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Development of an easy-to-implement pesticide-related food product score: potential and limitations

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Consumer information by the «M-Check PPP» score

PPP = plant protection product

– Aim: be simple, intuitive, easy comprehensible and communicable, transparent

– Similar scores have already been developed for climate change impacts and animal welfare (M-Check sustainability rating (2022))

Aim of «M-Check PPP»

Inform consumer about the **environmental impact from pesticide use** arising from agricultural production of food products.

High score =
low environmental impact

The order of magnitude of the environmental impact depends on several factors/variables …

– plant protection product (PPP) / active ingredient
– amount of PPP used
– time of application of PPP to the crop (crop growth stage)
– application technique
– surrounding ecosystem (waters, soil type, animal species present…)
– etc.

Methodological approach

Develop a **robust method** based on registered PPP from seven preselected food products, which is able to:

1. approximate the theoretical **freshwater ecotoxicity potential from PPP use during production** of the food products

   Parameters considered = country of origin of the food product, list of registered PPP, production guidelines

2. Transform the results of the ecotoxicity potential into a **scoring system**

Food products and production/label systems considered

Food product	Country /Area	Conventional production	Migros guidelines	Integrated production	Organic prod.	Demeter	Max Havelaar
Potato	CH	X (CHC)		X	X (CHO)	X	
Apple	CH	X (CHC)	X (MP)	X	X (CHO)		
Apple	EU	X (EUC)			X (EUO)		
Wheat	CH	X (CHC)		X	X (CHO)		
Wheat	EU	X (EUC)			X (EUO)		
Rapeseed	CH	X (CHC)		X	X (CHO)		
Rapeseed	EU	X (EUC)			X (EUO)		
Sugar beet	CH	X (CHC)		X	X (CHO)		
Sugar beet	DE	X (EUC)			X (EUO)		
Carrot	CH	X (CHC)		X	X (CHO)	X	
Banana	Central America	X (GG)	X (WWF)		X (EUO)	X	X (WWF)

EUC: EU regulation on conventional production
EUO: EU regulation on organic production
CHC: Proof of Ecological Performance
CHO: CH regulation on organic production

GG: GlobalGap (scenario considering all PPP)
WWF: World Wide Fund for Nature (based on WHO guidelines and PAN list)
MP: Internal guidelines at Migros for pomaceous fruit production

General framework

Country of origin

Food product

Production system

Registered PPP/active ingredients

1

Function

Final score

2

Approximation of ecotoxicity potential

Approach based on the pesticide consensus

(UNEP, 2019; European Commission, 2017)

Approximated value of the ecotoxicity potential (*E*)

w: substance
c: crop
h: country

Application amount of active ingredient (*A*)

$$E_{c,w,h} = CF_{c,w} * A_{c,w,h} * N_{c,w,h}$$

Culture-specific characterization factor (*CF*) based on a combination of USEtox and PestLCI consensus

- USEtox (Fantke *et al.*, 2021; Rosenbaum *et al.*, 2008)
- OLCApest (Fantke *et al.* 2020, Nemecek *et al.* 2022)
- EF (European Commission (EC), 2013)

Number of pesticide applications (*N*)

Data availability

- Tier 3
- Tier 2
- Tier 1

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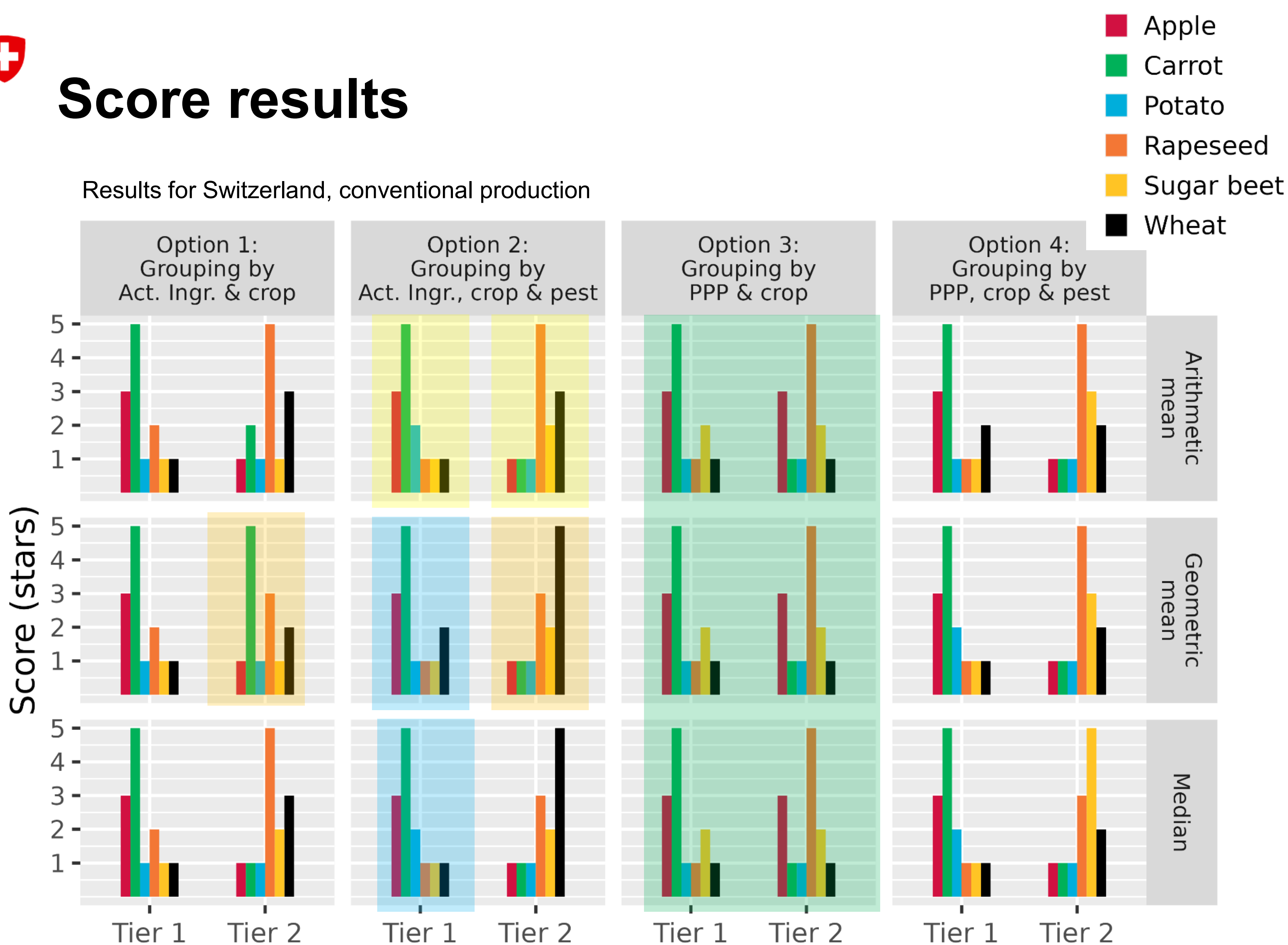
Score results

Results for Switzerland, conventional production



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Factors impacting ecotoxicity results

External factors

- Inclusion/Exclusion of **PPP or active ingredients**
  - **Country-specific**
  - **Guidelines** for production/label system
- Changes in **CF value** (e.g. from newer method versions)

Internal factors

- Type of **data aggregation** applied (e.g. mean vs. geometric mean)
- Selected **CF value** (e.g. different depending on which source used)
- **Data availability** (e.g. application amount)

Factors impacting score results

The star system depends largely on the **type of system used** (logarythmic vs. non-logarythmic, range vs. group size, etc.)

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Plausibility check

- PPP field data **from agricultural production from Swiss farms** has been used to verify results
- Comparisons were made for:
  - 6 food products, 2 production/label systems, 1 star system, 3 data availabilities

23 of 36 combinations (**64%**) had identical star results

5 of 36 comb. (**14%**) had a difference of one star

8 of 36 comb. (**22%**) had a difference of two or more stars

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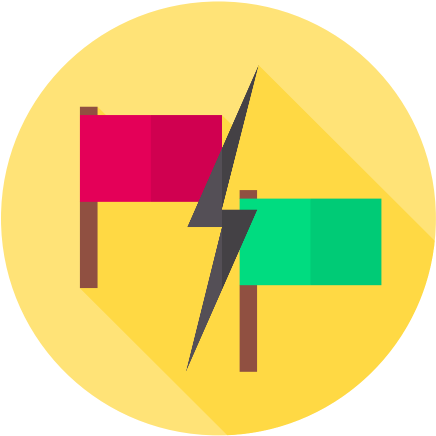
Limitations of the method



Due to **limited data availability**,
the following points (among others) can not be considered currently:

- Yield of the crop
- Differentiation between crop varieties
- Other downstream processes in the supply chain (e.g. PPP use for storage)
- Integration of farm-specific PPP data

Further limitations

- Location- and application-specific parameters (e.g. rainfall, soil type, etc.)
- Impact of PPP on human health, on terrrestrial and marine ecosystems as well as PPP residues on food products.
- Agricultural policy measures (e.g. buffer strips, drift reduction, etc.)

Conclusion and outlook

- The method developed evaluates **potential effects of PPP use** from agricultural production on freshwater ecotoxicity based on PPP which could be used according to pesticide registration and production guidelines
- The method provides **plausible results** for investigated food products and can be applied with reasonable effort
- An **under- or overestimation of the ecotoxicity potential** compared to reality is possible, since the estimation corresponds by definition to a potential and not to the effective ecotoxicity calculated by measured data
- Limitations are mainly due to **limited data availability**

Outlook

- Ensure **method robustness** by applying it to a larger sample of food products and make adjustments, if needed
- Develop an approach to score **compound food products**

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