Survey of farmers' reaction to modern silvoarable systems

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Survey of farmers' reaction to modern silvoarable systems in Europe

Will European farmers adopt silvoarable agroforestry technology in the near future?

Captions for the cover pictures

The different teams involved in the survey have investigated the constraints and the potential on agroforestry expressed by samples of farmers, and the likely uptake of agroforestry. Target areas have been identified in each country to study the farmers' attitude.

1. The introduction of trees in crop area could be a technical problem... What is the farmer opinion about it?

2. French landscape in a very intensive area for cereal production. In such area, where farmers have been used to uproot trees in their crop area, could agroforestry systems have a place?

3. In seven countries, we have been interviewing farmers to get their reaction and feeling about agroforestry, like here with Andrea Pisanelli from the CNR in Italy.
List of persons who have participated in the survey

SAFE Coordination: **Christian Dupraz** (INRA)

Leader WP2 and survey responsible: **Fabien Liagre** (APCA)

**Interviews and regional survey report:**

France: **Fabien Liagre** (APCA), Maité Bellido (INRA),

Germany: **Bernd Schindler**, Frank Schumann, Martina Mayus (INRA), Philip Nenninger, Maria Sader (FINIS)

Greece: **Kostas Mantzanas**, Evripidis Tsatsiadis, I. Ispikoudis and V.P. Papanastasis (Auth)

Italy: **Andrea Pisanelli**, Piero Paris (CNR)

Netherlands: **Michel Postma**, Martina Mayus (WU)

Spain: **Maité Bellido**, Gerardo Moreno, Eduardo de Miguel, Maria Jesus Montero (UEX)

United Kingdom: **Anil Graves** (Cran)

**Data Analysis:**

Fabien Liagre (APCA), Carole Barthes (Agroof Development), Mourad Ayouz (CNRS).

Special thanks to Jean Marc Barbier and Fabrice Dreyfuss (INRA UMR Innovation) for their help in the data processing.
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1. Introduction

Introducing silvoarable plots in a farm results in a key change in the farming system or in the farmer activity. Although agroforestry played an important role in the history of European agriculture, introducing trees back in the middle of cropped fields is a radical innovation in the modern context. The new silvoarable systems proposed by the SAFE consortium depart from the ancient systems with little mechanization.

Initially, the come back of silvoarable agroforestry in Europe was a researcher vision. A vision that is provocative for intensive farmers such as those from the Beauce French Province or the Bedford English region. Will the Spanish farmers from Castilla or the Dutch farmers show some interest or some suspicion for this new system? Which technical method European farmers will adopt when setting up some silvoarable plots in their farm? Are they ready to intercrop in the silvoarable plot of the neighbour landowner? What kind of questions do they raise and what advice do they expect from extension services in the future?

These are the (ambitious) goals of this deliverable: evaluating the acceptability of this major innovation by farmers. This was the main priority of the interviews realised for this purpose.

The different objectives of the survey were:

- To record initial feelings about agroforestry from unaware farmers
- To identify the major constraints for silvoarable agroforestry adoption from the point of view of farmers.
- To define if setting up an agroforestry plot on their farm in the near future was a sound prospect.
- To analyse how local regulations have an impact on farmers reaction
- To classify farmers’ according to their response to agroforestry.
- To define scenarios for WP7 farm-scale simulations

Seven countries have finally participated in the survey (see Figure 1). This is a significant effort compared to the 3 countries that should have done this according to the Technical Annex of the project. This was considered as very important tasks by all SAFE partners, and this explain that we concentrated more efforts in this task.
2. Methodology

The first step of the survey was to imagine a common methodology for each partner and local survey, mainly based on farmers’ interviews. A first evidence was that the questionnaire had to be exactly the same, and the way to conduct the interview had also to be the same. The main difficulties of the study were therefore the heterogeneity of the different countries involved in this task according to their agricultural context and the fair number of partners. We’ve imagined a common approach to consider the diversity of the rural contexts, from Greece to the United Kingdom! And we spent a lot of time exchanging about the content of the questionnaire... Another difficulty resulted from the different knowledge of some partners according to the modern silvoarable systems and the way to show this new idea to the farmers. And for some partners of the Research, who are used to work in closed experimental sites, it was quite new or unusual to interview some farmers...

2.1. Choice of the regions

The survey was supposed to be done in regions with no prior knowledge or practise of agroforestry (see Annex 1). For some countries, this condition was easy to carry out. That was the case for France, England, The Netherlands or Germany. In other countries, the traditional practices in agroforestry are still active and it was therefore difficult to find a province without any practices of association with trees. In these countries, (Italy, Greece and Spain), the survey was carried out in regions with very few trees left in the agricultural landscape.

In some cases, the lack of contact with farmers’ organisations or farmers’ extension services in these areas, and also due to the small budget of some partner made difficult the choice of the target area. In Greece, for example, the survey was realised in the Askio municipality though it would have been better to do the survey in other regions, such as the large plains near Thessaloniki or the plateaux near Kozani, with very few trees per hectare.
2.2. Constitution of the questionnaire

The objective of the study was to evaluate how farmers reacted to the proposal of establishing new silvoarable plots in their farm. We concentrated on silvoarable agroforestry and not sylvopastoral systems. Before farmers answered questions, they have been delivered standard information on the technical and economical aspects of new silvoarable systems, including their environmental value. Questions have also explored what level of subsidy or what kind of incitement is needed to adopt new silvoarable schemes. In consequence, we had to imagine a questionnaire that could not depend on local agricultural or forest policies, even if one of the goals of the questionnaire was of course to help identify limitations due to local policies.

The questionnaire was prepared with all the partners involved in this task. The full questionnaire is available in Annex (see Annex 2). It consists in mainly closed questions which allow comparisons between countries, and comparison of evolution over time.

The interview was structured into 5 parts:

- Recording general data of the farm: area, age, status of the farm…
- Analysing the feelings of the farmer towards trees: presence of isolated trees, hedges, level of maintenance of these trees…
- Exploring the feelings of the farmer to the silvoarable technology (a priori and a posteriori, i.e. before and after a slide-show presentation): list of positive and negative aspects, argument to set up a silvoarable project on his farm…
- Defining an agroforestry project for the farm. We asked each farmer to imagine a virtual silvoarable project and to define all the technical aspects they were thinking about and to explain all the technical choices they would have made (area, specie, intercrop, distance between the trees, maintenance of the trees…). We also asked them to describe the labour organisation of the project and to determine the level of investment they were ready to support (% of the financial investment).
- At the end of the interview, we asked him his feeling about agroforestry and if he was disposed to create some silvoarable plantations on his farm.

Each part has been analysed separately.

The people doing the interviews should use exactly the same documentation everywhere. A special slide-show has been created with photos of some European silvoarable systems (see Annex 3: Slide show). This slide show presents some photos of traditional and modern systems with extra photos showing the main features of the silvoarable systems. We didn’t consider the discussion about the juridical and subsidy aspects, due to the heterogeneity of each national context. Indeed, the possibility to get or not some subsidy for the plantation investment could have modified the farmer’s behaviour during the interview.

2.3. Constitution of the farmers’ samples

The methodology has been the same in each country. We tried to concentrate on interviews with farmers with no knowledge nor practice of agroforestry. Of course, in some countries,
such as Italy or Spain, we met some farmers with knowledge of agroforestry. In that case, we tried to analyse the questionnaire results separately. In any case, we tried to select some farmers in favour of agroforestry. That was not the aim of the study: if we had interviewed the farmers who were in favour of agroforestry, we would have learned, as a result, that they were in favour of agroforestry!

Consequently, they have been selected at random, to give a good perspective on farmers’ reactions to silvoarable agroforestry in a given region. 20 to 30 farmers have been interviewed in each region or country.

The interviews have been addressed to land-owning farmers and also leasing farmers. The common feature is that they don’t necessarily know anything about agroforestry and don’t necessarily have any agroforestry project on their land.

- Land-owning farmers: For each region, the first step was to identify a typology of the farming systems including details of the crop systems. According to this typology, we could select at random the farmers in the most representative types of farming systems including crops.
- Leasing farmers: a farmer can be an owner but also rent some part of the land. We can find out his/her reaction on the possibility of doing silvoarable agroforestry on the rented area.

To get the addresses of the farmers resulted as a main difficulty in trying to conserve a common approach. Some professional organisations have been reluctant to give the farmers’ data. Some countries such as The Netherlands had to pay to get the information. In France, thanks to the network ROSACE managed by the Chambers of Agriculture, it resulted relatively to be easy to get these data.

Photo 1: In France, regional meetings have been hold before the interviews with the extension services in each target regions to present the objectives and methodology of the survey. A strong collaboration with the Chambers of Agriculture helped to create the samples of the farmers. During these meetings, some officers expressed some doubts about the possible interest from the farmers about planting trees in their cropped fields...
<table>
<thead>
<tr>
<th>Partner</th>
<th>Country</th>
<th>Name of interviewers</th>
<th>Provinces</th>
<th>Number of interviews</th>
</tr>
</thead>
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<tr>
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<td>Maité Bellido Fabien Liagre</td>
<td>Centre</td>
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</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Poitou Charentes</td>
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<td></td>
<td>Franche Comté</td>
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</tr>
<tr>
<td>WUR</td>
<td>Netherlands</td>
<td>Michel Postma</td>
<td>N-Friesland</td>
<td>15</td>
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<td></td>
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<td></td>
<td>E-Achterhoek</td>
<td>14</td>
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<tr>
<td>UEX</td>
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<td>Maité Bellido Eduardo de Miguel Maria Jesus Montero Gerardo Moreno</td>
<td>Extremadura</td>
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<tr>
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<td>Castilla y Leon</td>
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<td>FINIS</td>
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<td>Bernd Schindler, Frank Schumann, Philip Nenninger, Maria Sader</td>
<td>Brandenburg</td>
<td>10</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>Schleswig-Holstein</td>
<td>6</td>
</tr>
<tr>
<td>AUTH</td>
<td>Greece</td>
<td>Kostas Mantzanas Evripidis Tsatsiadis</td>
<td>Municipality of Askio</td>
<td>20</td>
</tr>
<tr>
<td>CNR</td>
<td>Italy</td>
<td>Andrea Pisanelli Piero Paris</td>
<td>Central Italy (Umbria and Lazio)</td>
<td>20</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Northern Italy (Lombardia, Veneto)</td>
<td>20</td>
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<tr>
<td><strong>TOTAL</strong></td>
<td></td>
<td></td>
<td></td>
<td><strong>264</strong></td>
</tr>
</tbody>
</table>

Table 1: Number of farmers’ interviews performed by each partner for preparing deliverable D8.3.

The total number of interviews resulted very satisfactory (see Table 1). It was above expectations in some countries like in Spain. A total of 264 interviews have been available for the final analysis. Each team has submitted a national synthesis report following a common plan, as requested by the WP coordinator Fabien Liagre. The number of interviews could appear too poor for a statistical analysis when it’s below 20 for a given region. That was the case for the regions of 3 countries (Germany, England, and The Netherlands) and for the region of Franche Comté in France.

Each farmer has been contacted by phone to get the appointment. By phone, the interviewer presented the survey as a European Research Development Programme about an innovative system. In any case we didn’t mention agroforestry or trees, to avoid influencing the farmer before the interview or cancel some meetings with farmers against the tree presence in cropping area. The refusals to obtain an interview were therefore due to a planning problem of the farmer or a non interest in being interviewed in general. Many
farmers also stated that they had already devoted so much time in filling in forms and responding to questionnaires... In The Netherlands, some farmers were enthusiastic about a research in which farmers were asked for opinion about a new land-use system. But sometimes, some farmers’ wives, contacted by phone, refused to put their husband on the telephone before knowing what it was all about. After informing them about the reasons of the call, some replied that their husbands would not be interested or were too busy... But they usually called their husband!

The major reasons for not accepting an interview were:

- the farmer is too old, decreasing his farm or already stopped farming and thus is not interested in hearing or talking about innovative land-use systems
- the farmer does not have time for an interview
- the farmer is not interested anyway, often indicating that he is too much asked for contribution by all research-development interviews.

Farmers found willing to participate mostly indicated to:

- be interested or seeing no harm in hearing and sharing opinions about innovative land-use systems
- have time anyway, because they were not so busy at this time of year
- be so because they were interested also in sharing their knowledge for the purpose of a research development programme.

Photo 2: All the interviews have been realised face to face, like here in Italy with Andrea Pisanelli and a land owner. Each interview lasted between 30 to 90 minutes according to the interest and availability of the farmer.

The selection of the sample was therefore an extremely time consuming process, both with regards to the initial attempt to find farmers through farmers’ organisations and with regards
to the number of phone calls and contacts that had to be made to collect the data and meetings.

Despite this time consuming, the interviews have been generally welcomed by the farmers. In fact, in this particularly period of change concerning the Common Agriculture Policy, farmers were interested in discussing a new form of agriculture. Very few farmers have showed a real disappointment when we began to speak about tree plantation inside their cropping area… For example, in France, only 2 farmers (for 59 farmers in total) told us “If you’d told me that it was about planting trees in my plots, I wouldn’t have accepted to be interviewed…”. The majority of the farmers were very helpful and obliging. They often had to sacrifice their leisure time to find a mutually suitable time. Therefore, many interviews took place late in the evening or between two farming tasks. They answered the questions with a lot of patience, especially considering the length of the questionnaire and the amount of time that it took to complete. Thus, the interviews themselves were a most interesting experience. A lot of farmers were happy to discuss about new opportunities or possible diversification and thanked us for this. “We are always in pursuit of new ideas for the future,” as some of them told us…
3. Preliminary presentation of the sample

Who are the farmers we interviewed? And what are their farming systems? The first questions of the questionnaire allowed us to describe our sample and to give us the possibility to distinguish some groups to be analysed separately.

Of course, it’s very important to remember that these samples ARE NOT REPRESENTATIVE of a country but from a specific region we chose for the survey. It’s not the matter to compare the Greek farmer with the British one… We didn’t follow a national statistical approach at a national level. But at the regional scale, we suppose that the sample is representative. We can nonetheless point out that some differences we observed between the groups can occur because of some specific national contexts that we will try to precise.

3.1. About age of the farmers and succession…

![Figure 2: Distribution of the age of the farmers all regions taken together](image)

In the whole sample, every age bracket is well represented. But this homogenous distribution hides some regional disparities (Figure 3).

![Figure 3: Distribution of the interviewed by age and by region](image)

Thus, we can distinguish some regions with a homogenous distribution such as the regions from France, Germany, England and The Netherlands, and also the region of Extremadura in
Spain. Notice that the youngest samples are in both regions from Germany. The main feature of the other regions is that more than 50% of the farmers are more than 50 years old: Greece, Italy and Castilla la Mancha and Castilla y Leon in Spain.

The age of the farmer is a key parameter at the moment to analyse his attitude towards the feasibility of agroforestry. Of course, a young farmer, recently set himself up in his farming business has different objectives or obligations than an older farmer. And we can also imagine than the older farmers have other experience or way to see their farming activity… We will come back to this aspect in the statistical approach to see if the age has played a strong role or not in the possible adoption of the agroforestry idea.

When we tackle the possibility of a new farming system on a long term production that could be last more than one generation, we must take into account the eventuality for the farmer to have a successor on the farm (Figure 4). The presence of a successor can of course influence the decision of the farmer to invest or not.

In average, one third of the farmers know that they have a successor against one third who don’t know. Generally, older the farmer is, better he knows who will be his successor. And the regions where we have the older farmers in the sample are the regions where the farmers know that they have a successor. Similarly, the young farmer can’t name a successor because the children are too young. But we notice also that many farmers are suspicious about the agriculture future and don’t want to push their children, above all when they are students, to choose the farmer’s job. And many farmers indicated not to have a direct successor within the family. Many of these possible successors are in fact young neighbours of 30 to 40 years old who want to get more cropped area (like in the Netherlands, Germany or France). Many times farmers said they had rather not see their children becoming farmers, because of the bad conditions and prospects.

### 3.2. Juridical status of the farming system

For each farmer, we specified the status of the farming system to distinguish the individual farmers from the companies with more than one member.
In the French sample, 40% of the farmers are working under cover a society, in association with one or more farmer, generally a family member (brother) or an external associate. These companies allow to share the production costs (machine for example). We find again this feature in the samples of Germany or England, or Spain. In other countries, almost all the farmers are under an individual structure. For Greece, it’s due to the fact that their farming activity is a part-time job and that in this region, the juridical use of farming company is not common.

3.3. **Responsibility of the farmers in the rural society**

During the interview, we also asked the farmers their degree of implication in the rural life: are they invested in local politics? Have they a part in an agricultural organization (cooperative, technical organization, ...) ? Some teams of the survey, especially in Italy and Spain, have obtained the list of farmers thanks to the help of some cooperative or agricultural institutes. This fact has therefore influenced the results to this question. In the other hand, without going too far in the interpretation of the results, the answers given by the farmers seem in some cases to confirm some social differences we can observe from a country to another.

The farmers of the German and French samples are more implicated in the political life than the other countries. In Italy, France and Spain, a strong part of the farmers are involved in some agricultural organizations, often in some cooperative structures.

In the United Kingdom and the Netherlands, a significant percentage of the farmers are representative of private food companies.
3.4. Area and farming systems

At the moment to take the decision to plant trees in the field, the question of land tenure and also of the importance of the area available for planting is an important variable to analyse. We asked each farmer to describe the importance of the cropped area, the number if hectare he owns and the kind of farming system he developed on his farm (kind of system, number of crops).

3.4.1. Farming area and land tenure

The total area of the farms we visited is relatively heterogeneous and depends of the regional context. In Askyo (Greece), the sample is really definite by small agricultural sizes. On the contrary, in Castilla y Leon (extensive cereal systems) or in Brandenburg (historical reasons), we observe very big farms.

<table>
<thead>
<tr>
<th>Country</th>
<th>&lt;20 ha</th>
<th>20-50 ha</th>
<th>50-100 ha</th>
<th>100-200 ha</th>
<th>200-300 ha</th>
<th>300-500 ha</th>
<th>500-1000 ha</th>
<th>&gt;1000 ha</th>
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<td>UK</td>
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<td>22</td>
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<td>10</td>
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</tr>
<tr>
<td>total %</td>
<td>18%</td>
<td>17%</td>
<td>22%</td>
<td>23%</td>
<td>8%</td>
<td>5%</td>
<td>4%</td>
<td>3%</td>
<td></td>
</tr>
</tbody>
</table>

Table 2: Number of farms according to their field area.

We must nonetheless point out that when we considered the farm area according to the number of persons working on the farm, the average of some region decreases strongly. This consideration reduces the differences between the regions (see Table 1).
Region | Area by farm Ha/farm | Area by worker Ha/worker | Total of workers/farm
---|---|---|---
West Macedonia (Gr) | 3,6 | 1,3 | 1,5
North (I) | 45,8 | 36,9 | 1,7
N-Friesland (N) | 52,4 | 39,2 | 1,4
E-Achterhoek (N) | 61,0 | 46,0 | 1,5
Poitou-Charente (F) | 114,7 | 98,9 | 1,4
Center (I) | 119,6 | 44,4 | 2,4
Castilla-La Mancha (S) | 120,4 | 50,7 | 3,2
Franche-Comté (F) | 130,1 | 98,6 | 1,3
Castilla y Leon (S) | 133,9 | 83,4 | 1,7
Centre (F) | 134,7 | 104,1 | 1,4
Extremadura (S) | 302,3 | 80,1 | 10,9
Bedford (UK) | 305,9 | 106,5 | 3,4
Schleswig-Holstein (G) | 391,7 | 162,6 | 3,4
Brandenburg (G) | 1454,4 | 65,0 | 11,8
**total** | **200,4 ha** | **69,6 ha** | **3,5 w**

Table 3: Average of the total farm area and of the farm area by worker for each region.

In fact, except the Askyo sample where the average represents only 1.3 ha/farm, we can distinguish 2 groups of samples:

1. The sample where the farms don’t exceed more than 50 ha by worker: that’s the case of the regions of Italy and The Netherlands, Castilla la Mancha.

2. The sample where the farms exceed 65 ha by worker: we can name the regions of France, UK and Germany and also Castilla y Leon and Extremadura. In Germany, after the Second World War, some huge farms have been created to organise the production. In the Brandenburg sample, we have 3 farms which count more than one thousand of hectares (the biggest farm counts 6458 ha where are working 39 persons!). But with the reunification of Germany, many small farms came into existence alongside these cooperatives. These small farms have been considered in the sample constitution.

More than 50 % of the farmers we interviewed are owner of more than 50 % of their cropped fields. And 38% own the totality of their land. Only in the samples of France, farmers are used to rent a large part of their fields : more than 75 % of the farmers rent more than 50% of the field they cultivate. In Greece and Spain, a large part of the interviewed persons are retired farmers or land tenants who are renting their field to other farmers or paying some workers for cultivating (see Figure 7).
3.4.2. Farming system and diversification of the farms

In the methodology, we tried to select only farming systems specialized in crops. According to each region, it was not easy to satisfy this criterion. For example, in the Netherlands, the survey has been conducted mainly with farmers producing both cereals and livestock. In the countries of the South, a lot of farms include fruit production (orchard and vineyard) (see Figure 8).

Figure 8: Farming systems specialization of the farms selected for the samples.

In a perspective of adoption of a silvoarable system, the diversity in term of crops produced by the farmer is interesting to study: could represent a possible flexibility at the moment to
choose the best couple tree/crop to associate? Or could it be a significant indicator of adaptability of the farmer?

![Bar chart showing number of crops produced by farmers in each region.]

**Figure 9: Number of crops produced by the farmers in each region.**

Again, in the description of this variable, we can distinguish the Mediterranean regions from the template regions. In UK, Germany, France or in the Netherlands, the number of crops produced by the farmer is generally higher than the farmer from Greece, Spain or Italy.
4. Trees consideration in the farming systems

4.1. Feeling about trees in crop field…

How are rural trees considered by the farmers? Could the adoption of a silvoarable system be linked with a special feeling with the trees? Could a farmer be interested in creating a silvoarable project even if he hadn’t any tree in his fields?

Photo 3: A beautiful oak in the limit of two plots in the Centre Province in France. In this region, most of the farmers we interviewed didn’t know the history of these isolated trees. The trees were often considered as an obstacle to the regrouping of lands. If the farmers admit their environmental and social value of the rural trees, they also mean an over cost for the labour of the farmer and above all a reduction of the eligible area to the European crop payment…

Photo 4: In some regions like here in Askyo in Greece, rural trees are very common. These oak trees are integrated in the traditional landscape. The agricultural plots are usually small. In 2003, a project of regrouping the land cause irreversible damage in this landscape. How to reconcile the tree presence with the income obligation of the farmers who need to extend his farming area to survive?

In the sample, we have the same proportion of farmers having or not hedges surrounding their fields. The French and Spanish farmers have almost none hedges, excepted for the regions of Franche Comté and Extremadura.

In 43% of the cases, farmers have no isolated trees in their fields, above all in the regions of Franche Comté, Centre, Bedford and Castilla y Leon (see Figure 10). In Franche Comté, which is a high forested region, farmers avoid to conserve the trees in the poor crop land they have. They try to separate carefully trees from crops. In Centre, where we have very few trees in the landscape, it's more a question of agricultural tradition. In this very productive region, the habit is to devote the maximum area for crops. In Spain, half of the farmers have no trees in their field to increase the eligible area to the CAP payments…
In the farms where we find some trees, it must be pointed out that the trees have not a very high economical value. Only 18% of farmers owning field with isolated trees have planted themselves some trees (see Figure 11). The majority of the others farmers recognized that they don’t know their history and who have planted them. Generally the existing trees are conserved principally for the fruits or the fodder and the firewood production they offer. The second argument given by the farmers for keeping the isolated trees is for the environmental value or the landscape. But when the trees are getting older, they usually cut them without replacing them.

We can underline nonetheless that the farmers from Spain are still considering the trees as a possibility of income. The trees are pruned and the use of replacing the dead trees is still frequent. On the other hand, in The Netherlands or in Germany, none of the farmers indicated to maintain these trees nowadays for reasons of production. Most farmers say to maintain the trees because of their landscape value and/or because of the rules.
A majority of farmers recognized to have cut some isolated trees in their field, principally for mechanical adaptation. It’s particularly true in France, UK, the Netherlands and Greece where the farmers said also that trees are usually pruned to prevent problems with the machines and to decrease the effects on the crop.

Figure 12: Are these trees pruned or maintained in any way?
Farmers declared in Greece and Italy that they usually cut the trees to get more area and to aid the machine access.

4.2. Do the farmers like the trees?
54% of the farmers have declared to like against 38% who consider themselves as uninterested and 8% who don’t want to hear something about trees.

Figure 13: Do you like trees in general?
In the sample, a strong difference is observed between the regions. We have a strong proportion of farmers who like trees in Italy, Germany, Extremadura, United Kingdom, in Achterhoek or Poitou-Charentes. In Poitou-Charentes, the presence of the trees in the rural landscape is historical and some local areas are famous for their hedged farmlands. We can notice that in Achterhoek, the regional government support the tree conservation and give also some subsidy for the tree plantation which can help to increase the tree affinity… In fact,
in this region, despite a very high percentage of farmers loving the trees in our sample, very few of them have trees in their own farm...

Most farmers responded positively to the question if, in general, they liked trees. Most farmers though, added something like “but only in the forest, where they belong to” or “as long as they are not on my fields”.

To avoid mechanical problems and to improve the subsidy eligibility of their fields, farmers are used to cut the trees. During the interviews, it’s perceptible that farmers didn’t know the history of the existing trees in their field. The decreasing of the traditional uses of the trees reduces the interest in conserving them. Most of these trees are old and the plantation schemes are not adapted to the modern context of their farming systems. Trees are therefore seen as a problem to improve the efficiency of the farmers’ labour. When they keep the trees, they usually maintain them until they die out and very few of them are then replaced.

Nonetheless, besides a perceptive economical value, the notion of improving the landscape by the tree presence is very important in farmers’ mind, above all in the region where there are a few trees in the rural landscape. And the availability of a subsidy seems to convince some farmers to keep the isolated trees.

Many farmers are now torn between keeping or not the existing trees for regulations reasons... On one hand, the tree presence represents a cutback in their CAP payment, but on the other hand, he can get European subsidy to maintain or to plant new trees, and this, thanks also to the new agro-environmental measures. In some cases, it could also be prohibited to touch the trees... The lack of coherency in the regulations puts the farmers in trouble and complicates the management of the farm.

## 4.3. Perception of agroforestry

One of the main conditions we tried to reach in the sample constitution is to interview farmers with no prior knowledge of agroforestry. Of course, it was quite possible to meet some farmers who knew these systems, above all in some countries where the traditional systems still exist. Before going further in the study of their reaction to agroforestry, we examined the eventual knowledge of each interviewed farmer about agroforestry. First, we recorded the definition they would have given to the word agroforestry. After explaining the definition exactly consists in, we collected the source of their possible knowledge of agroforestry.

25 % of the farmers have given the right answer to the definition (see Figure 14). In the traditional regions of agroforestry such as Italy or Greece, this percentage is higher. In Brandenburg, Schleswig-Holstein or Franche Comté, where the systems of Pré-verger and Streuorbst are still very present in the rural landscape, farmers gave a right definition. They nonetheless saw agroforestry as a possible association of the trees with pasture more than with crops.

For one third of the sample, and it’s particularly true in Spain, the word agroforestry means a tree plantation on an agricultural land. The term “forestry” refers immediately to a forestry activity, cancelling the prefix “agro”. In that case, it rather gives a negative feeling from an agricultural point of view, meaning a disappearing of the crop in an agroforestry project...
Figure 14: Definition given by the farmers to the word “Agroforestry” before the slide show

First, it must be underlined that effectively a majority of the farmers have never heard about agroforestry (see Figure 15), according to our selection methodology. It’s interesting to notice that in France or The Netherlands, farmers have discovered agroforestry by reading articles in some newspapers or scientific reviews than by personal experience. Some farmers, during the interview, have also shown us the article about this topic that they have conserved in their files, demonstrating a first interest to this practice. Even in Franche Comté, where man has the possibility to visit some traditional systems, farmers have rather discovered the notion of agroforestry in some professional newspapers. While in the Mediterranean regions, farmers know agroforestry mainly thanks to some concrete experience they have seen in their region.

Figure 15: Source of the knowledge of the agroforestry systems

After the discussion, one third of the farmers said that they have seen some silvoarable systems above all in Italy, Greece, Extremadura and Schleswig-Holstein. In Askyo and in Schleswig-Holstein, the SAFE programme has set up some experimental plots, which of course influences strongly the knowledge of the farmers who were interviewed… In Bedford,
some farmers of the sample knew the existence of a scientific experimentation in the University of Cranfield.

| According to our initial requirement, the majority of the farmers didn’t know the silvoarable systems. A large part of the farmers are a little confused with the suffix “forestry” in the word agroforestry which gives to think that agroforestry means an afforestation system. Only 25% of the farmers gave a right definition, mostly farmers who are involved in professional or political charges. The discussions pointed out also that the communication around agroforestry, either in the professional or scientific literature or thanks to the visit of some experimental plots, plays an important role for the dissemination of the agroforestry idea. |

5. **First impressions after the slide show**

The slide show corresponded to the idea of agroforestry of the farmers who know agroforestry (see Annex 3). The photos impressed some farmers who didn’t know this kind of farming systems above all because in some photos, it seemed possible to harvest between the trees... One of the general comments was that, effectively, if the trees are well disposed, perhaps it’s possible to intercrop. Without responding to their direct questions, we pointed out all their remarks and tried to rank them, separating the negative remarks from the positive ones.

A general comment was also that, at the beginning of the discussion, the farmers were more likely to list the negatives points rather the positive ones!

### 5.1. The interesting aspects suggested by the photos

When we asked the farmers what was the main positive point they would underline in the silvoarable systems, more than half of them see above all the production aspect. Only a quarter placed the environmental value in first place. Finally, 16 % didn’t see any advantage in agroforestry (see Figure 1).

![Figure 16: Positive aspects mentioned in first place after the slide show.](image)

The main interesting aspect seen by one third of the farmers is the possibility to produce a good quality timber and to increase the feasibility of the farm activities. But investing in agroforestry is considered as a possibility of diversification, thanks not only to a new production (timber), but also to a secondary production such as a fruit production. Some farmers underlined also some new production possibilities such as an evolution of the cropping area toward a pasture production. All these economical aspects are more present in the Mediterranean countries such as Spain, Italy and Greece where there is a strong market for timber production (see Table 4). In the other countries, these aspects are also very present but on a same degree as the environmental aspects.

The notion of environment is difficult to work out in the farmers’ mind. Many farmers answered that the main advantage they see is for the environment but without précising on which aspect... On the contrary, other farmers named concrete environmental aspects such as the effect on the plot biodiversity and above all on the soil and water protection. But the main aspect is certainly the quality of the landscape offered by the trees introduction in the
field. Indeed, the landscape is named by a large number of farmers, above all in France and England, even if it’s not always the first advantage they underline. In regions with very few trees in the landscape like in the region Centre in France, farmers put forward the impact on the small game regeneration.

Looking at the possibility to produce some trees for timber, farmers have placed the possibility to harvest for themselves the trees before than for the possible descendants. Only 4% of the farmers have mainly considered agroforestry as a good opportunity to leave a patrimony to their family.

To plant trees in their field would be considered as an opportunity to give a better image of the farmers or to improve their relations with the landowner. Even if this aspect is mentioned by 2% of the sample as the main positive aspect, it’s frequently named in the discussion. In England, it’s one of the main features suggested by the farmers as much as the improvement of the landscape and the diversification.

A first surprise of these interviews is that farmers have been aware of the economical potentialities that the silvoarable systems proposed, more than the environmental aspects. They appreciate the possibility to diversify their farming income thanks to the timber production but also thanks to a secondary production. Agroforestry is therefore seen, not only as a bi-production system but as a system of possible several productions. Trees conserve their traditional image of multipurpose production. The silvoarable system is also seen as a progressive system, with possibility to change the crop rotation according to the trees development. The main environmental aspect that the farmers mentioned is the improvement of the landscape. The lack of knowledge about the agro-environmental performances pushes the farmers to speak about the environment aspects in general. And the majority emphasized the fact that in the new CAP policy, agriculture and environment must be linked. In this context, agroforestry could respond to the Brussels concerns… but for

| Region                  | Bedford | Brabant | Castilla y Leon | Castilla Mancha | Centre | Achatheh | Extremadura | Franche Comté | Italy Centre | Italy Nord | Friesland | Poitou-Charent | Schleswig-Holstein | Macedonia | Tot |
|-------------------------|---------|---------|----------------|-----------------|--------|----------|------------|--------------|--------------|------------|-----------|-----------|-----------------|----------------------|------------|-----|
| **Rentability**         | 4       | 3       | 13             | 10              | 6      | 3        | 13         | 2            | 6            | 7          | 1         | 4         | 1                | 6                   | 79          |     |
| **None**                | 2       | 5       | 5              | 1               | 1      | 1        | 7          | 6            | 7            | 3          | 3         | 3         | 5                | 42                   | 42         |     |
| **Diversification**     | 1       | 1       | 7              | 3               | 2      | 9        | 3          | 3            | 3            | 1          | 3         | 1         | 6                | 42                   | 42         |     |
| **Environment general** | 1       | 3       | 2              | 6               | 2      | 1        | 3          | 2            | 1            | 1          | 6         |           | 28                   |          |     |
| **Landscape**           | 2       | 1       | 3              | 4               | 2      | 1        | 2          | 1            | 1            | 1          | 1         | 1         | 18                   |          |     |
| **Soil and water conservation** | 2   |         | 3              |                 | 3      |          | 1          | 3            |               | 11         |           |           | 12                   |          |     |
| **Patrimony**           | 3       | 1       | 2              | 1               | 1      | 2        | 1          |               | 1            |            |           |           | 11                   |          |     |
| **Intercrop improvement** | 1   |         | 2              | 2               |         |          |            |               | 7            |            |           |           | 7                    |          |     |
| **Subsidy**             | 1       |         | 3              |                 | 2      |          | 1          | 1            | 1            |            |           |           | 6                    |          |     |
| **Biodiversity**        |         |         |                 | 2               | 2      |          |            |               | 1            | 1         |           |           | 6                    |          |     |
| **Climate**             | 1       |         |                 | 2               |         |          | 1          | 2            |               |            |           |           | 6                    |          |     |
| **Farmers' relation**   |         |         |                 |                 | 1      | 1        | 1          | 1            | 2            | 1          |           |           | 6                    |          |     |

Yellow: Economical aspects – Blue: Social aspects – Green: Environmental aspects

Table 4: Positive aspects given by the farmers in first place for each region.

Looking at the possibility to produce some trees for timber, farmers have placed the possibility to harvest for themselves the trees before than for the possible descendants. Only 4% of the farmers have mainly considered agroforestry as a good opportunity to leave a patrimony to their family.

To plant trees in their field would be considered as an opportunity to give a better image of the farmers or to improve their relations with the landowner. Even if this aspect is mentioned by 2% of the sample as the main positive aspect, it’s frequently named in the discussion. In England, it’s one of the main features suggested by the farmers as much as the improvement of the landscape and the diversification.

A first surprise of these interviews is that farmers have been aware of the economical potentialities that the silvoarable systems proposed, more than the environmental aspects. They appreciate the possibility to diversify their farming income thanks to the timber production but also thanks to a secondary production. Agroforestry is therefore seen, not only as a bi-production system but as a system of possible several productions. Trees conserve their traditional image of multipurpose production. The silvoarable system is also seen as a progressive system, with possibility to change the crop rotation according to the trees development. The main environmental aspect that the farmers mentioned is the improvement of the landscape. The lack of knowledge about the agro-environmental performances pushes the farmers to speak about the environment aspects in general. And the majority emphasized the fact that in the new CAP policy, agriculture and environment must be linked. In this context, agroforestry could respond to the Brussels concerns... but for
some of them, this reality doesn’t seem to attract them! And a 20 % of the sample has badly received the agroforestry idea to the point they didn’t recognize any positive aspects.

5.2. The main constraints spotted by the farmers

From the start, when it became clear that agroforestry could also be practised spatially by the integration of trees and crops on the same plot, most farmers immediately reacted sceptically and started to summarise the supposed negative aspects of trees on arable land (see Figure 17).

![Bar chart](chart.png)

Figure 17: Negative aspects mentioned in first place after the slide show.

The most common concern is about the possibility to go on intercropping without decreasing the yield and the quality of the crop. A general reaction is to compare with the bad yield they obtain near the forest outskirts. It is expected that the competition effect of the trees, partly by the roots, but mainly through the shade, would have a great effect on the productivity and quality of the intercrop. In the Netherlands, they often gave the example of decreased growth height of maize or the decreased tuber volume of potatoes grown alongside the trees. However it’s interesting to notice that the problem of yield decreasing is above all pointed out by the farmers from the Mediterranean regions (see Table 5). In these countries, the poor net margin the farmers get from their crop is not sufficient to absorb any yield reduction. Faced to this concern, farmers ask some crucial conditions for the timber market or for some extra subsidies.

In France and in the Netherlands, farmers raised the problem that through the shade of trees and the related increased humidity, plots and crops will also dry slower. This may give some problems of crop maturity or disease, for example with the ripening of grains, the drying of mown grass and increased chances of phytophtra in potatoes.

The second and third main negative aspects expressed by the farmers are the complexity to cultivate between the trees and the problems of mechanization. Some farmers declared not to be prepared to this kind of farming system. To intercrop between trees requires a specific know-how.
In the northern countries, where we observe a larger number of crops existing in the farming systems, the fixed width between the trees make difficult the use of different machines according to the crops. For example, when the distance is adapted to a cereal, it’s not really adapted for other crops such as potatoes or beetroot (France, The Netherlands, and Germany). The trees themselves could even make very difficult the use of some machines like the beetroots harvest machine. The difficulty of running a combine harvester alongside a tractor and trailer so that the combine would not have to stop each time it was full was mentioned by many farmers.

The width between the trees is fixed for a long term period. And when one would like to scale up and buy bigger machines, the silvoarable plots are not more adapted to the new mechanical context (Spain, France, and The Netherlands).

The trees require more attention from the farmer when he cultivates along them. He must avoid any contact with his machine above all with the harvest and spray machines. This requirement could cost more time for ploughing, spraying or harvesting. This remark often results from a personal experience where the farmers are obliged to skirt around the isolated trees they have in their own field. And some farmers rise that this overtime could represent an over cost when a contractor is paid on an hourly basis. Or if the contractor is paid by hectare, they simply fear that he could refuse the job…

Table 5: Negative aspects given by the farmers in first place for each region.

The perennial presence of the trees fixes the agricultural landscape and raises some specific problems:

- In the northern countries, where we observe a larger number of crops existing in the farming systems, the fixed width between the trees make difficult the use of different machines according to the crops. For example, when the distance is adapted to a cereal, it’s not really adapted for other crops such as potatoes or beetroot (France, The Netherlands, and Germany). The trees themselves could even make very difficult the use of some machines like the beetroots harvest machine. The difficulty of running a combine harvester alongside a tractor and trailer so that the combine would not have to stop each time it was full was mentioned by many farmers.

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If these aspects are not exclusive, some farmers raised some particular problems which prohibit the development of a silvoarable project:

- A very small size and a badly adapted configuration of the plot.
- A specific irrigation system which prohibits a tree presence, such as a pivot irrigation machine.
- In presence of a drainage system, the tree roots could cause irreversible damages. The drainage system, necessary to remove excess water from the irrigated land or from a heavy soil, is often less than one metre deep.

In the majority of the regions, farmers are afraid of the market risk. On one hand, they point out the possibility to lose all the tree production in a climatic accident. And on the other hand, they are suspicious to invest in a production that they will harvest in a very long time. If they are still alive to enjoy the trees profitability…

To encourage a land owner to invest in a tree plantation, farmers think that it requires a subsidy for planting and maintaining the trees. And that’s the problem they underline: how to believe in the permanence of a subsidy policy on a long term period? The expected dependency of government subsidies to make agroforestry feasible is considered as a negative aspect. Most of the farmers don’t trust the changing European policies regarding the Agro-Environmental Measures. Another policy aspect suggested by some farmers regarding the CAP policy, is to be sure that the trees will not decrease the crop payments.
But this last aspect was little developed by the farmers. We can do the same remark about the problem of the status, which was underlined by very few farmers. Status problems after planting trees in cropped field seem not to be a major concern of the farmers. In the same way, a very few farmers also saw agroforestry as a social constraint with the landowner or any local communities.

Finally, some farmers considered agroforestry as a threat for the environment. In some forested regions, the tree plantations are bad considered and close the landscape (Franche Comté and Achterhoek). Other farmers enjoyed the open-field landscape, which gives the cultural value of the region (Friesland and French Centre). And this traditional aspect should not be changed by forestry policies. In addition, various Dutch farmers mentioned also that trees could have a negative impact on the geese and other birds preferring the open-field. And some farmers in Friesland mentioned that thanks to the open-field, the sea-wind avoids pest problems on animals (louse).

Most farmers could easily list a whole range of negative aspects, concluding sometimes that agroforestry could not be profitable, excepted with a consequent and above all permanent subsidy. Only a 4 % didn’t recognize none negative points…

The main concern was about the possibility to get a normal intercrop production between two lines of adult trees… Farmers usually compare to the bad production they harvest near the forest border line, where the crop suffers a lot from the tree competition.

The answers given by the farmers allowed us to distinguish the exclusive constraints to develop an agroforestry project from the constraints which are or should be studied by the Research Development.

The main surprise was that the regulation or status aspects haven’t been entered by very few of the farmers. The main negative aspects have been more about the technical aspects. The farmers are wondering if this new farming system would not cost too much over time to them and ask to see by themselves the mechanical and agronomical feasibility. Farmers who have a good feeling with the trees think that it wouldn’t cost any excess of labour to have trees in their field. They also trust the timber market. But, as the rest of the sample, they wonder if it would be possible to keep a good yield of the intercrop with the years.

One of the main constraints is also the possible dependence of a long term subsidy which would not have a secure permanency because of the policy changes.

5.3. **The main reasons to plan a silvoarable project**

After collecting their reaction about the slide show, our third question was: from all of these reasons, what would be the most important for you to venture into a silvoarable project in your own farm? For 86 % of the farmers, the economical objectives come before the environmental ones. The first reason given by the farmers, above all in Spain and France, is also a condition: they would consider a project for its feasibility and the profits it could give to us (see Table 6).
The willingness to diversify with a new production is more marked in Italy and Greece. In Italy, they attach more importance to the timber value, while in Greece, the fruit or firewood production is the first argument. In some regions, where we observed a strong opposition to the agroforestry idea like in Friesland, farmers will imagine a project only if the subsidies are consistent.

If the farmers lay down first the condition of the feasibility, the youngest tend to think more about the diversification and the impact on the environment (landscape) an agroforestry project could bring. While the oldest think more about the production of timber and the subsidies.

The farmers who rent a land would accept a silvoarable project proposed by the owner below two conditions, ranked at the same level: the system mustn’t damage the crop production and the subsidy level must compensate the loss of income.

Again, it seems that the question to create a capital to leave to their family is not the first consideration. They are inclined to invest above all if they can profit from their investment. The decision to create some project is conditioned to some feasibility parameters: no influence on the crop yield, no impact on the subsidy level of the farm and a possible extra subsidy for the plantation. In other words, the silvoarable project must be more profitable than the present situation. This profitability is described at two levels: the net margin should be maintained (subsidy and no over-cost), and the long term profitability should be interesting for the owner.

The possibility to diversify their productions is a key factor in the present agricultural context. In some regions, the agro-environmental aspects could be a strong argument to decide a silvoarable investment. The creation of an original landscape is an alternative which could convince some farmers, above all in some regions with very few trees in the landscape like in Bedford or the French Centre.

At least, it’s interesting to notice that some farmers would adopt agroforestry to manage their timing better and to reduce their mechanization costs. In that case, the main objective is therefore to decrease progressively the crop area to free them partly of their farming labour, without reinvesting in new machines or activities...
6. **If you have to imagine a virtual project**

After this first discussion, we put the farmers in a virtual position where they had to imagine a project for their farm. Which kind of technical decisions would they have taken and for which reasons? Which kind of problems they would have spotted? Those were the aims of this third part of the interviews.

### 6.1. Which kind of association?

For some farmers, it was not so easy to imagine a virtual project, arguing that they need more information to give answers to some specific questions. In general, they didn’t know which would be the best couple to associate in agroforestry. Most of the farmers had poor knowledge about the tree performance and potentiality, and which would be the best crop to seed between two lines of trees.

- **Which tree specie?**

As a consequence, the slide show impressed some farmers about the technical choices to make. For the tree selection, the farmers named the common species: walnut, poplar, oak or wild cherry (see Figure 18). Farmers have mainly chosen the trees for local habits. They know that these trees are growing well in their region or they have seen some samples near their farm.

![Figure 18: Tree specie chosen by the farmers](image)

In the Mediterranean area, farmers preferred the traditional oak and olive trees above all in Italy where it’s very common to find these species associated with crops or pasture. In Spain, many farmers have chosen poplars and walnuts. In Castilla y Leon, the most important argument is to get a valuable timber for almost 90% of the sample which is surprising in the Mediterranean area. In fact, in Spain, a big programme of afforestation, above all with walnuts could explain this result of Castilla y Leon.

For all the regions, 50% of the farmers who have chosen walnuts, poplars or wild cherries, explained their choice for the profitability of the timber or the quick growth of the tree. 10% of the farmers justified their choice for the possibility to get a double purpose production: timber and fruits (or fire wood or mushrooms). (see Annex 6)
In the regions where we find very few trees in the landscape, farmers have some difficulties to choose particular specie. That’s the case of the Centre province in France or in the Dutch provinces.

- **Which kind of crop?**

Again, in general, a large part of farmers didn’t know which kind of intercrop they would seed between the trees… 27% of the farmers think it would be better to stop cultivating. And 53% think that it would be possible to go on cropping. The others think that they would think to change for a fodder crop or a pasture.

Farmers who think it’s possible to go on cultivating would go on cultivating the same crop as before the tree plantation. They would not change their habits. Sometimes, it’s simply an obligation to respect the crop rotation of the farming system. Only the farmers, used to cultivate spring crop, such as sunflowers or vegetables, would think about changing their habits for some agronomical reasons, arguing that with the shade competition, it would be better to change the crop specie.

![Crop choice to intercrop](image)

**Figure 19: Crop choice to intercrop**

The best crops would be the winter cereals. In second place, we find the fodder crops or pasture. The most heard argument for choosing a winter crop was that the trees would cast less shade in winter, giving the crop a growth advantage. Other reasons were that the trees would suffer less of root-damage by machinery in winter. For both grass and grains, the main reasons for choosing these crops were the ease with the machinery and the shade-tolerance. But none could make some assumption about the best crop for this kind of system. Some breeders cultivate some fodder cereals. In that case, they take less care about a possible decreasing of the yield or a possible irregular maturity of the grain.

Potatoes and beets are considered the worst intercrops (Especially in the Netherlands, France and Spain), mainly because of their intolerance to shade and the expected inefficiency with the machinery. Since these are generally the crops with the highest margins, they are expected to give the highest loss of margin in an agroforestry system. Due to their lack of shade tolerance, maize or sunflower are generally not considered as a good option. Nonetheless, some farmers noticed that maize could be a good option to be associated with
poplars. Two farmers in France noticed that the young poplars benefit from the maize presence during the first years. In Spain, farmers fear that the crops such as tomato or pepper which demand a lot of treatments could suppose a phytosanitary problem for the trees (bad pesticide tolerance).

In the driest regions, the possibility of irrigation can modify some crop choices, above all in the Mediterranean countries. In Spain or Italy, for example, it would authorize the production of some intercrops which demand a lot of water such as maize or tobacco.

- **Annual or perennial crop?**

Many farmers could not say if they would plant an annual or perennial crop. They often replied it would depend on the farm management or the soil type.

Farmers who thought that the fodder crop or a pasture was better adapted gave different reasons. First, they think that a perennial crop would need less machinery on the field and would also avoid some possible extra labour and damage to the trees. The second reason is that a perennial crop would appear more shade-tolerant.

We tried to synthesize all the farmers’ comments about the constraints or the advantages in a silvoarable system for each kind of crop (see Table 7).
<table>
<thead>
<tr>
<th>Crop</th>
<th>Constraints</th>
<th>Advantages</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Winter Cereals</strong></td>
<td>1. Nutrient competition</td>
<td>1. Shade tolerant</td>
</tr>
<tr>
<td></td>
<td>2. Birds predation</td>
<td>2. Less water competition (deep roots)</td>
</tr>
<tr>
<td></td>
<td>3. Barley could dry later than wheat, problem in the northern regions</td>
<td>3. Well adapted biological cycle, harvest period</td>
</tr>
<tr>
<td></td>
<td>4. Humidity problems (moisture)</td>
<td>4. Less labour</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5. Poor number of treatments</td>
</tr>
<tr>
<td><strong>Maize</strong></td>
<td>1. Water competition</td>
<td>1. Possibility to irrigate</td>
</tr>
<tr>
<td></td>
<td>2. Light competition</td>
<td>2. Machine compatibility</td>
</tr>
<tr>
<td></td>
<td>3. Nutrients competition</td>
<td>3. Harvest period</td>
</tr>
<tr>
<td></td>
<td>4. Shade for the young trees</td>
<td></td>
</tr>
<tr>
<td><strong>Sunflower, oilseed</strong></td>
<td>1. Light competition</td>
<td>1. Easy to harvest</td>
</tr>
<tr>
<td></td>
<td>2. Biological cycle not adapted (seeding period)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3. Birds predation</td>
<td></td>
</tr>
<tr>
<td></td>
<td>4. Too many pesticides operations</td>
<td></td>
</tr>
<tr>
<td></td>
<td>5. Pest damage to the trees</td>
<td></td>
</tr>
<tr>
<td><strong>Tobacco</strong></td>
<td>1. Light competition</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2. Water competition</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3. Labour cost increase</td>
<td></td>
</tr>
<tr>
<td><strong>Vegetables (tomato, pepper, asparagus, etc)</strong></td>
<td>1. Pest and insect damages</td>
<td>1. Less nutrient competition</td>
</tr>
<tr>
<td></td>
<td>2. Machine incompatibility</td>
<td>2. Well adapted biological cycle (asparagus)</td>
</tr>
<tr>
<td></td>
<td>3. Light competition (tomato, pepper)</td>
<td>3. Shade tolerance (asparagus)</td>
</tr>
<tr>
<td><strong>Beetroot, potatoes</strong></td>
<td>1. Machine compatibility</td>
<td>1. Shade tolerant (potatoes)</td>
</tr>
<tr>
<td></td>
<td>2. Light competition (beetroots)</td>
<td></td>
</tr>
<tr>
<td><strong>Rice</strong></td>
<td>1. Flooding system (damage to the trees)</td>
<td></td>
</tr>
<tr>
<td><strong>Wine</strong></td>
<td>1. Light competition</td>
<td>1. By traditional experience</td>
</tr>
<tr>
<td><strong>Flower</strong></td>
<td>1. Light and nutrient competition (bulb flowers)</td>
<td>1. Manual labour (treatment and harvest) for cut flowers</td>
</tr>
<tr>
<td></td>
<td>2. Pest control</td>
<td></td>
</tr>
<tr>
<td><strong>Alfalfa, leguminous</strong></td>
<td>1. Competition for the trees the first years</td>
<td>1. Increase soil fertility</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2. Shade tolerance or light efficiency</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3. Less labour, machine compatibility</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4. Less water competition (deep roots)</td>
</tr>
<tr>
<td><strong>Pasture</strong></td>
<td>1. Competition for the trees the first years</td>
<td>1. Shade tolerance</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2. Less labour, machine compatibility</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3. Shade for animals</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4. Less financial impact</td>
</tr>
</tbody>
</table>

Table 7: Classification of the constraints and advantages for each crop to intercrop in a silvoarable system, according to the feeling of the farmers.
The farmers’ first opinion would be to choose winter crop or perennial crops. We can underline 4 key parameters for choosing the best adapted crop:

- They give a preference to a crop which could begin its growth period before the trees, such as the winter cereals. The winter crops are well considered due to the fact that they are well installed when the trees begin to develop their leaves. In that case, it would be easier for the crop to reach the biological needs, despite the tree presence.

- The poor number of mechanical operations needed by the crop and the ease to use some specific machines between the trees are a strong argument to select a crop for intercropping. Farmers make the hypothesis that it’s not convenient in agroforestry to cultivate too much between the trees... The less you go through your plot the better. Perennial crops are often selected for this reason. But we can also name the maize: despite its poor shade tolerance, it’s often named by the farmers as the best crop due to the mechanical ease.

- Some crops could interact positively with the trees (deep roots and nitrogen benefit). That is the case for the leguminous and alfalfa.

- Farmers would choose first the crop which demand a poor number of pesticide treatments. On one hand, it supposes less machines operation in the plots, and on the other hand it avoids a possible negative interaction between the chemicals products and the trees.

The crops which fulfil these necessary conditions are: winter cereal (above all wheat), asparagus, fodder crops and also maize.

On the contrary, the worst crops named by the farmers are: oil crop (oilseed and sunflower), bulbs crop and root crop, maize and vegetables. The main parameters to avoid some crops in agroforestry are:

- A bad interaction between trees and crops, in order of frequency: competition for light, water and nutrients. Above all for the spring crops.

- Sensibilities to weed or pest damages due to the tree environment: humidity (moisture), pest attack (insects) or predator damage (birds, slugs, …). Above all for oilseed and vegetables.

- A difficulty or incompatibility to use some machines (above all potatoes and sugar beets).

6.2. On which kind of land?

Are the farmers ready to plant on fertile land, where they get the best crop yield? Or do they think that it’s better to plant trees on a poorer soil? A strong surprise was that farmers would install an agroforestry plot rather in good or medium land than in bad land. But this general result must be declined according to each region (see Figure 20).
In fact, in the Mediterranean regions, the majority of the farmers are ready to plant in their best lands (till 60% in Castilla y Leon or 55% in West Macedonia!). In the Northern countries, farmers show caution at the moment to decide on which quality of land they would plant the trees. Many of them are unsure about which choice they would make. It’s in Bedford, in Italy North and in the French and Dutch regions that we found the smallest number of farmers in favour of planting in good land. But with the exception of the region of Friesland in The Netherlands, in these regions, we observe the same proportion between the farmers who would plant in a fertile land rather than in a poor land. The question was a little more difficult for the farmers from Friesland where the soil quality is very homogeneous in this part of the Dutch landscape!

Many farmers from Northern countries explained that it would be better to plant trees where they can’t get crops yield. In this meaning, planting trees was often done only on the poorest lands or when a land was being taken out of production, like in a forestry approach. Many of them thought therefore that an afforestation project must be geographically separated from the cropping area...Which differs from a silvooarable approach.

Other farmers explained that if they have chosen the bad land, it was to improve this kind of land and to try to find a soft diversification of the existing cropping system. Therefore, they would try to get a double production from this kind of land or to increase the value of these lands.

Farmers who have chosen best land explained their choice first to get a better result from the timber production (above all in Spain). In this country, where the net margins are lower, farmers are ready to invest in good land to get a quicker production of timber. We also have to underline that in the Mediterranean countries, the net margin are obtained thanks to the CAP payment. Without grants, crops are not feasible. And many farmers think that in the worst land, even the trees couldn’t grow...That’s not the case in the Northern countries where it’s possible to get some positive net margins from the crops even without grants. Therefore, it’s essential for the farmers not to penalize too much the production.
6.3. **Main technical features of the plantation**

What area would plant the farmers? What would be the importance given to the cropped area and the woody area?

In the continuity of the previous conclusions, the farmers from the South distinguish themselves by the fact that they would plant more surface than in the countries of the North. They would plant about 15 to 35% of the total cropping area of the farm, up to 96% in the case of Greece (see Table 8). In the countries from the North, the standing surface is situated between 2 and 12%. The farmers from the Netherlands are particularly careful in their approach by emitting the hypothesis that if they planned some silvoarable project, they would only use 2% of their farm area.

<table>
<thead>
<tr>
<th>Region</th>
<th>% of the cropping area in agroforestry</th>
<th>Area planted in agroforestry (ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>N-Friesland</td>
<td>2%</td>
<td>5</td>
</tr>
<tr>
<td>E-Achterhoek</td>
<td>2%</td>
<td>2</td>
</tr>
<tr>
<td>Schleswig-Holstein</td>
<td>3%</td>
<td>8</td>
</tr>
<tr>
<td>Franche Comté</td>
<td>8%</td>
<td>10</td>
</tr>
<tr>
<td>Poitou-Charentes</td>
<td>9%</td>
<td>10</td>
</tr>
<tr>
<td>Brandenburg</td>
<td>9%</td>
<td>12</td>
</tr>
<tr>
<td>Centre</td>
<td>10%</td>
<td>13</td>
</tr>
<tr>
<td>Bedford</td>
<td>12%</td>
<td>20</td>
</tr>
<tr>
<td>Italy Centre</td>
<td>14%</td>
<td>8</td>
</tr>
<tr>
<td>Castilla y Leon</td>
<td>16%</td>
<td>14</td>
</tr>
<tr>
<td>Italy North</td>
<td>22%</td>
<td>16</td>
</tr>
<tr>
<td>Castilla-La Mancha</td>
<td>28%</td>
<td>43</td>
</tr>
<tr>
<td>Extremadura</td>
<td>34%</td>
<td>30</td>
</tr>
<tr>
<td>West Macedonia</td>
<td>96%</td>
<td>1</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>22%</strong></td>
<td><strong>18</strong></td>
</tr>
</tbody>
</table>

**Table 8: Proportion of the cropping area planted by the farmers in each region**

We also asked the farmers what would be the minimum size of a plot to set up a silvoarable system (see Table 9). The minimum size of the plots varies from 1 to 11 ha.

<table>
<thead>
<tr>
<th>Region</th>
<th>Minimum width of the plot (m) - L</th>
<th>Minimum length of the plot (m) - l</th>
<th>Deduced minimum area (ha) – L x l</th>
</tr>
</thead>
<tbody>
<tr>
<td>West Macedonia</td>
<td>44</td>
<td>110</td>
<td>0.5</td>
</tr>
<tr>
<td>Extremadura</td>
<td>93</td>
<td>185</td>
<td>1.7</td>
</tr>
<tr>
<td>Poitou-Charentes</td>
<td>107</td>
<td>200</td>
<td>2.1</td>
</tr>
<tr>
<td>Bedford</td>
<td>122</td>
<td>198</td>
<td>2.4</td>
</tr>
<tr>
<td>Achterhoek</td>
<td>100</td>
<td>300</td>
<td>3.0</td>
</tr>
<tr>
<td>Franche Comté</td>
<td>100</td>
<td>350</td>
<td>3.5</td>
</tr>
<tr>
<td>Schleswig-Holstein</td>
<td>134</td>
<td>340</td>
<td>4.6</td>
</tr>
<tr>
<td>Centre</td>
<td>188</td>
<td>306</td>
<td>5.6</td>
</tr>
<tr>
<td>Castilla</td>
<td>200</td>
<td>300</td>
<td>6.0</td>
</tr>
<tr>
<td>N-Friesland</td>
<td>233</td>
<td>470</td>
<td>11.0</td>
</tr>
</tbody>
</table>

**Table 9: Minimum size of a plot to be integrated in a silvoarable project**

The Mediterranean farmers would plant more trees than in the Northern countries. They would plan some plantations where the trees row distance would be closer than in a
temperate context. These distances would fluctuate between 10 to 30 m while, in the Northern countries, they would rather fluctuate between 20 to 40 m (see Table 10). As consequence, the densities were lower in the Northern countries, varying between 40 to 70 trees by hectare, while in the Mediterranean region, the densities fluctuated a lot, between 80 to 120 and sometimes up to 200 trees/ha in some regions such as Castilla La Mancha or in Greece.

In general, it was not so difficult for the farmers to imagine the distance between the lines of trees but concerning the distance between the trees on the line, many farmers admitted they couldn’t know what would be the ideal distance.

<table>
<thead>
<tr>
<th>Distance between the trees rows (m) (Range mini – maxi)</th>
<th>Distance between the trees on the row (m)</th>
<th>Density</th>
</tr>
</thead>
<tbody>
<tr>
<td>Franche Comté</td>
<td>27 (24 → 30)</td>
<td>8</td>
</tr>
<tr>
<td>Poitou-Charentes</td>
<td>23 (14 → 26)</td>
<td>9</td>
</tr>
<tr>
<td>Bedford</td>
<td>28 (20 → 30)</td>
<td>7</td>
</tr>
<tr>
<td>Schleswig-Holstein</td>
<td>29 (25 → 40)</td>
<td>6</td>
</tr>
<tr>
<td>N-Friesland</td>
<td>25 (20 → 40)</td>
<td>7</td>
</tr>
<tr>
<td>E-Achterhoek</td>
<td>27 (20 → 40)</td>
<td>6</td>
</tr>
<tr>
<td>Italy Centre</td>
<td>24 (10 → 20)</td>
<td>7</td>
</tr>
<tr>
<td>Centre</td>
<td>27 (26 → 30)</td>
<td>6</td>
</tr>
<tr>
<td>Italy North</td>
<td>19 (12 → 30)</td>
<td>7</td>
</tr>
<tr>
<td>Castilla y Leon</td>
<td>21 (20 → 30)</td>
<td>5</td>
</tr>
<tr>
<td>Extremadura</td>
<td>19 (10 → 40)</td>
<td>5</td>
</tr>
<tr>
<td>Castilla-La Mancha</td>
<td>14 (10 → 20)</td>
<td>7</td>
</tr>
<tr>
<td>West Macedonia</td>
<td>13 (12 → 25)</td>
<td>5</td>
</tr>
</tbody>
</table>

Table 10: Distances between the trees in the virtual project

The distance between the trees rows depends generally on the width of the machines but also on the will to give more importance to the trees or to the crops... The behaviour of the farmers is different in the Mediterranean region than in the temperate region.

In the following table, we compare the decisions of 3 countries’ samples: Spain on one hand and France and England on the other hand (see Table 11).
Table 11: Main technical decisions in the samples of Spain, France and England about the tree plantations.

<table>
<thead>
<tr>
<th></th>
<th>Poitou-Charentes</th>
<th>Centre</th>
<th>Franche Comté</th>
<th>Bedford</th>
<th>Castilla y Leon</th>
<th>Castilla-Mancha</th>
<th>Extremad.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Distance of the trees rows</td>
<td>22.6</td>
<td>26.6</td>
<td>26.7</td>
<td>28.1</td>
<td>21.2</td>
<td>14.5</td>
<td>18.9</td>
</tr>
<tr>
<td>Width tree area</td>
<td>2.6</td>
<td>2.2</td>
<td>3.3</td>
<td>4.0</td>
<td>1.3</td>
<td>1.9</td>
<td>1.5</td>
</tr>
<tr>
<td>Width intercropping area</td>
<td>20.0</td>
<td>24.4</td>
<td>23.2</td>
<td>24.1</td>
<td>20.0</td>
<td>12.6</td>
<td>17.4</td>
</tr>
<tr>
<td>Width Machine width</td>
<td>20.5</td>
<td>23.0</td>
<td>20.3</td>
<td>21.3</td>
<td>6.2</td>
<td>4.7</td>
<td>6.4</td>
</tr>
<tr>
<td>Number of machine width</td>
<td>1.2</td>
<td>1.2</td>
<td>1.2</td>
<td>1.5</td>
<td>3.7</td>
<td>3.7</td>
<td>3.8</td>
</tr>
<tr>
<td>Width of the headland</td>
<td>20</td>
<td>22</td>
<td>21</td>
<td>27</td>
<td>12</td>
<td>8</td>
<td>8</td>
</tr>
</tbody>
</table>

In Spain, the main technical criteria to choose the distance between the trees rows is the width of the harvester, while in France or England, it’s the width of the boom sprayer. In fact, the number of pesticide treatments is very low in Spain. Facing to a poor gross margin, Spanish farmers try to get the minimum cost of production. On the contrary, in the temperate countries, better yields demand a higher crop protection. The tree component is better valued in the Mediterranean region than in the temperate region where the first objective is still the crop production.

In consequence, in Spain, we noticed a smaller width between the lines of the trees. Many farmers have given the priority to the trees in their virtual system. When the crop production is better like in Castilla Y Leon, then the distances are more important.

However, the in-row tree distances were justified by a majority of farmers all over the countries to give the priority to the trees.

We can also underline, that many farmers have chosen to enlarge the distance between the trees row and the crop limit. In Spain, the tree-crop distance is shorter: the Spanish farmers would crop up to less than one meter from the trees. And many of them know by experience that it’s possible to crop just near the trees without any consequent effect during a large period. While in England or France, farmers would let between 1.5 and 3 m between the trees and the crop line.

Photo 7: Which distance to conserve between the trees row and the crop limit? On the left, the “Mediterranean” choice which is more intensive regarding the tree/crop interaction, and on the right the “temperate” choice where the farmer want to avoid any contact between the trees and the crops.
The majority of the farmers wouldn’t plant along the contour lines because this did not correspond to the reality of their fields, but also because it would be difficult to go across the slopes using farm machinery, except if the lines of trees are straight. In that case, they would plant in staggered rows. Only 15 % of the farmers would plant the trees according the contour lines.

One British farmer said that farm machinery was an inevitable reality of modern farming and, in consequence, new systems should properly consider their use. There was a general consensus in the Northern countries that intercrop widths would have to be in multiples of commonly available sprayer widths, so that there would be no overlap of spraying. A further refinement to this statement was that the intercrop width would also need to be in multiples of combine harvester widths, so that there would be no overlap of the harvester take. Many farmers stated that once the intercrop width is set, this would limit their ability to change to wider sprayers in the future. And some farmers in France would plant larger to be able to change their sprayer for a wider one in some near future (till twice the existing width). If the design of the plot is well defined, some farmers think it should not be a problem to crop in a silvoarable system because machine characteristics should have been thought of. The suspicious ones think that a secure distance between the trees and the crop must be kept. The records of the damage produced by the branches or the roots of the outskirts are still in the farmer memory...

A few farmers also mentioned the possibility of being able to fold up the ends of the treatment lines to make them narrower. In that case, the width of the cropping alley is smaller than their width of their boom sprayer. And to conclude for this topic, we can precise that this question of sprayers seems not to be a problem for the organic farmers who don’t treat their crops so much... Many Mediterranean farmers are near to be in an organic farming system because of the little level of pesticides they use. In many of these regions, the net margin is defined by the crop payment. That’s the main reason why farmers in Spain Greece or Italy would plant more trees in more intensive design than in the Northern Countries.

**6.4. Management of the silvoarable system**

Many farmers expressed some difficulties to imagine which management of the silvoarable system they would adopt.

**6.4.1. Intercrop area management**

With the years, the trees development could affect the evolution of the intercrop yield. And when man intercrops between the lines of adult trees, he can take the decision to reduce or not the intercrop area. We asked each farmer what would be his attitude facing a possible decreasing of the crop yield (see Figure 21).

A first surprise was that more than 40% of the farmers don’t consider a reduction of the intercrop area. They think that the choice between the tree lines would be sufficient to maintain a crop activity up to the tree harvest. They prefer to make their machines pay and to avoid the cost of the soil maintenance without any crop income. They also prefer to keep the profitability linked to the CAP payment.

In this decision to maintain the intercrop, we don’t observe any regional features.
Concerning the farmers who consider an area reduction, they don’t really know how to reduce the alley width. Their first feeling would be to suppress a seed drilling more than by single seed line.

At the end of the tree rotation, when it’s supposed that the intercrop will become no profitable, what would be the attitude of the farmers? One third of the farmers declared nonetheless that they would go on intercropping (see Figure 22). Another third would replace the annual crop by a fodder crop or just by a natural pasture. Only 6% would maintain a bare soil.

Irrigation is not a problem to set up some experimental plots according to the farmers. Moreover, we noticed that farmers who irrigate are more interested by agroforestry than the others to set up some silvoarable plots (53% interested against 30%, not interested -17% don’t know). But this result must be stated for each irrigation system. We must distinguish the irrigation systems that allow the tree presence or not.
Pivot or linear system. This kind of irrigation system prohibits any tree plantation. But, in these farms, many farmers expressed the idea to plant the non-irrigated area. These areas could be some isolated plots, without any possibility of irrigation, or some parts of irrigated parcels but which are not accessible by the ramp (plot corners for example which can represent more than one ha each). In such a scheme, farmers want to increment the plus value of the field.

Gun system with roller. The farmers who use guns are rather against to plant trees in their irrigated area. It would suppose a higher cost of irrigation. Indeed, they would have to adjust the irrigation area to the intercrop alley, and so to reduce by half the irrigation angle. This adaptation supposes to double the irrigation time and the wear of the machine. But still one third of the farmers using this system are nonetheless interested in planting some trees in their crops.

50 % of the farmers using sprinklers to irrigate their cropping field would be ready to invest in a silvoarable project. This kind of system is particularly adapted for plantation where the distances between the tree lines is less than 20 m.

The boom associated with a roller is certainly one of the best options for agroforestry. We met only 4 farmers using this modern system and 3 are interested in the concept of agroforestry in their irrigated field. This kind of system presents different widths, generally from 25 to 50 m. It’s the same traction system as with a gun system but... with a boom.

The flood irrigation system is seen as well adapted to agroforestry. More than 60 % of the farmers who practice a flood system are interested to create some silvoarable projects in their irrigated parcels. That’s particularly the case in Spain and Greece where these systems are common.
6.4.2. Tree area management

Which kind of soil maintenance for the trees area?

Strong differences in the answers of the farmers have been spotted according to the climatic zones (see Figure 23). The Mediterranean farmers want to avoid water competition for the trees and a majority would consider a bare soil as the best option. While in the temperate zone, farmers would protect more the soil. One third would be ready to seed the tree area. This option would avoid some pest problems and to control the weeds.

But in both cases, one third of the farmers need some advices...

![Figure 23: Soil maintenance on the tree area according to the climatic region](image)

To maintain the soil, the mechanical option is the most current choice (see Figure 24). Temperate farmers would mow or cut the weed, while the Mediterranean farmers would harrow. A 6% would use, in both regions, some plastic mulch to cover the soil. But again, more than 20% of the farmers don’t know which would be the best method.

![Figure 24: Techniques of soil maintenance of the tree area](image)
Some farmers suggested associating some ornamentals plants or trees between the silvoarable trees. These plants would be sold before ten years to developers or garden centres. This would provide a faster return on invested money. This crop would not induce a shade reduction, because they would be harvested before the canopy became too extensive.

6.5. Development of the project

6.5.1. Labour management

The large majority of the farmers would take care themselves of the tree maintenance.

For 10 % of the farmers, it would be the opportunity to make their farm’s labourers work (see Figure 25).

In fact, for some farmers who are employers, it’s the possibility to manage better the workers’ labour. Tree maintenance can be done during some relatively quiet periods, regarding the agricultural activity.

![Figure 25: Who would realise the tree maintenance?](image)

Bigger is the farm area, the more the farmer will call for an external company to maintain the tree plantations. Half of the farms that have more than 160 ha by farm worker, would contract some companies. It could be easily explained by the poor time available for extra labour in the case of the bigger farms. Despite a better efficiency of the machinery, the most important surface doesn’t offer necessarily more free time for some experimental experience.

To conclude this aspect, we can underline that if we join the answers of the farmers who would call some supports (companies or workers), we reach 24 % of the farmers. This result would be interesting to analyse in terms of job creation or market possibilities for the wood companies. It means that it exist a market for companies who want to invest in this field or an alternative of diversification for a farmer who wants to offer some services to some neighbours. We will come back to this result to know what would be the behaviour of the farmers who are really interested in creating some silvoarable projects in the following chapter.
6.5.2. Sharing the maintenance costs in agroforestry

More than half of the farmers (55%) are ready to share the cost of investment in a wood machine or special crop machine like an adapted boom if necessary (see Figure 26).

![Figure 26: Would you be ready to share a machinery cost?](image)

At the question to know if they would be also ready to share the cost of a labourer, 45% are still considering this option (see Figure 27). The Italian and German farmers are the most disposed to this eventuality. In France and Spain, farmers are more cautious and don’t see a real opportunity of such an option.

![Figure 27: Would you be ready to share a worker cost?](image)

6.5.3. Is it possible to consider a collective project?

50% of the farmers consider that agroforestry isn’t necessarily an individual initiative but could be a collective one. Again, in Italy and Germany, farmers seem to be more ready to consider the possibility to set up a collective project. The Spanish and French farmers are more reluctant (see Figure 28).
Farmers would choose other farmers to be associated to a collective project. Only 12 farmers thought associating some family members.

10 other farmers proposed to be associated with a company or a bank to set up the plantation. In such a system, they imagined to be paid for the tree maintenance. They would receive interest for this labour. We can notice that we met one of these enterprising farmers in almost each country.

At least, the final decision for planting or not, is more a family decision. Only one third of the farmers would take the decision alone (Figure 29).

**Figure 28: Do you consider a collective project?**

**Figure 29: Who would take the decision to plant?**
7. Farmers attitude towards agroforestry

7.1. Are farmers interested in throwing themselves into an agroforestry venture?

To evaluate the interest of the farmers towards agroforestry, we finished the interview by asking some questions about the possibility to intercrop in new parcels or to intercrop in some existing rented parcels. At least, we asked them if agroforestry could constitute a concrete alternative for their own farm and which amount of money they were disposed to invest in this kind of project.

7.1.1. Would farmers accept to collaborate with an interested land owner?

We asked the farmers if they would be interested in the proposal of a neighbour to intercrop in a new parcel, converted into agroforestry. Faced to this eventuality, 54% of the farmers would be disposed to sign such a contract with the neighbour.

Some reluctant farmers emitted the possibility that it could make difficult to use contractors on the parcel because of the trees. Indeed, the trees could limit the use of special agricultural machinery. Others said that they would be afraid to damage the branches by using some specific machines such a combine harvester. These problems could lead to extra costs.

But for the majority, getting more cropping area is quite interesting for the farm profitability. But some financial compensation should be considered.

![Figure 30: Percentage of farmers ready to intercrop in a new rented parcel.](image)

7.1.2. Would farmers accept to intercrop in a rented area?

The following question was about the possibility to intercrop in an existing parcel they rent to a landowner. In that case, it supposes for them a reduction of the farming area…

In that case, 40% of the farmers are still disposed to accept that the owner plants trees in the rented parcels, but under conditions such as a diminution of the rent. This percentage is higher for farmers who rent more than half of their cropping area. More than 50
% of the farmers who rent more than 40% of their cropping area would be ready to such a contract.

7.1.3. Would farmers attempt a personal silvoarable project?

After talking about virtual project, we asked if they could be interested to set up some silvoarable plot in their own farm. The result was quite surprising: **48% of the farmers are disposed to invest in agroforestry.** This result has to be considered by regions due to a strong heterogeneity in the answers (see Figure 31). Without any surprise regarding the preliminary results of the study, the Mediterranean farmers think more about the setting up of some plots, above all in Italy and Greece. In the northern countries such as France, England or The Netherlands, farmers are more reluctant. But, even in these countries, where man supposed that farmers try to put off the trees from their cropping area, 20 to 40% of the farmers consider this option. The idea of planting trees in a well-managed system attracted many farmers.

![Figure 31: Would you attempt a silvoarable project?](image)

Considering only the farmers interested in attempting some project, 80% would plant in a near future, against 40% in the general sample.

Of course, we must not consider that 48% of the farmers we interviewed will initiate next year some silvoarable projects... Farmers set some conditions to this eventuality. At the end of the interview, more than half of the farmers doubted about the real profitability of such a system. One third asks questions about the technical feasibility, and one quarter pointed out the subsidy compatibility. In general, they want to see some concrete experiment. As a farmer said: “We don’t mind about photos, we must visit some plots!”. All these reactions allow defining scenarios to be explored by the Research Development, and some of them have been studied inside the WP7 and 8 during the Safe period (see Annex 7).

It is well known by interviewers that a role game often induces a temporary “euphoria”, which leads to ignore real life constraints. This is well known from social investigators, and often used by door-to-door salesmen. This aspect could have an effect on these results.
Nonetheless, this result shows clearly the interest of many farmers for agroforestry in all European countries. After only one hour of interview and a slide show of 10 pictures, the number of farmers ready to invest in a project in a near future is impressive. This result is much higher than our expectations before the interviews.

Another point that is interesting to note, is that the farmers who declared to be against any project represent less than 40%. The rest of the sample hesitated. The proportion of farmers interested is therefore higher than the farmers who are reluctant!

### 7.1.4. Which amount are they ready to invest?

It’s interesting to know which amount of money the farmers would be ready to invest to cover the costs of the plantation. In other word, just to know which level of subsidy they would demand to consider the possibility to invest or not. It gives an appreciation of the farmer’s motivation in favour of agroforestry.

We compared the answers from the farmers interested in (see Figure 33) with the general sample (see Figure 32). In that case, almost one third of the interested farmers would be ready to assume the totality of the plantation costs... In both cases, farmers think that a subsidy covering half of the costs would be necessary.

![Figure 32: Amount of money that farmers would invest in agroforestry for the tree plantation.](image)

![Figure 33: Amount of money that INTERESTED farmers would invest in agroforestry for the tree plantation.](image)
7.2. **Who are the farmers ready to invest?**

7.2.1. **The main statistical features of the motivated farmers**

A multi-dimensional analysis allowed discerning typical behaviours of farmers regarding agroforestry. The objective of this section is therefore to identify the determinants of the decision to carry out a project on one hand and on the other hand the factors that influence the importance of the planted area.

The whole statistical analysis is detailed in annex 8.

This statistical analysis pointed out 2 types of motivated farmers:

1. Older farmers constitute the most important group. They are between 45-55 years old in general. They would initiate a project more for environmental reasons. The presence of a successor in the farm is not really a motivation for them to plant, with the eventual objective to let a timber capital for inheritance. The silvoarable project would cover rather a small area (less than 10 % of the farming area).

2. Young farmers constitute the second group. They are about 35-45 years old. Younger is the farmer, the most he tries to perform the economical profitability of his project. He would initiate a project for economical reasons, and if the project seems profitable, he would plant a larger surface (from 20 to 100% of the cropping area…).

The statistical analysis allows describing the main features of the motivated farmers:

1. They have smaller area by worker. The cropping area / worker is about 40 ha against 70 ha for the farmers not interested in a project. Farmers with few surfaces to manage have more time to invest in agroforestry. They want also to diversify the farm incomes without penalizing the existing productions.

2. The farmers better informed are more disposed to initiate a project than the others. And the surface of the project would be bigger. Some motivated farmers showed some old articles they had conserved about agroforestry.

3. 25 % of the motivated farmers would plant more than 25 % of their cropping area. Many farmers consider agroforestry as a real diversification of their cropping area. Some very motivated farmers are ready to invest up to their total farming area... The motivated farmers employ more workers than the average. The tree maintenance is a possibility to optimise better the worker(s) activity. Agroforestry can convert the part time job of a worker to a full time. 10% of the motivated farmers would also ask to some companies to work in their project.
If the farmer doesn’t assume this task, he can ask a company or a labourer working in his farm. 10% of the interested farmers would contract a company for the tree maintenance. And other 16% would use their own farm’s worker for this purpose.

4. The motivated farmer comes from the Mediterranean rather than the temperate regions. There is a strong disparity in the results according to the climatic zone. Spain and Italy seems to be “the countries of agroforestry”. It’s in France, England and the Netherlands that we have the most statistical probability to find a farmer against a project. The farmers from the temperate zone demand more guaranties on the feasibility than the Mediterranean farmers.

5. The motivated farmers would also consider more the possibility to intercrop in some new parcels (see Figure 35) or, why not, in a existing parcel they rent to a land owner (see Figure 36).
7.2.2. **Main technical option for their project**

What would distinguish the motivated farmers from the others considering their technical options in the virtual project?

1. They would plant more surface

2. They would plant rather in several plots than just only one.

3. They would choose good agricultural fields rather than bad fields (above all in the Mediterranean zone).

4. They would try to intercrop up to the end of the tree rotation.

5. The relative crop area would be more intensive in the Mediterranean zone than in the temperate zone. Mediterranean farmers would intercrop more near the tree lines. On the opposite, northern farmers would let a bigger distance between the tree line and the crop limit (see table 12).
<table>
<thead>
<tr>
<th>Planted area (ha)</th>
<th>Castilla y Leon</th>
<th>Castilla-Mancha</th>
<th>Extremad.</th>
<th>Centre</th>
<th>Franche Comté</th>
<th>Poitou-Charentes</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>9.9</td>
<td>56.4</td>
<td>38.2</td>
<td>19.7</td>
<td>9.6</td>
<td>13.2</td>
<td>31.5</td>
<td></td>
</tr>
<tr>
<td>Planted area (% farming area)</td>
<td>10%</td>
<td>24%</td>
<td>45%</td>
<td>8%</td>
<td>10%</td>
<td>13%</td>
<td>22%</td>
</tr>
<tr>
<td>Tree density at the plantation</td>
<td>152.0</td>
<td>145.8</td>
<td>183.7</td>
<td>53.0</td>
<td>32.0</td>
<td>50.8</td>
<td>142.9</td>
</tr>
<tr>
<td>Maximum machinery width</td>
<td>6</td>
<td>6</td>
<td>6</td>
<td>24</td>
<td>23</td>
<td>22</td>
<td>11.7</td>
</tr>
<tr>
<td>Nb of machinery widths*</td>
<td>3.9</td>
<td>3.3</td>
<td>4.0</td>
<td>1.4</td>
<td>1.2</td>
<td>1.2</td>
<td>2.9</td>
</tr>
<tr>
<td>Distance Tree-crop</td>
<td>0.55</td>
<td>0.85</td>
<td>0.7</td>
<td>1.25</td>
<td>1.85</td>
<td>1.2</td>
<td>1.05</td>
</tr>
</tbody>
</table>

Table 12: Main technical differences between motivated and no-motivated farmers in 3 countries (Spain, France and England) concerning the distance of tree plantation.

* This parameter represents the ratio: distance between the tree lines / width of the wider machine. It helps to understand if the distance between the lines can authorize one or several machines ways.

In France, the choice of the distance between the tree lines depends on the width of boom sprayers. The distance between the tree lines represents between 1.1 up to 1.4 the width of the boom. The motivated farmers would plant more area, which represent between 8 to 13 % of the total farming area. In Spain, we notice that the distance between the tree and the crop line in less than one meter. One of the reasons is the small size of the machines. A small machine is easy to drive and allow to crop near the trees. The use of a large boom demands a safe distance between trees and crop, to avoid any damage with the trees.

### 7.3. Can we trust these results?

#### 7.3.1. The case of the French study

In France, all the results from the interviews have been presented in each target region. Three local meetings have been organised in Prahecq (Poitou-Charentes), Orleans (Centre) in December 04 and in February 05 in Besançon (Franche Comté). These meetings were the opportunity to discuss all the results with the technicians who helped to create the sample and the farmers who were interviewed.

The results we observed for France were quite surprising, even if they were lower in comparison with the results of the European sample. In very productive region (Centre) or on the contrary, in region where it’s difficult to maintain the agricultural area faced to the forest development (Franche Comté), the reaction of the farmers was enthusiastic to the silvoarable idea (see Figure 37). If many farmers pointed out all the technical difficulties, they showed a deep interest to be informed about the potential of these systems – 80% wanted to be contacted again.
Figure 37: Are the French farmers interested in creating some silvoarable project? A third of them said that it could be an option in a short term future. And 12% seemed to be really motivated.

Even if the percentage of interested farmers in attempting some silvoarable projects is less important than in the European study, almost 30% of the French farmers said they would think about it. In the Region Centre, we found a large number of farmers against this possibility. On the contrary, we have more possibilities to find an interested farmer in Poitou-Charentes.

This result was a strong surprise for the Chambers of Agriculture. Faced to this result, we realised an opinion poll with all the people who worked in the Farmer’s reaction study. We wanted to know their opinion before showing them the results. Almost 50 questionnaires were sent to them to sound up their opinion about the farmers’ reaction. And we received 25 answers. After the analysis of these questionnaires, we should be able to say that a few technicians were able to forecast these final results.

Figure 38: Technicians forecast about the answers of the farmers according to their interest in creating or not a silvoarable project. If the technicians share the same interest as the farmers concerning the possibilities of development of agroforestry, they nonetheless think that not so many farmers would be interested in this option.

Before each regional meeting, we phoned each farmer, two years after the interviews, to sound up again if they were thinking about a silvoarable project, if they had changed their mind about agroforestry (see Figure 39).
Figure 39: Evolution of the interest in creating a project for the French farmers who have been interviewed in 2003.

After 2 years, the farmers interested in attempting a project are less important than the first time, although we have still 10 farmers who are still enthusiastic. Finally, only half of the interviewed don’t imagine to plant trees in their cropping area, although some of them don’t close the door to this eventuality… In case of great subsidy, they can adopt their farming system!

We must also underline that 7 farmers have initiated some discussions with their technicians to see how to set up their silvoarable plot for 2005 (2 in Poitou-Charentes, 2 in Centre and 3 in Franche Comté)! From these 7 farmers, 5 had said that they were interested, one that he was undecided and the last one was against any project… This last farmer changed his mind about some environmental goal. In fact, his village decided to protect their water catchment’s area and to adopt some agro-environmental measures to maintain a good water quality. Therefore he himself proposed a silvoarable measure. This programme will concern many farmers of this area. We can add that, again in this environmental approach, another farmer we interviewed could propose an agroforestry measure for the same reason in his village. The rest of the farmers who want to plant trees in their crop give some economical reasons (diversification and inheritance) or just want to improve the landscape.

One of them told us during the interviews: “Your system is fantastic! But if you don’t succeed to change the European regulations to take into account the agroforestry specifications, you are an idiot! Sorry to tell you that!!”

7.3.2. How many European farmers will take the plunge?

We saw in the French case that if the number of farmers interested has decreased, we still have a large part of them who are ready to study a setting up of a silvoarable plot in their farm. At the European scale, how many farmers from the 48% who declared being interested are ready to take the plunge?

To answer this question, we designed an indicator of interest for the silvoarable technology that could then be compared with the answer the question: “Do you consider a silvoarable project in near future on your farm?». This indicator was built by mixing several questions and weighting the answers (Table 12).
<table>
<thead>
<tr>
<th>Question</th>
<th>Answer</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>97. Do you envisage a collective project?</td>
<td>Yes</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Doesn’t know</td>
<td>0.5</td>
</tr>
<tr>
<td>98. Would you be ready to share machine costs?</td>
<td>Yes</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Doesn’t know</td>
<td>0.5</td>
</tr>
<tr>
<td>99. Would you be ready to share worker cost?</td>
<td>Yes</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Doesn’t know</td>
<td>0.5</td>
</tr>
<tr>
<td>104. If a neighbour proposed an intercropping area for you to use, would you accept?</td>
<td>Yes</td>
<td>2.5</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Doesn’t know</td>
<td>1</td>
</tr>
<tr>
<td>105. If your landlord proposed to make an agroforestry project on the land you rented from him/her, would you agree?</td>
<td>Yes</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Doesn’t know</td>
<td>1</td>
</tr>
<tr>
<td>106. If the investment were between 1000 to 1600 euros/ha, what proportion would you be willing to pay?</td>
<td>0</td>
<td>-1</td>
</tr>
<tr>
<td></td>
<td>1-25 %</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>25-50 %</td>
<td>0.5</td>
</tr>
<tr>
<td></td>
<td>50-75 %</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>75-99 %</td>
<td>1.5</td>
</tr>
<tr>
<td></td>
<td>100 %</td>
<td>2</td>
</tr>
<tr>
<td>114. What is your opinion on agroforestry? (Mark from 0 to 10)</td>
<td>Mark 0-3</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Mark 4-6</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Mark 7-10</td>
<td>2</td>
</tr>
<tr>
<td>44a. What tree species would you choose for a project on your farm?</td>
<td>Couldn’t name species</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Named 1 species</td>
<td>0.5</td>
</tr>
<tr>
<td></td>
<td>Named &gt; 1 specie</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Named trees in general</td>
<td>0.5</td>
</tr>
<tr>
<td>24. Have you heard of the word &quot;agroforestry&quot;?</td>
<td>Yes with right definition</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Yes with wrong definition</td>
<td>0.5</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>0</td>
</tr>
<tr>
<td>25. If &quot;yes&quot; how have you heard of it?</td>
<td>Yes, personal experience</td>
<td>1.5</td>
</tr>
<tr>
<td></td>
<td>Yes, demonstrated origin (article filed…)</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Yes, origin well defined</td>
<td>0.5</td>
</tr>
<tr>
<td></td>
<td>Other</td>
<td>0</td>
</tr>
<tr>
<td>31. Do you have trees in the cropped area of your farm?</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>none, 2: &lt;10 trees/ha, 3: 10-20 trees/ha, 4: 20-30 trees/ha, 5: &gt;30 trees/ha</td>
<td>0.5, 1, 1.5, 2</td>
</tr>
<tr>
<td>32. Who planted them?</td>
<td>Parents</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Grand Parents</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Himself</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Doesn’t know</td>
<td>0</td>
</tr>
<tr>
<td>Agroforestry Interest Indicator</td>
<td>Mark / 20</td>
<td></td>
</tr>
</tbody>
</table>

Table 12: Calculation of the farmer Agroforestry Interest Indicator.
This indicator is clearly linked to the motivation of the farmer. The answers given for the possibility of setting up a project in a near future can be therefore compared to the indicator. This resulted in different profiles of farmers accounting to their motivation for a silvoarable plantation.

The Agroforestry Interest Indicator will allow identifying 4 classes of farmers according to their interest:

1. High motivation, ready to invest in a project in a near future
2. Motivated but cautious. Defines conditions first (such as payment eligibility).
3. Without defined opinion but the concept is considered attractive. Wonders if it could apply to his farm.
4. Reluctant, but still open in case of very high grants…

We calculated the value of this indicator for all the farmers of the sample (see Figure 40).

*Figure 40: Motivation degree for setting up a project according to the interest indicator.*

In France, the average for the 3 regions is about 17 %... exactly the percentage of farmers who will initiate such a project. But we can underline that this success is also link to other parameters in France. First, the possibility to get a subsidy for the plantation of the trees and the CAP payment for the intercrop area is a strong support for agroforestry. Secondly, during the SAFE programme, many articles have been published in professional newspapers, showing the results issued from the Research experience.

At the sample level, 48 % of the farmers have declared to be interested. But “only” 34 % seem to be motivated to initiate some projects. Let’s see what will happen in a couple of years...
8. Conclusion

Despite what man could think, farmers are not closed to the possibility to have trees in their farming area. Trees have been disappeared because of mechanical adaptation, land regrouping and because farmers didn’t want to lose CAP payments.

But if tree plantation is well adapted to the mechanical conditions, trees are not more considered as an obstacle. After 30 minutes of discussion and a slide show of traditional and modern silvoarable systems, half of the farmers concluded the interview saying that they would be interested to set up some agroforestry plots in their own farm. With more agroforestry experience, Mediterranean farmers are more ready to this eventuality than the farmers of the Northern Countries. But even in some intensive agricultural region, where man can observe no trees in the fields, one third of the farmers are interested. That was a strong surprise for the Safe consortium, which was not expecting such an interest from the cereal farmers. And it was not expected at all by the extension services in the different countries which are still a little suspicious about this result...

Different advantages have been underlined by the farmers. The main advantages that farmers have pointed out are rather economical than environmental. The most important one is the possibility to diversify the farm production. Faced to the agriculture prospect and the possible decreasing of the Single Farm Payment in the future by the modulation effect, farmers prospect for new opportunities. Agroforestry could be one of them. Other interest for agroforestry was the possibility to comply with the new CAP conditions (Good Agricultural Environmental Conditions). But above these CAP considerations, agroforestry is seen as a possibility to improve the agro-environmental performances of the farm (nitrogen leaching, soil erosion, biodiversity), with a system which can make money for the future contrary to most of the AEM which are not profitable and depend from an unstable subsidy.

But as said one French farmer, “farmers don’t mind about photos, they need to visit some experiment”. And the majority of the farmers set some conditions for the adoption of agroforestry. Which kind of impact will the trees have on the crop yield? How many trees will they have to plant? 80% of the farmers want to be contacted again.

Farmers required two main conditions before taking some decision:

1. They want to know more about the agronomical performances of such a system. They need results from the research programmes. They wish to visit some existing experimental plots and to see by themselves if wheat can grow between the trees (in quantity and quality)...They also want to be sure about the economical results of these systems (investment level, cash flow evolution, timber price).

2. CAP regulations should be adapted to agroforestry. All the farmers agreed to say that if this kind of system complies with the GAEC, it mustn’t penalize the farmers regarding the CAP payment. Tree area should be eligible to the SFP payment. And a subsidy of 50% of the investment costs is considered by the farmers as a minimum aid to support an agroforestry project. At least, farmers underline that with the new aerial control system, farmers who have scattered trees will be penalized. They asked therefore for a simplification of this control system.

If the 2 conditions of adoptions are set up, as it’s almost the case in France, we can expect that a large number of farmers will adopt agroforestry (more than 100 projects in 4 years in France). This future increasing of the agroforestry area will be the concrete expression of the
farmers’ interest we observed during our interviews. For example, in France, 12 % of the farmers we interviewed have initiated some projects for 2005, 2 years after being interviewed.

This important interest from the farmers and the eventuality that in a next future farmers will adopt agroforestry at a large scale, question us about the political consequences:

- The interviews results open some doors for the Research Development. During the discussions, various questions have been made by the farmers that can help the National Research Institutes to define some topics.

- The interviews results question also the extension services in each country to think about the best way to supervise the future development of agroforestry and to train the farmers but also the technicians about the agroforestry subject.
9. Index of figures

Figure 1: Seven countries have been involved (Spain, France, England, Italy, Greece, Germany and Netherlands) which represents 14 provinces in total. 16 persons have participated to the interviews of 264 farmers.

Figure 2: Distribution of the age of the farmers all regions taken together

Figure 3: Distribution of the interviewed by age and by region

Figure 4: Do you have a successor to take over the farm? Range of answers given by region (%).

Figure 5: Respondent’s farming status

Figure 6: Responsibility of the farmers in the rural society by country sample

Figure 7: Distribution of the owned area proportion for each region. For example, in Franche Comté, 20% of the farmers own more than 80% of the field they cultivate while 25% own less than 20%.

Figure 8: Farming systems specialization of the farms selected for the samples

Figure 9: Number of crops produced by the farmers in each region.

Figure 10: Number of isolated trees in the cropped field of the farm

Figure 11: Who have planted the isolated trees?

Figure 12: Are these trees pruned or maintained in any way?

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Franzel, Steven Charles.2002 Development and Agroforestry: Scaling Up the Impacts of Research 196 p Oxfams


13. Annex 1: Target regions description

13.1. England
The survey was located in Bedfordshire in the Midlands of England. According to the June census of the 1999 census, the majority of farm holdings in Bedfordshire are arable farms and “mixed and other types” of holdings. Most of these farms have less than 100 hectares, but a significant number are more than 100 hectares in size.

The total agricultural area of approximately 89000 is devoted primarily to cereal production (46%). Wheat comprises (37%) of the total area and barley (9%). Other significant crops include canola (9%) and field beans for stock feed (4%). Set-aside (11%) and grassland (14%) are also significant in contributing to the total agricultural area of Bedfordshire. A large number of holdings are also involved in livestock rearing (16%) using 12% of the available agricultural land. Woodlands cover only 2% of the agricultural area, although they comprise 6.6% of the total area of Bedfordshire (Forestry Commission 2002).

13.2. Netherlands
For the Netherlands chosen was for 2 distinct regions, which differed a lot in soil-type, landscape and farm type:

De Achterhoek

De Achterhoek is located on the sandy grounds in the East of the Netherlands. Although plots got bigger and agriculture intensified with the redistribution of lands in the 60s/70s of the last century, the landscape is still characterised by many landscape elements such as hedges, tree lined plots, solitary trees and copse wood bushes. Government regulations intend to maintain and even promote these elements, since they are considered as cultural heritage of this region and as having high natural value. The many estates contribute for a
big part to the culture-historical and natural values of the areas. Trees are abundant and quite some forests can still be found, partly on estate property.

Both farm-size and plot-size in this region are comparatively small. Dairy farming and intensive stock farming and the accompanying pastures and fodder crops (grains, maize, potatoes, and beets) dominate the agricultural sector. Still a lot of farms are mixed farms, producing (partly) the fodder for their animals.

Northern Friesland

The North of Friesland is also the most northern part of the Netherlands and predominantly consists of marine clay deposits. The Northern and Western part of this region border the Waddenzee, the Southern part border the Northern Sands. The landscape is culturally very wide-spaced and open. Plots are often separated by ditches. Especially after the redistribution of lands, hardly any trees or bushes are found in or around fields.

Farm size and plot size in Northern Friesland are considerably bigger than in the Achterhoek. The agricultural sector traditionally consists of dairy farming, but nowadays also (seed)potatoes, sugar-/fodder beets and vegetables are much cultivated. Less mixed farms are found than in the Achterhoek: farming systems tend to increase and specialise on either cattle breeding or crop production for reasons of efficiency. Since the region is a stop-over place for many travelling birds, such as goose, quite some (dairy)farmers are involved in compensation-subsidies for letting them graze in their lands or for mowing management/protecting nests.
13.3. France

The survey in France was located in 3 regions: Poitou-Charentes, Centre and Franche Comté.

- The region Poitou-Charentes

Agriculture in Poitou-Charentes is much diversified. Agriculture employs more than 10% of regional employment.

40% of the farms in Poitou-Charentes are in a cropping system. The main crop is wheat with a medium yield of 7 t/ha. We find also maize (CAP payment effect) and sunflower, oil seed and barley.

The tree is an important component of the landscape. The region is well known for the importance of the existing hedges, but also for the isolated trees (such walnut or chestnut trees).

In the south of the region, vineyards are dominant such as the famous Cognac.

- The region Centre

The rural landscape in the region Centre is much diversified, from intensive agriculture from the Beauce area where we find the best yield in France for wheat, to the south of the region mainly constituted by pasture and breeding systems.

But cropping system is the essential system and constitutes an important production centre in France. Wheat is the main crop. We find also barley and rape seed but also sunflower and maize. A lot of farms are located in « intermediary » regions where the common yield is medium. The wheat yield fluctuates between 5 to more than 10 tonnes/ha... To not depend too much from the CAP payment, farmers try to find some alternative solution with some specialized crop. The region Centre is the first region for the Oil seed production for energy.

The typical landscape is a bare field on thousand hectares... But in the south, we can find large forest, famous for hunting.

- Franche Comté

The region Franche Comté is the second wooded region in France after Aquitaine. Forest cover 43% of the territory. In such a context, farmers try to defend the agricultural land facing the rural exodus.

Breeding systems are the most important farming systems in Franche Comté. Cropping activity is poor, except the crops for fodder (barley for example). With the CAP policy, we have assisted during the last ten years to an extension of the maize area to the detriment of the pasture system. But the profitability of these intensive systems is linked to the grant level.

In such a context, it was therefore interesting to know how farmers consider the possibility to plant trees in a region, where the main problem is to improve the crop yield and to decrease the production costs.
13.4. Germany

The choice of regions fell upon the Lauenburg Lake District, in the federal state of Schleswig-Holstein and the Region of Oder-Spree near to Berlin in the federal state of Brandenburg. Both regions are on the North German Plane. Agriculture is large scale with some fields as large as 100 Hectares. Both regions are heavily forested. Whereas in Lauenburg it is mainly deciduous in Oder-Spree conifers dominate, woodland and agriculture are very separate. Due to the beautiful countryside, manz lakes and rivers, as well as the vicinity of large towns make the areas popular for local tourism. As a result there are conflicts between the interests of farmers, nature conservancy and tourism. Tourism is becoming more important as a source of income for farmers, direct marketing and hospitality is growing slowly but steadily. The soil quality is poor or mediocre, mostly a sandy clay or a clay sand. Farmers have to deal with a wide variation in quality. The yield is also very variable and lies under the German average. The farmers plant mostly cereals, rape and maize.

Soil erosion is a problem, it is caused by strong winds and long dry spells, particularly in summer.
In Schleswig Holstein the farms have grown over many generations, whereas in Brandenburg huge conglomerates, with several thousand hectares, were created after the second world war. With the reunification of Germany many small farms came into existence alongside the cooperatives.

It seemed particularly interesting in view of the strong nature conservancy interests, the demands of tourism and the relatively poor yield in the regions, that Agroforestry could solve the conflicts of interest whilst at the same time offering new sources of income. We were curious to observe if despite the relatively similar conditions in the regions the response to our questions would be influenced by their very different histories. 

### 13.5. Greece

**Name: Municipality of Askio, Greece**

Most of farming in the area is maintained due to crop subsidies by the EU and the farmers, mainly tenants, cared only for the crops and not for the trees. In the few cases where the owners themselves were involved in the cultivation of the systems, the inputs in terms of fertilizers, pesticides, etc. were limited. In the areas where the land was consolidated and irrigation became available, the owners and farmers eliminated the trees in order to increase the crop yield and facilitate the use of agricultural machines.

Map location at national level: Municipality of Askio belongs to the prefecture of Kozani, West Macedonia, Greece.

### 13.6. Italy

The survey was carried out in Central (Toscana, Lazio, Umbria and Marche regions) and Northern Italy (Veneto and Lombardia regions). The investigated areas (figure 1) are located in hilly lands, poor or medium soil fertility conditions in Central Italy where a more extensive agricultural system is common; in Northern Italy the plane morphology of the lands and the fertile soil are favourable for adopting intensive agricultural practices. The choice of the regions reflects the aim to inquire a wide range of conditions that could affect the adoption of silvoarable systems.
13.7. Spain

En España se ha realizado el muestreo en tres Comunidades Autónomas. Para seleccionar las más idóneas los criterios han sido: la existencia de grandes superficies de cereal, la presencia de sistemas agroforestales y de infraestructura y el conocimiento de contactos previos que pudieran facilitar la realización del estudio. Según estos criterios, las Comunidades Autónomas elegidas son:

- **Extremadura**: Región donde está localizada la Universidad de Extremadura, quien realiza el estudio. Este hecho supone un mayor conocimiento de la zona así como una mayor facilidad para el desarrollo del estudio. Por otro lado, parece conveniente conocer la reacción de los agricultores en una comunidad donde ya existen los sistemas agroforestales (dehesa) así como varias experiencias de producción de madera noble con especies como el nogal, cerezo y roble americano.

- **Castilla y León**: Región productora de cereal por excelencia en España. Esta región es la mayor productora de trigo (35% de la producción nacional), cebada (49%), centeno (76%) y maíz (28%). En cuanto a superficie, se mantiene la misma proporcionalidad, existiendo por tanto grandes extensiones desarboladas.
Castilla-La Mancha: Segunda región en producción y superficie de cereal en España (trigo, cebada, avena, centeno y maíz). Por otro lado, existe en la región la combinación de cultivos “viña-olivo” que puede afectar a la reacción de los agricultores ante los sistemas agroforestales.
14. **Annex 2 : Questionnaire**

**General data**

1. Interviewer Name
2. Country
3. State
4. Province
5. Date
6. Name of the interviewed
7. Responsibility (economical or political responsibility)
8. Age
9. Address
10. Phone
11. Mail
12. Land Tenure
13. Farming system
14. Other
15. Farming status: the farmer can work alone or inside a society.
16. Number of workers (farmer or owner + salaried + family)
17. Number of salaried workers
18. Total cropping area
19. Owned area
20. Rented area
21. Number of crops
22. Successor?
23. Age of the successor

**Introduction**

Note: This introduction permits us to evaluate the knowledge of the person on agroforestry and his/her feeling about trees…

24. Do you know the word "agroforestry"?
25. How?
26. What's your definition of agroforestry?
27. Have you ever seen some practices?
28. Do you know some persons making agroforestry?
29. Have you some hedges?
30. Length of hedges
31. Have you some trees on your cropping area?
32. Who planted them?
33. These trees are pruned, maintained?
34. Have some lonely trees been cut?
35. For which reason?
36. What is the interest to keep the lonely trees?
37. Other
38. Feeling about trees: this question can be filled by the interviewer according to the precedent answers.

**Slideshow presentation**
Presentation comments

39 Is the slideshow correspond to your agroforestry idea?
40 A - What are the main differences?
41 B - Up to you, what are the positive aspects in agroforestry?
42 C - Up to you, what are the negative aspects in agroforestry?
43 D - If you’d planned an agroforestry project, what would be your main objectives?

Note: The interviewer has a table of possible answers. He writes the answers from 1 to n, according to the order of answer. For example, if the interviewee speaks first about landscape and then about diversification, we note in the table provided, “1” for landscape and “2” for diversification.

Virtual project...

44 Kind of association: Tree choice and crop choice. Reasons.
45 Do you imagine a secondary production?
46 Which one?
47 Planted area
48 Planted area at the end of the interview (after the interview and the discussion, we notice that the person often change the area to plant.)
49 On which kind of land unit?
50 Number of annual plots
51 Distance between the tree lines
52 Why?
53 Other
54 Distance between the trees on the line
55 Why?
56 Other
57 Width of the intercropping strip at the beginning:
58 Why?
59 Other
60 Width of the intercropping strip at the last year of intercropping:
61 Why?
62 Other
63 Width of the cropping border
64 Why?
65 Other
66 Minimum width of the plot
67 Why?
68 Other
69 Minimum length of the plot
70 Reason
71 Other
72 Would you plant along the contour lines?
73 Comments
Machinery: we note only the data for the machine, which seem to represent some constraint for the farmer.

Example: width of the sprayer boom

Precise the kind of irrigation system

<table>
<thead>
<tr>
<th>Pivot system</th>
<th>gun</th>
<th>fixed sprinkler</th>
<th>boom + roller</th>
</tr>
</thead>
<tbody>
<tr>
<td>[Image]</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Comments
With the years, will you decrease the intercropping width?
Why?
Decreasing system:
Who will do the operations?
If tree maintenance suppose 3 or 4 days/ha, who will do the maintenance?
Which kind of soil maintenance on the tree line?
How would you maintain the system on the tree line?
Which soil occupation after the last annual crop?
Would you choose rather a winter or a spring crop?
Reason
An annual crop or perenial crop?
Reason
What would be the best adapted crop for intercropping?
Reason
What would be the worse crop for intercropping?
Reason
Do you think it's possible irrigating?
Reason
Is there some chimical product to avoid?
Which ones?

Project development

Do you imagine a collective project
Would you ready to share a machine cost?
Would you ready to share a worker cost?
Which kind of partner
Other
Who will take the planting decision?
Other
If a neighbour proposed you an intercropping area, would you accept?
If one of your owner proposed you to make an agroforestry project on the area you rent, do you agree?
If the investment represent 1000 to 1600 euros/ha, which part are you ready to support?
Which kind of subsidy?
Would you need some technical advices for trees?
On which aspects?
Would you need some technical advices for intercrops?
On which aspects?

Conclusion

Following this interview, which aspect can slow down or forbid agroforestry project?
Which kind of solution or research thematic would you propose to solve them?
Global opinion on agroforestry
Do you want to attempt to an agroforestry project?
If the farmer agree, do you attempt to an agroforestry project?
For when?
Is your age a factor of decision in this?
For which reason?
Do you want to be contacted again?
Post interview comment
Scenario to be tested
15. Annex 3: Slide show
16. **Annex 4: Presentation of the sample**

Responsibility of the farmer in the rural society

![Responsibility of the farmer in the agricultural society](image)

Size of the farm

<table>
<thead>
<tr>
<th>State</th>
<th>NB Name</th>
<th>Total cropping area</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>&lt;20ha</td>
<td>20-50 ha</td>
</tr>
<tr>
<td>Bedford</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>Brandenburg</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Castilla y Leon</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>Castilla-La Mancha</td>
<td>6</td>
<td>9</td>
</tr>
<tr>
<td>Centre</td>
<td>7</td>
<td>11</td>
</tr>
<tr>
<td>E-Achterhoek</td>
<td>1</td>
<td>7</td>
</tr>
<tr>
<td>Extremadura</td>
<td>7</td>
<td>5</td>
</tr>
<tr>
<td>Franche Comté</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>Italy Centre</td>
<td>5</td>
<td>4</td>
</tr>
<tr>
<td>Italy Nord</td>
<td>5</td>
<td>1</td>
</tr>
<tr>
<td>N-Friesland</td>
<td>7</td>
<td>7</td>
</tr>
<tr>
<td>Poitou-Charentes</td>
<td>1</td>
<td>6</td>
</tr>
<tr>
<td>Schleswig-Holstein</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>West Macedonia</td>
<td>19</td>
<td>1</td>
</tr>
<tr>
<td>Total</td>
<td>46</td>
<td>41</td>
</tr>
</tbody>
</table>
17. Annex 5: Presence of the trees in the farming system

Have you hedges in your farm?

<table>
<thead>
<tr>
<th>Area</th>
<th>Hedges on Farm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Franche-Comté (F)</td>
<td></td>
</tr>
<tr>
<td>Poitou-Charente (F)</td>
<td></td>
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<tr>
<td>Centre (F)</td>
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<td>Bedford (UK)</td>
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<td>Brandenburg (G)</td>
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<td>Schleswig-Holstein (G)</td>
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<td>West Macedonia (Gr)</td>
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<td>E-Achterhoek (N)</td>
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<td>Castilla y Leon (S)</td>
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<td>Castilla-La Mancha (S)</td>
<td></td>
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<tr>
<td>Center (I)</td>
<td></td>
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<tr>
<td>North (I)</td>
<td></td>
</tr>
</tbody>
</table>

Why isolated trees have been cut in your field?

The reasons why the isolated trees have not been cut

<table>
<thead>
<tr>
<th>Area</th>
<th>Production</th>
<th>Landscape Value</th>
<th>Rules</th>
<th>Inheritance</th>
<th>Other</th>
<th>Unknown</th>
</tr>
</thead>
<tbody>
<tr>
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<td>Poitou-Charente (F)</td>
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<td>Schleswig-Holstein (G)</td>
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<td>E-Achterhoek (N)</td>
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<td>Castilla y Leon (S)</td>
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<td>Center (I)</td>
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<tr>
<td>North (I)</td>
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</table>
18. Annex 6: about a virtual project

Which kind of tree specie would you plant?

Why do you choice these species to plant in your virtual project?

<table>
<thead>
<tr>
<th>Kind of association: trees</th>
<th>wild cherry (%)</th>
<th>oak (%)</th>
<th>various (%)</th>
<th>red oak (%)</th>
<th>poplar (%)</th>
<th>don't know (%)</th>
<th>walnut (%)</th>
</tr>
</thead>
<tbody>
<tr>
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<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>100</td>
</tr>
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<td>0</td>
<td>0</td>
<td>0</td>
<td>100</td>
</tr>
<tr>
<td>Extremadura</td>
<td>0</td>
<td>0</td>
<td>0</td>
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<td>0</td>
<td>0</td>
<td>0</td>
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<td>100</td>
</tr>
<tr>
<td>Schleswig-Holstein</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>100</td>
</tr>
<tr>
<td>West Macedonia</td>
<td>0</td>
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<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>100</td>
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</table>

<table>
<thead>
<tr>
<th>Walnut</th>
<th>Poplar</th>
<th>Various</th>
<th>Oak tree</th>
<th>Wild cherry</th>
<th>Olive tree</th>
<th>Fruit tree</th>
<th>Don't know</th>
<th>Unknown</th>
</tr>
</thead>
<tbody>
<tr>
<td>5%</td>
<td>28%</td>
<td>27%</td>
<td>23%</td>
<td>21%</td>
<td>29%</td>
<td>7%</td>
<td>33%</td>
<td>10%</td>
</tr>
<tr>
<td>34%</td>
<td>21%</td>
<td>17%</td>
<td>23%</td>
<td>29%</td>
<td>7%</td>
<td>33%</td>
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<td>23%</td>
<td>35%</td>
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<td>62%</td>
<td>21%</td>
<td>75%</td>
<td>33%</td>
<td>0%</td>
<td></td>
</tr>
<tr>
<td>17%</td>
<td>7%</td>
<td>7%</td>
<td>21%</td>
<td>7%</td>
<td>7%</td>
<td>5%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3%</td>
<td>9%</td>
<td>3%</td>
<td>7%</td>
<td>7%</td>
<td>7%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18%</td>
<td>7%</td>
<td>23%</td>
<td>15%</td>
<td>25%</td>
<td>13%</td>
<td></td>
<td></td>
<td>29%</td>
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<tr>
<td>65</td>
<td>43</td>
<td>30</td>
<td>26</td>
<td>14</td>
<td>16</td>
<td>15</td>
<td></td>
<td></td>
</tr>
<tr>
<td>26%</td>
<td>17%</td>
<td>12%</td>
<td>10%</td>
<td>6%</td>
<td>6%</td>
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<tr>
<td>6%</td>
<td>6%</td>
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<td>6%</td>
<td>8%</td>
<td>10%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8%</td>
<td>10%</td>
<td>10%</td>
<td>10%</td>
<td>8%</td>
<td>10%</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Which kind of secondary production would you envisage with the trees?

![Bar chart showing various regions and production types.]

Which kind of crop?

![Bar chart showing various regions and crop types.]
Which area would you plant (ha)?

![Bar chart showing planting area percentages for different regions.]

Main technical feature for each region

<table>
<thead>
<tr>
<th>Region</th>
<th>Distance between the lines of trees</th>
<th>Width of the intercropping strip in the establishment year</th>
<th>Width of the intercropping strip in the last year of intercropping</th>
<th>Width of the headland</th>
<th>Minimum width of the plot</th>
<th>Minimum length of the plot</th>
<th>Minimum area</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bedford</td>
<td>28</td>
<td>24</td>
<td>24</td>
<td>27</td>
<td>122</td>
<td>198</td>
<td>2.4</td>
</tr>
<tr>
<td>Castilla y Leon</td>
<td>21</td>
<td>20</td>
<td>20</td>
<td>12</td>
<td>/</td>
<td>/</td>
<td>/</td>
</tr>
<tr>
<td>Castilla-La Mancha</td>
<td>14</td>
<td>14</td>
<td>11</td>
<td>8</td>
<td>127</td>
<td>1313</td>
<td>16.5</td>
</tr>
<tr>
<td>Centre</td>
<td>27</td>
<td>24</td>
<td>20</td>
<td>22</td>
<td>188</td>
<td>306</td>
<td>5.6</td>
</tr>
<tr>
<td>Achterhoek</td>
<td>27</td>
<td>25</td>
<td>12</td>
<td>17</td>
<td>100</td>
<td>300</td>
<td>3.0</td>
</tr>
<tr>
<td>Extremadura</td>
<td>19</td>
<td>17</td>
<td>16</td>
<td>8</td>
<td>93</td>
<td>185</td>
<td>1.7</td>
</tr>
<tr>
<td>Franche Comté</td>
<td>27</td>
<td>23</td>
<td>23</td>
<td>21</td>
<td>100</td>
<td>350</td>
<td>3.5</td>
</tr>
<tr>
<td>Italy Centre</td>
<td>24</td>
<td>21</td>
<td>18</td>
<td>/</td>
<td>/</td>
<td>/</td>
<td>/</td>
</tr>
<tr>
<td>Italy North</td>
<td>19</td>
<td>17</td>
<td>14</td>
<td>/</td>
<td>/</td>
<td>/</td>
<td>/</td>
</tr>
<tr>
<td>N-Friesland</td>
<td>25</td>
<td>22</td>
<td>20</td>
<td>10</td>
<td>233</td>
<td>470</td>
<td>11.0</td>
</tr>
<tr>
<td>Poitou-Charentes</td>
<td>23</td>
<td>20</td>
<td>15</td>
<td>20</td>
<td>107</td>
<td>200</td>
<td>2.1</td>
</tr>
<tr>
<td>Schleswig-Holstein</td>
<td>29</td>
<td>27</td>
<td>18</td>
<td>25</td>
<td>134</td>
<td>340</td>
<td>4.6</td>
</tr>
<tr>
<td>West Macedonia</td>
<td>13</td>
<td>6</td>
<td>5</td>
<td>17</td>
<td>44</td>
<td>110</td>
<td>0.5</td>
</tr>
</tbody>
</table>
19. Annex 7 Scenarios to be explored by the Research Development

A first analysis of the interviews resulted in a list of scenarios that were forwarded to WP7. All scenarios feature interesting questions from a farmer perspective, but only few will be tested by WP7. This list is also the possibility to point out the demand from the farmers toward the Research Institutes.

**Agronomical scenario**

<table>
<thead>
<tr>
<th>№</th>
<th>Title</th>
<th>Description</th>
<th>Scale</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>LER¹ impact on economic results</td>
<td>What is the minimum biophysical efficiency of tree/crop systems to be attractive to farmers? We need to assess the sensitivity of the profitability of silvoarable plots to the LER. The answer may depend on the tree and the crop species, the site fertility, the</td>
<td></td>
</tr>
</tbody>
</table>

**Technical scenarios**

<table>
<thead>
<tr>
<th>№</th>
<th>Title</th>
<th>Description</th>
<th>Scale</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.1</td>
<td>The strategy for designing a new silvoarable plot.</td>
<td>What is the impact of the strategic options adopted at the start of a silvoarable project on profitability? Examples of these strategic options are the choice of a tree species, the distance between the tree lines, the total tree density, the distance between the intercrop and the tree line, the numbers of tree rows in a field (odd or even?), the option to mix tree species… Such options impact on labour needs, on productivity, and on profitability.</td>
<td></td>
</tr>
<tr>
<td>2.2</td>
<td>Location of the new silvoarable plot</td>
<td>Where should the silvoarable project be established? On high fertility plots, or on marginal land?</td>
<td></td>
</tr>
<tr>
<td>2.3</td>
<td>What size for a new silvoarable project?</td>
<td>Size matters. A large plantation can induce extra costs or problems for tree care. The project should be compatible with the labour availability, the cash flow should be maintained over the years, and the profitability should be ensured. The option to split the project in several annual plantations should be explored.</td>
<td></td>
</tr>
</tbody>
</table>

**Policy scenarios**

¹ The LER is a measure of the productivity of a silvoarable plot compared to pure agriculture and pure forestry (see WP6-7 reports)
<table>
<thead>
<tr>
<th>No</th>
<th>Title</th>
<th>Description</th>
<th>Scale</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.1</td>
<td>Agroforestry and new CAP policy – 1st pillar</td>
<td>Agroforestry was not considered in the CAP so far. We suggest to compare two scenarios for including agroforestry plots in the new CAP: In the Single Farm Payment scheme, we suggest to compare two options: The cropped area of a silvoarable plot is included in the SFP The total area of a silvoarable plot is included in the SFP The consequences on the payments rights at the farm scale should be explored.</td>
<td>Plot</td>
</tr>
<tr>
<td>3.2</td>
<td>Agroforestry and new CAP policy – 2nd pillar</td>
<td>What grant scheme to stimulate silvoarable projects? They may include subsidies for the tree plantation, compensation payments for agriculture loss, and agri-environmental measures. Different combinations must be explored. The no-subsidy scheme is a reference. The assessment can be done from an end-users point of view, but also from a policy-maker point of view.</td>
<td>Plot</td>
</tr>
<tr>
<td>3.3</td>
<td>Agroforestry and land/profit taxation schemes</td>
<td>An agroforestry plot is neither an agricultural plot nor a forestry plot. The impact on agroforestry profitability of each of these taxation schemes should be made. In France, this resulted in the conclusion that agroforestry is simply impossible if we stick to these two schemes. A proposal for a new tax category is therefore under construction. The consequences on the value of the land must be evaluated.</td>
<td>Plot</td>
</tr>
</tbody>
</table>
## Farm Strategy scenarios

<table>
<thead>
<tr>
<th>No</th>
<th>Title</th>
<th>Description</th>
<th>Scale</th>
</tr>
</thead>
</table>
| 4.1 | Increasing the farm size with agroforestry...                       | According to our survey, most farmers agree to intercrop a neighbour plot with a new silvoarable plantation.  
What contract for this situation?  
What economic consequences for the owner and the farmer?  
What consequences for the SFP rights?  
What is the best option for the farmer to increase his farm size: buy the land, rent the land, or contract agroforestry?                                                                                                                                  | Plot Farm      |
| 4.2 | Precision agriculture and silvoarable plot                          | Intercrops require a specific management.  
What are the best tactical schemes for the inter-crops when the yield decreases as a result of tree competition? This is relevant for all management options (fertilisation, pest control, seeding density…). A biological control of pests may be observed in silvoarable plots due to the increased biodiversity. What impact on profitability? | Plot           |
| 4.3 | Tree care: do it yourself?                                          | What is the best option for maintaining the trees? Is it economically sound to contract the job?                                                                                                                                                                                                                                                                                                                                                           | Plot           |
| 4.4 | What is the best time during the life cycle of a farmer to invest in agroforestry? | What advantages for a young farmer to invest in agroforestry? For a senior farmer?                                                                                                                                                                                                                                                                                                                                                               | Farm           |
| 4.5 | Agroforestry and machinery                                          | Is it worth investing in new machinery adapted for a silvoarable scenario? Example of an irrigating system adapted to the alley cropping system.  
Is it interesting to share the investment with neighbours?                                                                                                                                                                                                                                                                                                                                                                               | Farm           |
| 4.6 | Agroforestry and employment                                         | A large or a collective project could provide opportunity to employ some person(s) on the farm. This scenario will compare the worker cost with a company cost, taking into account the improvement of the tree maintenance and the consequences on the economical results.                                                                                                                                                                                                                                        | Plot and Farm  |
| 4.7 | Agroforestry and the environment                                    | In various sensitive areas or water catchments areas, different solutions are offered to the local authorities: to replace crops by pasture or forestry, to impose environmental measure or… to propose some silvoarable measure. This scenario will compare the cost of these different options for the local authorities and the consequences for the farm incomes.                                                                                                 |                |
## Sensitivity analysis to the markets

<table>
<thead>
<tr>
<th>N°</th>
<th>Title</th>
<th>Description</th>
<th>Scale</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.1</td>
<td>Agroforestry and market prices</td>
<td>Impact of compared price variation for wood and crop products.</td>
<td>Plot</td>
</tr>
<tr>
<td>5.2</td>
<td>Policy variations</td>
<td>Impact of the sustainability of the grant regimes.</td>
<td>Plot</td>
</tr>
<tr>
<td>5.3</td>
<td>Natural risk and insurance</td>
<td>Impact of natural risks on trees (storm, floods, pests…). What insurance strategy, what impact on the profitability?</td>
<td>Farm</td>
</tr>
</tbody>
</table>
20. Annex 8: Statistical Analysis

Mourad Ayouz (CNRS) and Fabien Liagre (APCA) carried out the multi-functional analysis of the sample. It was a very hard work due to the strong heterogeneity between the regional samples and the poor number of data for some regional sample.

Introduction

The objective of this section is to identify the determinants of the decision to carry out a project of agroforestry and the factors which influence the ground level planted out of tree. Empirical work is based on a European sample of 263 owners. Information was collected in 7 countries in 13 European areas.

We use two endogenous variables. An indicator is equal to 1 when the surveyed farmer states to want to carry out a project of agroforestry. The second endogenous variable we used makes it possible to distinguish three groups of farmers: owners who have stated not to want to plant trees, the owners who have stated to want to plant from 1 to 25% of the farming area, and the owners having emitted the wish to plant more than 25% of their farming area. According to our tests, the threshold of 25% of the farming area seems to be the most discriminating.

After having carried out a preliminary analysis of data (non parametric tests), we consider a probit binary to explain the probability of carrying out a project of agroforestry. Then, we estimate a probit ordered (with known thresholds) in order to estimate the determinants of the following probabilities: probability of not planting, probability of planting from 1 to 25% of the farming area, and the probability of planting more than 25% of the farming area. In order to measure the weight of each explanatory variable identified on the endogenous variables, we measure the marginal effects of those. It is possible thus to estimate the effect of each variable on the probability of carrying out a project of agroforestry, and of evaluating their effects on the probability of planting more than 25% of the farming area.

1. Endogenous variables.

47.5% of the farmers of the sample stated to want to carry out a project of agroforestry. In addition, 60.5% of the farmers said that they would plant trees on 1 to 25% their surfaces. 24% only seem ready to plant more than 25% of their total surfaces. It thus seems that overall the farmers do not have a strong propensity to plant trees on large surfaces. Paradoxically, among the people having stated to want to carry out a project of agroforestry, we have 10.4% of chances to find a farmer having stated not to want to plant trees. In technical terms, this does not enable us to regard the two endogenous variables as being conditional one with the other. In table 1, we notice among the farmers having stated to wish to carry out a project of plantation, the probability of observing a farmer who wishes to plant 1 to 25% of his surface is 60.80%. This proportion is identical to this one we obtained for the group of farmers who stated not to want to carry out a project. Into final, we will arrive to well distinguish the choices of the farmers only when we study the decisions to plant more 25% of the SAU or when we analyze the choices specifically not to plant trees.
Table 1: Conditional probabilities of the events joined to plant and decision to carry out a project

<table>
<thead>
<tr>
<th>Decision to carry out a project</th>
<th>No</th>
<th>Yes</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Percentage of surface to plant</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Not to plant</td>
<td>20.29</td>
<td>10.40</td>
<td>15.59</td>
</tr>
<tr>
<td>To plant 1-25%</td>
<td>60.14</td>
<td>60.80</td>
<td>60.46</td>
</tr>
<tr>
<td>To plant more than 25%</td>
<td>19.57</td>
<td>28.80</td>
<td>23.95</td>
</tr>
<tr>
<td>Total</td>
<td>52.47</td>
<td>47.53</td>
<td>100.00</td>
</tr>
</tbody>
</table>

2. Explanatory variables of the decision to choose a project.

We used a vector of explanatory variables relating to the characteristics of the farmers, on the information which they hold, and on the characteristics of the exploitation.

Distribution of the number of exploitation.

The number of farmer distributes in a rather heterogeneous way between the various States (the test of the khi two rejects the hypothesis of a homogeneous distribution because the Khi two we obtained is equal to 49.4 for 12 degrees of freedom, which is equivalent to one p-value lower than 1%). Our sample includes more farmers of Italy (14.8%) and farmers of the regions of Castilla-La Mancha and Extremadura (11.4% respectively).

The distribution of the farmers according to their wishes to carry out a project of forestry is more or less marked according to the studied European areas’ (the test of the khi two gives statistics of 50.755 for 12 degrees of freedom). Indeed, the highest probabilities to observe a farmer who doesn’t wish (or who doesn’t know if he wishes) to carry out a project of agroforestry is in the area of the Centre (Fra). This probability is 5.70% for the farmers of Extremadura. It is in Castilla la Mancha that we find more farmers having answered to want to make agroforestry, followed-up by the farmers of Extremadura (joined probability of 5.70).

If we think in term of conditional probabilities, we can note that there are 84.62% of chances to find in Italy a farmer who wishes to carry out a project of agroforestry. Just as there is 60% of chances to find a farmer who want to carry out a project in Castilla la Mancha or in the region of West Macedonia. On the opposite, there are 80% of chances to find a farmer who doesn’t want (or who doesn’t know) if a project of agroforestry constitutes an option in the following areas: Bedford, Centre, and Franche Comté.

Because of the sample size, we preferred to use indicators by country. For farmers Spanish (the largest sample because they represent 32.32% of the total sample), we have 52.94% of chances to find a farmer who have stated to want to conclude a project. For the French who accounts for 22.43% of the sample, we have 27.12% of chance to find farmers favourable to a project of agroforestry. This conditional probability is 84.62 for the Italians. It is thus in Italy that we would likely find the largest number of farmers ready to carry out a project of agroforestry. Admittedly, we can notice that in Great Britain a great proportion of farmers are in favour of a project of agroforestry but the farmers of this country account for only 7.6% of the sample. On the whole, the test of Khi two allowing testing the connection between the two variables (decision to carry out or not a project and the polytomic variables allowing
distinguishing the various countries) gives a high statistics about 45.018 per 6 degrees of freedom, which is equivalent to one p-value of 0.001.

Table 2 Conditional probability Prob (to carry out or not a project / country)

<table>
<thead>
<tr>
<th>Choice of project</th>
<th>D</th>
<th>FRA</th>
<th>GR</th>
<th>I</th>
<th>N</th>
<th>SP</th>
<th>UK</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>No to project</td>
<td>43.75</td>
<td>72.88</td>
<td>40.00</td>
<td>15.38</td>
<td>75.86</td>
<td>47.06</td>
<td>80.00</td>
<td>52.47%</td>
</tr>
<tr>
<td>Yes to project</td>
<td>56.25</td>
<td>27.12</td>
<td>60.00</td>
<td>84.62</td>
<td>24.14</td>
<td>52.94</td>
<td>20.00</td>
<td>47.53</td>
</tr>
<tr>
<td>Total</td>
<td>6.08</td>
<td>22.43</td>
<td>7.60</td>
<td>14.83</td>
<td>11.03</td>
<td>32.32</td>
<td>5.70</td>
<td>100.00</td>
</tr>
</tbody>
</table>

We sought to oppose the farmers of the South of Europe (Italy, Greece and Spain) compared to the other countries of Europe. From the binary Probit estimates (see the table), we can notice that only the parameter associated with the indicator making it possible to distinguish the Italian farmers is significantly different from 0, which confirms that it is in Italy that we have the most voluntary farmers to carry out a project of agroforestry. The test of Wald makes it possible to say that the French farmers and the Spanish farmers don’t distinguished themselves from the other countries (the test of Wald gives statistics 4.6808 per 2 degrees of freedom, which is equivalent to one p-value of 0.0963). According to our calculations (see the table of the marginal effects), on average, if we go from an unspecified country to Italy, it’s possible to increase by 1% the probability of finding a farmer who wishes to carry out a project of agroforestry.

Characteristics of the heads of exploitation.

We used a series of variables which allow appreciating the effect of the socio-demographical variables on the endogenous variables.

There are more chances to find agroforestry potentialities when farmers are 45-50 years old. The distribution of the ages of the farmers on the sample is rather usual (see figure below). It has a bimodal form with a pick at 40 (7.1%) and 50 years (5.5%). The median age is 46 years (the average age is 47 years). The age of the first quantile is 39 years. It is in West Macedonia that one finds the oldest farmers (57 years median age). On the opposite, it is in the region of Centre that we find the youngest farmers (38 years median age).
The non-parametric test of U of Mann Whitney makes it possible to think that the decisions concerning the project of agroforestry are different according to the age (we obtain statistics $S = 17203.5$, $Z = 2.16314$ for one p-value $\text{Prob} > |Z| = 0.0305$). The farmers who stated to want to carry out a project of agroforestry are older compared to the other farmers. Indeed, the median age is 49 years for those who wish to carry out a project against 42 years for those which refuse to carry out this type of project. It appears thus that it is in the areas where one finds less old farmers (Centre for example) that we have less farmers favourable to agroforestry. What it should be retained, it is that the farmers who are most likely to carry out a project of agroforestry are between 45 and 55 years old (let us recall that the average age is 46 years). To show that, we have to classify the farmers according to an ordered polytomic variable which makes it possible to distinguish those who are less than 36 years old, those who are between 36 years and 40 years old etc (the test of the khi two between the variable “age range” and the indicator of the project gives statistics of 14.132 per 5 degrees of freedom, which is equivalent to one p-value of 0.015). The probability of observing a farmer wishing to carry out a project of agroforestry is higher for the age brackets 45-50 and 50-55. Indeed, the probability of finding a farmer ready to carry out a project is 60 % among the 45-50 years. This probability is 62.50% for the 50-55 years.

Table 3 Conditional probability $\text{Prob}(\text{choice of project} / \text{Age group})$

<table>
<thead>
<tr>
<th>Age Classes</th>
<th>Choice of project</th>
<th>No for the project</th>
<th>Yes for the project</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;36</td>
<td>48.57</td>
<td>36-40</td>
<td>40.48</td>
</tr>
<tr>
<td>36-40</td>
<td>69.23</td>
<td>45-50</td>
<td>50-55</td>
</tr>
<tr>
<td>40-45</td>
<td>64.29</td>
<td>50-55</td>
<td>&gt;55</td>
</tr>
<tr>
<td>45-50</td>
<td>37.50</td>
<td></td>
<td></td>
</tr>
<tr>
<td>50-55</td>
<td>48.33</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>13.31</td>
<td>19.77</td>
<td>15.97</td>
</tr>
</tbody>
</table>

The estimated binary probit confirms this result. Indeed, in table n°3, we can note that only the parameters associated with the class 45-55 years are significant with the usual
thresholds. The test of Wald which allows testing if the parameters of the various age groups are equal gives statistics of 12.3382 per 4 degrees of freedom, which is equivalent to one p-value of 0.0150. The parameters of the various age groups are thus different between them.

A second test of Wald lets to think that nothing distinguishes the 45-50 years from the 50-55 years old. Indeed the test of Wald gives statistics of 0.0577 for a degree of freedom, which is equivalent to one p-value of 0.8102. A third test of Wald lets to think that the effects of the age groups between 45-55 years are different from 0 (the test of Wald gives statistics 6.8037 per 2 degrees of freedom, which is equivalent to one p-value of 0.0333). By using the group of more 55 years old, we can establish with much precision that a farmer who is between 40 and 45 years old has 3% of chances of more to be an agroforester compared to a younger farmer or a farmer who is more than 55 years old. This probability is equal to 2% for the farmers who have 45-55 years old.

**Characteristics of the farm**

**The farmers the less equipped in factors of production are most inclined to carry out a project of agroforestry.** We have used the farming surface by worker in order to measure the impact of the equipments on the probability of carrying out a project of agroforestry. The distribution of the surface/worker unit makes it possible to measure the equipments of the farmers. On the sample, this variable does not follow a normal law. The median surface is 48 ha with a high standard deviation of 69.63 ha. Whereas for the first quantile the surface is 13.33 ha, for the third quantile it is 100 ha (the kurotosis is 5.31). It seems that the older farmers are less equipped in factor of production by worker (the coefficients with Pearson and of Spearman are significantly different from 0 but weak values: -21 to -24 %). They are thus the less equipped farmers who are most inclined to carry out a project of agroforestry. Indeed, surface (by worker) median is 40 ha for those who wish to carry out a project of agroforestry whereas the surface is 73ha for the other farmers (the test of U-Man gives one p-value lower than 1%).

The binary probit estimated confirms that the effect of the surface by worker has a negative effect on the probability of carrying out a project of agroforestry. However if the sign associated with this explanatory variable is always negative, it is significant only for 10% (when we estimate a specification without the indicators country which are sources of co-linearity). According to marginal effects' that we estimated, the quasi estimated elasticity is -0.007, i.e. an increase of 1% of the equipment (surface by worker) decreases only by -0.7% the probability of carrying out a project of agroforestry.

**The fact of having a successor on the exploitation does not have an effect on the probability of carrying out a project of agroforestry.** We introduced a variable with three methods which makes it possible to know if the farmers have a successor or not (the last method includes the farmers who have stated not to know). For each modality, we have almost 33% of farmers (the test of the differences in proportions gives very weak statistics of about 0.692 per 2 degrees of freedom). According to our preliminary tests, it seems that the variable which gives information on the succession is not strongly related to the choice to carry out or not a project (the test of Khi two gives statistics of 5.293 per 2 degree of freedom, which is equivalent to one p-value of 0.071). By introducing into the model probit a binary variable which allows distinguishing the farmers having a successor from the other farmers, we note that this variable is never significant statistically with the usual thresholds.

**The fact of the cereals specialization does not influence the probability of carrying out a project of agroforestry.** To be able to distinguish the behaviours of a monocropping farmer from the other farmers, an indicator was introduced which is equal to 1 when it represents farmers practising monoculture. This category of farmers accounts for 60.8% of
the sample. However, on the contrary to what is allowed, there are so many chances to find in
the group of monocropping farmers, farmers who want to set up some project than farmers
who don’t want (the test of Khi two gives one p-value of 0.31). Thus, the fact of being a
cropping farmer does not influence the probability of carrying out a project of agroforestry.
Indeed, as we can see it in the results of estimation of the probit, the parameter associated
with the indicator which allows discriminating the cropping farmers is never significant.

**It seems that there are more chances to find agroforester farmers in the individual
farmers.** We introduced a binary variable which indicates if the farmer has an individual
statute (if not it is worth 0 in the contrary case). In opposition to farmers’ members, it seems
that there are more possibilities to find farmers wishing to carry out a project of agroforestry
in the individual farmers. It should be said that 81.37% of the farmers of the sample are
individual farmers. It is not astonishing thus to note that the probability of finding a farmer
individual among the individual farmers is very high (about 88%). However, the probability of
finding an individual farmer among those which do not wish to carry out a project of
agroforestry is also very high (about 75.36%). The test of Khi two gives high statistics of
6.910 for a degree of freedom. Fisher’ S Exact Test gives for 2-Tail a probability of 1%.

<table>
<thead>
<tr>
<th>Wish to carry out a project</th>
</tr>
</thead>
<tbody>
<tr>
<td>No</td>
</tr>
<tr>
<td>Company</td>
</tr>
<tr>
<td>Individual Farmer</td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

The binary probit confirms that the sign of the parameter associated with the variable status
of the farmer is positive but the parameter is very slightly significant (to 10% for the
specification without the indicators of country).

**When the process of decision-making is revealed by the interview, there are strong
chances that they are farmers inclined to carry out a project of agroforestry.** Some
studies showed the importance of the decision-making processes inside the agricultural
households. Our assumption is that a concerted family decision is favourable to the
agroforestry process. We introduced a nominal polytomic variable which enables us to know
which should make the decision to plant (or not) trees on the exploitation. We could
distinguish those: who have declared that it is up to them to make the decision, those who
have answered that they make their decision with a partner, from those who said that they
decide with the members of their family (13.31% of the sample). The two last groups are
divided into two sub-groups. Those gathered in “other process of decision “ (they account
for 19.77%) and those who “didn’t know “. These last ones represent our group of reference
(they account for 15.59% of the sample). The probability of finding among those who wish to
carry out a project of agroforestry some farmers who have declared that they would decide
alone is equal to 36.8%. While the probability to find in the group of potential agroforesters,
some farmers who have declared that the decision is made by them even in consultation with
the family is only equal to 14.40%. The test of Khi two confirms that the modalities of
decision-making have effects on the decisions of projects (the statistics of Khi two are 23.085
per 4 degree of freedom, which is equivalent to one p-value lower than 1%).
The binary probit estimated confirms the preliminary tests. The parameters associated with this explanatory dimension are strongly significant. However, the test of Wald shows that the parameters associated with each modality of this explanatory dimension are equal (the test of Wald gives statistics of 2.3213 per 3 degree of freedom, which is equivalent to one p-value of 0.5084. A second of test of Wald makes it possible to confirm that if the parameters associated with this explanatory dimension are equal, they are however different from 0 (the test of Wald gives statistics of 17.8632 per 4 degree of freedom, which is equivalent to one p-value of 0.0013). On the basis of these results, and on the basis of our calculation of the marginal effects, we can conclude that compared to those which answered "I don't know who will take the decision to plant", those who gave given an answer have between 7 to 10% more of chances to be potentials agroforestiers.

Information of the farmers

Those who have given a right definition of agroforestry are generally inclined to carry out a project of agroforestry. The interviews made it possible to classify the farmers according to their definition of the agroforestry. 24.7% of the farmers declared that agroforestry means an association agriculture-tree. 32.7% answered that it is a question "of planting trees on arable land". Only 7.2% assimilated agroforestry with "rural forestry". And we have to underline that 35.4% didn’t know or didn’t want to answer. In the whole, 35.4% of the surveyed farmers could not define the concept of the agroforestry. This problem of information is not related to the age (the test of Kruskal-Wallis gives statistics of 2.0728 per 3 degrees of freedom, which is equivalent to Prob > CHISQ = 0.5574). And according to our tests, if we take into account the level of farming surface by farmer, nothing says that compared to the small farmers, the larger farmers know agroforestry better (the test of Kruskal-Wallis gives statistics 3.2262 per 3 degrees of freedom, which is equivalent to a probability of 0.3580).

It seems that best informed are the farmers, more inclined are they to set up a project of agroforestry (the test of the khi two gives statistics of 13.182 per 3 degrees of freedom). In the table below, we can notice that among those which answered that the agroforestry is "an association tree-agriculture", we have a probability of 63.08% to find a farmer ready to carry out a project of agroforestry. According to our tests, there are not significant differences between those who answered "forestry" and those who answered "that they didn’t know" agroforestry. For this reason, we join these 2 last groups in the same category, used as modality of reference compared to the two groups of farmers having answered "association tree-agriculture" and having declared that agroforestry is "to plant trees in field".

## Decision to carry out a project

<table>
<thead>
<tr>
<th></th>
<th>NO</th>
<th>YES</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Who takes the decision?</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Farmer</td>
<td>38.41</td>
<td>36.80</td>
<td>37.64</td>
</tr>
<tr>
<td>Farmer and partner</td>
<td>11.59</td>
<td>16.00</td>
<td>13.69</td>
</tr>
<tr>
<td>Farmer and family</td>
<td>12.32</td>
<td>14.40</td>
<td>13.31</td>
</tr>
<tr>
<td>Other</td>
<td>13.04</td>
<td>27.20</td>
<td>19.77</td>
</tr>
<tr>
<td>Doesn’t know</td>
<td>24.64</td>
<td>5.60</td>
<td>15.59</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>52.47</td>
<td>47.53</td>
<td>100.00</td>
</tr>
</tbody>
</table>
Table 4 Conditional probability of the cross table choice of project and information

<table>
<thead>
<tr>
<th></th>
<th>Y= 1</th>
<th>Y= 2</th>
<th>Y= 3</th>
<th>Y= 4</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>no to a project</td>
<td>36.92</td>
<td>48.84</td>
<td>68.42</td>
<td>63.44</td>
<td>52.47</td>
</tr>
<tr>
<td>Yes to a project</td>
<td>63.08</td>
<td>51.16</td>
<td>31.58</td>
<td>36.56</td>
<td>47.53</td>
</tr>
<tr>
<td>Total</td>
<td>24.71</td>
<td>32.70</td>
<td>7.22</td>
<td>35.36</td>
<td>100.00</td>
</tr>
</tbody>
</table>

The estimated probit confirms that those who knew how to define agroforestry have chances to be potentials agroforestiers. Indeed, the parameter associated with the indicator which indicates if the farmer gave the good definition for agroforestry is always significant, whatever the selected specification. However, the parameter associated with the second modality (those who answered that it was about "to plant trees on arable lands") is not significant. It thus seems that it is not possible to distinguish the differences between this group of farmers and the group of reference. The test of Wald of equality between the parameter associated with the first methods ("Agroforestry is an association tree-agriculture"; i.e. the good response) and the parameter associated with the second modality ("Agroforestry is planting trees on arable lands") make it possible to conclude that the null hypothesis is refused with the threshold of 10% (the parameters in questions are not equal to 10% ; the test gives statistics of 2.7174 for a degree of freedom, which is equivalent to one p-value of the 0.0993). Estimated marginal effect is weak. The fact of defining agroforestry well increases only 1% the probability of carrying out a project of agroforestry.

Preferences and beliefs of the farmers.

Preferences compared to the trees

The interview makes it possible to know if the farmers have particular preferences compared to the trees. A variable with three modalities makes it possible to distinguish between those which like the trees of those which declared that they "don't know" or "don't like the trees". In term of conditional probabilities, we notice that among those which stated not to wish to carry out a project of agroforestry, there are 57.25 % of farmers having stated not to like the trees ("or who they did not know if they to like them). On the contrary, the conditional probability to find among those who like the trees, some farmers wishing to realize a project is 59.31%. Because of the data distribution on the basis of certain numbers of preliminary tests, we chose to use an indicator which makes it possible to discriminate between those who stated to like the trees and the other groups of farmers (the test of Khi two gives statistics of 8.033 per 1 degree of freedom, which is equivalent to one p-value of 0.005).

The binary probit shows that the parameter associated with the indicator (which is equal to 1 if the farmer stated to like the trees) is significant to 5% for the first specification. But as soon as we introduce the indicators of country, this parameter becomes non significant. The tests which we carried out push us to believe that there is a connection between this indicator of the preferences of the farmers and the indicator country. According to the estimated marginal effects', the fact of liking the trees increases by 0.6% the probability of being a potential agroforester.

Opinions on agroforestry

It was requested to the farmers to declare if agroforestry is beneficial from an economic, environmental, and social point of view. Only 31% of the farmers have spotted up some
environmental reasons whereas 48.7% of the farmers mentioned some positive economic reasons. It also comes out from it that 99% of the farmers do not see any main social benefit related to the agroforestry. According to our calculations, the joined probability to observe farmers who don’t wish to carry out a project of agroforestry (respectively to those who wish to carry out a project of agroforestry) and to declare that agroforestry is beneficial economically is equal to 30% (respectively of 19%). There are 56.52% of chances to find among those who don’t wish to carry out a project of agroforestry, farmers who have declared economic advantages for agroforestry.

With regard to the environmental aspects, there are as many chances to observe farmers who want to carry out projects of agroforestry when they anticipate environmental advantages or not. Indeed, the test of Khi two gives rather weak statistics of about 3.024 for a degree of freedom, which is equivalent to one p-value of 8.2%.

The beliefs concerning the economic benefit seem to be related to the choices to carry out or not a project of agroforestry (the khi two is 7.167 for a degree of freedom). By introducing an indicator which is equal to 1 if the farmer declared that agroforestry is beneficial from an economic point of view, we note in the model probit, that the parameter associated with this variable is significant with the usual thresholds. The sign of the parameter is negative what confirms that those who declared that agroforestry has positive economic aspects have strong chances not to become an agroforester. According to our calculations, the fact of declaring aspects economic positive of the agroforestry decreases the probability of carrying out a project of agroforestry of -1%.

3. DETERMINANTS OF THE LEVELS OF PLANTED AREAS

We seek to explain the probability of not planting, the probability of planting between 1 and 25% of the farming area, and the probability of planting more than 25%. With the exception of the explanatory dimension relating to the decision-making processes (which is endogenous with the decision to choose a percentage of surface to be planted), we use the same explanatory variables which enabled us to estimate the probability of carrying out a project of agroforestry. After having carried out the preliminary tests, we will present the estimations results of an ordered probit with known threshold and the calculations of the marginal effects of the explanatory variables on the probability of planting more than 25% of the farming area (probability of being a large agroforester).

The age of the farmer does not seem to influence the percentage of surface to be planted. By retaining the age groups as explanatory variables of the probability of stating a percentage of farming area to be planted, we note according to our tests, that the age has only one very weak influence on the surfaces to plant (the test of Khi two gives statistics 16.402 per 10 degrees of freedom, which is equivalent to one p-value of 0.089). The statistics of the Phi and the V of Cramer give to very low values lower than 25%. The statistics of Gamma especially give a value 0.119 for an asymptotic standard deviation of 0.080. The ordered probit confirms our preliminary tests since the parameters associated with the age groups are never significant with the usual thresholds (the test of Wald of nullity of the whole of the parameters associated with the age groups gives statistics of 2.3138 per 5 degrees of freedom, which is equivalent to one p-value of 0.8042).

The presence or not of a successor does not influence the decision to plant. Indeed, 32.32% of the farmers stated to have a successor on the exploitation. But nothing indicates that this variable has an unspecified influence on the decisions to carry out a project of agroforestry as nothing pushes us to think that this variable influences the levels of the planted surfaces (the test of the khi two gives one p-value of 34%). The ordered probit
confirms these preliminary tests. The parameter associated with this indicator is never significant.

**The farming system does not seem to influence the surfaces to be planted.** As we said previously, 60.84% of the farmers are cereals farmers. It seems that we find this farming system in the various categories (0%, 25% or more than 25% of the surfaces (the test of Khi two gives weak statistics of about 3.01 per 2 degree of freedom). The ordered probit confirms these preliminary tests. The parameter associated with this indicator is never significant.

**The economic potential seems to push the farmers to plant trees.** 48.67% of the farmers declared that the first benefit of agroforestry is economical. But the usual tests indicate that the anticipated economic benefit influence the level of the surface to plant (the test of Khi two gives statistics of 4.222 per 2 degrees of freedom, which is equivalent to one p-value of 0.121). However, the ordered probit shows that the fact that the farmer considers that agroforestry has positive economic aspects increases the probability of planting more than 25% (and thus reduced probability of not planting). The parameter associated with this indicator is significant with the usual thresholds. According to the estimated marginal effects', the fact of declaring benefit economic positive associated with the agroforestry increases the probability of being a large agroforester (agroforester who would plant more than 25% of the farming area) of 7%.

**The level of information of the farmers influences the surface to be planted.** 24.71% of the farmers have given a right definition to the word “agroforestry”. These farmers will tend to plant more than 25% of their total surface. In fact it is on this group (potential) of large agroforesters that information seems to influence. Indeed, among those who defined agroforestry well, we have 34% of chances to find farmers having stated to want to plant more than 25%. In the whole, the test of the khi two gives statistics of 7.037 per 2 degrees of freedom. However the connection seems to be weak since the statistics of the Phi and the statistics of the V of Cramer are 16%.

Tableau 5 Conditional probability Prob(level of surface / good definition of the agroforestry)

<table>
<thead>
<tr>
<th>Good definition</th>
<th>0</th>
<th>1</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Importance of planted area</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Planted 0%</td>
<td>18.18</td>
<td>7.69</td>
<td></td>
</tr>
<tr>
<td>Planted 1-25%</td>
<td>61.11</td>
<td>58.46</td>
<td></td>
</tr>
<tr>
<td>Planted more than 25%</td>
<td>20.71</td>
<td>33.85</td>
<td></td>
</tr>
<tr>
<td></td>
<td>75.29</td>
<td>24.71</td>
<td>100.00</td>
</tr>
</tbody>
</table>

For those who gave a bad definition to agroforestry, in particular those who said that agroforestry consists in "planting trees on arable lands", they represent 32.70% of the sample. It seems that we find the same proportions of this type of farmers according to declared surfaces' (the test of Khi two gives one p-value of 22%).

The ordered probit confirms that the fact of defining agroforestry correctly increases the probability of planting more than 25% of the farming area. On the opposite, the estimate of the associated parameter with the indicator which discriminates the second group of farmers (those having declared that agroforestry is to plant trees on arable lands) is not very precise.
The test of Wald seems to indicate that the associated parameters with the two modalities are equal (the test gives statistics of 1.8331 per 1 degree of freedom, which is equivalent to one p-value 0.1758). According to our calculations, the effect of information on the probability of planting more than 25% varies from 8 to 16%.

**Those who stated to like trees have chances to be large agroforester.** Only 13.69% of the sample declared “to like the trees”. The test of the khi two gives high statistics of 8.563 per 2 degrees of freedom, which is equivalent to one p-value of 1%. However the connection is not very strong since the statistics of the Phi and the statistics of the V of Cramer are 18%. The statistics of Gamma confirm these tests since this metric distance is 0.454 with asymptotic standard deviations of 0.134. Ultimately, among those who stated to like the trees we have 41.67% of chances to find farmers cultivating more than 25% of their farming area (against 21.15% for the group of reference).

The ordered probit confirms these preliminary tests. Indeed, the parameter associated with this indicator always significant, is estimated with more precision. According to our calculations of the marginal effects, the fact of stating to like the trees increases the probability of planting more than 25% of the farming area of 19% (on average).

**The fact of having a statute of individual farmer does not seem to increase the probability of being a large agroforester.** 81% of the farmers have an individual statute. According to our calculations, the fact of having an individual statute (in opposition to an company member) increases the probability of being a large agroforesters (the test of Khi two per 2 degrees of freedom gives statistics of 10.926 what is equivalent to one p-value of 0.004). The probability of finding among the individual farmers a farmer who plants more than 25% of his surface is 28% (against 6.12% among the farmer with statutes of company member). However the connection between the statutes and the planted surface is weak since the statistics of Cramer give a value of 20% (the statistics of Gamma of 0.370 for one p-value equal to 0.115).

Tableau 6 : Conditional probability Prob(% of surface to be planted /statutes of the farmer)

<table>
<thead>
<tr>
<th>Individual Status versus collective</th>
<th>Importance of the planted area</th>
<th>0.00</th>
<th>1.00</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>0% of the farming area</td>
<td></td>
<td>16.33</td>
<td>15.42</td>
<td>15.59</td>
</tr>
<tr>
<td>1-25% of the farming area</td>
<td></td>
<td>77.55</td>
<td>56.54</td>
<td>60.46</td>
</tr>
<tr>
<td>&gt;25% of the farming area</td>
<td></td>
<td>6.12</td>
<td>28.04</td>
<td>23.95</td>
</tr>
<tr>
<td></td>
<td></td>
<td>18.63</td>
<td>81.37</td>
<td>100.00</td>
</tr>
</tbody>
</table>

The results of the ordered probit seem to confirm the assumption that the effect of the statute is null. Indeed, the associated parameter with this variable is never significant with the usual thresholds.

**The large farms tend to plant low surfaces.** The average surface per worker unit is 67.74 (the median is of 48ha per work unit). But as we mentioned above, this measurement of the equipments is very variable (standard deviation of 69.6384 ha per work unit). Those who stated not to plant a tree have on average 62.08h per worker unit whereas those who answered to plant from 1 to 25% of their SAU have an average of 85.85 ha per worker unit.
What is notable is that those who wish to plant more than 25% of their farming area have only 25.73 ha per worker unit. In final, the test of Kruskal-Wallis gives statistics of 61.730 what is equivalent for 2 degrees of freedom to one p-value largely lower than 1%. The variance analysis makes it possible to obtain statistics of Fisher of 19.35, which is equivalent to one p-value lower than 1%. We can thus conclude that the averages and the medians of the equipments are different according to categories' of farmers (those who stated not to plant, those who answered to plant 1 to 25%, and those who anticipate to plant more than 25%).

The test of Scheffe (confirmed by Tukey’s Studentized Range (HSD) Test) makes it possible to see clearly that there is no difference in term of equipment (surface per worker unit) between those who stated not to want to plant and those who stated to want to plant between 1 and 25% of their farming area (see table below). Thus, the use of the surface per worker unit as explanatory variable especially makes it possible to discriminate between those who do not want to plant versus those who want to plant more than 25%

Tableau 7 Result of the test of Scheffe allowing to see the differences in averages of the equipments between the various categories of farmers who plant

<table>
<thead>
<tr>
<th>Comparison</th>
<th>Lower Limit</th>
<th>Difference</th>
<th>Upper Limit</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 - 1</td>
<td>-4.351</td>
<td>23.773</td>
<td>51.897</td>
<td></td>
</tr>
<tr>
<td>2 - 3</td>
<td>36.213</td>
<td>60.117</td>
<td>84.020</td>
<td>***</td>
</tr>
<tr>
<td>1 - 2</td>
<td>-51.897</td>
<td>-23.773</td>
<td>4.351</td>
<td></td>
</tr>
<tr>
<td>1 - 3</td>
<td>4.125</td>
<td>36.343</td>
<td>68.562</td>
<td>***</td>
</tr>
<tr>
<td>3 - 2</td>
<td>-84.020</td>
<td>-60.117</td>
<td>-36.213</td>
<td>***</td>
</tr>
<tr>
<td>3 - 1</td>
<td>-68.562</td>
<td>-36.343</td>
<td>-4.125</td>
<td>***</td>
</tr>
</tbody>
</table>

Note : Comparisons significant at the 0.05 level are indicated by '***'.

1 for those who do not plant
2 for those who plant between 1 and 25%
3 for those who plant more than 25%

The ordered probit confirms these tests (see table). Indeed, the parameter associated with the surface by worker is strongly significant. The sign is negative that confirms the assumption that the equipments factors have a negative influence on the probability of being a large agroforester (agroforester of more than 25% of the farming area). According to our calculations of the marginal effects (see table), the quasi elasticity of the equipments compared to the probability of planting more than 25% of the farming area is equal to -5%, i.e. that the increase of 1% of the surface by worker decreases the probability of planting more than 25% by -5%.
Spain, land of agroforestry. As we have already mentioned, the sample is dominated by the farmers of Spain 32%, France 22.43% and Italy 14.83%. We have only 5% of chance to find a large agroforester among the French farmers. In Spain this probability is largely higher 31% (double) whereas in Italy this probability is equal to 26%. On the whole of the sample, it’s in France that we have the most chances to have a medium agroforester (who stated to be able to plant between 1 and 25% of his farming area).

Tableau 8: conditional probability Prob(% surface to be planted/country)

<table>
<thead>
<tr>
<th>Surface to plant</th>
<th>D</th>
<th>FRA</th>
<th>GR</th>
<th>I</th>
<th>N</th>
<th>SP</th>
<th>UK</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>0%</td>
<td>18.75</td>
<td>16.95</td>
<td>0.00</td>
<td>12.82</td>
<td>68.97</td>
<td>1.18</td>
<td>13.33</td>
<td>15.59%</td>
</tr>
<tr>
<td>1-25%</td>
<td>75.00</td>
<td>77.97</td>
<td>5.00</td>
<td>61.54</td>
<td>24.14</td>
<td>68.24</td>
<td>73.33</td>
<td>60.46%</td>
</tr>
<tr>
<td>&gt;25%</td>
<td>6.25</td>
<td>5.08</td>
<td>95.00</td>
<td>25.64</td>
<td>6.90</td>
<td>30.59</td>
<td>13.33</td>
<td>23.95%</td>
</tr>
<tr>
<td>Total</td>
<td>6.08</td>
<td>22.43</td>
<td>7.60</td>
<td>14.83</td>
<td>11.03</td>
<td>32.32</td>
<td>5.70</td>
<td>100.00</td>
</tr>
</tbody>
</table>

The ordered probit confirms that Spain remains the country of predilection for agroforestry. Indeed, according to our calculations, compared to the other countries of Europe, the farmers Spanish have 20% of more chances to be large agroforesters (agroforesters of more than 25% of the farming area). Lastly, according to a test of Wald, nothing indicates that France and Italy differentiate other countries of Europe (group of reference). Indeed, the statistics of Wald are 0.6455 per 2 degrees of freedom, which is equivalent to one p-value of 0.7241.