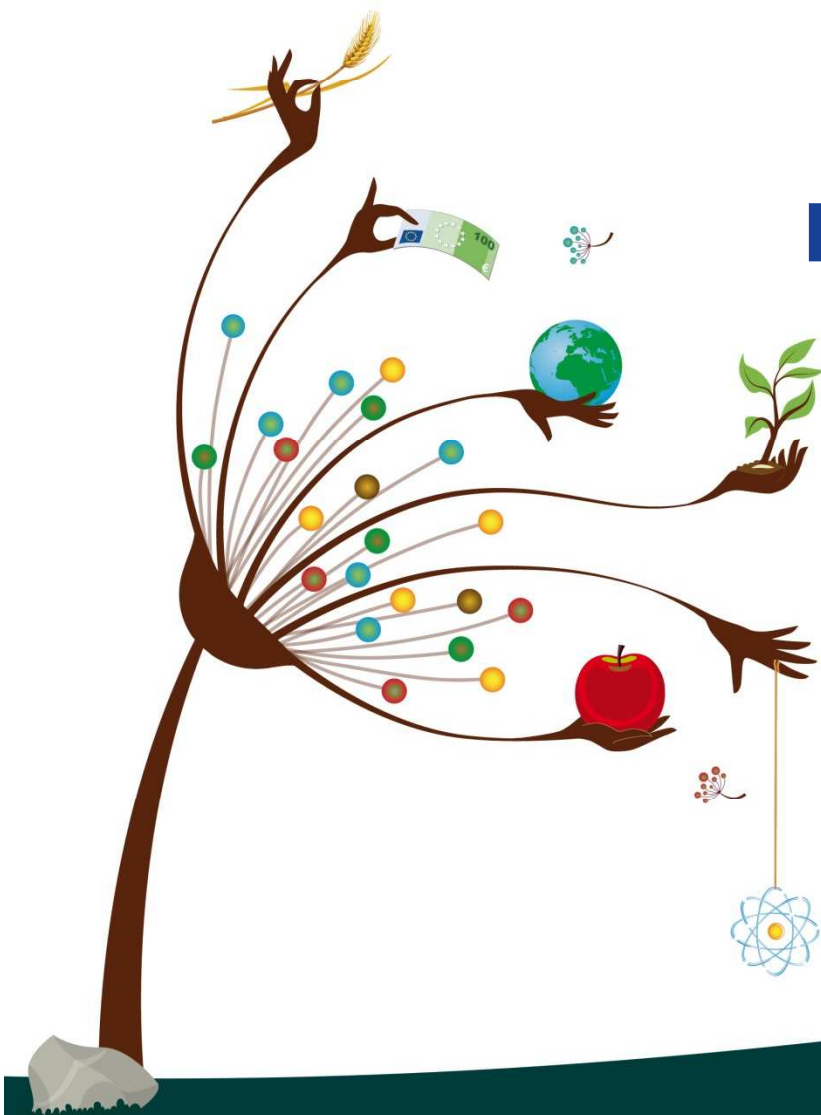


The European Commission's science and knowledge service

Joint Research Centre

Pest management after neonicotinoid and fipronil restrictions

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JRC - D4 – Economics of Agriculture

- Within JRC Directorate D **Sustainable Resources**
- Scientific support to EU policy-makers
- Analysis of agricultural policy, rural development, food security, trade, climate change mitigation
- Adoption and impact of agricultural technologies
- Based in Seville (Spain)

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Introduction

- Neonicotinoids: 25% of global insecticide sales
- Systemic: most relevant as seed treatments (also soil/foliar)
- Do they threaten bees? 2013 EFSA opinions on imidacloprid, thiamethoxam, clothianidin, fipronil
- EC Regulation No 485/2013 bans treatments of several crops with 3 most common neonics from December 2013
- EC Regulation No 781/2013 bans fipronil treatments from March 2014
- Most relevant for: maize, rapeseed, sunflower

Research objective

- What are the impacts of the neonicotinoid and fipronil restrictions on farmers?
- How do farmers adapt to the restrictions, in particular their pest management?
- D4 initiated the study, with DG SANTE following

Methodology

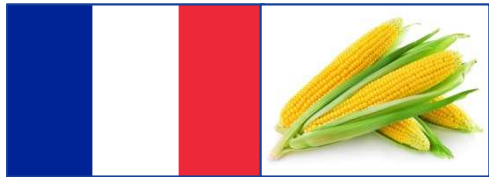
- 8 case studies of maize/OSR/sunflower growers in 7 EU countries
- Regions with high adoption of restricted substances and high target crop production
- Target population: farmers using restricted substances before restrictions
- Representative samples of 100 farmers per case study
- Agronomic & pest management practices, cost, yield, perceptions
- Growing seasons before restrictions (2012/13, 2013/14) and after restrictions (2014/15)



Analysis of survey results

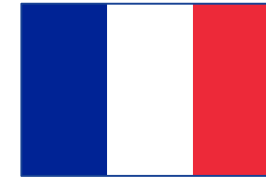
- Active substances for seed and soil/foliar treatments
- Treatment frequency index: sum of applications of soil/foliar insecticides
- Other (non-insecticide) adaptation measures
- Farmer perceptions:
 - Impact on time and cost of crop protection
 - Perceived effectiveness old vs. new seed treatments
 - Perceived occurrence of pests and beneficial insects

Main results





Maize in France



Seed treatments:	Thiamethoxam replaced by thiacloprid
Soil/foliar treatments:	Pyrethroid increase (25% to 55% of farmers)
Treatment frequency:	Increase (1.1 to 1.4 insecticide uses)
Other adaptations:	Increase pest scouting (20% of farmers)
Time to protect crop:	Increase (40% of farmers)
Cost to protect crop:	Increase (60% of farmers)
Effectiveness seed treat:	Thiacloprid less effective (60% of farmers)
Pest pressure:	Increase (30% of farmers)
Beneficial insects:	<i>-no significant change-</i>

Farmer perceptions



Maize in Spain



Seed treatments:	Clothianidin replaced by thiacloprid
Soil/foiar treatments:	<i>-no significant change-</i>
Treatment frequency:	Increase (0.1 to 0.2 insecticide uses)
Other adaptations:	<i>-no significant change-</i>

Farmer perceptions

Time to protect crop:	Increase (40% of farmers)
Cost to protect crop:	Increase (60% of farmers)
Effectiveness seed treat:	Thiacloprid less effective (80% of farmers)
Pest pressure:	Increase (60% of farmers)
Beneficial insects:	<i>-no significant change-</i>



Maize in Italy



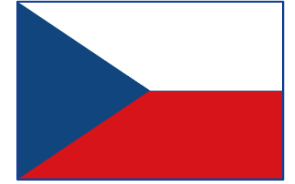
- Seed treatments: *-no significant change-*
- Soil/foliar treatments: Clothianidin replaced by tefluthrin (before)
- Treatment frequency: *-no significant change-*
- Other adaptations: Earlier sowing (20% of farmers)

Farmer perceptions

- Time to protect crop: *-no significant change-*
- Cost to protect crop: *-no significant change-*
- Pest pressure: *-no significant change-*
- Beneficial insects: *-no significant change-*



OSR in the Czech Republic



Seed treatments:	Thiamethoxam replaced by untreated seeds
Soil/foliar treatments:	Pyrethroid increase (80% to 95% of farmers) Organosphosphate increase (65% to 75%)
Treatment frequency:	Increase (3.7 to 4.4 insecticide uses)
Other adaptations:	Increase pest scouting (55% of farmers)
Time to protect crop:	Increase (75% of farmers)
Cost to protect crop:	Increase (80% of farmers)
Pest pressure:	Increase (60% of farmers)
Beneficial insects:	<i>-no significant change-</i>

Farmer perceptions



OSR in Germany



Seed treatments:	Clothianidin (+beta-cyfluhtrin) replaced by untreated seeds
Soil/foliar treatments:	Pyrethroid increase (65% to 85% of farmers)
Treatment frequency:	Increase (2.4 to 3.1 insecticide uses)
Other adaptations:	Increase pest scouting (65% of farmers) Increase sowing density (45% of farmers) Later sowing date (45% of farmers)
Farmer perceptions	
Time to protect crop:	Increase (95% of farmers)
Cost to protect crop:	Increase (85% of farmers)
Pest pressure:	Increase (70% of farmers)
Beneficial insects:	<i>-no significant change-</i>



OSR in the UK



Seed treatments:	Thiamethoxam replaced by untreated seeds
Soil/foliar treatments:	Pyrethroid increase (60% to 95% of farmers)
Treatment frequency:	Increase (0.7 to 3.4 insecticide uses)
Other adaptations:	Earlier sowing date (60% of farmers) Increase mechanical pest control (30% of f.) Increase pest scouting (25% of farmers)

Farmer perceptions

Time to protect crop:	Increase (80% of farmers)
Cost to protect crop:	Increase (85% of farmers)
Pest pressure:	Increase (60% of farmers)
Beneficial insects:	<i>-no significant change-</i>



Sunflower in Hungary



Seed treatments:	Thiamethoxam replaced by untreated seeds
Soil/foliar treatments:	Pyrethroids increase (5% to 40% of farmers) Neonics increase (0% to 20% of farmers)
Treatment frequency:	Increase (0.2 to 0.9 insecticide uses)
Other adaptations:	Increase sowing density (25% of farmers) Increase mechanical pest control (20% of f.)

Farmer perceptions

Time to protect crop:	Increase (75% of farmers)
Cost to protect crop:	Increase (75% of farmers)
Pest pressure:	Increase (55% of farmers)
Beneficial insects:	<i>-no significant change-</i>



Sunflower in Spain



Seed treatments: Fipronil replaced by tefluthrin

Soil/foliar treatments: *-no significant change-*

Treatment frequency: *-no significant change-*

Other adaptations: *-no significant change-*

Time to protect crop: Increase (20% of farmers)

Cost to protect crop: Increase (30% of farmers)

Effectiveness seed treat: Tefluthrin less effective (45% of farmers)

Pest pressure: *-no significant change-*

Beneficial insects: *-no significant change-*

Farmer perceptions

Conclusions

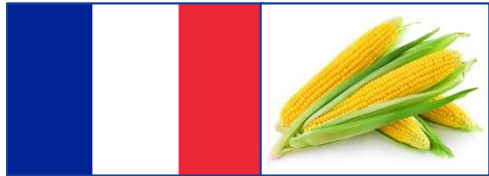
1. Restricted active substances mostly disappear
2. Farmers replace them with other substances (pyrethroids, other neonicotinoids)
3. Fewer seed, more soil and foliar treatments
4. In addition, other adaptation measures taken

- Farmer perceptions
5. Pest management more cost- and time-intensive
 6. Alternative seed treatments less effective
 7. Pest incidence increasing, beneficial insect incidence not affected

Thank you for your attention

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Detailed results



Seed treatments (% of farmers using a substance)

Substance or class	2012	2013	2014	2012	2013	2014	2012	2013	2014
	Maize								
	France			Spain			Italy		
Neonics (r)	87 ^a	86 ^a	0 ^b	92 ^a	93 ^a	2 ^b	14 ^a	16 ^a	16 ^a
Neonics (u)	2 ^a	5 ^a	90 ^b	2 ^a	0 ^a	78 ^b			
Pyrethroids							2 ^a	a	a
Unknown substances				6 ^a	6 ^a	10 ^a	2 ^a	2 ^a	1 ^a
Untreated seeds	26 ^a	30 ^a	37 ^a	a	a	10 ^a	82 ^a	81 ^a	82 ^a
	Rapeseed								
	Czech Republic			Germany			United Kingdom		
Neonics (r)	100 ^a	94 ^b	12 ^c	99 ^a	81 ^b	3 ^c	98 ^a	98 ^a	3 ^b
Pyrethroids	16 ^a	12 ^a	4 ^b	94 ^a	80 ^b	3 ^c	20 ^a	16 ^a	0 ^b
Carbamates	0 ^a	1 ^a	8 ^b						
Untreated seeds	1 ^a	6 ^a	87 ^b	1 ^a	19 ^b	97 ^c	2 ^a	3 ^a	97 ^b
	Sunflower								
	Hungary			Spain					
Neonics (r)	92 ^a	14 ^b	1 ^c	11 ^a	11 ^a	2 ^b			
Fipronil (r)				89 ^a	85 ^a	8 ^b			
Pyrethroids	1 ^a	1 ^a	3 ^a	11 ^a	16 ^a	75 ^b			
Unknown substances	0 ^a	3 ^{ab}	4 ^b						
Untreated seeds	7 ^a	83 ^b	88 ^b	18 ^a	19 ^a	24 ^a			

Different superscript letters indicate statistically significant differences at the 5% level.

Soil and foliar treatments (% of farmers using a substance)

Substance or class	Soil/ foliar	2012	2013	2014	2012	2013	2014	2012	2013	2014
Maize										
France Spain Italy										
Neonics (r)	S		24 ^a	54 ^b				72 ^a	28 ^b	24 ^c
Pyrethroids	S, F	22 ^a	24 ^a	54 ^b				28 ^a	54 ^b	59 ^b
Carbamates	S	24 ^a	19 ^a	19 ^a						
Chlorpyrifos	S, F				2 ^a	14 ^{ab}	19 ^b	4 ^a	3 ^a	3 ^a
Chlorantraniliprole	F, S	5 ^a	10 ^a	12 ^a				1 ^a	0 ^a	0 ^a
Metaldehyde	S, F	43 ^a	41 ^a	43 ^a						
Other substances	F, S	7 ^a	5 ^a	7 ^a				3 ^a	3 ^a	4 ^a
Unknown substances					1 ^a	2 ^a	3 ^a	5 ^a	3 ^a	3 ^a
No treatment		13 ^a	17 ^a	11 ^a	97 ^a	84 ^{ab}	78 ^b	16 ^a	15 ^a	15 ^a
Rapeseed										
Czech Republic Germany United Kingdom										
Neonics (u)	F	47 ^a	56 ^b	62 ^b	44 ^a	45 ^a	35 ^a	0 ^a	0 ^a	8 ^b
Pyrethroids	F, S	68 ^a	81 ^b	95 ^c	60 ^a	64 ^b	86 ^c	62 ^a	59 ^a	95 ^b
Chlorpyrifos	F	52 ^a	64 ^b	74 ^c						
Metaldehyde	S	1 ^a	1 ^a	1 ^a						
Pymetrozin	F	2 ^a	2 ^a	3 ^a	10 ^a	3 ^a	5 ^a	0 ^a	0 ^a	3 ^a
Indoxacarb	F	1 ^a	1 ^a	2 ^a	4 ^a	7 ^a	6 ^a			
Unknown substances		9 ^a	7 ^a	7 ^a	18 ^{ab}	15 ^a	27 ^b	0 ^a	0 ^a	2 ^a
No treatment					2 ^a	1 ^a	1 ^a	38 ^a	41 ^a	5 ^b
Sunflower										
Hungary Spain										
Neonics (u)	F	1 ^a	15 ^b	19 ^b						
Pyrethroids	F, S	7 ^a	39 ^b	39 ^b	5 ^a	9 ^a	11 ^a			
Carbamates	F	2 ^a	11 ^b	6 ^{ab}						
Chlorpyrifos		2 ^a	2 ^a	2 ^a	10 ^a	1 ^a	0 ^a			
Buprofezin		1 ^a	0 ^a	3 ^a						
Unknown substances		7 ^a	5 ^a	6 ^a						
No treatment		81 ^a	32 ^b	23 ^c	87 ^a	91 ^a	89 ^a			

Different superscript letters indicate statistically significant differences at the 5% level.

Treatment frequency index

	2012	2013	2014	2012	2013	2014	2012	2013	2014
	Maize								
	France			Spain			Italy		
Total	1.93 ^a (0.10)	1.98 ^a (0.09)	2.29 ^b (0.10)	1.03 (0.02)	1.16 (0.08)	1.13 (0.11)	1.36 (0.13)	1.30 (0.09)	1.27 (0.08)
Treated seeds	0.89 (0.04)	0.91 (0.04)	0.90 (0.04)	1.00 (0.00)	1.00 (0.00)	0.90 (0.06)	0.18 (0.06)	0.19 (0.07)	0.18 (0.07)
Soil and foliar	1.04 ^a (0.08)	1.07 ^a (0.09)	1.38 ^b (0.10)	0.03 ^a (0.02)	0.16 ^a (0.08)	0.24 ^b (0.09)	1.18 (0.14)	1.12 (0.13)	1.10 (0.12)
	Rapeseed								
	Czech Republic			Germany			United Kingdom		
Total	4.77 ^a (0.12)	5.02 ^b (0.12)	4.61 ^a (0.16)	4.37 ^a (0.16)	4.24 ^a (0.16)	3.19 ^b (0.15)	1.95 ^a (0.09)	1.90 ^a (0.08)	3.44 ^b (0.19)
Treated seeds	1.18 ^a (0.04)	1.15 ^a (0.05)	0.24 ^b (0.05)	2.03 ^a (0.04)	1.85 ^b (0.05)	0.06 ^c (0.03)	1.21 ^a (0.05)	1.18 ^a (0.04)	0.03 ^b (0.02)
Soil and foliar	3.61 ^a (0.12)	3.87 ^b (0.12)	4.36 ^c (0.15)	2.32 ^a (1.16)	2.40 ^a (0.16)	3.11 ^b (0.14)	0.74 ^a (0.07)	0.72 ^a (0.07)	3.42 ^b (0.19)
	Sunflower								
	Hungary			Spain					
Total	1.27 ^a (0.07)	0.91 ^b (0.06)	0.93 ^b (0.06)	1.25 ^a (0.08)	1.21 ^a (0.08)	0.95 ^b (0.07)			
Treated seeds	1.04 ^a (0.04)	0.17 ^b (0.04)	0.09 ^c (0.03)	1.10 ^a (0.04)	1.11 ^a (0.04)	0.85 ^b (0.05)			
Soil and foliar	0.23 ^a (0.05)	0.74 ^b (0.06)	0.85 ^b (0.06)	0.15 (0.05)	0.10 (0.04)	0.11 (0.05)			

Different superscript letters indicate statistically significant differences at the 5% level.

Other adaptations

	Maize			Rapeseed			Sunflower	
	France	Spain	Italy	Czech Republic	Germany	United Kingdom	Hungary	Spain
Increase sowing density	5	6	3	8	45	12	26	
Earlier sowing date	3	2	20	3	2	61	5	2
Later sowing date	5		1		47	1	8	
Reduce crop area		1	1	1	5	1	9	3
More mechanical control		6	7		2	30	20	1
More pest scouting	22	10	9	54	64	25	12	6
None	75	77	63	39	21	26	43	88

Farmer perceptions of impact (% of farmers)

	Maize			Rapeseed			Sunflower	
	France	Spain	Italy	Czech Republic	Germany	United Kingdom	Hungary	Spain
Crop protection requires more/similar/less								
Time	37/63/0	40/60/0	13/87/0	76/21/0	93/7/0	81/19/0	74/25/0	19/81/0
Cost	57/37/6	59/33/8	11/89/0	79/16/0	83/14/0	84/14/2	73/23/4	32/68/0
Insecticides	44/54/2	43/56/0	10/90/0	77/22/0	85/11/0	81/19/0	70/28/2	11/89/0
Effectiveness of restricted vs. replacement seed treatment								
Higher/equal/lower	61/36/3	79/20/0	-	-	-	-	-	44/50/5
Incidence higher/similar/lower								
Soil pests	29/66/5	61/39/0	5/95/0	62/30/8	70/29/2	60/40/0	53/44/3	1/99/0
Foliar pests	22/72/6	61/33/6	4/96/0	48/41/11	38/59/3	8/92/0	51/47/2	1/99/0
Beneficial insects	4/96/0	1/93/6	0/100/0	3/84/13	3/94/3	8/91/1	10/96/0	0/99/0