



Possible changes in order to solve the pesticides problem

*-Spanish farmers and fruit exportation companies are
looking for a solution.*



Salvador Rincón Amat

*SLU, Department of Economics
Degree Thesis in Business Administration
C-level, 15 ECTS credits*

*Thesis 498
Uppsala, 2007*

ISSN 1401-4084
ISRN SLU-EKON-EX-498--SE

Possible changes in order to solve pesticides problems

- Spanish farmers and fruit exportation companies are looking for a solution.

Förändringar som leder till en lösning på besprutningsproblemen

- Spanska lantbrukarna och fruktexportföretagarna söker en lösning.

Salvador Rincón Amat

Supervisor: Bo Ölhmér

© Salvador Rincón Amat

Sveriges lantbruksuniversitet
Institutionen för ekonomi
Box 7013
750 07 UPPSALA

ISSN 1401-4084
ISRN SLU-EKON-EX-No.498 –SE

Tryck: SLU, Institutionen för ekonomi, Uppsala, 2007

Summary

The pesticides use has increased in agriculture in Almeria (south-eastern Spain). At the same time the pesticides have become less efficient and rules have been made stricter. The farmers and the fruit exportation companies have to deal with the problem that emerged in November 2006 when residual from illegal pesticides were detected by the EFSA (European Food Safety Agency). As a consequence, the companies and the farmers have had to face the mistrust from the buyers, especially from the biggest market, the German one.

The purpose of this thesis is to study how the fruit exportation companies and the farmers analyse the problem of choosing a reliable alternative. The starting point of the study is to see how the decision making process looks like in the five companies in the study. The farmers' way of managing the problem is analysed from the point of view of the learning and changing process.

The study is based on interviews made with five companies and eight farmers. The empirical part is presented as case studies divided into different subcategories; "predator companies", the "newly started company" and the "specialized company". One case study about the farmers is also presented.

The companies have different ways to face the problem with pesticides. The "predator" companies will promote a new production system based on biological control of plagues that will eliminate all use of pesticides in greenhouses and be effective in the fighting of plagues. The other companies and the farmers who do not try the new methods have a few options, such as producing with pesticides and testing the production in all of the phases. Another option is to specialize in only one product (i.e. tomatoes). The last possible option is to produce organically.

The "predator" companies have concluded that the best way to face the problem is to apply the biological control of plagues. They have reached this conclusion based on prior experiences and with good help of the new technologies in matters of biological control. The farmers have looked at the problem from another perspective based on their worries about the profitability of their productions. The farmers have to learn a new method of production that could be the key to success for the agriculture in Almeria.

Key terms: Management process, distrust, experience, biological control of plagues and production change.

Sammanfattning

Användandet av besprutningsmedel har ökat inom jordbruket i Almería i sydöstra Spanien. Samtidigt har gifternas effektivitet minskat och regelverket angående användandet av dessa har skärpts. Odlare och exportföretag måste ta itu med problemet som dök upp i november 2006 när rester av förbjudna bekämpningsmedel upptäcktes av EFSA (Europeiska Matsäkerhetsrådet). Som en följd av detta så möttes företag och odlare av misstänksamhet från köparnas sida, speciellt från Tyskland som är den största marknaden.

Syftet med denna uppsats är att studera hur exportföretagen och odlarna analyserar frågan om hur man väljer ett pålitligt alternativ. Utgångspunkten för studien är att titta på hur beslutsprocessen ser ut hos de fem företagen som studeras. Odlarnas sätt att handskas med problemet analyseras med utgångspunkt i lärande- och förändringsprocesser.

Studien baseras på intervjuer med fem företag samt åtta odlare. Den empiriska delen presenteras som fallstudier uppdelade i olika underkategorier; "rovinsektsföretagen", "det nystartade företaget" och "det specialiserade företaget". En fallstudie angående odlarna presenteras också.

Företagen har olika sätt att handskas med besprutningsproblemet. "Rovinsektsföretagen" kommer att använda sig av ett nytt produktionssystem som är baserat på biologisk kontroll som eliminerar användandet av alla besprutningsmedel i växthusen och som är effektiva i kampen mot skadeinsekter. De andra företagen och odlarna som inte kommer att använda de nya metoderna har även de alternativ, såsom att producera med bekämpningsmedel och då testa produktionen i alla dess skeden. En annan möjlighet är att specialisera sig på bara en produkt (t.ex. tomater). Det sista alternativet är att producera organiskt.

"Rovinsektsföretagen" har dragit slutsatsen att det bästa sättet att handskas med problemet är att använda biologisk skadedjurskontroll. De har kommit till denna slutsats genom att basera sig på tidigare erfarenheter och med hjälp av ny teknologi vad gäller biologisk kontroll. Odlarna har sett problemet från ett annat perspektiv grundat på oron för produktionens vinst. Odlarna måste lära sig en ny metod som skulle kunna bli nyckeln till framgång för jordbruket i Almería.

Nyckel ord: Management process, misstänksamhet, erfarenhet, biologisk skadedjurskontroll och produktionsförändring.

Table of Contents

1 INTRODUCTION.....	1
1.1 PROBLEM BACKGROUND	1
1.2 PROBLEM	1
1.3 THE ALTERNATIVES	2
1.4 AIM.....	4
2 METHOD	5
2.1 <i>Qualitative interview</i>	5
2.2 <i>Case study</i>	5
3 A THEORETICAL PERSPECTIVE REGARDING ANALYZING AND CHOOSING ALTERNATIVES	6
3.1 THE DECISION MAKING PROCESS	6
3.1.1 <i>Problem detection</i>	6
3.1.2 <i>Problem definition</i>	7
3.2 BOUNDED RATIONALITY	8
3.2.1 <i>Choice behaviour; alternative rationalities</i>	8
3.3 COMMUNICATION AND ADVISORY THEORY. THE FRUIT-EXPORTATION COMPANIES WAY OF INFLUENCING FARMERS	8
3.3.1 <i>The change</i>	9
3.3.2 <i>Learning</i>	9
4 BACKGROUND FOR THE EMPIRICAL STUDY	12
4.1 THE “ALMERIA MODEL”	12
4.2 ORGANIZATION OF THE AGRICULTURAL SECTOR.....	12
4.3 THE DIFFICULTY OF USING LEGAL PESTICIDES IN THE ACTUAL CASE	13
4.4 BIOLOGICAL CONTROL OF PLAGUES	14
5 RESULTS AND ANALYSIS.....	15
5.1 THE EMPIRICAL STUDY	15
5.1.1 <i>Case study: The “predator” exportation companies</i>	15
5.1.2 <i>Case 2: The “specializing” exportation companies</i>	17
5.1.3 <i>Case 3: “The newly started company”</i>	18
5.1.4 <i>The farmers</i>	18
5.2 OVERVIEW OF RESULTS AND ANALYSIS.....	19
5.2.1 <i>The main problem for farmers and companies</i>	19
5.2.2 <i>The detection of the problem</i>	21
5.2.3 <i>The activity of change in companies</i>	21
5.2.4 <i>Learning by doing. The change in farmers</i>	22
5.2.5 <i>Discussion</i>	24
6 CONCLUSIONS	25
BIBLIOGRAPHY	26
<i>Literature and publications</i>	26
<i>Internet</i>	26
<i>Personal messages</i>	27
APPENDIX 1: RAPID ALERT SYSTEM FOR FOOD AND FEED.....	28
APPENDIX 2: EUROPE’S MINIMAL RESIDUAL LIMITS.....	31

1 Introduction

1.1 Problem background

The farmers have traditionally used pesticides in order to control the plagues that have been common in the intensive agriculture in the greenhouses. At the same time the laws have become more restrictive and many of the pesticides that the farmers use contain substances that are not permitted in the European Union, as for instance isofenphos-methyl in peppers or oxsmyl in courgettes exported to Sweden week 11 in 2007 (See Appendix 1, RASFF, 2007) (see attachment). The EFSA (European Food Safety Authority) is the organisation that is responsible of testing the food that people consume in Europe. The AESAN, the Spanish office for food security, released a report that explains that the residues are not dangerous to people's health (Internet, AESAN, 2006). Nevertheless, the continuous findings of illegal substances in fruit from Almeria should be enough to get the attention of the fruit exportation companies before the problem gets bigger.

Nowadays both the companies and the farmers have started to pay the consequences. According to the Spanish law (Internet, Real Decreto 1945/1983) the producers and sellers of products that contain illegal substances would have to face economical sanctions. The regional government, Junta de Andalucia, imposed fines on 24 fruit export companies and 25 farmers in Almeria in November 2006. The quantity of the fines was in the case of the companies of 120000 € (Internet, Ideal, 2007-03/04). Another aspect that we have to take in account is that the fruit import companies could decide to stop buying fruit from Almeria. It makes the situation very delicate and risky for the fruit export companies and for the farmers who have to look for solutions.

1.2 Problem

The farmers:

The first goal of a farmer is to earn money from the cultivation of fruit and vegetables. The farmers have to face several problems to ensure their benefit. One of the most serious problems they have to affront is the fight against the insects and plagues, since the most of the pesticides are prohibited or inefficient they don't have much of a choice. Some farmers buy illegal pesticides and take the risk of the pesticides is detected in their fruit and that they have to pay fines as consequence and to close their greenhouse for the whole season. It could lead to a desperate situation for farmers who might have endangered their profits.

The farmers who don't uses illegal pesticides complain about the lack of information about others ways of fighting against the plagues and they are worried that the government will not do anything to help them, for example there are no incentives at all to produce in ecologically or integrated (biological control of plagues: To fight against plagues through introducing other insects that kill the plagues). Now a lot of farmers are unmotivated and some of them are thinking about leaving their production and look for another job.

The problem for farmer is then how to get a profitable business without using illegal pesticides¹.

¹ Even if the pesticides are legal, it become illegal if use in quantities bigger than permitted.

The fruit exportation companies:

The companies have the same goals as the farmers, i.e. to earn money and to ensure the future. But the stakeholders involved are different. The companies which sometimes belong to the farmers associated in cooperatives or S.A.T. (Anonymous Union of Workers), they have to sell the fruits and vegetables to external buyers (in Spain or in other countries). The problem of the pesticides affects the companies in several ways; if a company has sold fruits with residues of illegal substances and it is detected, then they have to pay a fine of 120.000€. Then, and most importantly is that the buyers will stop trusting the selling company that could lead to a delicate situation for the economy of the seller. Some of the buyers have start to buying fruit and vegetables in other markets in countries as Morocco or Israel instead of buying in Almeria.

The problem for the companies is to persuade the farmer to not use the illegal pesticides in order to get back the trust from the international market. They have to look for new alternatives in their own interest.

1.3 The alternatives

The problems caused by the illegal pesticides have some plausible solutions, suggested by the companies. The solutions are mainly from the data collected from companies and farmers. I analyse the different alternatives to using pesticides through the different case studies.

a) The first alternative: to produce with biological control of plagues.

The companies and farmers collaborate to produce with biological control of plagues. These companies will lead the transformation of the production system from a system that uses pesticides (in large quantities) to a system that practically does not use this. This is the most ambitious of all the proposed alternatives, and the one that can really be achieved.

Advantages and disadvantages of biological control of plagues

The biological control of plagues will be introduced to the fruit exportation companies and farmers as the most possible solution to fight the plagues. The advantages that the biological control has are the following:

- It respects the environment and the human health because pesticides are not used
- It stops most of plagues and the damages they produce.
- Predators kill the insects that produce plagues, not the insects that do good.

But the biological control of plagues has some inconvenient that make some farmers skeptical to change from pesticides to predatory insects. The inconvenient are the following:

- It requires patience and quite much training
- Predators are sensitive to pesticides. You can not use pesticides if you have biological control. (In most of the cases).
- The results are not immediately. Pesticides kill all harmful insects (and predators). Predators kill only one plague insects. Predators are sometimes specialized in one harmful insect.

b) The second alternative: specializing

This alternative consists in that both the farmers and the company specialize themselves in producing and selling only one product that is not so sensitive to insects and plagues. In case study 2 this product is tomatoes.

Advantages and disadvantages of specializing

One of the soundest advantages of specializing is to get a bigger know-how of production, if you are a farmer or in marketing if you are a seller. A second advantage is to get a niche in the market that no one has occupied yet. But a third and more important advantage, in relation with this thesis is that the companies can choose to specialize in a product that does not need very much pesticides treatment. In the case of tomatoes, the farmers use bees to pollinate the tomatoes flowers therefore they can not use very much pesticide. (Food in Europe, 2007)

In the case of specializing, the disadvantages are many. First of all, the farmer can not send other products to the company if it was the case that the farmer likes to introduce a new product each year (as it happens with the other companies). Specializing is not really an alternative to solve the problem because the companies we study are not willing to specialize because they have traditionally offered a complete supply. Then the farmers, who are stakeholders, should leave the company and look for a company that will offer the product that they cultivate, i.e. if the company decide to specialize in peppers, all the farmers that actually do not cultivate peppers should to sell their cucumbers, beans or tomatoes to other companies. To change a company supply means to change the whole production system and there are no examples of these in the region. Other companies that have specialized have been specialized from the beginning. The last inconvenience is that specializing is not a guarantee to solve the pesticide problem. For instance, a company that specialized in peppers, which is the most affected product in the pesticides problem, should look for alternatives to pesticides nowadays.

c) IPM and the testing alternative

This alternative is based on the fact that companies increase the number of tests made with farmers and try to ensure that there are not pesticide residual in the vegetables. IPM (Integrated Pest Management) is a method that uses the information about the pesticides life cycle and their interaction with the environment to apply the pesticides in a responsible way. (Internet, EPA, 2007)

Advantages and disadvantages of testing

Integrated Pest Management has been the solution that many companies applied when the European markets started to be stricter about pesticides residual in fruits. But the IPM has not given the solution to the farmers that have used pesticides wrongly and companies that have been forced to test the fruits. A consequence of the testing alternative is that the companies should look for new markets that are not very restrictive with pesticides in order to sell the vegetables that have higher pesticides levels than permitted. The solution of testing has been applied by all of the companies during this year since the crisis with the pesticides started. Nevertheless, this solution is considered only as a short run solution because it is expensive for the companies to test all the vegetables, and it is possible to sell “not tested” vegetables that can instead be detected by the EFSA (European Food Security Agency).

d) The farmers go into the organic production

To produce and sell ecological products is one of the best alternatives to avoid using pesticides.

Advantages and disadvantages of going into organic production

To produce ecologically is an alternative to using pesticides that mean a plus to the farmer in prices and life quality. It is better for the farmer's health because he does not have to be exposed to pesticides or chemical products. Another advantage is the increased demand of organic cultivated products in Europe, i.e. Sweden where the government will introduce measures that are incentives to buy ecological products. Nevertheless, most of the farmers do not make the change to organic production because they are not sure of the benefits. This way of producing needs more knowledge and patience because they can not use the same fertilizer. (Food in Europe, 2007)

The organic food production applies some of the concepts of the biological control of plagues and the IPM but differs from those practices in the use of fertilizers or in the use of synthetic chemicals in the case of IPM. (Internet, EPA, 2007)

1.4 Aim

The aim with this study is to investigate how agricultural export companies deal with analysing and choosing alternatives in order to face environmental problems. I am interested in analysing the decision making process in order to understand the changes in the organisations to face the illegal pesticides problem and analyse factors influencing those changes in farmers too.

- How do companies and farmers evaluate the alternatives to illegal pesticides?
- Why have not the problem been faced before?

The fruit-exportation companies and the farmers of Almeria have had to adapt very quickly to the new situation. In this study we will see some important factors that explain the changes that they have had to face.

2 Method

The study is based on qualitative research methods such as interviews and cases studies with a number of executives from the export companies and with farmers in Almeria. In the area 85 fruit-exportation companies operate (internet2, infoagro.com, 2007) I selected 5 of those and made interviews with them. I made interviews with eight farmers (in the neighborhood of the companies) out of 32000 that are registered in Almeria (Internet, SIDYM. 2007/05-30). So the sample is not representative for a quantitative study.

A previous literary study of the matters in as decision making process and environmental communication has being done previously to the study.

The study is limited by the geographic area of the case and is oriented towards fruit export companies and farmers from the region. Then the study will focus in the companies and farmer that will work with biological control of plagues.

2.1 Qualitative interview

I will use qualitative interview because this method gives information that is directly relevant to understand the processes that happened in the companies and farmers. I will have direct opinions and reflection from the interested in the study. The interview give us the opportunity of know the ground of the problem in deepness. (Kvale, Steinar. 1997)

The interviews have been done to farmers and companies executive. I have made eight interviews with farmers and five with executives companies.

The interviews consisted of four different parts; the first one about the main problems affecting the companies and the farmers, the second was about the problem with pesticides. The third was about the changes as consequence of the problem and the last one was about the communication. The interviews are disposed in this way because of the theoretical study.

When it comes to the form of the interviews it consisted in open and yes or no question as a "Question Funnel" in a process, not a series of independent question. In the open questions I did not give the interviewed people any alternatives to chose between but they came up with them. The result of those interviews has been much good information that I present in the cases study.

2.2 Case study

Case study is an instrument that helps us to study a problem in deepness when we want to see how the problem affects a few companies and farmers. Case study was the best form to present the results from the interviews and give us the mainly differences between the companies and between the companies and farmer. (Merriam, Sharan B, 1993)

To simplify the understanding of these cases I analyse the companies that will work with biological control of plagues in a group that I called "Predator" and then the three companies that compound this group in Company A, B or C. Two more groups have been defined to give the reader an image of the whole context. The farmers' case study has been summarized in one group to facilitate the understanding of the problem in the context. The case studies are presented following the disposition of the theoretical part, focusing on the decision making process, but making some differences in the headline of each case to mark out the differences between the perspectives. I chose to present these four cases because they show different approaches to the same problem.

3 A theoretical perspective regarding analyzing and choosing alternatives

3.1 The decision making process

A basic model of decision making process includes four main phases or steps, problem detection, problem definition, analysis and choice and implementation. I will like to go through these steps as a theoretical background of the activity of change in organizations.

3.1.1 Problem detection

As most authors define it, a problem is detected when the actual situation differs from the desirable one. In other words, according to Klein G. & Pliske R (2003) "Problem detection is the process by which people first become concerned that events may be taking an unexpected and undesirable direction that potentially requires action"

Problem detection can be divided in two subcategories: problem identification and problem acceptance. (Kleindorfer et al., 1993)

In the cases I study in this thesis, problems are discovered as a consequence of a reactive or passive problem finding (from an external signal) more than proactive or purposive one. The companies I study recognised the problem through outside influences or by personal experiences.

By discovering that goals, values and needs are being unsatisfactory starts to lead a process of problem solving.

Some characteristics of the problem detection process are that human decision making is limited by our perception, memory, and attention. The different focus in perception lead to discrimination in the stimuli we get. Memory can be divided into an immediate memory that is called short-term memory and the memory that stores the information that belongs to the past, the long-term memory. The repetition of items that belong to the short-term memory will lead to that item is stored in the long-term memory. (Kleindorfer et al, 1993)

In those cases I study, there are different companies, some of them are so new that they do not have experience enough to keep a long-term memory but they will react in order to other perceptions as a process of attention in which they pay attention to the items that could affect their goal, values and needs.

The goals, needs and values are important to determine how the desirable situation is. If a goal is not achieved then we have a gap between the desirable situation and the status we actually have because a goal is an "end-state" as a consequence of a planning activity.

(Öhlmer et al., 2000). A farmer that has a goal of selling a determined quantity of fruit to a determined price should be able to understand that there is a problem if their goals are not fulfilled (if their goals were reliable).

The goals are determined for the decision maker and they can be changed. Nevertheless, the values and needs are not predetermined. A value is a "personal or social preference for desired end-state and appropriated means of attaining them" (Öhlmer et al., 2000) A need is a primary drive and values are derived from it.

In the cases I study there are farmers and companies. The goals of a company can be easily recognised as organization. With the farmers you can define the values and needs as it concerns individuals but values and needs are difficult to define in organizations. (Öhlmer et al., 2000)

3.1.2 Problem definition

Problem definition or problem representation (Kleindorfer et al, 1993) considers the potential improvements or alternatives of problem solving. The problem definition somehow implies the acceptance of the problem. The cumulative experience that the decision makers possess will determine the way they will define the problem. According to Kleindorfer there are three models: historical, communicated, and planning models.

- Historical models: The problem that is detected is similar to problems that have been detected before.
- Communicated models: Others' experiences are used to supply our own lack of experience in the case. In this category we can include the word of mouth, media...
- Planning models: A planning model is a proactive or purposeful model. There is a measured plan with the goals. If something is not going according to the plan the deviation will be detected and the problem defined.

Why do we fail in the problem- finding process?

According to Diamond et al. (2005) the decision makers in a complex organization take decisions (or do not do it) that could lead to errors. Sometimes it can lead to the collapse of a society, organization... The errors are the following:

1. Prior experiences in problems:
 - A prior experience is not a guarantee that the problem will be anticipated. If the decision maker didn't pay attention in the past or if the item has not been reheard enough to belong to our long-term memories.
 - Decision makers may be reasoning by false analogy. When we face a problem we try to do as in past experiences but maybe the characteristics of the actual problem differ from the old one.
2. Perceiving or failing to perceive a problem:
 - Imperceptible origin of a problem. A problem that is literally imperceptible as a result of a poor technology.
 - Distanced managers: the managers of a company may not know about a problem because they are not in contact with some of the stakeholders who are around the company.
 - An up-and-down fluctuated slow trend. When something becomes a problem we analyse it but the problem shift down and stop being priority so we forget it. For environmentalists a clear example is the global warming: it is difficult to affirm that all the years' temperature increases with the same speed but some years are warmer and other colder.
3. Failing in attempting to solve a problem once it has been perceived. It is because there are different interests between the stakeholders and we use the term "rational behaviour" or "rational bad behaviour". A conflict arises if the decision maker takes a decision that is against the rest of the interested.

Another classification of errors that leads to a bad acceptance of a problem is described in this way (Kleindorfer, et al. 2005):

- Detecting a problem when there isn't one.
- Not detecting a problem when there is one.
- Solving the wrong problem.

3.2 Bounded rationality

A model of rational choice, based on a classical model of decision making, is not enough to understand the rationality of choice in real decision contexts. A rational choice implies that the decision makers have perfect information about the possible problem since they know about all the possible alternatives in the future. Those models assume a future preference as an exogenous variable but future preferences could be different, especially in the case of collective decision making since values and needs are more difficult to determine, and as consequently also the preferences (see 3.1.1 Problem detection/ Goals, values and needs) because an individual has probably not the cognitive capacity to remember or understand all the possible alternatives, it is said that rationality is bounded. (Bloisi et al, 2003)

3.2.1 Choice behaviour; alternative rationalities.

To help us understanding choice behaviour Bloisi (2003) has divided rationality into four alternatives that he calls “ideas”. These are the four alternatives and some explanations:

- Limited rationality: because it is very difficult for us, as individuals or groups, to have full control over all the alternatives that we have when a decision making problem surges.
- Contextual rationality: the attention that decision makers give a problem can be partially perturbed by other simultaneous processes in the same context.
- Game rationality: individuals acting in relation to each other for their own interest. The group take decisions which outcomes as a collectivist could help to reach individual objectives.
- Process rationality: The most significant is how rational the process of decision is, more than the own outcome of it.

Rationality is present in economics in other ways too. The economics can be defined as the study of how we allocate, in a rational way, the scarce resources that we have. Economics have traditionally worried about the outcome of the rational choice rather than considering the choice process itself. It is because the economics tend to maximize, and then the choice process is less important than the outcome. However, a better focus in the process of choice could provide more understanding to the rationality of choice. (Bell et al., 1988)

3.3 Communication and advisory theory. The fruit-exportation companies way of influencing farmers

To facilitate the change the fruit-exportation companies should take in account the advisory theory and communication in order to influence the farmers.

A simplify model of advising farmers:

The objective of the advisory is to influence the farmers in order to help them to solve the part of the problem that they need to solve. The advisor has to help the farmers to solve and defining the farmers' problem.

To help the farmer to solve the problem an advisor has to consider the following points:

- Consider the most important of the problem because the time is a limited resource.
- Try to engage the farmers as much as possible in the process of solving problem.
- The advisor gets important knowledge and feedback during the process.
- The advisor has to be involved in solving problem.

A simplify model of advising farmers give us a general view of the problem and how we can act to help the farmers to face the problem.

3.3.1 The change

The objective of the advisory is to influence the different actors to change. The change is the solution to the problem. Some authors as Haegglom (1982) propose a simplify model of advising farmers based on five different steps; get information, get interested, judge the alternatives and make the decision.

INFORMATION→ INTEREST→ JUDGING ALTERNATIVES→ MAKING DECISIONS

The model is susceptible to compare with the model of a process of change from the point of view of learning that is represented in point 3.3.2

The first part of the four step model is to get informed; they receive the information from several sources. Once they get the information they are interested in to know more about the new techniques. The farmers can understand the problem and think about the new technique as a possible solution. Then the farmers have to judge the different alternatives, the advantages and disadvantages of using the new technique. The last step is to make a decision that in this case consist in accept or no the new technique.

At understand this model is important to the advisor for to know how to use the different tools they have in each step of the model. The tools that the advisor uses are presented below:

- Communication tools: The advisor can use mass media in the first steps of the model in order to inform as many people as possible. This kind of information is not specially deep but general. To the people that become interested, the group media method like shows and courses is a good tool to start judging the alternatives. The individual media is the last tool that the advisor needs to use. In this last part the advisor will see the individual characteristics of the farmer.
- Cooperation: The advisor could cooperate with the different actors of the problem. The advisor can link those actors in order to achieve the solution of the problem. The advisor can i.e. to mediate between farmers and the government or try to link the suppliers and farmers.
- The target group: The advisor can expect that the target group presents different characteristics and that some divergences can appear.

(Haegglom, S. 1982)

3.3.2 Learning

According to Leewuis (2004), learning is the process of cognitive change. Trough actions, a person receive simultaneous feedback that leads the process of cognitive change.

The expression “learning by doing” means that own experiences have more meaning than others’ formulations. The decision making process is described here as “the final outcome of

longer-lasting learning processes with varying degrees of deliberateness or consciousness” (Leeuwis et al, 2004 p. 152)

A process of change can be described as a succession of the following issues:

INFORMATION → KNOWLEDGE → LEARNING → ATTITUD TO CHANGE → CHANGE IN ACTION

The relationship information -> knowledge -> learning -> attitude -> action, it is not as simple as it may seem. To induce a change in other persons' action we will be capable of persuading or manipulating. “The conscious use of communication to help people forming sound options and make good decisions” (Leeuwis et al. 2004)

A number of things which will provoke a change in people are:

- If people are scared / direct effects
- Information is repeated.
- Seen others do something differently
- Group pressure
- Discussion
- Logic-rational reasoning
- Finding another way to do it

To make a change there are internal and external motivations. The internal motivations have to do with the feelings (“people are scared”) and with the logical-rational reasoning and individual learning. The external motivation is more related to the group pressure and the collective learning and the knowledge as part of the community (Wegner, 1998, p 6)

Information is the first step to make a change. But that is while learning when you are building the attitude to change in action. “Cognitive change – in other words learning, is an integral part of everyday life. We all act, and receive feedback from our environment, which in turn leads us to adapt our cognitions.” (Leeuwis et al. 2004, p 147)

Here, Leeuwis introduce a new aspect that is very important in change; the one that is about the experiences “we all act...” The experience will make you act in a determinate way because you have learnt about something. An experience is the start of a reflection which leads to a new conceptualization, “cognitive change”, and then you will be able to change in action. But achieving this cognitive change will be not too easy either. The acting is the final outcome of many learning processes, “reflexive monitoring of actions” (Giddens, A. 2005) The complexity of the model we describe here could be released from the point of view of the knowledge. Wenger E. (1998) states four premises to understand learning and knowledge:

- We are social beings. The fact that we are social beings influence our way of learning and understanding.
- Knowledge is a matter of competence with respect to valued enterprises. It means the things we can do, we have the “know how”.
- Knowing is a matter of participating in the pursuit of such enterprises. The active engagement in the activities to get the “know how”
- Meaning. The social being has the ability to experience the world and its participation in it as meaningful.

Knowledge is part of the community (“community of practice”) (Wegner E, 1998) the learning process in a community is part of being an active participant in the community.

The learning process is affected by some factors depending on the context that the decision maker is in. Those factors could affect in a positive or negative way. Some individuals or group do not have enough predispositions to learn and they will start to learn only when the

problem becomes obvious. The factors that affect the process of learning are the following: (Wegner E, 1998)

- The relative importance of an experienced problem: a gap between the desired situation and the actual one has to be perceived by all people involved in the organization. All of them have to have the same priorities.
- Direct involvement with a problem: people who are not directly affected by a problem will not have the same attitude to aware it, it means, they will not be interested in learning.
- Urgency: When a problem becomes obvious the motivation for to solve it increases and the motivation to learn about it too.
- Self-efficacy and environmental efficacy: It is about being confident with the environment. Actors have to feel enough reciprocity from the other actors involved in it.
- Complexity and observability: the complexity of the problem is another factor that will affect the capacity or motivation of learning.
- Clarity about the nature of a problem: actors will be more motivated to learn about a problem when its nature is recognized and stakeholders agree with it.
- Perceived social consequences and risks associated with accepting alternative cognitions: a process of learning in which actors will accept a new alternative cognition as a consequence of economical or social risks.
- Social and organisational spaces: the process of learning is in this case affected with the environment in which learning takes place, new ideas will be accepted or not depending on it.
- Resources and safe spaces for experimentation: experimental learning needs resources to go ahead without being constrained by the lack of time or by other resources.
- Stress and trauma: the different pressures that are affecting people in those situations in which learning is absolute necessary makes the actors involved having more difficulty to distinguish between priorities, goals and values.

4 Background for the empirical study

The following chapter will give a brief introduction to the agriculture system in Almeria. The agriculture in Almeria is based on horticultural production in greenhouses with an intensive use of technology. The technological advances have been necessary to produce in a competitive way because the area is arid and the lack of water is a fact. The transformation of one of the most arid and poor areas in Spain into an area that produces vegetables that are supplied all over Europe, has become known by the name of “The Miracle of Almeria” or the “Almeria Model”.

4.1 The “Almeria Model”

In 1961 the first greenhouse was built in Almeria and now there are more than 27000 Hectares of greenhouses in this area. And what was one of the poorest areas in Spain got in the 90s one of the highest BNP per capita in Spain. An important support industry grew around the economy facilitated by the farmers.

The “Miracle” was possible because of the following factors:

- Colonization and agricultural development politics: The politics consisted in guaranteeing the water resources to the farmers. The project started in the 50s.
- Changes in the demand as a consequence of the changes experienced in European society during this period. The incorporation of more vegetables in the Europeans’ daily menu is an important incitement, too.
- The development of the technology in production, transportation and commercialization made possible that the vegetables produced in Almeria could be transported to the rest of Europe, with a stable production in winter time thanks to the technology in the greenhouses.
- Socio-cultural factors: an important immigration flow and the initiative of the farmers.
- Another factor to take into account is the financial one. Banks have been present from the beginning and lend money to farmers who want to buy or build greenhouses.

(Internet, SIDYM. 2007/05-30)

4.2 Organization of the agricultural sector

The agricultural sector has in the area of study some characteristics that I will resume in this chapter.

The marketing systems in Almeria can be divided (a grosso modo) into three categories: auctions, wholesaler at origin and associative organisations. The horticultural crop farmers in the Almeria province can be divided into two groups, those who sell as individuals and those who sell as an association. Those who sell as individuals are around 57 % of all producers in Almeria and 43 % are farmers who are associated. (Martinez Paz J.M et al. 2001-2002)

Marketing systems at origin

The different marketing systems that the farmer can use to sell their productions are the following:

Associative system:

- Cooperative: the farmer is associated in order to concentrate the supply and takes a greater part and benefits more actively from the commercial chain. It means that the products are transformed before being sent to their destination.
- S.A.T. (Agrarian Transformation Society): Other associative form is the S.A.T. where the stakeholders are less but often with a bigger production. They are not subordinate to some of the rules that you are in a cooperative.

Individual system:

- Auctions: The farmers take their fruit and horticultural crops to the auction where independent intermediate or wholesaler in destination will buy in a reverse auction (the price will decrease until someone buys it).
- Wholesaler in origin: they buy directly from farmer or in auctions, and then prepare the product to sell in destination.
- Other ways to sell the production is through direct sell to a wholesaler in destination or direct selling from the greenhouse to a buyer.

(Martinez Paz J.M et al. 2001-2002)

The farmers especially those who are associates in cooperatives, used to associate to constitute an O.P.F.H. (Fruit and Horticultural crop Producers Organization). This is a way of permitting them an easier access to European Union support through the OCM (Market Common Organization)

4.3 The difficulty of using legal pesticides in the actual case

One of the company directors (Company B) told me about the difficulty of using pesticides and the IPM method to reduce the plagues as a consequence of the different regulations in the countries of the European Union and Switzerland. There is not a fixed permitted quantity in the levels of residual (pesticides) that can be found in the fruit. Different countries and different levels, that imply that the producers have to plan the season very carefully and decide from the beginning which pesticides will be used in a production which will be sold to United Kingdom and which pesticides will be used by farmers that sell to Germany. That is practically impossible to guarantee for several reasons. One of the reasons is that the fruit exportation companies often have contracts with the importation companies to sell a determinate volume of production; nevertheless the volume that farmers can produce is uncertain. In this case, if the production to United Kingdom is not enough they can not sell fruits from a farmer that produces to sell in Germany because he/she may be using a pesticide that is not permitted in United Kingdom. Other consequence is that the companies can not attend the demand of fruit from a country if they have use one pesticide that is not permitted in this country. When there is an excess of production it will be very difficult to get a buyer for the same reason. In the Appendix 2 shows a complete frame with the minimal values of active substances that can be found in the different countries and the minimal value in all the cases. A table shows with the harmful insects (the same I present in heading 4.4), the pesticides that can be used to fight the insects (in the vertical axis) and the different countries minimum value of residual and the minimal value in sum. The different countries minimum value of pesticides residual permitted give us a relation that make very difficult for farmer to fight against plagues in a efficient way. Other problem to farmers that used the Integrated Pest Management is that they have to respect the pesticides life cycles to avoid residual in fruits.

4.4 Biological control of plagues

I consider very important introducing this heading as an approach to the actual case study. One of the soundest alternatives to avoid the fines and sanctions for pesticides residual in the fruits is to adopt a radical change in the way of production. The sound change is the transition towards a system that does not need the use of pesticides instead; the biological control of plagues consists of a preventive system that makes predatory insects fight the insects that form plagues (**internet, infoagro.com, 2007**) Below I will present a table with the insects which produce plagues, damages and diseases and also the predatory insects that fight each one of the harmful insects.

Table 1: Harmful insects and the respective predators

Harmful insects	Damages	Predator
White fly (<i>Trialeurodes vaporariorum</i>)	<ul style="list-style-type: none"> - Affect growth in plants - Transmitting diseases 	<i>Encarsia formosa</i>
Thrips (<i>Frankliniella occidentalis, Thrips tabaci</i>)	<ul style="list-style-type: none"> - Produces necrosis in plants - Transmission of diseases 	<i>Neoseiulus barkeri</i> y <i>Amblyseius cucumeris</i>
Red spider (<i>Tetranychus cinnabarinus</i> & <i>T. urticae</i>)	<ul style="list-style-type: none"> - Irreparable damages in plants that dry and died 	<i>Phytoseiulus persimilis</i>
Plant-louse or aphid (<i>Myzus persicae</i>)	<ul style="list-style-type: none"> - Plants become dried - Transmission of diseases - Reproduces harmful fungus 	<i>Aphidoletes aphidimyza</i>
Caterpillar (<i>Spodoptera exigua, Spodoptera littoralis, Autographa gamma, Chrysodeixis chalcites, Helicoverpa armigera</i>)	<ul style="list-style-type: none"> - Holes and bite marks in fruits - Produces rotting in plants 	<ul style="list-style-type: none"> - <i>Bacillus thuringiensis.</i> - <i>Trichogramma spp.</i> - <i>Chrysoperla spp.</i> - <i>Bacillus thuringiensis.</i>
Citrus leaf miner (<i>Phyllocnistis citrella</i>)	<ul style="list-style-type: none"> - Damages in leaves, reduce the photosynthesis capacity in plants 	<i>Ageniaspis citricola</i>

Source: infoagro.com, 2007

5 Results and Analysis

In this chapter I will present the empirical study that is formed by four case studies and an overview and analysis of the cases.

5.1 The empirical study

In this part I present the cases that represent the empirical study. The cases will be divided between fruit exportation companies and farmers. The aim with the case studies is to show the different ways to manage the problem by companies and compared to farmers.

In the first case study I take the companies A, B and C and compare them to each other because they will apply the same kind of solution. The structure of the case studies is based on the theoretical overview.

5.1.1 Case study: The “predator” exportation companies

Not all of the companies face the crisis in the same way. In this case study, I compare the three companies A, B, and C which are the companies that show more interest in innovation. I name them the “predator companies” because they try to develop an agricultural system based on the biological control of plagues and the use of predatory insects. The similarities between the companies are several, and all three of them have been on the market for more than 15 years and they work in a similar way.

Detecting the pesticides problem in companies

One of the most important similarities in this case is that the companies A and B both have past experiences with pesticides. In the case of company A the first indication that a problem could appear was 12 years ago when the Swedish companies complained about some pesticides residues in fruit bought from company A. The Swedish importation companies sent tables with the permitted pesticides levels that the company should adapt to.

Company B sees the problem as a progressive one. The pesticide problem has increased over time. Three years ago some of the farmers who are stakeholders in the company (B is a cooperative) were obliged to pay fines because forbidden pesticides residues (methamidophos) were found in their fruit.

The quality technicians from company C told me that the problem was quite predictable because the quantities of pesticides used had increased the last years.

Evidences of the problem

The problem has not been evident to the companies until the last crisis that started in November 2006. For company B the clearest evidence was when the main importer country, Germany, came into the problem. When the German companies rejected to buy the fruit, the companies became aware of the seriousness of the problem, because the biggest volumes are sold to Germany.

For company A the evidence started to be clear three or four years ago because of a problem with methamidophos that also affected company B (see 5.2.1). Company A became aware of the seriousness of the problem, at the same time as company B and C; in November 2006. As

a consequence, the company was obliged to face paying fines and some of the buyers stopped trusting in the company. The manager of company A told me that “before November we were unaware of the seriousness of the problem”

In company C the levels of pesticides found were over the permitted level in some of the farmers’ production, also before it was detected by the mechanism of the market RASFF. The problem with pesticides residues has affected the companies, especially when it comes to the decreasing quantity of product demanded, and for the loss of credibility among the clients. The first thing that the companies did about the problem was to intensify the analysis of fruit, (in the case of company A, up to three times more analysis). Company A hired more technicians and gave more information to the farmers. The companies have changed the production plan and they are ready to produce between 80% and 90% of all production in a biological way next year, and up to 100% of the peppers, the most affected product. One more consequence of the problem has been that the laboratories have been overloaded with work and the companies and the farmers have to wait for a long time to know the results.

Looking for alternatives

In company A, the organic production was not considered an alternative, but only as a different line of products that the company could sell to satisfy some clients. After the crisis, company A now thinks that organic production is really a possibility or an opportunity to get an advantage in the market. For company A, the first step is to establish the biological control of plagues.

Company B has taken that step, too, and next year most of the production will be with biological control. Company B got to the conclusion that it was impossible to produce using pesticides because the permitted levels are so low that the poison became inefficient. Company C told the same thing. They also said that an environmental policy will be applied and the technicians will increase the contact with farmers. Nevertheless, they were very worried about the problem with plagues.

The alternative which is biological control seems obvious now, but three years ago they thought that the biological control of plagues was impossible to apply successfully. Now they have no choice and they think that the technology has advanced enough to use the biological control in a successful way.

The “predator companies” have found as the most possible alternative to use biological control in their farms and they also avoid the use of pesticides.

How will they do it?

One more thing that company A and B have in common is that both companies will act in a similar way in order to achieve the objective of a production free from pesticides.

Companies A and B have chosen to produce with biological control. To achieve this, both companies will get predatory insects to give to the farmers who are associated in their companies. Companies A and B are going to make some investments to get their own predatory insects. The farmers will get the information and education from the companies’ technicians. Company A will start a smaller scale production as a demonstration for the rest of the farmers. I don’t have information about how company C will get the predator insects but they will get the insects in a similar way as A and B company.

The ecological production will work somewhat differently between the two companies A and B. Company C will not have an ecological production. Company A will start looking for markets for a larger ecological production, company A is a few steps ahead of company B in the ecological sector. In autumn 2007, Company B will start the ecological production, but as experiment at first, before they invest more resources in this alternative.

5.1.2 Case 2: The “specializing” exportation companies

One of the companies I interviewed told me that the pesticide problem will not affect their company that much. This is because the company is offering the market only one product, tomatoes. Tomatoes have not been that affected by pesticides problem, in part because bees are used to make the tomatoes flowers germinating.

How did they see the problem?

The fact that I introduce the case of this company as a case study is to show that there are other alternatives to face the problems, although this alternative is maybe not compatible with the other companies that work with a complete supply of vegetables. This case is quite special because it is about a company working with tomatoes and not with peppers that has been the most affected product in this crisis.

The company knew about the problem at the same time as the others companies: when the first news about the pesticides residual appeared in the newspapers. The first evidences of the problem came when the Regional Government (Junta de Andalucía) required that the company made an irregular analysis of peppers. The company that usually does not work with peppers had started a project with peppers as an experiment.

Looking for alternatives

The alternatives for this company have been more or less clear since the incident mentioned above, and they will continue with the model that has brought them some success. The project with peppers has been abandoned and the company’s main focus is to ensure the niche they’ve made for themselves during the ten years that the company has been on the market. The main problems affecting this company are the other countries’ competition and the cost of production and quality. The pesticides problem is in third place. The company’s policy to avoid pesticides problem is to make the farmers sign a contract in which the farmers will follow the rules about the company’s pesticides policy suggested through the technical department. If a farmer uses another pesticide then she/he will be expelled from the company. In short; the company’s focus to face the pesticides problem is to analyse the products and to have a hard policy with stakeholders.

Problem with these alternatives

Specializing requires that the farmers who are associated specialize themselves, too. It could be a problem because some farmers would prefer to harvest different vegetables depending on the season, but the company works only with tomatoes.

The cost of analyzing all the batches of vegetables is one of the things that worry the company. To increase the number of analysis brings a higher cost to ensure the quality.

5.1.3 Case 3: “The newly started company”

Not all companies have the experience gathered through the years to know how to face a problem like the one I’m studying. This section will focus on a three years old company that lacks the know-how from former experiences. I will put my emphasis on how the company search the information that is needed to affront the problem.

Problem detecting and the first evidences

For a newly started company, with only three years in the market, the problem could seem quite different. Nevertheless, the first evidence came at the same time as it did for the other companies; in November 2006 as a consequence of the pesticides residual that were found in peppers from Almeria.

In the newly started company, a new factor played a role to detect the problem: it was the word of mouth. The company got information from other fruit exportation companies with more experience. Then the problem was evident when the European companies started to stop buying vegetables from Almeria.

How the problem affects the company

The company was very affected by the problem, first because some clients stopped trusting in the company and then because they were afraid of getting sanctioned and banned. The exportation of fruit and vegetables has been very affected since November 2006 and the company has decreased its benefits.

Choosing a solution

How to act when the problem started was a difficult question for the company leaders. The process of looking for a solution started with getting help from the more experienced companies, “the friend companies”. That search gave them a first answer, and they decided to increase their monthly analysis in the farms.

5.1.4 The farmers

This capitel has the intention to tell the way the farmers see the problem. The study is based in eight interviews made to young farmers, all of them under forty years old after follow the advice of leader of company A about the generational change.

The problem

The farmers have experienced a continuous decreasing in their benefits as consequences of a trend of falling prices and a increasing in prices from support industry. The decreasing benefit is the biggest problem they have and the pesticides crisis had have an important roll in it. The plagues have been more aggressive than before, the pesticides that can be used have been inefficient to control the plagues and the prices have increased in time too.

The farmers' problem definition

The problem with pesticides is named by farmers in different way that the companies do. For farmers the problem is that it is impossible to control the plagues even do they uses big quantities of pesticides.

This problem, in the form that farmer named it, have had some consequences, one of those consequences is that many farmers have been offered pesticides in the illegal market and some of them have accepted as a desperate measure. The result of this using has not been the expected, two of the farmer from this study was sanctioned and had to pay fines and two other diseases as a consequence of using pesticides.

Six of eight farmer told that have used illegal pesticides and five affirm that they assume the risk despite they know that the pesticides was not permitted.

Alternatives and changes

After the crisis of November 2006 the attitude of the farmers has change. Most of them told that they are willing to offer a better product to consumers also vegetables free from pesticides. The majority of the farmers have planed the introduction of biological control of plagues to the next season and some of them are interested in ecological production. On the other hand, farmers were more pessimistic than companies under this process, three of the young farmers from this study wanted to look a new job and rent or sell their greenhouses. The rest was thinking about to combine the farmer activity with another activity or part time job.

The farmers think that the solution to the pesticides problem is to use a system that not need pesticides as biological control of plagues or organic production but they think that there are more factors that influences the problem, these factors are that the sector have to be more united against the problems and that the Government should give economic support to guarantee the profitability of farms in the area.

5.2 Overview of results and analysis

In this chapter I will analyse the results of the interviews I did with the fruit-exportation companies and with the farmers. In this part I start the analysis of the question parting from the different issues I deal with in this work. In this analysis I will clarify the relation between the theoretical part, the decision making process, and the case study, with help of the interviews.

5.2.1 The main problem for farmers and companies

The first step of the interviews I did was to ask the company leaders and farmers which was the main problem affecting their activities. The objective of this question was to know if the pesticides problem is thought to be one of the main problems in both cases.

The answers in the case of the companies are resumed in the table below:

The companies chose the three main problems they have and gave them a number from one to three depending on the importance of the problem.

Table 2: The problems described by the companies

Problem describes ↓	Company →	A	B	C	D	E
Excessive dependence of European shoppers					1	
Unfair competition from other companies					2	
Pesticides residual and plagues control		2	1	1	3	2
Profitability		1		2		
Motivation in workers		3				
Other countries' competition			3			1
Cost of production and quality						3
Not defined laws in the whole EU (for pesticides uses and others)			2			
Lack of support from authorities				3		

In table 2 we can observe that there are three different locus of control, internal, and two externals, one about the market and one about politics. The first think we observe is that there are differences between the newly started company and the others. The newly started company (D) main problems are two external reasons, “excessive dependence of European shoppers” and “Unfair competition from other companies”. The other companies were more focused in internal problem as the profitability. Other difference is that two of the “predator” companies, B and C, told about political factors as they think that the companies and farmers should have more institutional help to avoid the use of pesticides.

The same method is applied in the case of the farmers:

Table 3: The problems described by the farmer

Problem describes ↓	Farmer →	1	2	3	4	5	6	7	8
Decreasing profit		1	1	1	1	2	1		1
Disunity in the sector							2	1	
Bad use of pesticides							3		
Inefficient pesticides and uncontrollable plagues		3	2	3	2	3		3	2
Unfair competition from other countries								2	
Cost of support industry				2					3
Lack of support from administrations			3		3				
Lack of legal skilled labour		2							
Difficult to pay back the inversion						1			

There are some differences in the way that farmers and companies see the pesticides problem. In the companies the pesticides problem is a priority, except for the younger company that name it as the third problem for them. For the farmers the pesticide problem is evident, all of them point to the problem with pesticides as one of the most important but the main problem for farmers is the profitability of their productions or as they tell the decreasing profits in last year.

5.2.2 The detection of the problem

All the companies had the idea that the pesticides was been used in increased quantities. Nevertheless the most of companies did not detect it as a problem. Only the companies with most experience had detected the problem.

Experience-based problem detection

The problem have been detected in first hand as consequence of the own experience that the companies had. The way in what companies detected the problem respond to a reactive problem finding based on external signal. This is the case of the companies that know star to work with biological control, in most of the case they have had to face some sanctions because the pesticides residual in the past. The fact that a problem was detected does not imply that the companies see the real dimension of the problem but they could react quickly when the problem started to be evident.

One of the companies describes the detection of the problem as an up-and-down fluctuated slow trend. As we saw in the theory an up-and-down fluctuating slow trend makes it very difficult to attempt a problem and make it easy to forget the problem or to look for short-term solutions. The different focus in perception that is characteristic of human decision making made that those fluctuations were discriminated.

Communicated models of defining problem

This is the case of the newly started company in the case study that defined the problem thanks to a more communicative model. The company got help from more experienced companies and from the media to detect and define the problem. The company that have been on the market for three year now have the possibility to follow the most experienced companies in order to get a long-term solution to the problem.

5.2.3 The activity of change in companies

Once the companies and the farmers have become aware of the problem with the pesticides and have chosen a solution, then they have to start a new search to get information about the way they will advise the farmer in order to introduce biological control (in the case of companies that choose this alternative), or how to apply the biological plague control directly, in the case of the farmers.

Information process: Preparing for the change

The companies have now started a new information process in order to prepare a revolutionary change in the way of production. The “predator” companies are somehow leading this change. In this case, the information process means informing the different actors that will participate in biological control, i.e. giving good information about the different predatory insects that will be present in each scenario, look at table 1 (point 4.4).

The companies and farmers worry about how they will get information about the possible supply for predatory insects which could be a problem for the new season. Other questions that have emerged during this process are: Should the companies themselves produce the predatory insects or should they buy them supply companies? Should the companies take the responsibility of getting the predators insects or give the responsibility to the farmers? In the case of company A and B, the company wishes to have control over this issue and they will

get the predators. In company C the methodology was not yet defined when the study was done.

Planning the change

The “predator” companies started planning the way of advising farmers about the new production method as quickly as they chose the biological control as the solution to the pesticides problem. Planning means to take in account many factors, especially some logistic factors and the tools for advise the farmers. In April 2007, when this study was done, the companies had already chosen which communication tools they would use to try to engage the farmers in the process. The new season will start in August 2007, and then the companies will be ready to collaborate with the farmers who will produce with biological control. The “predator” companies in this study will have between 80% and 90% of associated farmers who produce with biological control of plagues. The difference compared to previous years will be evident when close any farmers were using predatory insects in their greenhouses. The companies have had to convince the farmers about the new method of production. The first step was to inform the farmers about the problem and to get their interest about the fact that there are other ways to fight the plagues. The group media method has been used by the companies to help the farmers to judge the alternatives. Then the companies have to help the farmers individually. With the introduction of the biological control of plagues surges the need to contract new technicians that will help informing and guiding the farmers. Some companies are planning the production with farmers and clients in order to have knowledge about how much products they will have and how much products they will sell. This is the cooperation tool that the companies use. The companies cooperate with the different actors involved in the process, farmers, clients and suppliers to facilitate a solution.

Monitoring the change

In most of the cases, the technicians will be the link between farmers and companies. The technicians visit the farmers in the greenhouses and get information about how the process is going. One example of how the technicians will know that the process of change is working properly is because the “orius” a predatory insect will be easily detected in plants. The companies can in this way see the success of the new production system but the main indicator that the plan has been a success is through the analysis that the companies periodically will do to prove that the vegetables are really free from pesticides and to see that the harvest is not damaged by plagues. The companies have to get continuous feedback from the farmers in order to know if the plan works. They will get the feedback from their technicians with respect to the work that the farmers do, but the companies will get feedback from their clients too.

5.2.4 Learning by doing. The change in farmers

In the case of the farmers, there are different factors that differ from the companies’ way of managing the problem. In order to analyse how the farmers change, I deal with the learning process in individuals. Learning by doing means that the farmers will learn much more from their experiences than from theoretical knowledge. The farmers are the people who will be working with the biological control of plagues and because they will prove the success of the system.

Motivation to change

In farmer, have some factor been very important in order to motive the change. As we see in chapter 3.3.2, there are internal and external motivations to change.

In the case of farmers the internal motivation are provoke by scared factor. In the interviews, most of the farmers told that they will change because they were afraid of get fines or sanctions. Some farmers were more positive to change because they thought have find another way of producing without using pesticides.

The external motivations that have induced a change in farmers came in form of “group pressure”. Group pressure is described here from the position of the companies that do what possible to induce a change in farmer. That is because most of the farmer answer that they had not chance when they was asked if they accept the new method, they told that the new method was imposed but at the same time the told that it was good and positive. The community will have an important paper into induce the change because using pesticides will be not accepted from now in the region and farmer, companies and society will not accept they that cheat.

Learning biological control of plagues

Learning is the previous step that the farmers need to go before they want to change. This attitude will lead to the accepting of the new production method, biological control of plagues and organically too. In the case we study, the farmer that starts to cultivate with biological control have got information about the problem and about the propose solution. They got the information in several ways but usually in meetings with the executives. Then they got the knowledge about biological control by the engineers of the companies. The farmers have different opinions at this point of the process, some of then told me in the interviews that they were sceptics about the success of the new method of fighting plagues but other saw in it a good and long term solution, a few think that the biological control is a previous step to organically production.

Attitudes to change have been creating in farmers but the definitive success of the change can be observed from the season that starts autumn 2007 that the new technical will be applied. The success depends of the capacity of farmers of learn the new technical.

Factors affecting the learning process in farmers

The farmers and the companies were conscious that it was some problems with using pesticides but nobody was doing something about it. One of the reasons was that the problem was not so obvious before than in November 2006 and then the farmer had not the same predisposition to learn about other existents technologies.

A factor that provokes this change in predisposition to learn is the urgency of the problem, after November 2006 the problem become obvious and the farmers have to accept that is not possible to use pesticides with guarantee.

The farmers worry about the decreasing profits more than the problem with pesticides that made very difficult the detection of the studied problem.

The problem is considered as complex by the farmers and this have made it difficult the learning process as farmers have not got the enough motivation to learn about the possible solution. One factor affecting it was that they did not know about other possible method to fight the plagues. For instance, the possibility of produce organically existed but it was not perceived as a serious alternative but as a hobby.

The environment has played an important roll in this process. One of the companies executives told me that they hope that a generational change will have a positive

effect in the acceptance of new ideas because now are many old farmer that start to retire and younger farmers start to take over greenhouses productions.

The clarity about the nature of the problem was affected in the beginning of the problem by a situation of stress and trauma. That explains that the farmers was upset about other issues and saw the problem as a political one. Presumable advantages have the farmers that accepted the problem, and saw it with enough clarity because they get time to think about the new solution instead to look for “guilty”

5.2.5 Discussion

Why have the problem not been faced before?

The problem have been detected from more than eight years ago for the most experienced companies but for some reason the problem have not been faced successfully. Those reasons will be explained in this chapter.

The fact that the managers have the past experience of a similar problem is not a guarantee for to solve the problem successfully. Some of the managers of the companies in this study have had to face the problem before. They have got a short- term solution but the problem has emerged again. The first explanation to it is that the managers have not given the enough attention to the problem or that they tried to solve the wrong problem. The problem, as it is now, is that the fruit-importation companies from most of the European countries does not want to buy product from the region because the pesticides. In the past the problem was formulate in other terms, for instance: it was that some buyer from Sweden have complained about the pesticides residual in some vegetables. The solution to the problem then and the solution to it now are different because the problem has been defined different. If the problem then was formulated as now, the solution could be a long-term one. A short-term solution that was applied in the past was for instance, do not to send vegetables that have been produced with a certain pesticide to Sweden.

Maybe for the same reason the managers have not had enough contact with the farmer who is the producer. The main problem for farmers is to ensure the profitability. To do it they have increased the use of pesticides in order to fight the plagues. The manager of the fruit- exportation companies have not listened for the real problem that the farmer have and have focused in other issues. For example, they can focus in the quality, the quantity and the prices that are one of the things that most worry a farmer.

Other character of the problem is that it has taken the form of an up-and-down fluctuating slow trend. The problem has not affected to all the companies at the same time and when it emerges, the manager have given it some attention and then the problem has been forgotten. The first sign of the problem was for eight years ago, then this issue fluctuated down and it fluctuated up again for three years ago. To solve it, they applied some rules, increased the quality control and banned the pesticides that caused the alarm and then the managers focused in other problem.

In the past the alternatives to use pesticides in production have not been so many. The ecological production have not been an alternative, even now it is an option that only a few choose. The production with biological control was not an alternative, the farmer did not know about it, and them that know did not think that it was an alternative to use pesticides. For three years ago the biological control was consider as insufficient to fight the plagues in the greenhouses of Almeria.

6 Conclusions

In this last chapter I will conclude the results that I got from the analytical part (the case studies) in relation with the theoretical part.

The decision of changing from an agriculture that uses pesticides to an agriculture based on biological control of plagues is the solution that in best way can lead the companies to get their objectives of selling products without pesticides residual and consequently avoid the problem that pesticides residues have caused to the companies.

The present conclusion is based on the studies about the process of decision making that the companies have made since the problem was detected for the first time. The decision of changing the way of production is based on accumulated experiences that the older companies have had, especially the last eight years, when sporadically pesticides diseases have been followed of respective short term solution, maybe as a consequence of an up-and-down fluctuating slow trend that made the decision makers be focused in other problems. Before, the technology could not ensure good results either with biological control of plagues but now the companies have started believe in biological control as a real alternative. The last thing have done that the companies are able to make a new decision bases in prior experiences but taking care about of not doing the same errors. After the respective information search the companies were able to present some possible solutions, one of them, to continue as now and increased the analysis, was rejected by the “predator” companies that realised that the permitted quantities of pesticides residual in vegetables was so low that the companies could not ensure to farmers a production free of plagues.

The alternative of producing ecological existed before but it was not considered as a serious solution. Now have it been considered by companies too, at least two of the three “predator” companies, A and B. Nevertheless, ecological produced it seen as a new opportunity in the market.

About the farmers, the first thing I can conclude is that the farmers and the companies have had different points of view about the problem with the pesticides. For the companies the main problem is how to get products that do not have pesticides residual to avoid fines, bad publicity and in order not to lose customers. For the farmers the main problem is how to ensure their profitability.

The second thing about farmers is that the companies which choice have been to apply the biological control of plagues, have made the decision in base to prior experiences as the problem have been detected before and not solve successfully. Farmers decide to change to biological control of plagues or ecological thanks to the motivation that they got from companies and because they were scared about fines and sanctions. For farmers solving the problem is a question of learning how to do with the new production system and it is in their hands the success of the change.

Bibliography

Literature and publications

Bell D.E., Raiffa H. and Tversky A., 1998. Decision Making. Descriptive, normative and prescriptive interactions. Cambridge University Press

Bloisi W., Cook C.W. and Hunsaker P.L., 2003. *Management and Organizational Behaviour.* McGraw-Hill, Berkshire

Diamond, G. 2005. *Collapse: How societies choose to fail or succeed. Why Do Some Societies Make Disastrous Decisions?* Penguin (Non-Classics), London

Food in Europe, 2007. Course Literature. *Production, Processing and Composition.* SLU, Open University of the Netherlands and De Montfort University

Giddens, A. 2005. *Sociology.* Polity Press, Cambridge.

Haeggbloom, S. 1982. *Rådgivninglära – en försöksupplaga.* Sveriges Lantbrukuniversitet

Klein G. & Pliske R, 2003. *Problem detection,* p. 14.

Kleindorfer P.R., Kunreuther H. C and Schoemaker P.J.H., 1993. *Decision Science. An Integrative Approach.* Cambridge University Press.

Kvale, Steinar. 1997. *Den kvalitativa forskningsintervjun.* Studentlitteratur, Lund

Leeuwis, C. 2004. *Communication for Rural Innovation. Rethinking Agricultural Extension.* Blackwell publishing, Oxford

Martinez Paz J.M., Martinez-Carrasco Pleite F. Montoya Lázaro B. 2001-2002. *Revista de Humanidades y Ciencias Sociales* ISSN 1139-8205, N° 18, 2001-2002, pages. 29-42

Merriam, Sharan B, 1993. *Fallstudien som forskningsmetod,* Studentlitteratur, Lund

Wenger, E. 1998. *Communities of Practice.* Cambridge University Press

Öhlmer B., Göransson B., & Lunneryd D., 2000. *Business Management. Småskriftsserien No 114, Dept of Econ, SLU, p 9-16*

Internet

AESAN, Spanish Food Security Agency www.aesa.msc.es

En el caso de los pimientos frescos con residuos de pesticidas no autorizados, 2006-12-29

1. <http://www.aesa.msc.es/aesa/web/AesaPageServer?idpage=56&idcontent=6746>

EFSA, European Food Security Authority www.efsa.europa.eu

1. <http://www.efsa.europa.eu/en.html>

EPA, Environmental Protection Agency, United States.

1. <http://www.epa.gov/pesticides/factsheets/ipm.htm>

Infoagro.com (www.infoagro.com)

Biological Control of Plagues, April 2007.

1. http://www.infoagro.com/abonos/control_biologico.htm
2. <http://www.infoagro.com/frutas/comercializadores.asp?start=1&koq=3&act=8&clave=4&pais=34&p=1>

**RASFF, Rapid Alert System for Food and Feed
2007 Weekly Overview Reports**

1. http://ec.europa.eu/food/food/rapidalert/archive_en.htm

Regional Government of Andalusia www.juntaandalucia.es

Real Decreto 1945/1983 of consumers' food security

1. http://www.juntadeandalucia.es/agriculturaypesca/portal/opencms/portal/com/bin/port al/Legislaciones/1983/Normativa_7067/rd_83-1945.pdf

IDEAL, www.ideal.es/almeria

La crisis del pimiento deja multas a 25 empresas y 25 invernaderos de Almeria

1. http://www.ideal.es/almeria/prensa/20070304/local_almeria/crisis-pimiento-deja-multas_20070304.html

SIDYM International Symposium on Desertification and Migrations, www.sidym2006.org

Garcia Lorca A., 2006. Technological changes and migratory flows: The case of the intensive agriculture in Almeria (Spain). 2007-05-30

3. http://www.sidym2006.org/imagenes/pdf/ponencias/7_s2.pdf

Personal messages

Company A

General Director

Personal meeting, 2007-04-17

Company B

General Director

Personal meeting, 2007-04-16

Company C

Quality Systems Executive

Personal Meeting and visit to installations of company, 2007-04-16

The Newly Started Company

Executive

Personal meeting, 2007-04-18

The Specialized Company

Administration Personal

Personal meeting, 2007-04-04

Appendix 1: Rapid alert system for food and feed.

RAPID ALERT SYSTEM FOR FOOD AND FEED

The legal basis of the system is Regulation (EC) No 178/2002 laying down the general principles and requirements of food law, establishing the European Food Safety Authority and laying down procedures in matters of food safety (O.J. No L 31 of 1 February 2002).

The purpose of the rapid alert system for food and feed (RASFF) is to provide the control authorities with an effective tool for exchange of information on measures taken to ensure food safety.

To assist the members of the network, information is classified under two different headings :

• ALERT NOTIFICATIONS

Alert notifications are sent when the food or feed presenting the risk is on the market and when immediate action is required. Alerts are triggered by the Member State that detects the problem and has initiated the relevant measures, such as withdrawal/recall. The notification aims at giving all the members of the network the information to verify whether the concerned product is on their market, so that they also can take the necessary measures.

Consumers can be reassured that products subject to an alert notification have been withdrawn or are in the process of being withdrawn from the market. The Member States have their own mechanisms to carry out such actions, including the provision of detailed information through the media if necessary.

• INFORMATION NOTIFICATIONS

Information notifications concern a food or feed for which a risk has been identified, but for which the other members of the network do not have to take immediate action, because the product has not reached their market. These notifications mostly concern food and feed consignments that have been tested and rejected at the external borders of the EU.

Consumers can be reassured that products subject to an information notification have not reached the market or that all necessary measures have already been taken.

The Commission publishes a weekly overview of alert and information notifications. As it is necessary to strike the balance between openness and the protection of commercial information, the trade names and the identity of individual companies are not published. This is not detrimental to consumer protection, as a RASFF notification implies that measures have been or are in the process of being taken.

The public must be aware that the Commission is not in a position to release more information other than that published here. However, in exceptional circumstances where the protection of human health requires greater transparency, the Commission takes the appropriate action through its usual communication channels.

The Commission informs the authorities of third countries of notifications concerning products manufactured in, distributed to or dispatched from these countries. However, the fact that a country is mentioned as the origin of a product does not necessarily imply that the identified hazard(s) originated in the country concerned.

Week 2007/11

TABLE 1: ALERT NOTIFICATIONS

Notifications in blue typeface concern feed, all other notifications concern food.

DATE:	NOTIFIED BY:	REF.:	REASON FOR NOTIFYING:	COUNTRY OF ORIGIN:
12/03/2007	Norway	2007.0187	migration of primary aromatic amines from ladle	TAIWAN
12/03/2007	Ireland	2007.0188	arsenic in natural mineral water	LITHUANIA
13/03/2007	France	2007.0189	histamine in tuna steak (<i>Thunnus albacares</i>)	SPAIN
13/03/2007	Sweden	2007.0190	oxamyl in beans (with pods)	SPAIN
14/03/2007	the United Kingdom	2007.0191	rodent tail in cereal bar	THE NETHERLANDS
15/03/2007	Germany	2007.0192	unauthorised use of colour E 102 - tartrazine in noodles	VIETNAM VIA THE NETHERLANDS
15/03/2007	Germany	2007.0193	unauthorised use of colour E 127 - erythrosine in confectionery	THAILAND
15/03/2007	Sweden	2007.0194	oxamyl in courgettes	SPAIN VIA THE NETHERLANDS
15/03/2007	the Czech Republic	2007.0195	too high content of E 452 - polyphosphates in deep-frozen, glazed Alaska pollock fillet (<i>Theragra chalcogramma</i>)	CHINA VIA POLAND
15/03/2007	Latvia	2007.0196	cadmium in zinc sulphate	VIA POLAND
15/03/2007	the Czech Republic	2007.0197	aflatoxins in salted pistachio nuts in shell	IRAN VIA THE SLOVAK REPUBLIC
16/03/2007	Denmark	2007.0198	sell by date exceeded of fish and fish products	DENMARK
16/03/2007	Austria	2007.0199	Salmonella spp in chicken döner	GERMANY
16/03/2007	Germany	2007.0200	deterioration of rabbit fillet	THE NETHERLANDS
16/03/2007	the United Kingdom	2007.0201	erucic acid in chilli black bean sauce	CHINA VIA THE NETHERLANDS
16/03/2007	Germany	2007.0202	aflatoxins in pistachios	THE UNITED STATES VIA THE NETHERLANDS
16/03/2007	Italy	2007.0203	parasitic infestation with <i>Anisakis</i> of fresh mackerel (<i>Scomber scombrus</i>)	SPAIN
16/03/2007	the United Kingdom	2007.0204	Salmonella spp in tahini	GREECE

TABLE 2: INFORMATION NOTIFICATIONS

Notifications in blue typeface concern feed, all other notifications concern food.

DATE:	NOTIFIED BY:	REF.:	REASON FOR NOTIFYING:	COUNTRY OF ORIGIN:
12/03/2007	the Netherlands	2007.APV	aflatoxins in groundnuts	ARGENTINA
12/03/2007	Greece	2007.APW	aflatoxins in dried nuts product (bonita)	SINGAPORE
12/03/2007	the United Kingdom	2007.APX	unauthorised substance lincomycin in honey	CHINA

DATE:	NOTIFIED BY:	REF.:	REASON FOR NOTIFYING:	COUNTRY OF ORIGIN:
12/03/2007	Greece	2007.APY	aflatoxins in dried nuts product (cubanita)	SINGAPORE
12/03/2007	Germany	2007.APZ	unauthorised genetic modification and unlabeled irradiation of instant rice noodles	UNKNOWN ORIGIN
12/03/2007	the United Kingdom	2007.AQA	illegal import of and absence of health certificate(s) for various food products	VIETNAM
13/03/2007	Spain	2007.AQB	arsenic in dried seaweed	JAPAN
13/03/2007	Spain	2007.AQC	aflatoxins in dried figs	TURKEY
13/03/2007	Italy	2007.AQD	ochratoxin A in raw coffee	HAITI VIA BELGIUM
13/03/2007	Italy	2007.AQE	parasitic infestation with Anisakis of fresh mackerel	SPAIN
13/03/2007	Poland	2007.AQF	hymexazol in unhusked rice	UKRAINE
13/03/2007	Germany	2007.AQG	aflatoxins in raw pistachio nuts with shell	IRAN
13/03/2007	the United Kingdom	2007.AQH	too high content of E 210 - benzoic acid in soft drink	NIGERIA
13/03/2007	Germany	2007.AQI	aflatoxins in raw pistachio nuts with shell	IRAN
13/03/2007	the United Kingdom	2007.AQJ	too high content of E 210 - benzoic acid in soft drink	NIGERIA
13/03/2007	the United Kingdom	2007.AQK	too high content of E 210 - benzoic acid in soft drink	NIGERIA
13/03/2007	France	2007.AQL	sulphite unauthorised and unauthorised colours Sudan 1 and Sudan 4 in spice mixture	SYRIA
14/03/2007	the United Kingdom	2007.AQM	aflatoxins in sliced sour oranges	IRAN
14/03/2007	Italy	2007.AQN	aflatoxins in pistachio nuts	IRAN
14/03/2007	Italy	2007.AQO	aflatoxins in bitter apricot kernels	IRAN
14/03/2007	Italy	2007.AQP	aflatoxins in hazelnut kernels	TURKEY
14/03/2007	Italy	2007.AQQ	aflatoxins in hazelnut kernels	TURKEY
14/03/2007	Italy	2007.AQR	aflatoxins in pistachios	IRAN
14/03/2007	Germany	2007.AQS	unauthorised substance isofenphos-methyl in fresh sweet peppers	SPAIN
14/03/2007	Portugal	2007.AQT	cadmium in whole frozen cuttlefish	INDIA
14/03/2007	the United Kingdom	2007.AQU	Salmonella in canteloupe melon	COSTA RICA
14/03/2007	Cyprus	2007.AQV	chlorpropham in baby food	THE UNITED STATES
15/03/2007	Malta	2007.AQW	undeclared wheat in various cakes	TURKEY
15/03/2007	Malta	2007.AQX	undeclared wheat in biscuits	TURKEY
15/03/2007	the Czech Republic	2007.AQY	mould infestation of hazelnut kernels	GEORGIA
15/03/2007	Spain	2007.AQZ	too high content of sulphite in frozen crabs and prawn tails	ANGOLA
15/03/2007	Spain	2007.ARA	unauthorised colour Sudan 1 in chilli powder	EGYPT
15/03/2007	Germany	2007.ARB	oxamyl and unauthorised substance isofenphos-methyl in red sweet peppers	SPAIN
15/03/2007	Germany	2007.ARC	unauthorised genetically modified papaya	THE UNITED STATES
15/03/2007	the Netherlands	2007.ARD	yeast infestation of orange juice	THE NETHERLANDS
15/03/2007	the United Kingdom	2007.ARE	unauthorised and unlabeled irradiation of dried rice stick	THAILAND VIA CHINA (HONG KONG)
15/03/2007	Greece	2007.ARF	aflatoxins in almonds	THE UNITED STATES
15/03/2007	Greece	2007.ARG	aflatoxins in blanched groundnut kernels	CHINA
15/03/2007	Italy	2007.ARH	aflatoxins in walnuts with shell (Bertoteilla excelsa)	BRAZIL
15/03/2007	Slovenia	2007.ARI	migration of nickel and of manganese from egg whisk	CHINA

Appendix 2: Europe's Minimal Residual Limits

Europe's MRL (Minimal Residual Limits)

Active substance that fight each insect	Minimum value/ MRL (ppm)
Active substance Name of pesticide	
White fly (<i>Trialeurodes vaporariorum</i>)	
Alfa- Cipermetrin Leman	0,100
Azadiractin Aling	0,003
Bifentrin Talstar 10 LE	0,020
Buprofezin Applaud, Geiser	0,007
Imidacloprid Confidor	0,010
Lambda cihalotrin Karate Zeon	0,033
Metil- Perimifos Actellic 50 E	0,333
Pimetrocina Plenum 25 WP	0,333
Piridaben Sanmite	0,003
Piriproxifen Atominal	0,003
Teflubenzuron Nomolt	0,010
Tiacloprid Calypso	0,003
Tiametoxan Actara 25 WP	0,003
Thrips (<i>Frankliniella occidentalis, Thrips tabaci</i>)	
Acrinatrín Rufast	0,003
Azadiractin Aling	0,003
Deltamtrin Decis	0,067
Formetanato Dicarzol Gran	0,010
Melation Calig, Malathion	1,000
Metiocarb Mesurol	0,003
Naled Lainsect	0,003
Oxamilo Vydate 10 L	0,010
Spinosad Spintor 480 SC	0,003
Lufenuron Match	0,003
Red spider (<i>Tetranychus cinnabarinus & T.urticae</i>)	
Abamectina Vertimec	0,050
Sulphur Sulphur	50,000
Bifentrin Talstar	0,067
Plant-louse or aphid (<i>Myzus persicae</i>)	
No data	
Caterpillar (<i>Spodoptera exigua and others</i>)	
Cipermetrina Nurelle 10 EC	0,1
Deltamtrin Decis	0,2
Flufenoxuron Cascade	0,5
Indoxacarb Steward	0,5
Lambda cihalotrin Karate Zeon	0,1
Teflubenzuron Nomolt	0,5
Metomilo Lannate	0,5
Citrus leafminer (<i>Phyllocnistis citrella</i>)	
Abamectina Vertimec	0,050

Pris: 100:- (exkl moms)

Tryck: SLU, Institutionen för ekonomi, Uppsala 2007.

Distribution:

Sveriges lantbruksuniversitet
Institutionen för ekonomi
Box 7013
750 07 Uppsala
Tel 018-67 2165

Swedish University of Agricultural Sciences
Department of Economics
P.O. Box 7013
SE-750 07 Uppsala, Sweden
Fax + 46 18 673502