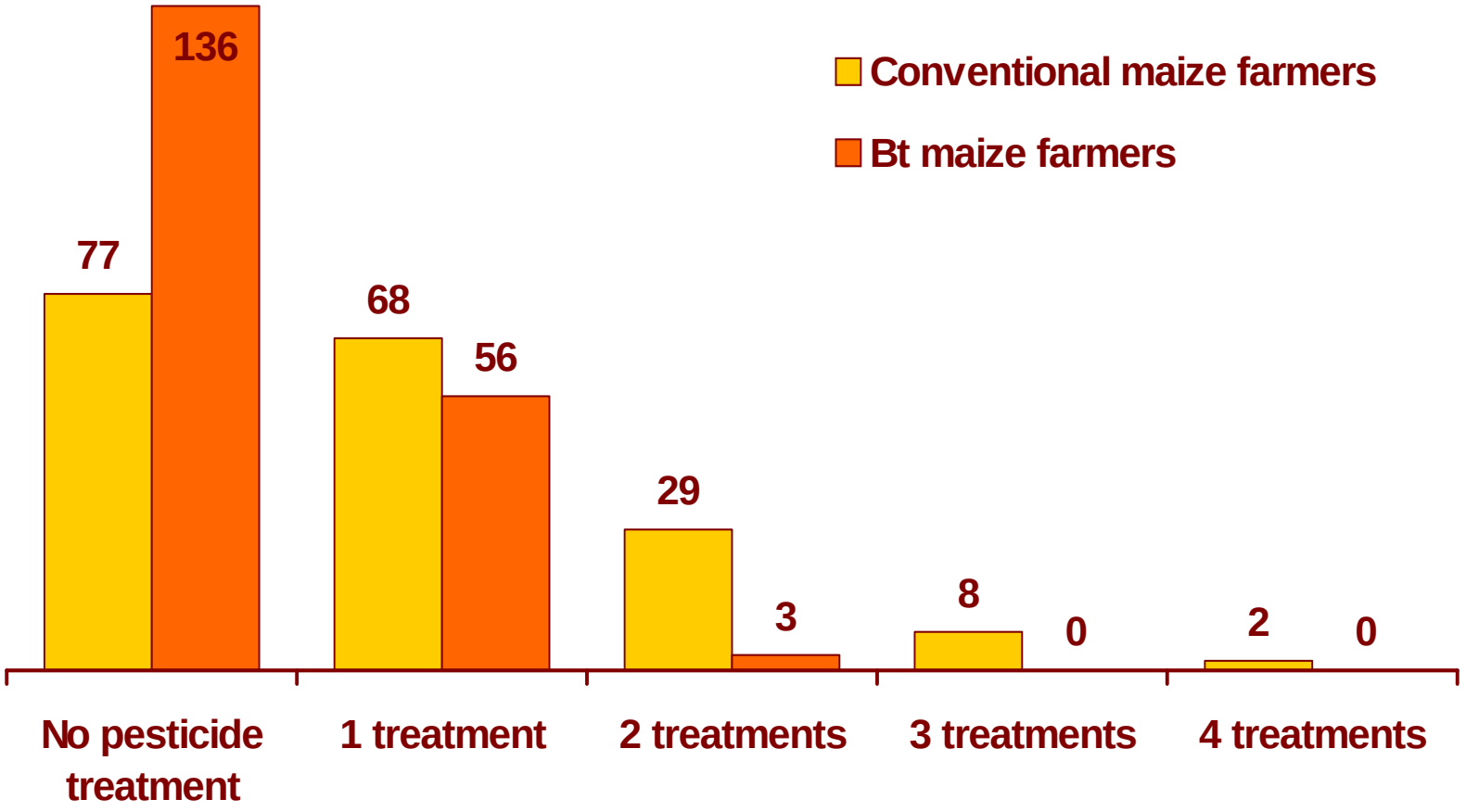
Types of maize grower	Regions: Castilla-La Mancha	Catalonia	Aragon	Total
Non-adopters	**61**	**52**	**71**	**184**
Full adopters	**42**	**66**	**87**	**195**
Partial adopters	**2**	**16**	**5**	**23**
Total region	**105**	**134**	**163**	**402**

Field work May-June 2005

Bt maize yields vs. conventional maize (price paid for harvest identical)



Number of insecticide treatments to control corn borers



Impact on insecticide use

Reduced insecticide use in corn borer control

58 % of conventional maize growers apply insecticide (average 0.86 treatments per year)

vs.

30 % of Bt maize growers (average 0.32 treatments per year)

Bt maize
economic benefits (2002-2004) for Spanish farmers

Yield increase : variable from neutral to 12% variable

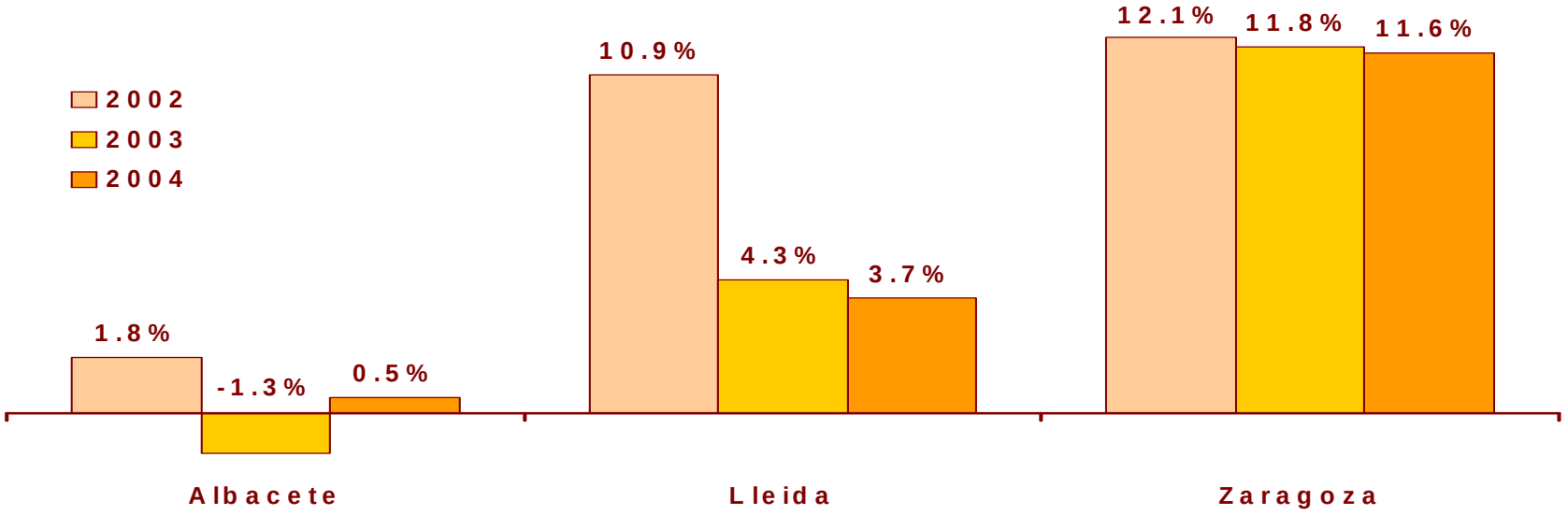
Harvest price Bt-conventional: identical

Reduced insecticide costs

Increased seed costs

Gross margin effects for Bt maize adopters in Spain: from neutral to 120 €/ha/year (2004)

Recent evolution of Bt maize adoption in Spain is consistent with the pattern of observed benefits



7957 ha (2005)
3659 ha (2007)
-54%

16830 ha (2005)
23013 ha (2007)
+37 %

21259 ha (2005)
35860 ha (2007)
+68%

Conclusions Bt maize agronomic and economic impacts (2002-2004)

Yield increase from neutral to 12%

Identical market price for harvests

Reduced use and cost of insecticides against borers

Bt seeds price differential

Impact on farmer's gross margin from neutral up to 120 €/ha/year

Geographic variability of benefits is reflected in the recent evolution of adoption (an indirect evidence of success)

Spanish farmers adopting Bt maize are not different than conventional maize farmers

No statistical differences in farm size, age, education, experience as maize growers, socio-economic level (50 variables)

Yield differences mostly due to the use of Bt maize

Differences in perception of risk of corn borer

A "divisible" technology (comes in seeds)

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Herbicide-Tolerant (HT) Maize

- Allows using non-selective herbicides
- Simple weed management
- 63% maize area in USA (23% HT, 40% BtxHT)
- Yield and Economic impacts

HT Oilseed rape

Allows using non-selective herbicides, simpler weed management

Canada: 98% canola is HT (over 80% transgenic)

80% under minimum tillage

France: €24 M/year in savings in weed control *(Desquilbet et al. 2001)*

Ex ante analysis of adoption and effects of HT maize and HT oilseed rape in Europe

Field survey in 2007 (over 1200 farms)

Potential adoption by farmers

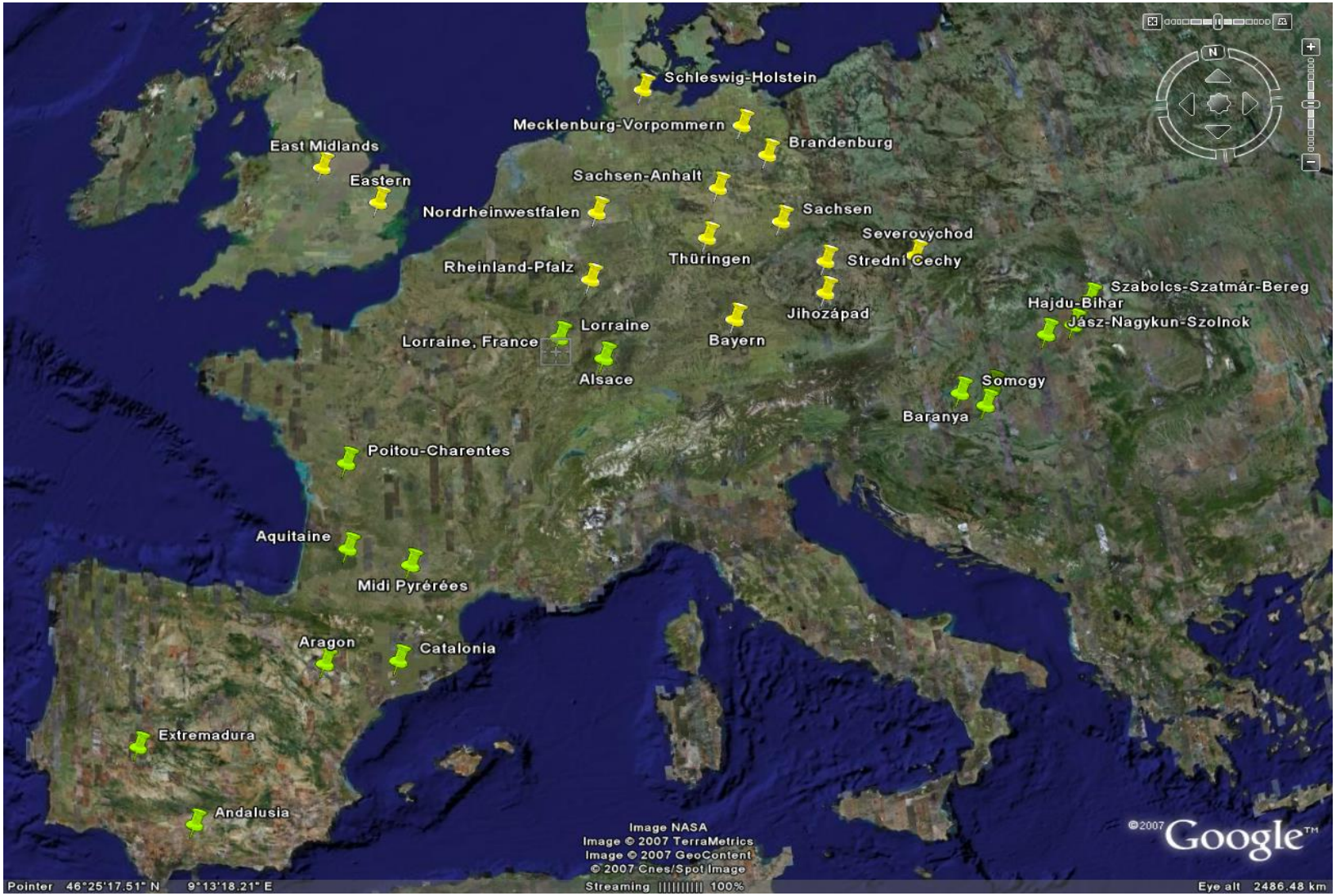
Factors determining decision to adopt or not

Model the impact of adoption on herbicide use and no tillage practices

Model the impact on farmer's economies

Influence of coexistence measures in adoption

Field work: surveyed farms (2007)



Field work-surveyed farms (2007)

Trait/Crop	Country	Number of farmers	Regions (Nuts1 or Nuts2)
HT rapeseed	Germany	208	Mecklenburg-Vorpommern, Brandenburg, Sachsen-Anhalt, Thüringen, Sachsen, Schleswig-Holstein, Nordrheinwestfalen, Rheinland-Pfalz Bayern
	United Kingdom	200	East Midlands, East of England
	Czech Republic	200	Střední Cechy, Jihozápad, Severovýchod, Jihovýchod
HT maize	Spain	104	Andalusia, Extremadura
	France	101	Aquitaine, Midi Pyrénées, Poitou-Charentes, Alsace, Lorraine
	Hungary	100	Del-Dunantul, Eszak-Alfold
Bt/HT maize	Spain	100	Aragon, Catalonia
	France	101	Aquitaine, Midi Pyrénées, Poitou-Charentes, Alsace, Lorraine
	Hungary	100	Del-Dunantul, Eszak-Alfold
	Total	**1214**	

Preliminary results: potential adoption of HT maize and HT rapeseed by EU farmers

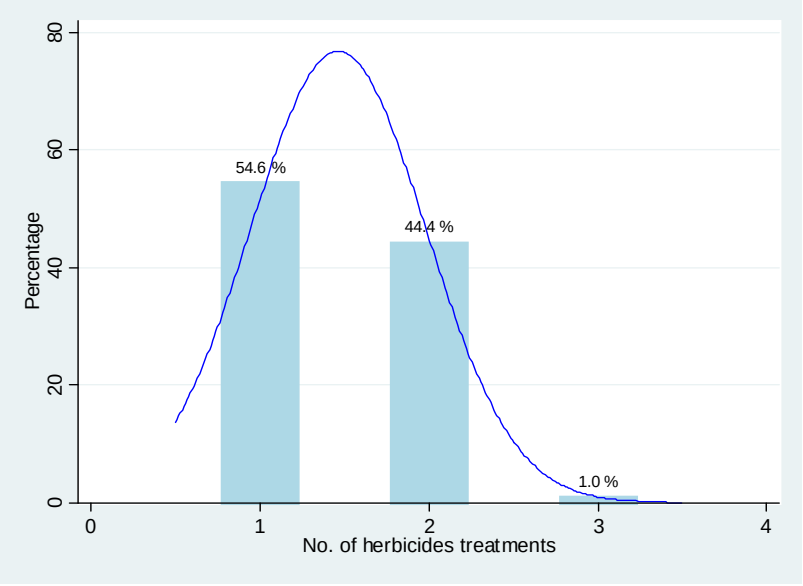
Trait/Crop	Country	(1) Likely+very-likely %	(2) Unlikely + Very-unlikely %	Ratio *(1)/(2)*
HT rapeseed	Germany	53,4	31,7	1,68
	United Kingdom	44,0	25,5	1,73
	Czech Republic	43,9	28,1	1,56
HT maize	Spain	36,5	38,5	0,95
	France	37,6	33,7	1,12
	Hungary	38,0	38,0	1,00
Bt/*HT maize*	Spain	48,3	35,0	1,38
	France	46,5	28,7	1,62
	Hungary	25,3	57,6	0,44
	Total average	41,5	35,2	1,18

Herbicide use in conventional maize EU

Number of herbicide treatments

EU

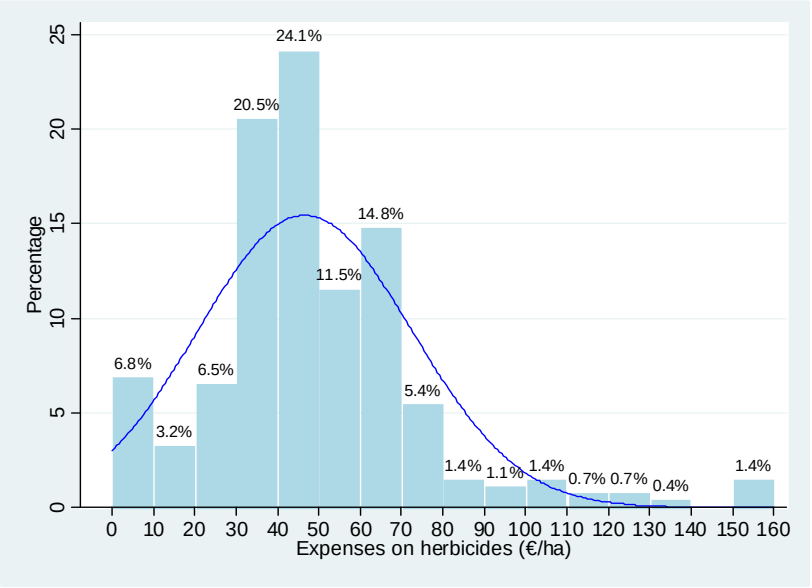
Obs= 304; Mean= 1.46; Median= 1; Std. dev.= 0.52



Expenses on herbicides (€/ha)

EU

Obs= 279; Mean= 47.77; Median= 45; Std. dev.= 31.98



Preliminary conclusions ex-ante analysis of adoption HT crops in EU

High potential adoption by farmers

Experience on the crop associated to likelihood of adoption

Baseline of current herbicide use and herbicide costs completed

Modelling effects of HT crop adoption on herbicide use changes and farmers revenues: ongoing work

Coexistence measures may have an impact on the decision to adopt

Concluding remarks

Agricultural economics research is essential

- to understand potential benefits of GM crops and its social distribution
- to quantify indirect effects on the environment (i.e.changes in pesticide use)

Experience and academic excellence exists in Europe, but few projects on-going

Networking, integration and funding needed

Thanks you for your attention

http://www.jrc.ec.europa.eu

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