



## Deliverable 1.1 – Appendix A2

# Changes in the agricultural practices by giving up ploughing in France

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# Introduction

It seems impossible to imagine that farmers might give up ploughing one day. However, conventional agriculture, involving ploughing, has been decreasing for some fifteen years. The alternative way of farming, usually referred by the term “reduced tillage practices”, actually include various types of tillage management, but all of them involve not ploughing.

## **1 : Definition of “not ploughing” terminology**

Not ploughing is the main characteristic of the “reduced tillage practices”. Three different types of reduced tillage practices can be distinguished:

### **1.1. Farmers performing “reduced tillage practices” using existing tools in the farm.**

It is usually the first step when a farmer decides to stop ploughing his fields. In that case, he substitutes ploughing for various other ways of tillage, depending on the crop he wants to establish:

- Deep tillage for soil loosening, using a tool with teeth like a subsoil cultivator or a loosening machine;
- Superficial tillage to prepare the seed bed, using tools with disks like cover crops;
- Sowing using ploughing sowing machine.

### **1.2 Farmers performing “reduced tillage practices” using specific machines**

This step logically follows the first one. Farmers are usually disappointed with regards to crop implantation. In addition, labour time per hectare is not reduced because of the successive use of the different tools. Farmers aim to employ just one machine doing all the tasks at the same time and ensuring high sowing quality despite the crop residues. The machines used in that case often are multi-functional and allow the farmer either to plough or to superficially till the soil.

- Tools with disks allow to till topsoil and to sow on the ploughed layer or the superficially tilled layer in presence of crop residues. These sowing machines usually are rapid.
- Combined tools joining deep tillage and sowing. These machines require high power and provide low work efficiency.
- Tools driven by powered mill. These sowing machines remove topsoil and lay the seed on the soil devoid of plant residue. The soil projections from the mill cover up the seed.

### **1.3. Farmers who practise direct drilling**

This practice is the final step for performing Soil Conservation Agriculture. The farmers aim to substitute mechanical tillage for the work of the roots of the plant cover in the soil. Cover crops species are chosen depending on farming rotation, and their roots should be strong enough to maintain soil porosity. Moreover, biomass production provides mulch that protects topsoil and improves biological activity. The sowing machines used usually present disks

which can strongly penetrate into the soil and lay the seed at the suitable depth, among a developed network of roots.

## **2. Farmer history and motivations depending on the area considered**

### **2.1 The Centre Region**

(Situation at Tours in Jean Claude Quillet 's farm)

- **Concerning filtering soils**

This farmer started in the 80s using the Semavator. First, this machine was occasionally employed to till filtering soils as a priority. The goal was to decrease the costs of replacing parts. In 1990, the farmer aimed to reduce labour time per hectare. The yields obtained after using reduced tillage practices were close to the one obtained using conventional practices. Nevertheless, labour time decreased by 4. Consequently, all the fields of the farm were converted to "reduced tillage practices".

- **Concerning silty and clayey soils**

Farmers of the Centre Region started to use a digging machine after having visited the Gers in 1980. When they went back to Indre-et-Loire, the farmers of Jean-Claude Quillet's CETA set new objectives for clayey soils because these soils required much energy and much time: they wanted to reduce by 2 labour time for ploughing. However, Jean Claude Quillet wanted to put more effort into this innovative process and to divide by 4 his labour time. For that, he chose a sowing machine combined to a digging machine, which allowed him to decrease his fuel consumption from 40 L to 18 L (representing a decrease of 55%).

The first cropping year, results were higher by about 10%, which was encouraging. An improvement of water infiltration was observed due to the removal of the ploughsole as early as the first year. When the Cher overflowed its banks, this improvement was observed on the fields liable to flood and having an important drainage capacity.

After two years of drought (89-90), giving low yields for superficial soils, the farmers of the GDA (20 farmers) brought together to consider former experiences. They concluded that ploughing should be definitely stopped in order to reduce mechanical costs. Therefore, the existing tools of the farms were used until 1993.

In 1994, they decided to buy in common (9 farmers) a Horsch sowing machine; with a mill devoted to sowing in filtering soils during the autumn. In addition, the first experiments were carried out for clayey and silty soils. Results were satisfactory regarding autumnal crops and disappointing for spring crops. The reasons were the following:

- Rapid wearing of the blades;
- Low work efficiency due to the width of the machine;
- Higher power consumption inducing higher fuel consumption;
- Higher weed infestation.

In 1995, according to the difficulties encountered, they sold the Horsch machine and bought two sowing machines with disks (American JD 750). It was the beginning of the

measurements in the direct drilled fields (600 ha). Yields for autumn crops were good, and farmers wanted to implement the practice for spring crops.

In 1996, they bought in common a “mono grain” pneumatic sowing machine devoted to spring crops (5 farmers for 350 ha). The first observations made during the sowing period showed that the soils were “hard-packed” due to successive rainfalls during the winter.

In 1997, after the GDA training with Claude Bourguignon, they began to grow cover crops. The covers aimed to

- Improve soil structure due to root exploration;
- Cover the soil during the winter and produce biomass.

In 1999, Jean-Claude Quillet grew all the spring crops in association with cover crops. The results were the following:

First agronomic effects:

- Multiplication of earthworms but also multiplication of slugs
- Accumulation of organic matter in topsoil that made the soil darker
- Higher trafficability
- Higher water infiltration

Economic analysis :

- Important decrease in fuel consumption
- Reduction in labour time
- Distribution of the tasks during peak periods
- Reduction of mechanical costs
- Decrease in weed infestation in comparison with “reduced tillage practices”
- Easy entry into the fields to apply fertilizers or weed killers and to harvest the crop, which guaranteed good yields.

Environmental analysis:

- Biodiversity increase (*Carabidae*, spiders, ladybirds...)
- Quicker breakdown of active substances in the soil
- Reduction of water table pollution by pesticides
- Potential recycling of nitrate losses by cover crops

CONCLUSION

Several crucial changes have been observed for 10 years using direct drilling:

- Soil analysis showed that organic matter content increased by 0.10 or 0.15 units per year;
- Cover crops react as biological pumps: oat sowed at the end of the spring is able to leave a low nitrogen balance at the end of the winter (0-30 Cm: N balance=15 Units. 30-60 Cm: N balance=4 units. 60-90 Cm : N balance=1.3 units)

Jean Claude Quillet hopes that his field observations will be confirmed by scientific results. To my mind, there are some research directions that would be useful in order to develop these practices:

- Carbon storage;
- Microfauna and macrofauna evolution;
- Pesticide and nitrate residue measurements in superficial and deeper water for DMC systems;
- Cover crops choices depending on the crop;
- Selection of varieties adapted to DMC systems.

## 2.2 Western area

(Situation in Alain Orhan's farm, Finistère)

Farmer-breeders' motivations in this area are based on two main reasons:

- Lack of availability due to the intensive breeding constraints;
- Important environmental pressure (slurry spreading).

During the 90s, there was still much family labour on the farms, which allowed doing the sowing tasks in pairs (the son sowed while the father was ploughing to prepare the soil).

Alain Orhan "I would have never imagined that I had to question the traditional way of soil tillage: ploughing. Nevertheless, deep ploughing, as I did with my father, leads to soil asphyxiation and loss of soil fertility. I was very worried about my soils which had become sensitive to crusting, difficult to crop and whose earthworm quantity decreased"

The living fauna, which can only develop in presence of air, was buried at the depth of 30cm and was condemned to die."

Without biological activity:

- Organic matter becomes fossilized instead of changing into humus (essential to the process of formation of the clay-humus complex). It turns into a blackish matter that releases carbon. The greenhouse effect increases.
- Soil isn't renewed anymore and dies;
- Soil becomes difficult to crop;
- Crust appears on the surface;
- Water doesn't infiltrate anymore and run off. Water run off conveys all the residues encountered to the rivers;
- Fertilizers and nitrates are not kept back anymore and are susceptible to leaching. It induces water pollution;
- A decrease in the humus rate is now observed in Britain despite the important quantities of organic matter returned to the soil.

Therefore, in 1992, Alain Orhan decided to implement the German practice that consists in sowing under mulch, under litter or under plant residues. For that, he bought a Sem Exact sowing machine from Horsch and fitted out the machines with low pressure tyres.

Technical management on Alain Orhan's farm for wheat-maize rotation:

1. After the wheat harvest, systematic sowing of a cover crop;
2. During the following spring, composted manure spreading and incorporation into the soil aided by mulch;

3. Soil cracking and maize sowing by the end of April or the beginning of May;
4. Harvest of maize grains from October 20<sup>th</sup> to November 15<sup>th</sup>. Wheat direct sowing using the Horsch with mill; while the crop residues were still left on the surface.

The goal was to reach a system functioning close to that of the original forest. For that, organic matter was left in the topsoil as it is in woods.

Owing to biological activity, this process worked in closed system, which prevented any pollution. The reasons were the following:

- Microbial fauna development in topsoil changed organic matter into humus;
- Humus joined with clay to constitute clay-humus complex, representing soil resources. The complex held fertilizers and they were released when the plants needed nutrients;
- Earthworms ingested fertilizers while they sank into the profile and digested them. They regurgitated new soil on the surface, at the origin of the high quality arable soil that we cultivated;
- Earthworms built galleries inducing an increase in soil porosity. The network made up by many small channels favoured soil drainage, soil aeration and soil loosening.

## CONCLUSION

I have been using these practices for 12 years on my farm. Since then, I have noticed the following changes:

- Soils became more permeable owing to the disappearing of the ploughsole;
- Soil erosion decreased in the case of silty soils sensitive to crusting;
- Labour time per hectare decreased;
- Crop root exploration became more homogeneous in the soil, which implied yield increase;
- Soil trafficability was improved which increased the number of working days;
- Fuel consumption per hectare decreased;
- The good functioning of the soil immune system came back, which reduced disease pressure;
- Birds came back to the fields because they found food and safety.

I hope that these new agricultural practices will erase the image of the conventional agriculture given by the media. The alternative practices let us consider a new form of agriculture, profitable to the environment and economically viable, which would renew French people's interest in Agriculture.

## 2.3 Northern area

This area is usually devoted to high margin crops, such as sugar beet or potatoes. It is not prepared for the reduced tillage or DMC systems, due to cropping plan issues or harvesting conditions.

In addition, gross margins are high; consequently many farmers do not put their practices into question. The conventional system based on ploughing goes on giving good results for these crops.

In Northern area, how could the limited development of reduced tillage practices be explained?



1. As far as the farms mainly cropped with cereal are concerned, several farmers adopted reduced tillage in order to increase the work efficiency. In the 90s, rapid sowing machines appeared. These machines had two main advantages:

- It was possible to sow in a soil prepared several weeks before;
- They provided high work efficiency (from 30 to 40 ha/day) because of their rapid working speed (15 km/hour on average).

2. The balance between conventional farms and conservative farms may reverse when farmers consider cover crops as a benefit. The obligation to establish intercrops for nitrate trapping in sectors classified as vulnerable areas may favour the change.

3. Many farmers stay alone on their farm; that is to say, they can't afford to keep the two different tasks: ploughing followed by sowing.

### CONCLUSION:

In this productive area delivering high gross margins, no-ploughing practices will only extend in case of farmer agronomic decision or administrative obligation (in order to respect the environment).

## **3. The main issues preventing the extension of reduced tillage practices**

### 3.1 Agronomic issues

While modifying cropping system management, new issues appeared:

- Slug infestation;
- Perennial weed species development (couch-grass or thistle);
- Soil compaction in case of silty soils sensitive to crusting;
- Crop residue management when sowing several crops (e.g. rape);
- Field mouse management in DMC systems.

### 3.2 Psychological issues

It seems that some farmers and officers in chamber of agriculture are still reticent about no-ploughing practices. Despite of the economic and environmental advantages, they worry about the increase in investment for cropping system management and the potential reduction in yields.

The main issues are psychological ones. Ploughing is an old practice, strongly linked to French agronomic traditions. Owing to ploughing, the farmer's work was less laborious and apparently efficient. Reduced tillage practices require efforts of adaptation and investment at the beginning (training, machines, etc.). These new practices disrupt the system's habits, involving chambers of agriculture, cooperatives, equipment manufacturers and chemical suppliers.

As far as the farmers are concerned, the adoption of new practices requires:

- Higher technical investment;
- Changes in mentality and questioning their existing knowledge;
- Reworking the cropping plan.

## **4. An example of farmer association promoting Conservation Agriculture : the FNACS (National Foundation for Soil Conservation Agriculture - Fondation Nationale pour une Agriculture de Conservation des Sols)**

The FNACS was born at Montargis in December, 2001, initiated by a dynamic group of farmers who wanted to exchange knowledge, to give life to farmer networks in their regions and to improve field experiences. These farmers aimed to favour the development of reduced tillage practices. Today, the FNACS has about 400 members.

### **4.1 What is the FNACS?**

The FNACS (Fondation Nationale pour une Agriculture de Conservation des Sols: National Foundation for Soil Conservation Agriculture), represents a meeting point for the farmers who present the following characteristics:

**FOUNDATION:** It was initiated by farmers who have a sense of responsibility and who are interested in performing these practices. FNACS members are at the other farmers' disposal.

**NATIONAL:** The members want to create an exchange of experiences. This is essential nowadays, in order to understand all the experiments that are being performed in the different areas of the French territory. For that, in the 6 main French regions, a vice-president was named. The experiences include:

- Experiences with no-ploughing in the broad sense;
- Fertilizer dose adjusting;
- Cover crops management.

“National” also means that the association should represent a link between the general public, the farmers and the administrative services, in order to demonstrate the suitability of innovative practices that respect the environment.

**AGRICULTURE:** The association is in favour of an agriculture that respects the environment. The principal actor should be the farmer, aware of the agronomic interest of the practices he uses. Soil Conservation Agriculture is a good way to increase farmer awareness, without forgetting the difficulties encountered in terms of cropping system management and psychological issues.

**CONSERVATION:** The innovative practices performed are capable of preventing from erosion and leaching, maintaining the productive capital, and renewing important carbon pools.

We have to take on board Antoine de Saint Exupéry's expression: “*we don't inherit the land from our parents, but we borrow it from future generations*”.

**SOIL:** Life in the soil should be maintained, while regenerating fauna necessary to soil harmony. Management should be directed by the desire to nourish the soil, which means nourishing soil biological activity.

## 4.2 The FNACS's work methods

The activities of the FNACS are mainly field operations in order to answer farmers' requests and to give them a broad view of various farms using no-till practices.

Since December, 31<sup>st</sup>, 2001; the FNACS has organized:

- 31 field meetings
- 4 national seminars.

3-day training programs have also been proposed involving various consultants. These training programs have been managed in collaboration with institutions that were able to get *Vivea* financings.

- 2 programs in the CERFPPA of Epine (Marne)
- 3 programs in the CETA d'Oc (GERS).

Concerning the circulation of information, 3 ways are used:

- The FNACS review (4 pages of semi-annual information);
- Fax diffusion to publish meeting dates;
- A website: [www.fnacs.net](http://www.fnacs.net).

## 4.3 The FNACS limits

The operation of the FNACS association is based on voluntary farmers. Activities are organized by the regional presidents in charge of creating activities for their area. Nevertheless, voluntary work is limited because the members already manage many businesses and don't have much time.

Moreover, the contacts the FNACS has in the Ministry of Agriculture and the Ministry of Environment congratulate the FNACS on what they have been doing, but they underline the fact there is no financing for the FNACS projects.

In addition, many farmers refuse to join the regional management committees; consequently there is no change of the leaders who would like to leave.

Unfortunately, the FNACS is running out of steam, because of the lack of financing and the absence of change of the volunteers.

## **CONCLUSION**

Due to globalization, more and more farmers are looking forward to avoiding ploughing, while setting up practices that respect the environment. These practices involve superficial tillage, which get the cropping system closer to the initial forest functioning. This natural system is based on green fertilizers producing high biomass volumes. It participates in the development of soil biological activity, which produces fertilizers without any loss by runoff or leaching. Soil improvement begins with the improvement of the soil biological process.

This evolution leads to a real Green Revolution in the four axes of Agronomy: tillage, genetics, pesticides and manure. French farmers can't stay out of this innovative challenge, which has already been taken up in other countries around the world.

That's why a group bringing together farmers from different French areas, decided to implement a national association called the FNACS. The objective of this association is to compare various experiences and to perform research on the promising practices of the reduced tillage. The group is composed of farmers working for farmers.

The coming issue would be to maintain sufficient activity within the association which is mainly run by volunteers.