PESTICIDE RETENTION BY WEEDS: DEVELOPMENT OF A NEW INDICATOR FOR CROPPING SYSTEM EVALUATION

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Introduction

Weeds cause crop yield losses but can also produce ecosystem services.

Objective 1: to develop a new indicator to assess weed contribution to decrease pesticide leaching and to connect it to the weed dynamics model FLORSYS (Colbach et al., 2014)

Objective 2: to evaluate existing cropping system in terms of weed impact on the environment depending on the crop management.

Material and methods

INDICATOR

Two major retention processes were considered: 1) pesticide interception by the weed canopy, 2) Pesticide uptake by weed roots. The indicator aims at assessing application efficiency for the herbicides and the potential of retention for the other pesticides (fungicides and insecticides).

CROPPING SYSTEM EVALUATION

Ten cropping systems were simulated using the weed flora dynamic model Florsys over 30 years and repeated 10 times with randomly chosen regional weather series. Pesticide retention indicator was then calculated for each cropping system and analyzed with the regression tree method to identify the influence of crop management on the pesticide retention potential of weed flora.

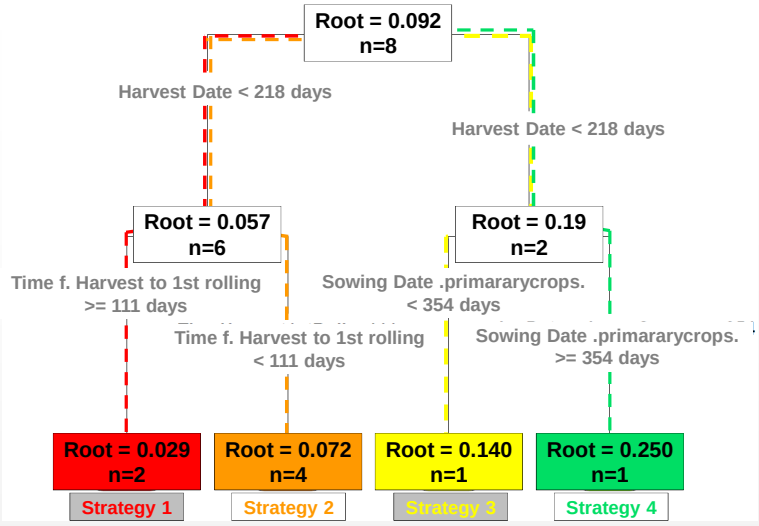
Preliminary Results

Result 1: identification of crop management strategy that affect the pesticide retention using the method of regression trees: example with the indicator of herbicide root uptake

Number of cropping system	Cropping System	Herbicide use	Insecticide + fungicide use
2	Standard (intensive)	++++	+++++
2	Integrated Weed Management: reduced tillage	+++	++
2	Integrated Weed Management: no mechanical weeding	++	++++
2	Integrated Weed Management: mechanical weeding	+	+++
2	Integrated Weed Management: no herbicide application	0	+

Ten cropping systems contrasted for weed management (Chikowo et al., 2009), were simulated with FLORSYS from 2000 to 2012.

Cultural practices that affect herbicide retention by root uptake



(n: number of cropping systems; Root: value of the herbicide root uptake indicator)

Result 2: identification of combinations of cultural practices leading to maximise or minimise the pesticide interception by the weed flora

Pesticide	Type of Interception	Number of strategy	Strategy	
			Minimise interception	Maximise interception
Herbicides	Foliar interception	3	≥ 3.6 tillage/year	< 3.6 tillage/year And plough frequency ≥ 1 year out of 2
	Root uptake	4	Harvest date before August 5th and ≥ 111 days between the previous harverst and the first Rolling	Harvest date after August 5th and sowing after December 19th
Insecticides+ Fungicides	Foliar interception	2	Cropcover duration (including temporary crops and catchcrops) < 9 months	Cropcover duration (including temporary crops and catchcrops) ≥ 9 months
	Root uptake	4	≥ 1.9 tillage between march and october and plough frequence 1 year out of 2	< 1.9 between march and october and sowing date after november 22 nd

Conclusion and outlook

- Cropping systems with low shallow soil tillage and a constant plough frequency promote the herbicide foliar interception;
- Cropping systems with low soil tillage, crop rotations characterized by a high proportion of spring crops, or a late sowing date for winter crops improve the pesticide root uptake;
- These primary results need to be extended to a larger number of cropping system and completed with multi-criteria analysis in order to take into account the antagonisms between indicators.

References

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