EVOLVING TOWARDS LESS PESTICDE USE IN APPLE FARMS: WHICH INDICATORS REFFLECT THE DIVERSITY OF FARM PRACTICES?

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Introduction

Pesticides are the most common solution used by French apple growers to deal with the numerous pests and diseases that damage the fruits. But European consumers are concerned about the impact of pesticides on the environment and health. Through the Sustainable Pesticide Use Directive, public authorities encourage growers to decrease their pesticide use. Thus, assessing the use of pesticide at crop, farm and regional level becomes instrumental for informing all the stakeholders involved in the apple supply chain. The Treatment Frequency Index (TFI) was created in the 80s in Denmark to better understand pesticide consumption and evaluate their intensity of use (Halberg, 2005). This study aims to analyze the values and limits of this indicator for evaluating and comparing different types of protection strategies.

Materials and Methods

The study has been carried out in the Center-West and South-East regions of France. It is based on the set of application schedules and semi-structured individual surveys of 35 growers including 23 members of two cooperatives and 12 independents. Growers were selected in order to get a diversity of farm circumstances and practices. A typology of protection strategies was built to classify growers according to their environmental and economic concerns. Three strategies were identified: (i) S1 growers have high environmental concerns and increase their gross margin through self-selling, (ii) S2 growers have moderate environmental concerns and secure a minimum income by diversifying their cultivar and/or outlets, (iii) S3 growers do not have specific environmental concerns and aim at reaching high fruit yields and quality to maximize their gross margin. The practices of each strategy were compared and described based on the use of several indicators.

Results and Discussion

First, pesticide use of each grower was assessed by calculating the TFI [protection] (herbicides and thinning products excluded) per farm with the following formula:
$\mathbf{TFI[protection]} = (\sum_{j=1}^{k}(\sum_{i=1}^{n}(AD_i \div RD_i)_j) \times A_j) \div \sum_{j=1}^{k} A_j$, with j = plot j, i = individual pesticide application, ADi = applied dose/ha, RDi = authorized dose/ha, Aj = area of plot j. TFI[protection] will be shortened as TFI.

The TFI varied from 0 to 50, with a mean of 34, which assumed a large diversity of protection practices within the sample. Such diversity was also shown by Marliac *et al*. (2015) within a sample of 24 organic growers. S1 growers had the lowest TFI (Table 1). But extra indicators were needed to distinguish the practices of S2 and S3 growers as they had similar average TFI. The percentage of TFI[natural products (bio-agents, copper and sulphur)] in the TFI was added. This indicator evaluates the efforts made by growers to substitute a part of the synthetic pesticide with products causing less impact on health and environment. It confirmed that S1 growers had specific practices. They reduced the number of sprays, and mainly relied on bio agents, copper and sulphur. The remaining treatments they sprayed were essential/mineral oils, clay and herbal teas. The TFI[natural products] also permitted us to differentiate S2 and S3 growers, with a replacement rate of synthetic pesticides with natural products accounting for respectively 16% and 6%. The number of alternative methods (mating disruption, hedgerows, nests, beneficial management) was also calculated. This indicator provides an evaluation of the efforts made by growers to reduce pesticide use in the long-term. It was high in both S1 and S2 strategy

but very variable in S3 strategy, since growers who based their protection strategy on synthetic pesticides could also implement alternative methods. Eventually, the TFI per ton showed that S1 growers applied less pesticide per ton than S2 and S3, although their yield was lower (respectively 17.5, 41.5 and 46.8 t/ha on average). This combination of indicators can be used by cooperative advisors or extension services to better evaluate the growers' practices and identify opportunities to support them evolving towards more sustainable practices. However, calculating these indicators requires regular digital monitoring of practices, which is not systematic especially among independent growers.

Table 1. Protection practices of the growers per strategy

	S1	**S2**	**S3**
# Of Growers	6	10	19
TFI	10.8	34.8	35.8
TFI[Natural Products]/TFI (%)	58	16	6
# Of Alternative Methods	3	3-4	0-4
TFI/t	0.5	0.8	0.9

Conclusions

Using TFI[protection] allowed to us to differentiate protection strategies using no synthetic pesticides. Supplementary indicators were required to describe strategies combining the use of pesticides and alternative practices. However, this set of indicators did not allow us to identify constraints at the farm scale that prevent growers from using less pesticide, such as work organization or production diversification. An in-depth analysis of the growers' decision making process is needed in order to define with them pathways towards less pesticide use.

References

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