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Inventory and analysis of possible social and economic bottlenecks to implement integrated control tools

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Glossary

AS: Apple Scab

Cat.: Catalonia

CD: Codling Moth

IFP: Integrated Fruit Protection

IGR: Insect Growth Regulator

MRL: Maximum Residue Limit

PO: Producer Organisation

dss: decision support system

Summary

The objective of this study was to identify possible social or economical bottlenecks to the adoption of Integrated Control tools for apple scab and codling moth. For doing so a questionnaire was sent to RA2.5 scientists and its results were completed by the outcomes of other studies achieved by the social scientists working in the RA3.5 sub activity.
If economical bottlenecks are perceived as prevalent by scientists, we suggest that this category can be partly explained by the influence of non economical elements. Particularly, Producers Organisations (POs) and advisors not only provide technical advice but contribute to the implementation of collective dynamics among farmers

The results also raise the importance of elements such as marketing opportunities for resistant cultivars or the need for citizens/consumers support

However ways to tackle:

- Bottlenecks linked to time management and to the farm organisation are important when adopting sanitation or using granuloviruses,
- Knowledge and technical gaps for orchard monitoring and orchard management for resistant cultivars

have to be further discussed and studied.

We end by a list of suggestions for further socio economic research.

1. Introduction

For studying the bottlenecks and facilitators for the use of IP tools in the orchards, a first step was to understand the perception of the issue by the research community. Its scientific point of view coupled with its contacts with the agricultural world would complete the analysis made in the RA3.5 social assessment sub activity of ENDURE. Following this idea, a questionnaire to be filled by RA2.5 researchers was conceived.
Its results were expected:

- To help the preparatory work for the meeting with advisors that is planned in February 2009 within the 2nd JPA
- To identify the needs for further sociological research that would have been conducted by INRA.
  During the first JPA, the RA3.5 team had already achieved some social study that is helpful for understanding the orchard case (for example, on the growers' trajectories leading to the adoption of IP tools, on the influence of supermarket schemes on growers' practices and on the framing of the public debate about pesticides) (Lamine et al., 2008). The questionnaire is meant to be a tool for identifying the need for complementary studies that could be necessary to implement at National levels.
  However implementing further studies would have necessitated the use of qualitative interviews made by native speakers. We suggested that they could be organised and financed in each region by the RA2.5 partners. Due to budget restrictions in the JPA2 this was not possible. Accordingly, the results of this work will be an element of future recommendations for social sciences research to be achieved on the orchard SCS within the 3rd JPA. As such this paper which presents the analysis of the researchers' answers to the questionnaire would have been better positioned as a milestone than as a deliverable.

Method: The questionnaire was double checked by the RA2.5 leaders and sent to the RA2.5 participants. It did include a specific focus on apple scab (AS) and codling moth (CM) which were identified by RA2.5 scientists as the main threats to apple orchards.
The partners involved were those defined for the orchard case study field research i.e. Rhone valley, Catalonia, Lake Constance (Swiss and German side) and The Netherlands. Answers came back from July to October 2008. Even though there were some differences in the quality of the answers, they still allow drawing a map of the main socio economical bottlenecks and facilitators that, according to researchers, are encountered by growers.

Meanwhile the presentation by the RA2.5 teamof the "*State of the art of control strategies of codling moth, apple scab and brown spot in Europe"* in La Grande Motte (Heijne &al, October 2008) emphasized the importance of socio economic bottlenecks described as the main adversary elements against the implementation of Integrated Fruit Protection (IFP).
For apple scab, economical elements (including labour) were identified by the RA2.5 team as the main obstacle to the use of IFP tool with technical barriers only mentioned for cultural methods. They are presented in Table 1. For the codling moth, the obstacles to IFP were economical but also "practical" ones linked to the work to be done in the orchards (Table 2).
From a social science point of view, such tables raise numerous questions.
First of all, what is the meaning of broad categories such as "practical", "technical", "economic"? Which are precisely the bottlenecks, the kind of practices or economic constraints at stake?
Secondly, how can no obstacles to the use of a tool such as resistant cultivars be associated with a 0 % of use in practice? More generally speaking, how to understand the scope of the variations of "use in practice" mentioned in the tables? Some goes from 5 to 100 %.
What do we know about tools that allow overcoming ever quoted obstacles such as labour costs? For example, for monitoring some region have a 70 % use while other have a 10 %

with labour cost as a main obstacle. Finally, is labour the only obstacle to the use of tools such as sanitation or corrugated cardboards?

Table 1: Obstacles to the implementation of IFP tools for apple scab (Heijne *et al*., 2008)

IFP tool	%regions	use in practice	obstacles
cultural methods	50	0 – 10	economic, technical
monitoring	90	10 – 70	labour
decision support	all	50 – 100	none
sanitation	all	0 – 70	labour
resistant cultivars	none	0	none

Legend : The colour code, is to quickly visualise, if the outcome is bad (more reddish) or good (more greenish) for as much as possible IPM production.

Therefore we chose to complete the previous tables - presented in La Grande Motte- with the results of our questionnaire in order to give a more complete description of the various categories that were mobilised by researchers. When inputs from the field work that was achieved on pome fruit production by the RA3.5 (social science) researchers (Lamine et al., 2008) can help the understanding of a situation, those elements were used as well, as were verbatim heard during the orchard SCS meeting in La Grande Motte.

We chose to merge in an economical category what was labelled under the themes “economic” and “labour” bottlenecks for IP tools. If economical bottlenecks are often mentioned we will see that non economical elements are involved in this category (3). We will then detail the socio technical elements that have also appeared (4). Beforehand, we will briefly describe the questionnaire (2).

Table 2 Obstacles to the implementation of IFP tools for codling moth (Heijne *et al*., 2008) .

IFP tool	no. regions	use in practice	obstacles
pheromone traps	all	5 – 100	none
monitoring damage S	all	1 – 100	none
monitoring damage H	all	5 – 100	none
corrugated cardboards	none	1	labour
dss – adults	90	100	none
dss – oviposition	90	90	none
dss – larval emergence	all	100	none
dss – generations	90	90	none
dss – thresholds	50	70	none
sanitation	90	0 – 50	labour
mating disruption	100	25	labour, economic, practical
granulosis virus	90	10 – 100	practical
combinations	90	variable, low	labour, economic
priority IGR ´s*	50	20	none
alternation IGR´s	80	80	none

*IGR stands for Insect Growth Regulators
Legend : The colour code, is to quickly visualise, if the outcome is bad (more reddish) or good (more greenish) for as much as possible IPM production.

2. Presentation of the questionnaire

The questionnaire objective was to understand the scientists' perception of bottlenecks and facilitators of the use of IFP tools.

The work done in RA3.5 on three pome fruit production areas in Switzerland, France and The Netherlands had underlined the important role played by three elements: producers' organisations (PO), advisors and marketing opportunities.

- Producers organisations because they gather producers sharing the same interests and can provide them with the social support that they need to change their practices. For example, producers are used to assess their work and their neighbours' according to criteria that have to change when entering an IP scheme. For example, the notion of cleanliness which is often used as a sign of good orchard maintenance evolves from an orchard with no weed "*mowed as in the Versailles gardens*" to an

orchard with no weed at the trees' basis. It is important to share such a change in the assessment criteria otherwise the pressure of neighbours is too strong and Producers Organisations provide this type of support.

- Advisors: the type of advisory service chosen by the producers might influence the technical choices.
- Marketing opportunities because fruit production is a market led activity in which the type of distribution influences what the producer can do. If the marketing is through direct selling or alternative forms his/her margin of action will be different than marketing through big distribution companies with a standardized demand. It must be noticed that, many of the producers that were interviewed for this study had no direct links with the consumers and were therefore completely dependent of the supermarkets' demand.

Therefore each of these themes was the subject of a question to the scientists.
We also wanted to get more information about the bottlenecks that could be linked to the growers' work organisation. As mentioned during the RA2.5 meeting in Lleida (May 2008), the work load is sometimes too hard for allowing the best treatment agenda; it is done whenever the producer has planned it even though it is not the best time. Had the scientists witness the same type of problems for IFP tools?
Finally the scientists were asked to fill tables detailing their perception of bottlenecks and facilitators for each IFP tool according to the type of pest at stake.

3. The economical factor

Economical factors preventing the adoption of IFP tools can be classified in three groups: cost of products, labour costs and market opportunities as it has appeared to be the main bottleneck for the use of resistant cultivars.

- The cost of products is not perceived as a major bottleneck apart from the cost of mating disruptors in the NL and Catalonia and the cost of granuloviruses in Catalonia and CH. To this extent the price of the product itself is not always the main issue: the fact that repeated application is necessary for granuloviruses is mentioned as a bottleneck by the NL researchers. Repeated application participates in increasing costs and might also explain the lack of practicability that is mentioned in table 2. As the price of mating disruptors or granuloviruses is not described as being part of the farms' main costs, it might be the sign of a fragility of the farms' margins and raises the issue of the necessity of conducting a detailed economical analysis of these margins.
- To the opposite, labour cost is one of the farms' main expenses. Therefore it is not a surprise to see all labour intensive tools such as monitoring (AS and CM), leaf removal (AS), mating disruption (CM) perceived as an obstacle to IFP. However,
    - Labour can be quite productive: a Swiss researcher state that even though market access is guaranteed, a difference can be made between the environmental impacts of growers according to the time that they dedicate to the manual maintenance of their orchards. It is a factor of success as an orchard in bad shape will be less productive.
    - The extra costs for monitoring are often supported in France by fruit growers' cooperatives /associations (interviews RA3.5) whose advisors also promote the use of monitoring. This is a first element underlying the importance of Producers' Organisations (POs). More generally speaking, Catalonian researchers mention that cooperatives can be facilitators of change because

they can handle common tasks when area wide implementation of IP tools is needed.

For mating disruption, it seems that the cost/efficicacy ratio is at stake in the NL and this raises the issue of taking into account thresholds in the economic analysis of the farms' management. According to the scientists, it is demonstrated that mating disruption is only effective in NL if infection level is low. If the infection level is higher, growers do no longer apply mating disruption but use other means.

When going into details, the labour issue also reflects:

- o A time management one: according to Dutch researchers sanitation represents an extra work that can't be combined with another work.
- o A need for equipment : together with their German colleagues Dutch researchers also mention the fact that machines for blowing or suction of leafs are not enough widespread.
- o A need for technical reassurance: while labour costs are perceived as the main bottleneck for the use of corrugated cardboards, NL researchers add that their efficacy is not demonstrated yet.

- No obstacles were identified for the use of resistant cultivars for apple scab in table 1; it means that there are no specific technical obstacles. To the contrary the almost zero level of use is linked by the researchers to the lack of market and, particularly, to the low interest of supermarkets (Table 3). Even among organic growers, it seems that the use of resistant cultivars is not widespread.

Table 3: Bottlenecks and facilitators for the use of resistant cultivars.

Resistant cultivar	**Bottlenecks**					**Facilitators**				
	Germany	NL	Cat.	CH	Fr	Germany	NL	Cat.	CH	Fr
Practical	Lack of technical knowledge		Nd			Education, Practical, scientific approach	Promotion by organic advisors	Nd.		Nd.
Economical	Time intensive.	No Market		No market	Marketing is difficult				Supermarkets' awareness Consumer sensibility	

Source: RA2.5 questionnaire. 2008

De facto, the market segmentation for apples is made by variety i.e. consumers will buy golden or granny or …. Therefore introducing a new variety requires:

- o Lots of marketing efforts and first of all, convincing supermarkets -which dominates the food supply chain with more than 70 % of the market share of fruit distribution (Table 4)- to take the risk of introducing a new variety on their fruit shelves.
- o A production that reaches a sufficient volume in order to be able to answer to the supply needs of supermarkets. According to a SCS researcher, this means a minimum surface of a 100 ha on Year 1. The involvement of a group of local producers is therefore important for reaching the required surface. It is another element advocating the development of producers groups.

Let us notice that the number of resistant varieties is:

- Already quite important
- Often attached to a national market (Kellerhals et al., 2004) while supermarkets are international players.

It might be part of the explanation of the difficulty encountered by those resistant varieties to find a place on the fruit shelves.

Table 4: Market shares of supermarkets in fruit distribution.

	Germany	NL	Catalonia	CH	France*
Supermarkets' market share	Nd.	75 %	Nd.	90 % through large distributors	71 %

Source: RA2.5 questionnaire. 2008. *CTIFL 2008.

To alleviate the marketing costs, the producers of resistant varieties have, in France, created marketing clubs on the model of those created for other varieties such as the Pink Lady. These clubs (e.g.: Pomalia for Ariane[1]) support growers and provide marketing and advertising services. But they ask for an entry fee that might discourage some growers.
Other forms of cooperation with supermarkets were mentioned such as the existence of "concept orchards" in the UK (Stephanie Williamson, meeting SCS, 2008) i.e. orchards financed by supermarkets and in which resistant varieties and/or IFP are tested.

This last news is important. As mentioned previously, the links between supermarkets and the growers' practices have started to be explored in the RA3.5 activity of the 1st JPA (deliverable n°DR3.5). Particularly, the capacity of specific supermarkets schemes to support the adoption of IFP was studied, showing a poor level of integration of IP demands by supermarkets. They focus on the respect of MRLs but pay little attention to the conditions of production to the exception of a couple of supermarkets' brands such as Carrefour. Even those brands are showing contradictory demands in their IP standards. From one side, growers are asked to implement all IFP tools, from the other side, the standards have to be applied on a given variety range which includes some of the most pest sensitive varieties such as the Royal Gala. Furthermore supermarket demands for skin perfection are as high in IP schemes as they are for conventional pome fruit production. It is then difficult for growers to achieve further reduction in their use of pesticides. Following this idea, the implementation of insurance schemes when growers adopt IP could be studied.
To the contrary, marketing clubs or concept orchards are tools for market access, it would be also interesting to have more research on these new forms of marketing and on their economics.

Marketing issues are not the only bottleneck for the use of resistant cultivars. As mentioned by the German researchers, the difficulties in managing orchards of resistant varieties might also represent a bottleneck. In France, those difficulties- including time consuming tasks- are even acknowledged by growers on the website dedicated to a resistant variety called "Ariane"[2]. They are part of the "technical" bottlenecks category which is mentioned on Table 1 for cultural methods. However "technical" and "practical" issues cannot be limited to the difficulties of management or to those linked with the handling of mating disruptors or granuloviruses. In many cases, socio technical elements that are not restricted to the orchards' boundaries have to be taken into account.

[1] http://www.pomme-ariane.com/fr/index.php
[2] http://www.pomme-ariane.com/fr/page.php?fid=4

4. The influence of socio technical elements.

From a comparison of the dynamics of IP development in four EU countries (UK, NL, F, CH), RA3.5 has identified five important factors of transition towards IPM: public policies, the involvement of research and extension services, the existence of collective dynamics among farmers, marketing strategies and the involvement of the civil society (cf. DR3.5 report). The issue of marketing has just been mentioned but we will go through the other elements to analyse what we can learn from the researchers' answers.

Public policies: Both a National and/or Local scales, public policies participate in the implementation of IFP. For example, in 85-89, Italian local authorities have played an important role in the coordination of IP programs (Codron et al., 2002). None of the researchers did mention public policies with the exception of Germany where, at local level, the Federal Ministry of Baden Württemberg is said to have supported the implementation of IFP and emphasized the cost reduction that it can achieve.

As far as research and extension service are concerned, convincing advisors/growers of the value of IP tools appears as a main challenge.

First of all because the use of pesticides is still the most common strategy and that, according to researchers, alternative strategies are only considered if the pest infestation is too important. For example, both Swiss and German researchers write that monitoring is still not a routine practice while it has been acknowledged of being a very important element of IP strategies. Bottlenecks to monitoring have been identified, for example, in the US, by Cliff Ohmart (2008) as "lack of pest economic thresholds, lack of quantitative pest monitoring methods". The need for such elements could therefore be explored with the advisors group that is planed to be held next February, as could be public the need for public policies as well.

Secondly because of the changes which have occurred in the organisation of some advisory services. For example, among all the respondents, only Dutch researchers emphasise the issue of convincing advisory services to promote DSS or sanitation. De facto, after the privatisation of the advisory system, private advisors represent 40 % of the NL market (Table 5). As they tend to recommend tools that will secure high yields, convincing them to adopt IFP tools as a first rank strategy is a big challenge.

Table 5 Composition of the advisory systems

	Germany (No data)	NL	Catalonia	CH	France
Independent	A foundation under private law.	Independent advisors (40 % of farmers refer to them)			Scarce (No data)
Input suppliers/ distributors	"Obst von Bodensee" Distribution company	30 %	20 %		Yes (No data)
Professional	Growers associations	Study groups/colleagues: 30 %		Study groups	Market led Growers organisations 40 % to 60 %
Public	Federal Ministry of Baden Württemberg		The Plant Protection Service (Public) Coordinates the work of Pest Control advisors hired by cooperatives/farmers associations and partially subsidize. 80 %	Cantonal advisors + Info on pest bulletin from the federal station	Agriculture chambers 20 %

Source: RA2.5 questionnaire. 2008

Thirdly because input suppliers and distributors still play an important role as advisors as shown in Table 5.

Finally, because growers' participation to organised groups supporting IP is not widespread and still represent a minority of growers as it is shown by Table 6. Moreover, it takes different forms, as the collective dynamics around IP vary in each country. In France, for example, some growers have been participating for a long time to the agronomical experiences led by technical research groups. From the other side, growers had to organise themselves to master the marketing of their products. Producer organisations (POs) were created for this aim. They gather 30 % of the growers and have their own advisors who play a major role in the implementation of IP tools (Table 6).

However, the impacts of IP study groups that gather researchers, advisors and producers are not well documented. We don't have much information about their potential influence outside the circle of participants.

Table 6 Growers' participation to an organised IP group is a minority.

Germany	NL	Catalonia	CH	France
No specific groups	Study groups of the National Fruit growers association (+/- 20 %)	Minority: Integrated Production Committee includes technicians from the public sector	At one cantonal level (Thurgau)	Market led groups.

Source: RA2.5 questionnaire. 2008

Growers could find support for implementing IFP from consumer/citizens.

The involvement of civil society has been described in RA3.5 in terms of NGOs involvement in the public debate or / and through the existence of alternative food systems anchored in IPM or organic production and supported by groups of consumers. Discussion with the researchers introduces another element: the impact of pesticide use on the relationships that are established with citizens.

People establish relationships with growers not only through a consumption loop but also as citizens with their own understanding of the agriculture's impact on the environment. To this extent, according to researchers, people walking next to an orchard that is been sprayed might develop a strong reaction against fruit growers. In France some growers are concerned by the re entry norms after spraying: lay people are not aware of them and they walk in the orchards. To the opposite, researchers mention the improvement of the attractiveness of the countryside for tourists as a positive side effect of pesticide use reduction and landscape management. They both increase the diversity and the quality of the landscape and allow the reappearance of fauna. Hearing birds again in the orchards is one of the examples that were given. However, interaction with consumers/citizens and farmers at local scale is not well documented and would require further research. Accordingly the RA3.5 team has suggested a new research task dealing with this issue for the 3rd JPA.

Finally researchers underline another socio technical issue which might need further study: the impact of the landscape management

According to the researchers, elements such as the land structure for example, the plots' size, is one of the main obstacle to the implementation of mating disruption tools (Table 7) as a minimum surface is necessary for its efficiency.

A way of overcoming this obstacle could be to share common practices between neighbouring orchards when they exist. A tool for implementing shared practices is the Producers Organisations. For example, in Italy, even though the average orchard surface is

only one ha (in some areas like Trentino Alto Adige); growers' cooperatives are strong and have played a major role in the adoption of mating disruption tools. In 2001, 20 % of the 70 000 ha of apple orchards had adopted mating disruption against codling moth among which 60% of the 17500 ha apple orchards of Alto Adige (Codron *et al*., 2002).

Availability of land is also at stake when growers would like to make IPM trials by planting new orchards on new land: in some area it is difficult to expand the farm size because of lack of available land.

A detailed analysis of the negotiations between growers and POs when allowing the implementation of landscape management would be necessary to understand each country's situation.

Table 7: Bottlenecks for the implementation of mating disruption

Bottlenecks					
	Germany	NL	Catalonia	CH	France
		Expensive	Expensive		nd.
		Labour cost	Labour cost		
Economics		Low efficacy			
Landscape management	Not always possible due to landscape structure: high diversity of perennial crops causes small orchards		Size of plots	Missing isolation Size of plots	

Source: RA2.5 questionnaire. 2008.

5. Conclusion

Results from the questionnaire to RA2.5 partners completed with RA3.5 results have allowed a better qualification of existing bottleneck categories which is summarized in Table 8.

It raised the importance of Producers Organisations in the adoption of new cultural methods, DSS, monitoring, mating disruption and more generally speaking in implementing collective dynamics among farmers.

It also shows the importance of the advisors in the adoption of sanitation and other cultural methods.

However ways to tackle

- Bottlenecks linked to time management and to the farm organisation are important when adopting sanitation or using granuloviruses,
- Knowledge and technical gaps for orchard monitoring and orchard management for resistant cultivars

have to be discussed and studied.

These results also raise the importance of elements such as marketing opportunities for resistant cultivars or the need for citizens/consumers support.

They could be a basis for building part of the discussion grid that will be used when interfering with advisors. The latter should not only help to fill knowledge gaps about technical bottlenecks but use their field experience to comment the other categories and help understanding new ones. Furthermore bottlenecks for the use of IGR, combination or corrugated cardboards are still not documented.

Some research needs have also been identified:

Research in economics.

- Impact of the farms' margins on the adoption of IP tools.
- Impacts of insurance schemes linked to the implementation of IP tools
- Economics of marketing clubs.

Research in sociology. Part of the research subjects has been tackled at least partly, by RA3.5 in the 1st and 2nd JPA:

- Influence of supermarkets demand on the growers IP practices.
- Advisor's perception of obstacles to the use of IP tools.
- Factors and conditions of transitions towards IP practices for growers (including margins of progresses linked to better work organisation).
- Extension services and farmers: a comparative study of information, attitude and decision making.

Other subjects are planned for the third JPA:

- Interaction of citizens/consumers and growers at a local scale.
- Influence of supermarkets in Central /Western Europe and possible evolutions.

  This last study could include elements about potential marketing opportunities for IP (including resistant cultivars)/study of what can be learned from existing IP marketing systems.

Other are not tackled:

- Obstacles to the creation of Producers' organisations.
- Analyse of incentives and of the influence of public policies
- Diffusion of innovation through IP study groups
- Impact of landscape management on the adoption of IP tools

The RA2.5 researchers' community will have to give suggestions and to decide on the socio economical studies that they find the most important to organize in the orchard SCS meetings that will be held within the next JPA3.

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Table 8: Bottlenecks for IFP tools in orchards.

Bottlenecks	**Economical**				**Practical**	**Technical**	**Social support**
	Labour	**Cost**	**Market**	**Other**			
Cultural methods						Lack of involvement from the advisory system.	Limited influence of IP Study groups?
Monitoring	No labour cost sharing with neighbours or POs.			Lack of pest economic threshold?		Lack of quantitative pest monitoring methods?	No support from POs
DSS							No support from POs
Sanitation	Labour intensive				Time management Lack of equipment	Lack of promotion by the advisory system. Efficacy of corrugated cardboards not demonstrated.	
Apple scab							
Resistant cultivars	Labour intensive	Entrance fees in marketing clubs	Lack of market. Producers have no marketing strategies	A minimum volume should be produced	Too many varieties compete with each others?	Orchard management is difficult.	No support from consumers
Codling moth							
Mating disruption	Labour intensive	Cost/ efficacy ratio not interesting		Small farm's margin?	Size of plots Availability of land	No PO involved	
Granulo viruses		Repeated application		Small farm's margin?	Repeated application		
Combination	nd	nd		nd	nd	nd	nd
IGR	nd	nd		nd	nd	nd	Nd