

## **Environmental LCA of the Swiss federal program**

"Extenso"

# (Extensive production of cereals and rape seed)

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# Differences between the investigated farming systems regarding pesticide use

Farming system	Herbicides	Fungicides	Insecticides	Baits	Growth- regulators
Conventional	All permitted products can be used.				
Integrated production	Pre-emergence herbicides not permitted. By mulch or direct seeding are total herbicides until the seeding moment permitted.	permitted	only with a special permission	In case of critical damages permitted	Permitted, out of CCC, CC
Extenso	permitted	not permitted	not permitted	permitted	not permitted
organic	not permitted	not permitted	not permitted	not permitted	not permitted

#### "Extenso" = extensive plant protection



## **Procedure used to assess the toxicity impact (1)**

Method Jolliet and Crettaz (1997); Margni et al. (2002):

Advantages:the only method with impact coefficients for the must<br/>investigated pesticides (57 of 64).Sound basis for the ecotoxic assessment.

Disadvantages:Weak fate analysis (gross assumptions, no<br/>representativeness).Apparent overestimation of the impacts of heavy metals.<br/>Worst case estimates.

Human toxicity: no adequate method for pesticide residues in food.



## Procedure used to assess the toxicity impact (2)

#### **Consequences:**

- $\rightarrow$  Analysis with and without heavy metals.
- → LCA results must be complemented by additional investigations in order to be useful for authorities.
- $\rightarrow$  No consideration of pesticides residues for human toxicity.



#### **Results: Aquatic Ecotoxicity**



Aquatic ecotoxicity by different farming systems of wheat, barley and rapeseed (in g Zn Equivalents / ha [colons] and in g Zn Equivalents / kg [rows])



#### **Results: Terrestrial Ecotoxicity**



Terrestrial ecotoxicity by different farming systems of wheat, barley and rapeseed (in g Zn Equivalents / ha [colons] and in g Zn Equivalents / kg [rows])



#### **Results: Aquatic Ecotoxicity**



Aquatic Ecotoxicity (only plant protection products) by different farming systems of wheat, barley and rapeseed (in g Zn Equivalents / ha [colons] and in g Zn Equivalents / kg [rows])



**Results: Terrestrial Ecotoxicity** 



Terrestrial ecotoxicity (only plant protection products) by different farming systems of wheat, barley and rapeseed (in g Zn Equivalents / ha [colons] and in g Zn Equivalents / kg [rows])



#### **Results: Aquatic Ecotoxicity**



Aquatic ecotoxicity of pesticide active matters. H: Herbicides, F: Fungicides



**Results: Terrestrial Ecotoxicity** 



Terrestrial ecotoxicity of different active matters (H: Herbicides, F: Fungicides, M: Molluscicides) by different farming systems of wheat, barley and rapeseed (in g Zn Equivalents / ha [colons] and in g Zn Equivalents / kg [lines])



### Interpretation

	Wheat	Barley	Rapeseed	
Functional Unit:	ha kg	ha kg	ha kg	
Energy ressources	92% 115%	90% 108%	96% 110%	
Global warming potential (100 years)	92% 115%	89% 107%	91% 105%	
Global warming potential (500 years)	92% 115%	89% 108%	92% 106%	
Ozone formation	92% 115%	91% 110%	95% 109%	
Human toxicity	93% 117%	92% 111%	96% 111%	
Aquatic ecotoxicity	100% 125%	79% 96%	119% 137%	
Aquatic ecotoxicity (PPP)	47% 59%	35% 42%	43% 49%	
Terrestrial ecotoxicity	98% 122%	53% 64%	138% 159%	
Terrestrial ecotoxicity (PPP)	26% 32%	36% 44%	45% 52%	
Aquatic eutrophication	106% 132%	94% 113%	122% 140%	
Terrestrial eutrophication	106% 132%	93% 112%	83% 95%	
Total eutrophication	98% 123%	100% 121%	96% 111%	
Acidification	103% 129%	93% 112%	86% 100%	
Biodiversity				
Soil fertility				
Judgment:	Energy O	ther impact categ	ories	
Very favourable	<67% <5	50% · · ·		
Favourable	<87% <7	74%		
Comparable				
Unfavourable	>115% >1	135%		
Very unfavourable	>150% >2	200%		



## **Conclusions of the study regarding pesticides (1)**

The "Extenso" program proves to be advantageous for the environment only in part for the domains of aquatic and terrestrial ecotoxicity and for the biodiversity.

The advantages for the ecotoxicity:

- Were only established when the effects of heavy metals (from fertilisers) were not included.
- Were in part originated by the reduction of the use of herbicides, not directly depending on the "Extenso" program.
- Were principally originated by 6 of the 57 considered active matters, and only in part connected to the prohibited use of determinated categories of pesticides.

The advantages of the "Extenso" program for the biodiversity were principally recognizable on the cultivation of rapeseed, because the major part of the cultivated surfaces are treated with insecticides.



## **Conclusions of the study regarding pesticides (2)**

The advantages of the "Extenso" program were found in only two of the investigated environmental domains. Because they emerged only in part or not at all in a sure form, the conclusion is, that the whole view of the "Extenso" program shows only insignificant advantages for the environment.

Operative recommendations. It must be verified if:

- a) the ecotoxicological effects of the following active matters on the environment are tolerable or if they exceed determinate threshold values: Isoproturon, Dimefuron, Methabenzthiazuron, Chlorothalonil and Lambda-Cyhalothrin.
- b) the permission to use the active matters cited in a) should be limited or prohibited (according to art. 12 of the Ordinance about the use of plant protection products. June, the 23rd 1999).
- c) the ecological usefulness of the "Extenso" program could be more important by a detailed choice of plant protection products instead by the prohibition of the use of entire groups of plant protection products.

