Initial Stakeholder Meeting Report
Mediterranean Silvoarable Systems in France

Work-package group 4: Agroforestry for arable farmers
Specific group: Mediterranean silvoarable systems in France
Date of meeting: 2 October 2014
Date of report: 8 October 2014
Location of meeting: Melgueil experimental station, Mauguio, Hérault, France
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1. Context

The AGFORWARD research project (January 2014-December 2017), funded by the European Commission, is promoting agroforestry practices in Europe that will advance sustainable rural development. The project has four objectives:

1) to understand the context and extent of agroforestry in Europe,
2) to identify, develop and field-test innovations (through participatory research) to improve the benefits and viability of agroforestry systems in Europe,
3) to evaluate innovative agroforestry designs and practices at a field-, farm- and landscape scale, and
4) to promote the wider adoption of appropriate agroforestry systems in Europe through policy development and dissemination.

This report describes one of about 40 initial stakeholder workshops to address objective 2. Further details of the project can be found on the AGFORWARD website: www.agforward.eu

2. Description of system

The Mediterranean climate creates constraints for agriculture due to the temporal heterogeneity of rainfall with periods of water shortage in the spring and summer, and high rainfall in autumn. Under certain conditions, silvoarable agroforestry (tree lines within the field) could alleviate this problem by improving water infiltration, limiting soil evaporation and reducing water requirements of crops under the shade of trees. The focus of this group is on field crops such as durum wheat, chickpea, and canola in such systems. The French SMART project is focusing on vegetable crops in such systems.

The potential for agroforestry in the Languedoc-Roussillon region of France has been estimated at 280,000 ha including 132,000 ha in arable systems (Cardinael 2011) (Figure 1). The area is partly constrained by the soil requirements of agroforestry (i.e. deep soils that will allow deep rooting of trees and sufficient water holding capacity to limit water competition between trees and crops, and no soil salinity that would reduce the choice of tree and crop species).

3. Participants

An initial stakeholder meeting on 2 October 2014 was attended by 11 stakeholders (Table 1) and 12 INRA employees. Two farmers completed the survey on the day of the meeting, one sent it by email and we are awaiting responses from other stakeholders. The farmers that attended the meeting are managing very different systems: one is a cereal grower who uses only animal traction for cultivation operations; one is a cereal producer who also hosts a vegetable producer on his farm (already in agroforestry); one produces fruits and vegetable (already involved in agroforestry) and the fourth one is a goat breeder. Considering the initial stakeholder invitations were sent to contacts made in previous projects in participatory plant breeding for organic farming, three out of the four farmers that attended the meeting were managing organic farms. Participants came mostly from the Hérault County, but some travelled from Gard, Drôme, Lot, Aude or as far as Savoie.

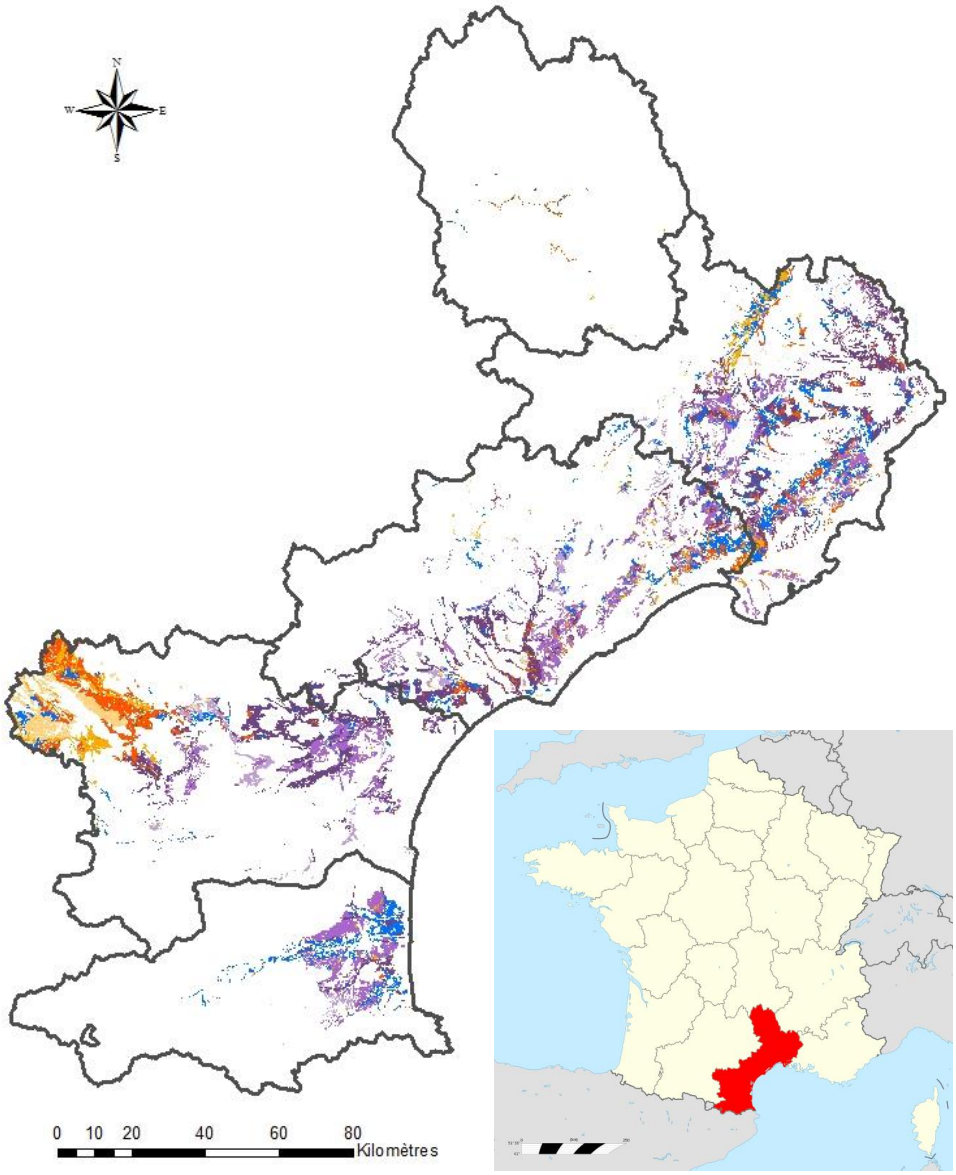

Figure 1. Map of potential areas suitable for agroforestry systems in the Languedoc-Rousillon administrative region, based on both soil characteristics (salinity, depth, water holding capacity), and current land use (meadows, arable land, vineyards). Green: meadows, orange: arable land, purple: vineyard, blue: mixed systems. Source: (Cardinael 2011).

Table 1. Types of stakeholders and number of participants

Type of stakeholder	No. of participants
Farmer	6
Representative from local council	1
Technical institute (olive oil production)	1
Food industry (pasta)	1
Farmer's cooperative (organic farming)	1
Seed production	1

4. Outline of the meeting

The meeting opened with introductory presentations including a general definition of agroforestry, description of experimental sites, and accounts of previous experience with plant breeding projects. This was followed by a discussion of innovations that could be included in the AGFORWARD project, field visits, and discussions around some of the innovations observed.

9.00 – 9:30	Welcome-coffee
9.30 – 10.00	Presentation of INRA Mauguio experimental station (Dominique Desclaux, INRA)
10.00 – 10:30	General presentation of agroforestry (Christian Dupraz, INRA)
10:30 – 11.00	Feedback from previous participatory plant breeding projects (Antoine Chiron, CEO AlpinaSavoie and Max Haefliger, BIOCIVAM11)
11.00 – 12.30	Discussion on the innovations that could be tested in the project and on the stakeholders feeling about advantages and drawbacks of agroforestry for their systems.
12:30 – 14.00	Lunch
14.00 – 15.30	Visit of an olive tree grove that could host some of the experiments and discussion on the possible treatments that could be tested.
15.30 – 16.00	Travel to the Domaine de Restinclières
16.00 – 18.30	Visit of fields under agroforestry since 1995 (cereal + hybrid walnut, cereal + poplar, vineyard + pine trees or high value timber trees) and discussion with the farmers managing the cereal system.

5. Morning session

The morning session took place at INRA Mauguio experimental station which specialises in plant breeding and hosts the French national genebanks for maize, wheat, *Medicago truncatula* and olive trees. Dominique Desclaux, Director of the experimental station, facilitated the meeting. It started with a short introduction by each participant, stating their occupation and experience with agroforestry (Figure 2).

Following this Dominique Desclaux presented the experimental station and facilities it offers (Figure 3). This includes an olive grove previously used for a research project on tree growth, which is now complete and could be used to grow crops in the shade.

Christian Dupraz (researcher, INRA) then gave a brief overview of the different agroforestry systems (Figure 4), the scientific results obtained so far on agroforestry and the questions that are still unanswered on the agronomical and economical performances of pioneering agroforestry systems.

Figure 2. Morning session at INRA Mauguio experimental station

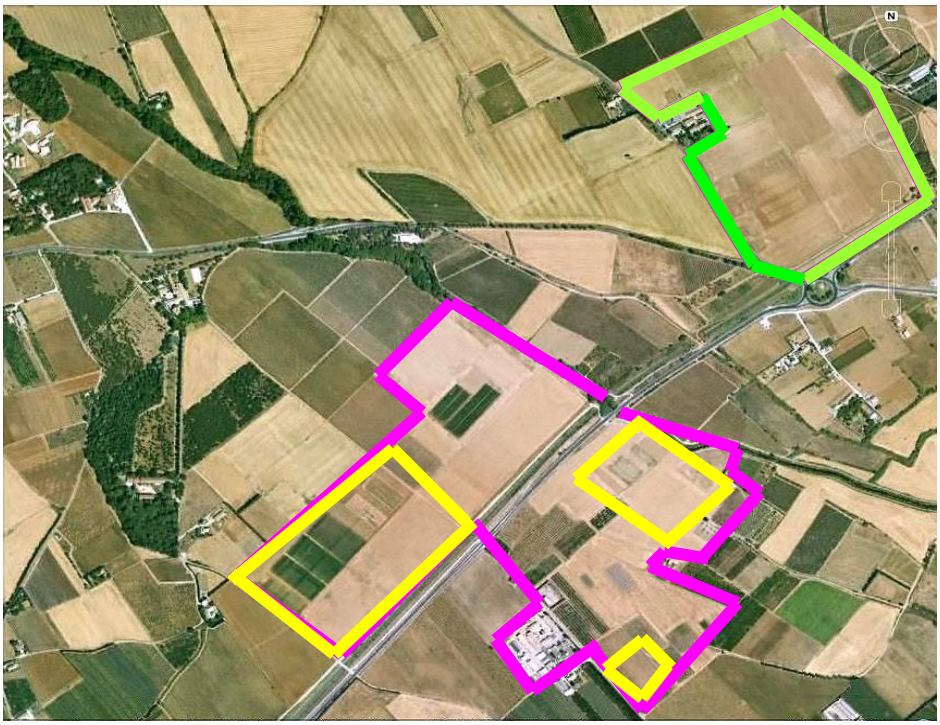

Figure 3. Aerial photograph of the INRA Mauguio experimental station with three main experimental platforms: Green: comparison between organic and conventional management to test varieties in different management conditions, Pink: GAMME platform, 35 ha, dedicated to experiments of cereal and fruit growing with low fertilizer and pesticide inputs, Yellow: DIAPHEN platform, three isolated plots heavily instrumented for high throughput phenotypic studies and accurate water and nitrogen dynamics measurements.

Figure 4. Examples of agroforestry systems from across Europe

After this, two former participants of a participative plant breeding project (selection of durum wheat varieties adapted to organic farming) provided feedback on the project. Max Haefliger (cooperative of organic farmers in Aude County) had a very positive view of the project, as it allowed the group to test varieties in a range of environments, to give credit to the farmers' knowledge and to foster collaborations between researchers, farmers, storage organisations, and the food industry. Antoine Chiron (CEO of AlpinaSavoie, one of the three pasta producers in France) explained that in his opinion, the project missed its main goal, as it did not produce a variety that could be registered officially because of the field conditions used during the certification procedure.

Then there was a general discussion around the innovations that could be tested in the AGFORWARD project and on stakeholders' views about the advantages and drawbacks of agroforestry in relation to their specific systems. The main topics covered in the discussion are summarized in Table 2a and 2b.

Table 2a. Topics covered during the general discussion (morning)

Title	Remarks
Innovations that could be tested	
Herbs and medicinal plants in the tree line	Both agronomical and economic advantages: ground cover against weeds, repulsive against insect pests (lemon-balm against aphids, mint against ants...), resources for bees and other pollinators (e.g. Agastache) possible commercialization, especially when in organic farming. Examples: tansy (*Tanacetum vulgare*), thyme (*Thymum vulgaris*), rosemary (*Rosmarinus officinalis*), lavender.
Use of different varieties close to the tree line and in the centre of the alley	Varieties can be chosen to be more tolerant to shade near the tree line (particularly on the northern side) and more adapted to full light in the centre. This innovation could also be useful to reduce disease spread, compared to pure varieties.
Use of sheep wool placed around the trees to reduce damage caused by boars and roe deer	Wool can be obtained free of charge from sheep breeders who are usually happy to get rid of it.
Advantages of agroforestry that should be quantified	
Wind-break effect	This effect could facilitate irrigation with guns
Limitation of soil drying	
Limitation of erosion	
Simplification of work associated with irrigation	Two farmers already use the tree line for irrigation: one with a fixed sprinkler line, the other with drip irrigation
Improvement of the image of agroforestry products for consumers	This could be estimated both in terms of the price premium consumers are willing to pay, and the improvements in market share. This effect is very important especially for high-quality products where the premium for agroforestry products could be substantial (e.g. olive oil).
Drawbacks of agroforestry that should be limited	
Increase of pest birds	Important for some crops, for example sorghum and pea, where this could be related to changes in the phenology of the crop.
Increased risk of wild fire	
Agroforestry systems that could be studied	
Olive trees in agroforestry	All the more relevant as the current trend for planting olive grove is to increase the width between trees. Agroforestry could provide supplementary income when the trees are young. Important to use plants that would not increase the risk of verticillium wilt.
Wood for energy biomass	
Irrigated grass-based systems	
Almond production	
Scientific questions	
Effect of irrigation on productivity, input use efficiency and resilience of agroforestry systems.	Would be required to compare irrigated and non irrigated systems on the same land unit.

Table 2b. Topics related to plant breeding covered during the general discussion (morning)

Scientific questions	
Is there a correlation between the ability to grow in the shade and straw height?	
Is there a negative effect of shade on head fertility?	Some crossings that were supposed to be very difficult to achieve were achieved in Montpellier research station, possibly as a result of the high level of sunshine in Montpellier.
Criteria for selection	
Earliness	In Restinclières field, there is a problem with rust at the end of the season.
Short straw	To avoid lodging due to wind eddies caused by the trees.
Ability to produce fertile flowers in the shade	
Low toxicity for people with coeliac disease	
Low impact of yellowberry (“mitadinage”) in the shade	Durum wheat is paid on quality, and yellowberry is very detrimental to the processing into pasta.
Development type	Even when sown in autumn, spring varieties start stem elongation as soon as days become longer, while winter type varieties have higher degree-days requirements for stem elongation; this may potentially be a drawback in agroforestry where temperatures rise later in the spring.

6. Field visit (olive grove)

The participants then visited an olive grove (Figure 5) at INRA's experimental station that could be used to conduct a preliminary screening of durum wheat varieties to identify those most adapted to shade. It is important to note that olive trees are evergreen trees, so the competition for light would be maximized, but the plot is equipped with an irrigation system, which would allow testing different levels of water competition. At the experimental site the trees are planted on a 5 m x 6 m rectangular grid. The alley between trees could be cultivated with either one pass with a 3 m-wide seeder, or two passes of 1.5 m-wide seeder adapted to a small experimental plot. There are approximately 5000 square meters available for crops, divided into seven alleys.

The discussion that followed focused on the protocol that could be used, in particular the varieties that could be used to "fill" the space around the tested varieties and as control to compare the performance of the durum wheat varieties under screening (this control cultivar could be 1023 and/or Claudio). A farmer proposed to grow lavender along the tree line, which could be harvested perpendicularly to the cropping alley, since the trees are planted on a rectangular grid. The representative of the technical institute for olive highlighted the fact that the association of olive tree, with legume crops and flowers was traditional in an area near Nice (South-East of France).

Figure 5. Visit of the organic olive grove at INRA Mauguio experimental station

Figure 6. Visit of the Restinclières estate: cereals + hybrid walnut (top), vineyard + cypress (bottom left), vineyard + service tree (bottom right)

Participants then visited the agricultural estate at Restinclières (
Figure 6) that belongs to a local municipal council and where agroforestry has been practised since 1995. The fields and vineyards on the estate are managed by local farmers, INRA (UMR SYSTEM and other teams) carry out experiments on the cereal part of the estate, and the agriculture extension service uses the vineyards. Several plots in the estate were visited: cereal + hybrid walnut, cereal + poplar, vineyard + pine trees and vineyard + high value timber trees). A discussion with the farmers managing the cereal system in the estate followed. They shared their experience of almost 20 years of farming an agroforestry system. In their opinion, the durum wheat variety "Claudio" is a very good variety as it has a short-straw (to prevent lodging), it matures early (to avoid rust attacks at the end of the cycle under the shade). The farmers have not identified any other pest problem so far.

7. Ranking of positive and negative aspects of agroforestry

The participants were asked to complete a brief questionnaire which sought to highlight the key positive and negative aspects of agroforestry systems. A similar methodology to that adopted by the Instituto Superior de Agronomia from Portugal (Crous-Duran et al., 2014) was used to interpret the questionnaire data. Scores were given to the answers as shown in Table 3. A score of twenty-five points was given to an item ranked first, while one point was given to an item ranked tenth. For each item, the points were added and the total points added to create a score for each aspect as shown in Table 4 (positive aspects) and Table 5 (negative aspects). An important point to highlight is that only one of the farmers already has an agroforestry field (first column in Table 4 and Table 5). This agroforestry farmer manages intra-field timber and fruit trees associated with vegetables in raised beds.

Table 3. Scoring points for each the rank

Rank	1	2	3	4	5	6	7	8	9	10
Points	25	18	15	12	10	8	6	4	2	1

Positive aspects

The principal positive aspects of agroforestry were seen to be income diversity, crop production, enhancement of biodiversity and wildlife habitats, and soil conservation (Table 4).

Negative aspects

Two respondents considered that cash flow, the lack of business opportunity and losses by predation were key negative issues (Table 5). One respondent gave rankings of 9^{th} and 10^{th} to labour and mechanisation as negative issues; this was interpreted as he/she perceiving that although they were negative issues, they were not that important.

Table 4. Positive aspects of a silvoarable system as ranked by three farmers

Aspect	Ranking			Score
	1	2	3	
Income diversity	10	1	2	44
Crop or pasture production		4	1	37
Biodiversity and wildlife habitat	2		4	30
Soil conservation	1			25
Animal production		2		18
Originality and interest	9		3	17
Animal health and welfare		3		15
Water quality	3			15
Carbon sequestration	8		5	14
Climate moderation	4			12
Crop or pasture quality/food safety		5		10
Runoff and flood control	5			10
Diversity of products	6			8
Timber/wood/fruit/nut quality	7	9		8
Farmer image		6		8
Labour facilitation (field management)			6	8
Profit		7		6
Timber/wood/fruit/nut production		8		4
General environment	9			2

Table 5. Negative aspects of a silvoarable system as ranked by three farmers

Aspect	Ranking			Score
	1	2	3	
Business opportunities			1	25
Cash flow		1		25
Losses by predation			2	18
Relationship between farmer/hunter			3	15
Administrative burden			4	12
Labour	8			4
Mechanisation	9			2

8. Qualitative written responses and next steps

Each respondent also gave written answers to the question: “what constraints and challenges could be addressed by changes to an existing agroforestry system or establishing a new agroforestry system”. The agroforestry farmer mentioned the increased problems with roe deer, wild boars, and slugs. One of the non-agroforestry farmers declared the cost of planting, and the third thought there were no constraints.

Each respondent also gave written responses to a question about potential solutions or research themes. The agroforestry farmer suggested there ought to studies about the different natural ways to manage roe deer, wild boars and slugs (e.g. sheep wool to repel wild boars or aromatic plants to

repel crop pests). A non-agroforestry farmer suggested, as a priority, research around solutions to protect trees against cattle and other animals. The second non-agroforestry farmer suggested there ought to be data gathered on the wide diversity of tree species.

Of the farmers that completed the questionnaire, two indicated that they would be interested in supporting research related to agroforestry.

9. References

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10. Acknowledgements

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