

The value of crop protection in the EU: Calculations of market and environmental effects

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(1) Introductory remarks: Problem setting

- Modern and highly productive agricultural technologies face a critical public.
- Arguments of opinion leaders are too often driven by perceptions & ideologies:
 - Toxic chemistry vs. non-toxic nature;
 - Healthy organic farming vs. unhealthy conventional farming;
 - Safe old breeding technologies vs. unsafe new breeding concepts.
- Bad news sell in media, which often use negative perceptions vs. positive facts.
- Our approach: The world is not black or white; it has different shades of grey!
 - Sometimes lighter, sometimes darker;
 - Always pros and cons have to be balanced;
 - Trade-offs need to be named and tried to be avoided;
 - Synergies need to be identified and preferred.
- A holistic assessment instead of too narrow impact analyses is missing.

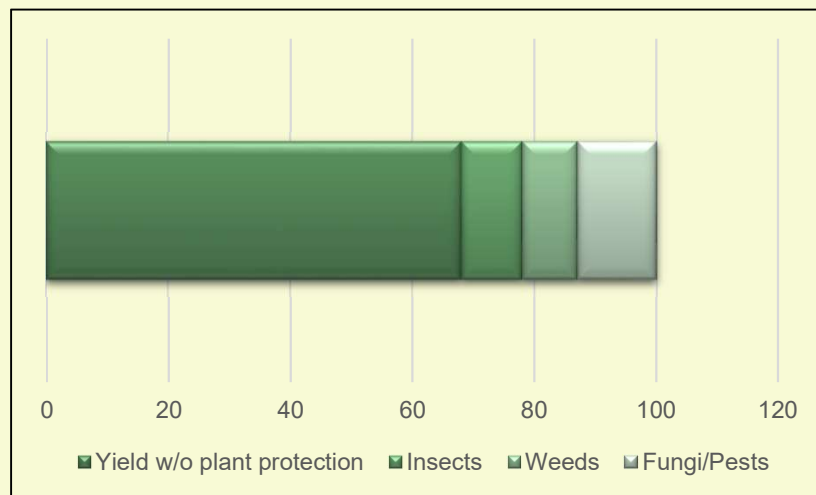
(1) Introductory remarks: Objectives

- Providing evidence of the multiple benefits of plant protection (and other technologies) applied in modern, high-productive agriculture:
 - Based on reproducible findings and scientific facts;
 - Based on standardized tools and sophisticated “peer-reviewed” methods;
 - Focusing on agricultural and environmental economics.

- Supporting a sustainable market access/success of particular technologies:
 - Specific plant protection products;
 - New plant breeding technologies;
 - Other approaches targeting high productivity in crop and animal production.

(2) Hypothetical reflections: Potential yields without plant protection

Yield depression without combating insects, weeds and fungi/pests



Source: Own calculations and figure based on Oerke (2006).

- Without targeted plant protection measures, yields would be much lower.
- Insects would contribute 10 percent.
- Weeds could cost additional 9 percent.
- Fungi and other pests might accumulate to 13 percent.
- Altogether, a third of harvestable yields could potentially be lost in the absence of necessary modern plant protection.
- Under specific circumstances even more yield depression might occur.

(2) Hypothetical reflections: Current yields of organic farming not using chemical plant protection in Germany

Yields in organic farming of Germany
(conventional farming = 100 percent)

	Marketing Year 07/08 – 09/10	Marketing Year 11/12 – 13/14
Wheat	45.2 %	43.0 %
Barley	52.4 %	50.1 %
Other Grains	49.4 %	46.7 %
Oilseed Rape	64.1 %	55.2 %
Potatoes	55.2 %	54.5 %
Sugar Beets	82.9 %	82.8 %

Source: Own calculations and figure based on TI (various years).

- Yields in organic farming of Germany are considerably lower than in modern, high-productive arable farming.
- The yield gap of farming not suitable for chemical plant protection has increased over time.
- 2007-2010: minus 48 percent.
- 2011-2014: minus 51 percent.
- The displayed yield differences already take into consideration comparable farm structures and natural conditions, but no long-term effects.

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(2) Hypothetical reflections: Current yields of low-input farming not using chemical plant protection in the EU

Yield of low input farming relative to productive agriculture in the EU

Wheat	Corn	Other Cereals	Oilseed Rape	Other Oilseeds	Potatoes	Sugar Crops	Pulses
-38	-27	-29	-33	-27	-31	-25	-22

Source: Own calculations and figure.

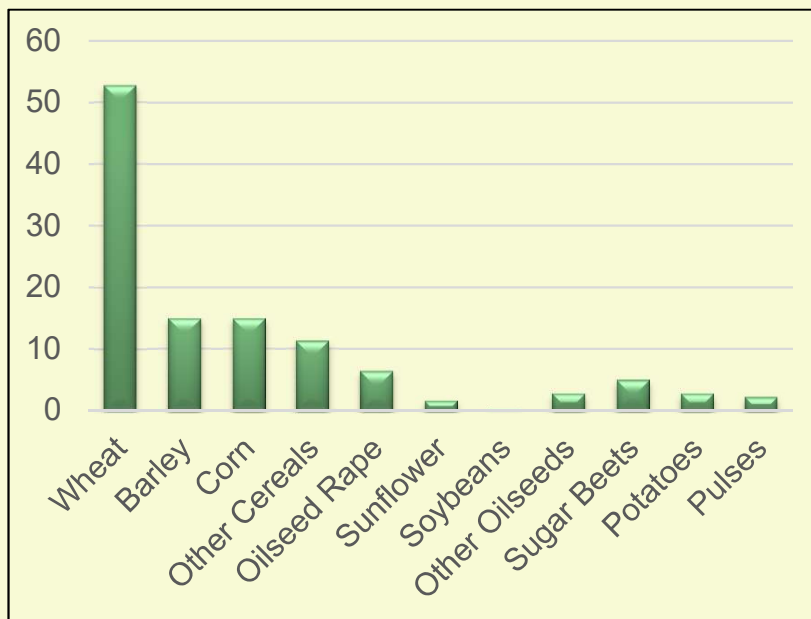
- Figures are based on a rather comprehensive meta-analysis of already existing studies.
- Accordingly, the calculated average yield depression in low input farming of the EU is 31 percent (i.e. almost equivalent to Oerke's estimates from 2006).
- Calculated yield gaps should be considered as rather conservative and tend to underrate the real yield gap.

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(2) Hypothetical reflections: Improved market conditions with systemic chemical plant protection in the EU

Additional domestic supply in the EU
(in million tons)



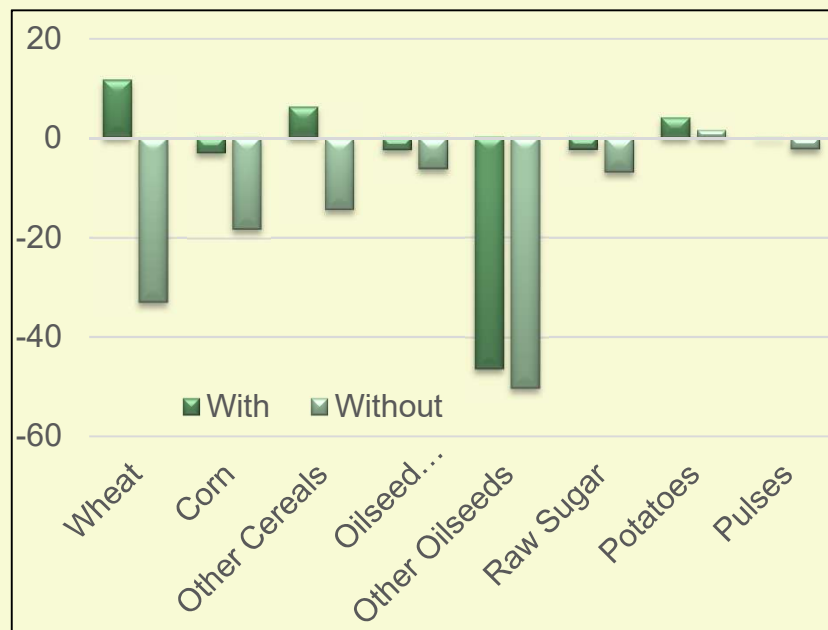
Source: Own calculations and figure.

- Additional annual production of grains of 100 million tons.
- Additional annual production of oilseeds of 10 million tons.
- Such a higher market volume contributes to market stabilization.
- It acts to reduce market price spikes and helps keep price volatility low.
- Furthermore, it creates extra income for farmers and – through the value chain – the society at large.

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(2) Hypothetical reflections: Without systemic chemical plant protection EU's trade balance would deteriorate

Trade with and without systemic application of PPP in the EU (in 10⁶ tons)



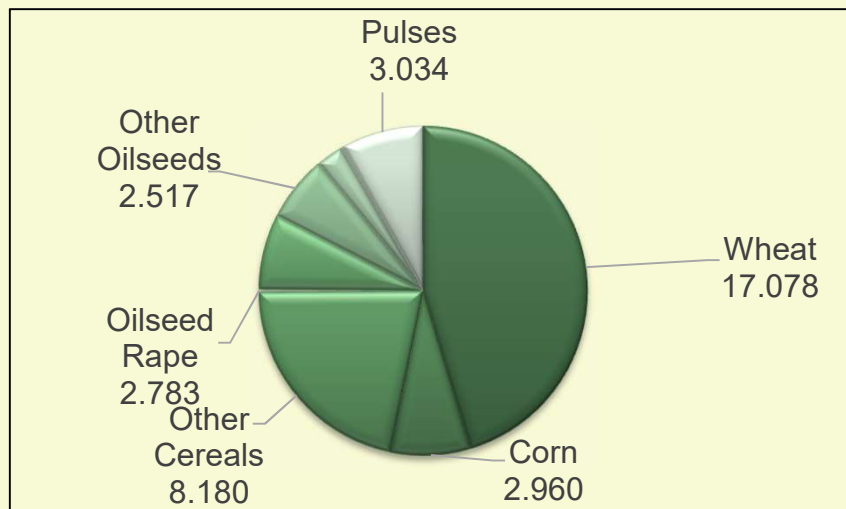
Source: Own calculations and figure.

- The EU agricultural trade balance, when broken down to the commodity level, would worsen considerably.
- The EU would become a net importer in all major arable crops:
 - All cereals,
 - All oilseeds,
 - Sugar crops and pulses.
- Trading partners would welcome such a situation.
- They would be willing to compensate by using more inputs to produce more!

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(2) Hypothetical reflections: According to Oerke's theorem, a considerable amount of extra global land would be ...

... needed without targeted plant protection in the EU (in million ha)



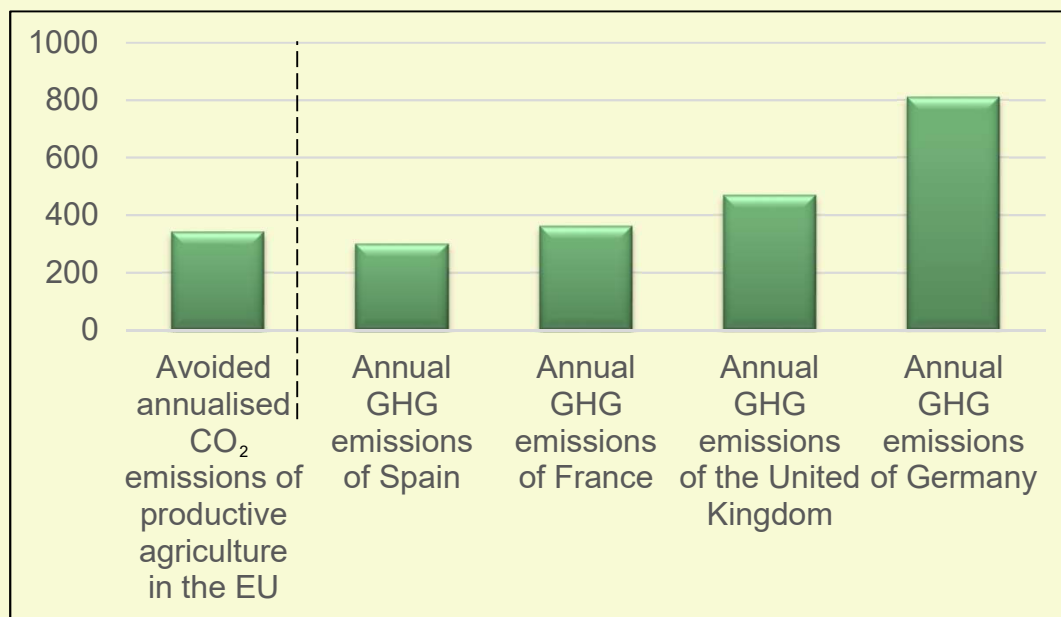
Source: Own calculations and figure.

- On balance, about 18 million hectares of virtual agricultural land are currently imported by the EU.
- Additional 38 million hectares (!) would have to be net imported when switching from productive agriculture to low input farming in the EU.
- This exceeds the territory of Germany and corresponds to a tripling of the EU's current net land imports.

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(2) Hypothetical reflections: Missing plant protection in the EU would considerably worsen global climate change

Avoided 'annualized' global CO₂-emissions in comparison (in million tons CO₂-eq.)

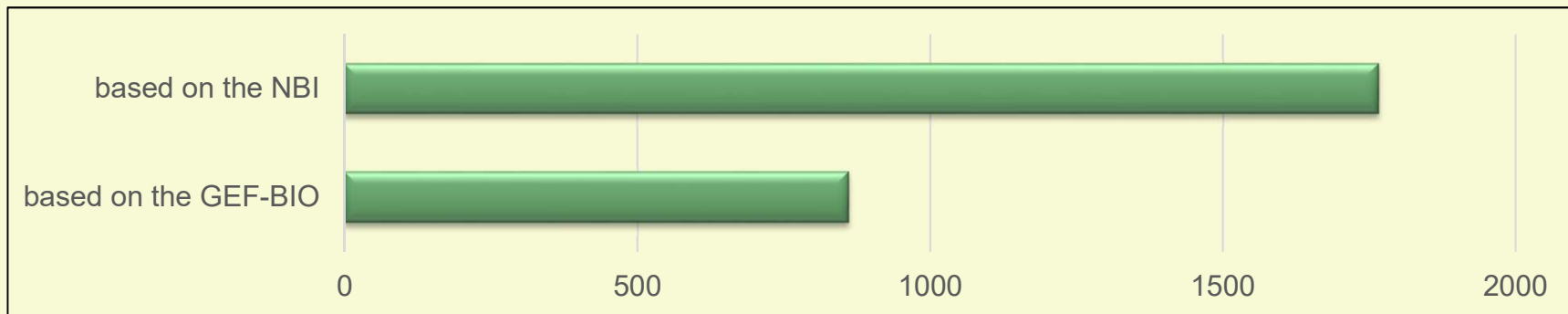


Source: Own calculations and figure.

- Plant protection in the EU avoids acreage expansion and, hence, 6.8 billion tons of global CO₂-emissions.
- This equals 60 times the Belgium GHG inventory.
- The avoided "annualized" emissions are 340 million tons of CO₂.
- If released, it would increase the EU's inventory of GHG emissions by 10 percent.

(2) Hypothetical reflections: Globally biodiversity is not lost, but preserved

Preserved global biodiversity of plant protection in the EU (in million index points)

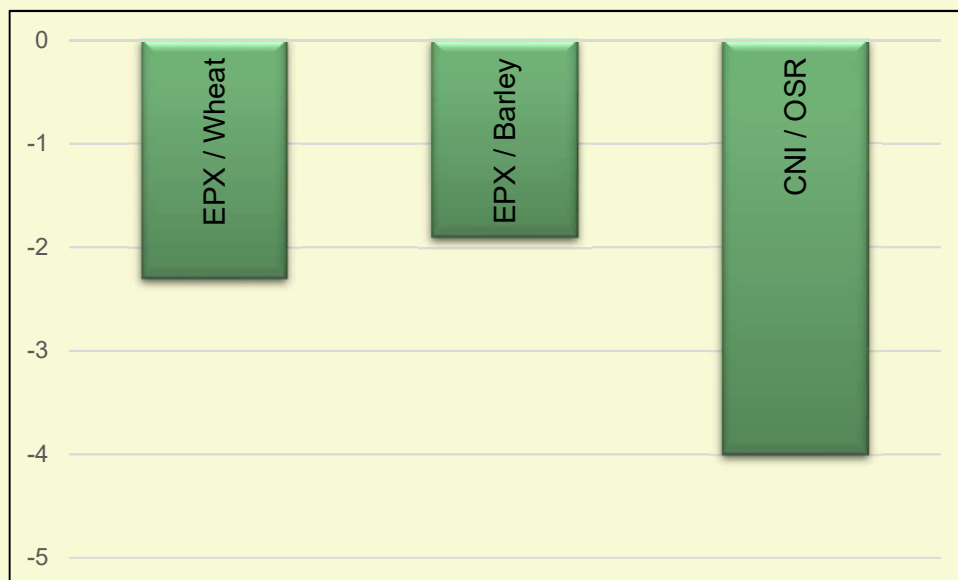


Source: Own calculations and figure.

- Preserved biodiversity is as large as the richness of species that can be found in 8.6 (17.7) million hectares of Brazilian (Indonesian) rainforests.
- This equals almost three (six) times the territory of a country like Belgium.

(3) Case-study findings: **Yield impacts** of eliminating EPX and CNI from the toolbox of European farmers

Short-term yield drop for EPX in wheat and barley as well as for CNI in oilseed rape (in %)

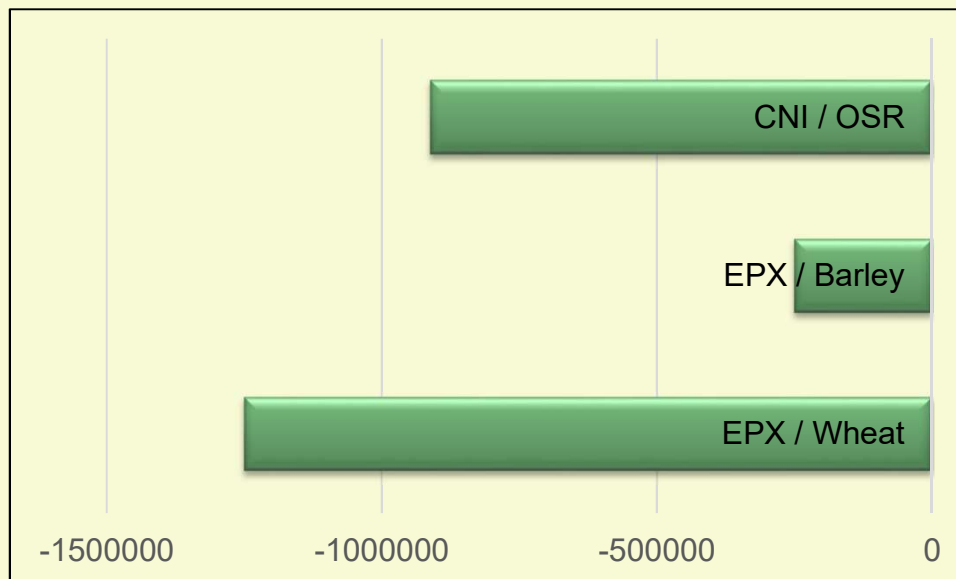


Source: Own calculations and figure.

- In the short-term already remarkable yield drops would occur (have occurred):
 - Wheat: – 2.3 %;
 - Barley: – 1.9 %;
 - OSR: – 4.0 %.
- In the mid- to long-term yield impacts are probably higher:
 - EPX / Wheat: – 5.8 %;
 - EPX / Barley: – 6.6 %.
- All the following arguments shall again be considered a rather conservative assessment.

(3) Case-study findings: **Supply impacts** of eliminating EPX and CNI from the toolbox of European farmers

Missing EU production when banning EPX in wheat and barley; CNI in oilseed rape (in tons)

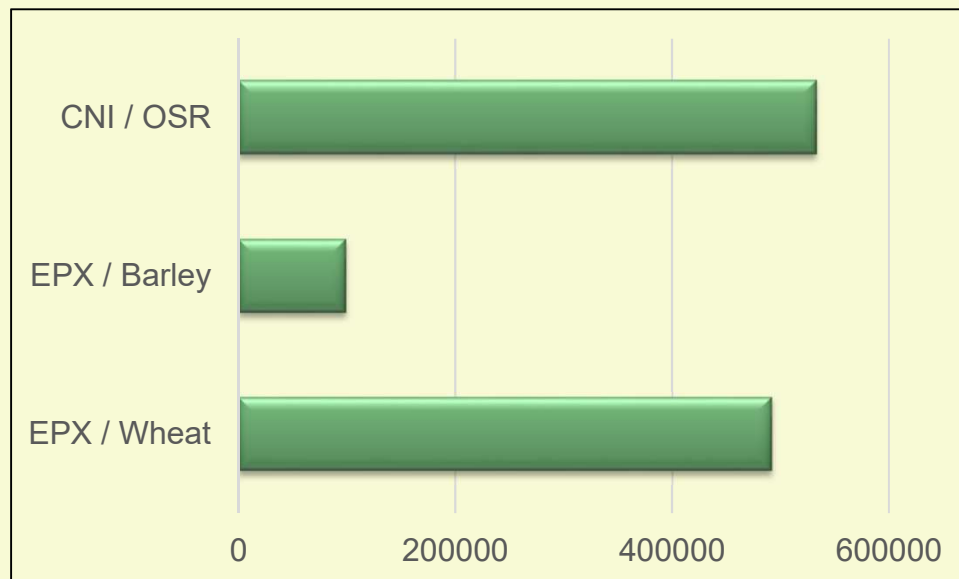


Source: Own calculations and figure.

- The short-term yield drops translate into missing harvest:
 - Wheat: – 1.250 million tons;
 - Barley: – 0.250 million tons;
 - OSR: – 0.900 million tons.
- Loaded on trucks, the additional harvest produced due to plant protection with EPX and CNI would cause a traffic jam of approximately 2,500 km.
- This is as long as the distance from Brussels to Moscow.

(3) Case-study findings: **Land trade impacts** of eliminating EPX and CNI from the toolbox of European farmers

Arable land additionally needed at global scale to compensate banning EPX and CNI (in ha)

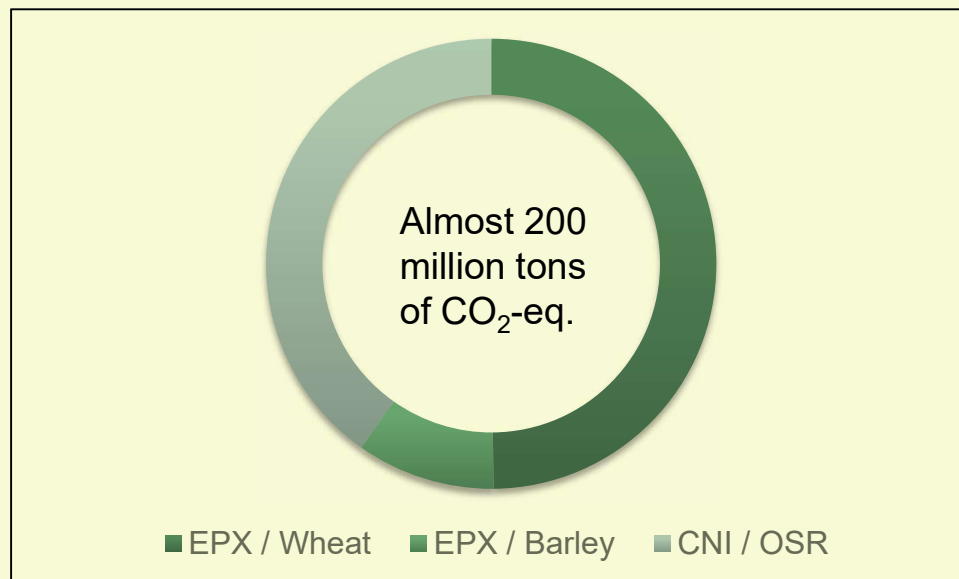


Source: Own calculations and figure.

- Compensation of production losses via global agricultural trade leads to the conversion of additional arable land:
 - Wheat: + 490,000 ha;
 - Barley: + 98,000 ha;
 - OSR: + 533,000 ha.
- This land is / would be won from natural or nature-like habitats.
- These habitats sequester carbon and preserve biodiversity, which is / would be lost as well.

(3) Case-study findings: **GHG impacts** of eliminating EPX and CNI from the toolbox of European farmers

Additional global GHG emissions of EU-wide banning EPX in wheat & barley; CNI in OSR



Source: Own calculations and figure.

- Additional global GHG emissions of necessarily converting land towards arable use:
 - Wheat: + 99 million tons;
 - Barley: + 20 million tons;
 - OSR: + 81 million tons.
- 110 million tons is what Belgium emits as a nation per year.
- Annualizing the 200 million tons leads to 10 million tons and is as much as the current entire Belgium agricultural emissions.

(3) Case-study findings: **water use impacts** of eliminating EPX and CNI from the toolbox of European farmers

Additional global water use of EU-wide banning EPX in wheat & barley; CNI in OSR



Source: sisgeography (2017).

- Globally water productivity is much lower than in the EU:
 - Wheat: at least -50% ;
 - Barley: approximately -40% ;
 - OSR: close to -50% .
- A EPX-ban would cause an extra global water use of 1.9 billion m^3 .
- The CNI ban has caused an additional global water use of 1.4 billion m^3 .
- This equals the water of the Rhine carried into the North Sea within more than/almost 1 week.

(4) Concluding remarks

- In essence, each percentage point of agricultural (land) productivity gained or saved in the EU with the meaningful application of plant protection products:
 - Allows to feed more than 10 million humans;
 - Reduces the EU's virtual land imports by more than 1.0 million hectares;
 - Acts to save well above 200 million tons in CO₂ emissions;
 - Preserves global biodiversity equivalent to fauna and flora of more than 500,000 hectares of rainforest;
 - Saves almost 50 million m³ of scarce global water resources.
- Apart from that, it
 - Increases the annual social welfare generated in EU agriculture by approximately EUR 500 million EUR and
 - Contributes EUR 500 to the annual income of an average EU arable farmer.

(4) Concluding remarks

- Our findings allow to state that meaningful plant protection in the EU:
 - Has a positive yield impact;
 - Preserves scarce global natural resources such as land and water;
 - Minimises the challenge we face in terms of global climate change and the worldwide loss of species.
- In addition it:
 - Has a positive quality impact;
 - Increases market volume and this decreases market volatility;
 - Improves the income of farmers and the society at large;
 - Provides food for millions of human being.



- The use of plant protection products is linked to numerous societal benefits which need to be taken into consideration while discussing the future of active ingredients.

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Thank you for your attention!

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