

Project PestiRed: reducing pesticide use while maintaining profitability

Solène Clémence, Sandie Masson and Alexander Zorn¹

Abstract- The PestiRed project aims to significantly reduce the use of plant protection products (PPP) in arable farming through consistent implementation and further development of integrated pest management. In this project, participating farms try to reduce their use of PPP by 75% on a so-called "innovative" plot, while cultivating a control plot as usual. The farmers follow a diversified crop rotation and use a combination of alternative methods to control weeds, pests and diseases. Profitability should not decrease by more than 10%. Agronomic and economic monitoring is carried out during the six years of the project. This article presents the PPP reduction and economic results of the first year of the project (2020). The PPP reduction goal is reached for almost all crops, except for potatoes and sugar beets. The economic target is not reached for potatoes and spelt, and is missed for feed barley. 1

INTRODUCTION

The awareness of the various problems caused by the use of plant protection products (PPP), like pest resistance, contamination of ecosystems and health problems encouraged the development of new instruments for risk reduction and sustainable use of PPP in Switzerland. For this purpose, an action plan was implemented in 2017 (Bundesrat, 2017). One of the measures enacted is the "Development of alternatives to chemical plant protection". It is in this context that the project PestiRed was set up (Wirth et al., 2020). Funded mainly by the Swiss Federal Office of Agriculture, the PestiRed Resource Project aims to reduce the use of PPP by 75% and to evaluate the practical on-farm implementation of alternative plant protection strategies.

However, replacing the use of PPP by alternative control measures is not without risk for the profitability of the farms. It may result in a reduced quality and quantity of agricultural output as well as in increased costs, which may both lead to a decrease in profitability. Therefore, second-order condition of the PestiRed project is to avoid a reduction in profitability of more than 10% when replacing PPP by alternative measures. In parallel, socio-economic research accompanies the project and looks at the assessment of alternative plant protection measures by the farmers regarding their potential for decreasing PPP and their economic efficiency.

This article presents the first year results of the project and aims to discuss the main objective of PestiRed: is it possible to reduce PPP use by 75%, while avoiding a higher than 10% drop in economic profitability?

METHODS

A total of 68 farmers were recruited in three Swiss cantons. Five diversified six-year crop rotations were designed, adapted to the pedo-climatic and economic context, with the help of advisors and scientists. On a so-called "innovative" plot, the PestiRed farmers implement a combination of multiple management measures to reduce their use of PPP (see fig. 1). At the same time, they cultivate a "control" plot in the usual way. Both plots follow the same crop rotation.

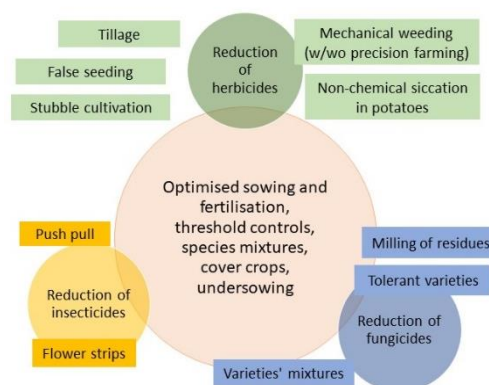


Figure 1. Plant protection measures expected to impact PPP use in the project PestiRed. In the middle circle: measures with combined effect on several categories of pests.

The participants record all the actions carried out per plot, control and innovative, in a computerised "field book" each year. For each action carried out, the farmers report the type of action (sowing, tillage, etc.), the date of the action, the plot (innovative/control), the machinery used, the quantity and cost of the products used, the surface treated, the cost of an agricultural contractor, as well as the working time. Apart from filling the "field book", farmers also report the selling prices, the yields of the plots and the direct payments obtained.

The treatment frequency index (TFI) for each product application was used as indicator for the evaluation of the reduction of PPP use. This indicator includes the quantity of each product applied comparing to its standard dose for the target and crop considered, and the treated area compared to the plot area (Gravesen, 2003). Summing the TFI for each product application gives the treatment frequency index of a plot (all PPP categories together).

The preparation of the data for the economic evaluation consisted of assigning a standard cost to the machines/tractors, which is then converted into Swiss francs per hectare. Product, contractor and labour costs are also considered. The analysis of the economic return is based on a calculation of the

¹Solène Clémence (solene.clemence@agroscope.admin.ch) and Alexander Zorn (alexander.zorn@agroscope.admin.ch) both research at Agroscope, Research Group Managerial Economics, Tänikon, Switzerland.
Sandie Masson (sandie.masson@agroscope.admin.ch) researches at Agroscope, Research Group Herbiology in Field Crops, Changins, Switzerland.

variable contribution margin (VCM). The VCM is composed of the benefits of the plot (sales revenue and direct payments but without project contributions), from which direct costs (seeds, fertilisers, PPP, etc.) and the costs of carrying out the work (machinery, labour and contractor costs) are subtracted. Differentiation of costs and benefits types allows identifying reasons for higher or lower profitability between the two plots of each farm.

RESULTS

Table 1 summarises the average treatment frequency index for each crop, of innovative and control plots in the first year of the project (2020). For all crops, except sugar beets, potatoes and sunflower, the TFI reduction between the innovative plot and the control plot was over 75%. In potatoes, the reduction was only 30% (mainly due to the high PPP requirements to secure the yield and quality of this crop) and 45% in sugar beets (mainly due to the use of herbicides). The reduction in sunflower is low (31%), however, the TFI is already low on the control parcel.

The provisional economic results for the year 2020 can be seen in Table 2. The objective of a maximum profitability drop of 10% was achieved for wheat, sunflower and rapeseed. For fodder barley, the goal was narrowly missed. For spelt and potato, the objective was not reached. In general, the decrease in the variable contribution margin (VCM) of the innovative plots is related to the decrease in yields and the increase in costs of carrying out the work. Farms with a higher VCM on the innovative plot have in some cases higher yields and/or lower costs on the innovative plot. Additional direct payments as well as premiums can improve the VCM. The trends in the preliminary results for 2020 are not identical for all farms and very variable.

DISCUSSION & CONCLUSION

The objective of reducing PPP use while maintaining economic profitability is not reached for all crops. Fungicides in potatoes and herbicides in sugar beets

Table 1. Treatment frequency index and difference between plots for the first project year (2020).

Crops ^a	Number of farms	TFI innovative	TFI control	Reduction
Wheat	17	0.15	1.22	88%
Barley	10	0.21	2.01	89%
Rapeseed	8	0.13	1.42	91%
Maize silage	7	0.19	1.68	89%
Potato	4	9.72	13.91	30%
Sunflower	4	0.50	0.72	31% ^b
Grain maize	3	0.06	1.59	96%
Spelt	3	0.00	0.00	-
Sugar beet	3	1.60	2.94	45%
Peas and barley	2	0.00	0.16	100%

^aArtificial grassland (no PPP use) and soybean (only one observation) are not represented.

^bFor sunflower, the objective is not reached, however, the TFI is already very low on the control plot.

Table 2. Variable cost margin (VCM) differences: \approx +/- 10%, < -10 - -20%, << -20 - -30%; <<< -30%. Flower strips were included in the final VCM in Fr./ha.

Culture ^a	Number of farms ^b	Innovative plot (I)	Difference in VCM	Control plot (C)
Wheat	13	I	\approx	C
Fodder barley ^c	4	I	<	C
Rapeseed	4	I	\approx	C
Potato	4	I	<<<	C
Spelt	3	I	<<<	C
Sunflower	3	I	\approx	C

^aArtificial grassland, grain and silage maize, pea-barley mixtures and sugar beet are not represented.

^bOnly farms that provided final prices were considered.

^cMalting barley and seed barley were not taken into account (different sales prices).

seemed difficult to reduce. Economic results vary considerably between farms. For example, not all innovative plots were linked to lower yields, and higher machine and labour costs. However, the data is scarce (only one year) and the economic results highly variable. The accumulation of data over the course of the project will make it possible to discern (or not) a trend, if for example machine and labour costs are increasing systematically, and if yields are frequently lower when reducing PPP.

In the PestiRed project, farmers receive contributions for the extra administrative work, the additional costs of the measures and the risk of crop losses. These contributions can be of interest to compensate for the partly lower economic profitability of innovative plots for certain crops. The analysis of the VCM with the PestiRed contributions is expected to provide valuable inputs for future agri-political decisions in the framework of the national action project to reduce PPP risks.

REFERENCES

Bundesrat (2017). Aktionsplan zur Risikoreduktion und nachhaltigen Anwendung von Pflanzenschutzmitteln – Bericht des Bundesrates. Bern, Bundesrat.

Gravesen, L. (2003). The Treatment Frequency Index: an indicator for pesticide use and dependency as well as overall load on the environment. Copenhagen, Pesticides Action Network Europe (PAN), Pure Conference.

Wirth, J., Steinger, T., Vogelgsang, S., Zorn, A., & Jeanneret, P. (2020). PestiRed: A Swiss on-farm approach to reduce pesticide use in arable crops. Deutsche Arbeitsbesprechung über Fragen der Unkrautbiologie und -bekämpfung. Julius-Kühn-Institut, Braunschweig, 290-294.