CONSTRUIRE ENSEMBLE
LES SYSTÈMES DE CULTURE DE DEMAIN

# The Syppre initiative at its midpoint

**PRESS CONFERENCE OF TUESDAY 8 DECEMBER 2020**

## Table of contents



Follow the Syppre initiative
www.syppre.fr

@ProjetSyppre

# Syppre, an innovative initiative for arable cropping system performance

***The Syppre initiative aims to promote the development of farming businesses that achieve multicriteria performance, by encouraging innovation at cropping systems level. It is part of an overall sustainability objective through the implementation of agroecological practices tailored to the farms and their specific environments. At the halfway point of the initiative (2015-2025), we have the first results yielded by the experiments: after 3 seasons, environmental performance has improved. Economic results, however, often show a deterioration. This is not necessarily linked to environmental performance, but rather to technical risks having been taken, and to having to learn to master new control levers as well as to manage more complicated systems. The observation period has not been long enough yet to assess such profound systemic changes, but the first findings and tools have been published. Tools are being designed to help farmers implement innovative systemic solutions. They are the first of a long series, which reflects the long-term nature of the Syppre initiative.***

With Syppre, Arvalis - Institut-du-végétal, the Institut Technique de la Betterave (applied agricultural research organisation for sugar beet) and Terres Inovia (technical centre for the oilseed and protein sector) share an ambition of producing reference data, knowledge, and tools that will facilitate transitioning towards cropping systems that achieve multicriteria performance.

This initiative, started in 2013 and launched in 2015, is based on a new cross-sectional approach, at cropping system and farm levels. It complements the work carried out by each institute to improve all aspects of performance for each individual crop. Syppre is focussing on the issues of sustainability in agriculture, by looking 10 years ahead: **meeting market demands, cost effectiveness and environmental excellence.**
The work is aimed primarily at **producers and people involved in development, and also concerns players in various sectors and production areas.**

When it was launched, the Syppre initiative was supported by the Scientific Interest Grouping on Arable crops (GIS GC-HP2E) and the “Innovative cropping systems” Mixed Technology Network (RMT Systèmes de culture Innovants). It is partly self-financed and also receives funding from the French “Agricultural and Rural Development” earmarked account (CasDAR), as well as from the National Agricultural and Rural Development Programme (PNDAR). The work carried out receives the scientific and financial support of the H2020 DiverIMPACTS (2017-2022) project.

The Syppre initiative **comprises three complementary technical pillars**: an observatory focussing on production systems and their performance, forward-looking experimental sites, and farmer networks. In 2020, it encompasses five regional variation projects spread through the different French arable production areas and managed and funded by the technical institutes involved. The regional projects are supported by local research and development partners, players from the various sectors and cooperative organisations concerned, as well as farmers (see appendix 2).

## Some technical objectives to meet the challenges of sustainable farming

At a national level, the Syppre initiative must contribute to objectives based on a forward-looking vision of agriculture over a decade, which is shared by all three institutes. They address the productivity, profitability and environmental excellence challenges, and have been translated into an array of indicators and levels to reach.

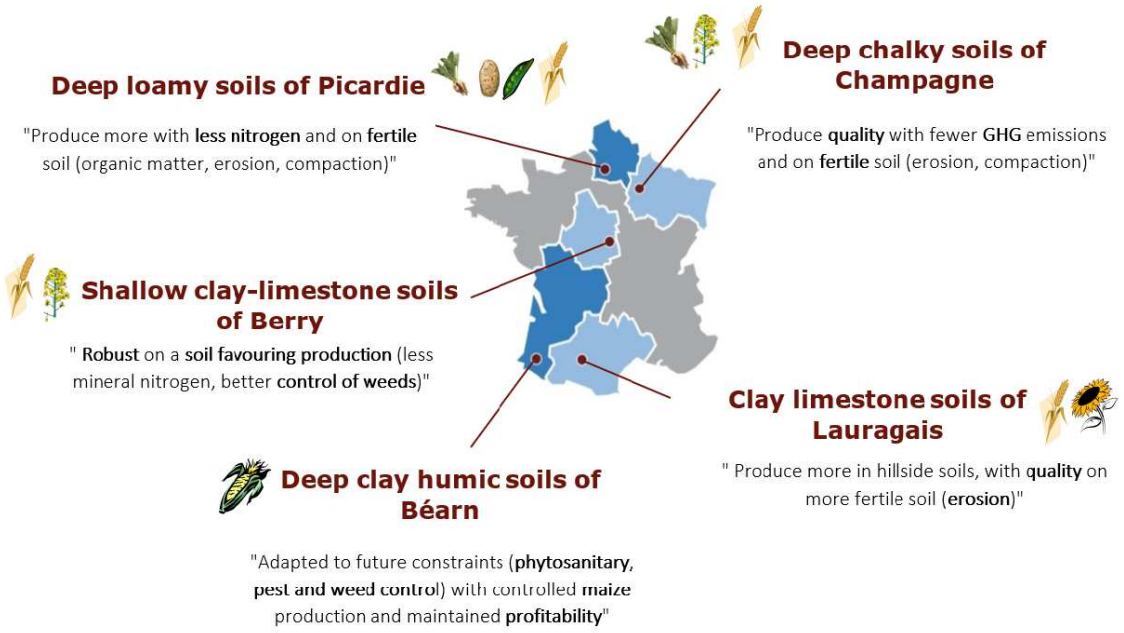
***Table 1: Syppre's objectives for cropping systems to meet French agriculture's challenges (*compared with 2012 regional reference point)***

| Challenges | Indicators | Innovative systems' targets/initial situation |
|---|---|---|
| **Productivity** | Raw Energy produced and exported (Megajoules/hectare) | Greater or same |
| | Energy efficiency (Megajoules/Megajoule) | Greater or same |
| **Economy** | Direct margin €/ha | Greater or same |
| | Family's GOS/MPU | Greater or same |
| | Variation coefficient of direct margin/ha | Lower or same |
| **Practices and Environment** | Treatment frequency index - Total product TFI | Trend towards -50%* |
| | Quantity of mineral nitrogen used (kg of nitrogen/ha) | Lower or equal<br>- to -20% |
| | Primary energy consumption (Megajoules/ha) | Lower or equal to -20% |
| | Greenhouse gas emissions TeqCO2/ha | Lower or equal to -20% |
| | Organic matter stocks (tonnes/ha) | Greater or same |

## Taking account of geographical characteristics

To study innovative systems in practice, the Syppre initiative has been split into five regional projects representing different case studies run in specific contexts.
Working groups involving several partners drew up a common vision of the main challenges of regional agriculture over a 10-year period, and defined the problems needing to be addressed locally for production systems in addition to the objectives set out at national level. Three themes were examined systematically, as they are inherent to a systemic approach over several years and play a major part in multicriteria performance: soil fertility, carbon balance, and weed management.

***Diagram 1: Outline of the main issues addressed by the 5 Syppre experimental sites***




## The three pillars of the initiative:

The Syppre initiative comprises three technical pillars – observatory, experimental sites, and farmer networks – that complement each other to support changes in cropping systems. The aim is to eventually adapt them to each of the project's regional entities, as and when local "resources" can be mobilised. In 2020, the experimental sites are operational in all five regions, links with innovative farmer networks are in place in the Champagne, Berry and Lauragais regions, and are being set up in the Béarn region. Pilot operations are underway for the regional observatories in Lauragais and Berry, and are being adapted for the other regions.
The three technical pillars are complemented by another one dedicated to the management of the data and knowledge produced through tools such as SYSTERRE® for instance, as well as by a pillar focussing on communication and on the utilisation of the deliverables produced. The creation of the new website www.syppre.fr and the Twitter account (@ProjetSyppre) reflect this approach.

**The three technical pillars complement each other and encourage the networks to give feedback on their experiences, the experimental sites to establish new knowledge, and the observatories to understand and monitor real farms.** They are based on the same set of objectives as those identified at national level and all the regional variation projects use the same methods to implement each pillar, with a view to feeding information to each other, and more importantly still, to produce an overall vision through the cross-sectional analysis of all the results.

### 1 - Observatories to attune innovation to the different production areas

This pillar of the Syppre initiative is designed to understand the cropping systems used by farmers as well as their level of performance across the board (multicriteria performance), while monitoring changes over time. Those observatories focus primarily on farms that fit a representative profile for each of the five regional projects in which Syppre is adapted according to the physical environment and types of production. They help to identify the areas in which cropping systems are being improved, and to guide the experimental work carried out at research stations or with farmer networks. Along with local expertise, the collected information helps to build representative farms where innovations that have been designed by research stations or with farmer networks can be assessed to ascertain their usefulness for farms within a given production area.

**Vincent Lecomte, Terres Inovia,**
**Head of the Syppre initiative's Observatory pillar**

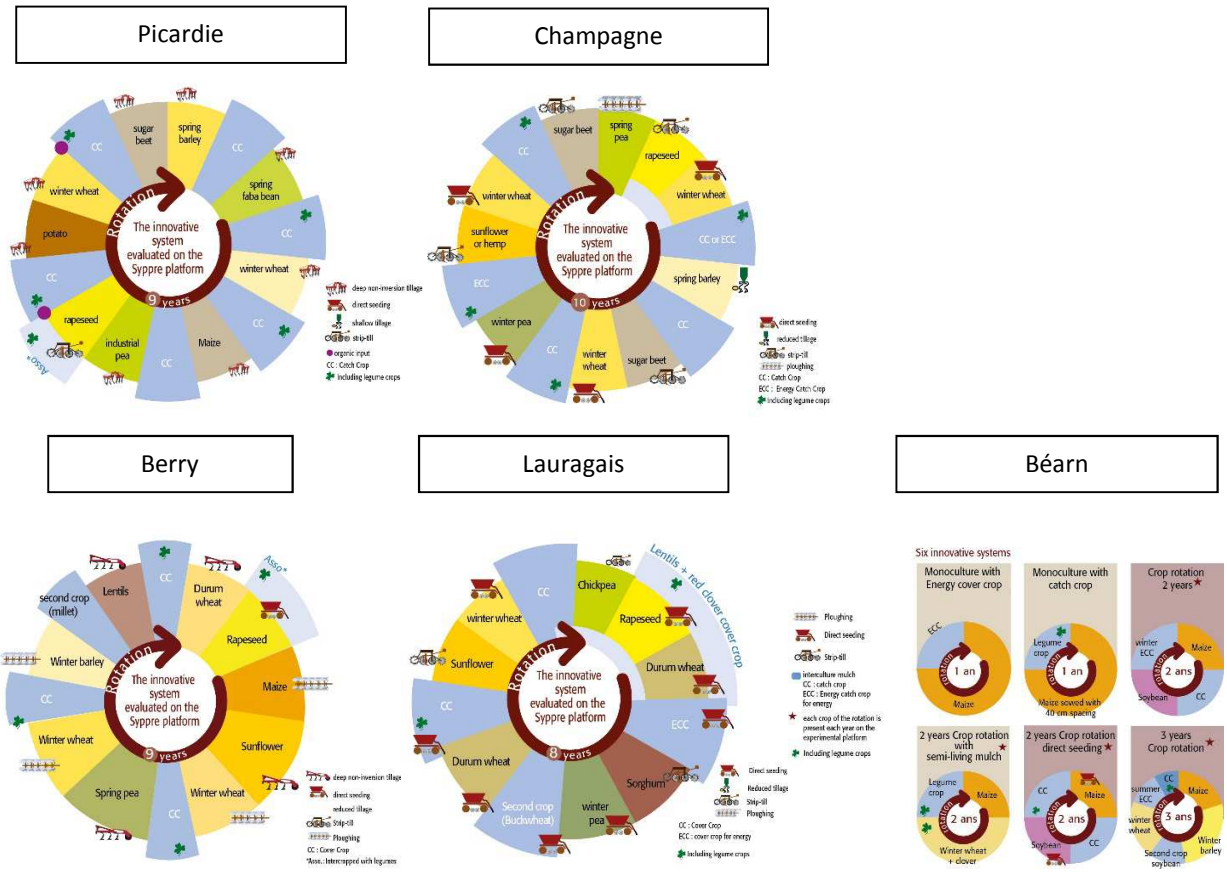
***What is your assessment of the observatory?***
*At the beginning, we had the very ambitious objective of setting up an observatory for all the different regions of metropolitan France. Since then, we have focussed this observatory on the regions that have innovative Syppre experimental sites and farmer networks. In 2019, in a pilot phase, the observatory's development was mainly concentrated on the Centre - Val de Loire region. Now, the challenges experienced by the innovative experimental sites and farmer networks determine our initiatives.*
*The Syppre initiative's observatory is all the more relevant today since the overall agricultural context is changing very significantly. We therefore need to acquire reliable reference data on cropping system diversification, on how farming practices are changing, on the impact of climate change, on how farmers are adapting to those changes, as well as on the quantified impact of innovations and how they are taken up. We are on the right track.*

***How should it be developed in the future, and where?***
*Going forward, we are going to consolidate the method developed in the Centre - Val de Loire by producing an operational manual that we will test in the Lauragais region. We will then review the data available in the Champagne region. Then, we will need to roll it out in all 5 of the Syppre regions and find a good balance between systems and between cropped species, for the innovations being tested.*
*The observatory helps to determine the impact of useful innovations at farm level. It helps to go from parcel level on the experimental site to farm level. The challenges of the different production areas and sectors are also part of the investigative scope. The observatory is used to quantify the impact of useful innovations and operates within the overall dynamics of the Syppre initiative, while being useful to farmers, of course.*

## 2 - Experimental sites that take risks so that farmers do not have to

**Set up for at least 10 years,** the experimental sites test, in field conditions, innovative systems that have been co-designed by groups of local players. They are managed according to rigorous experimental principles, on a scale and with working conditions akin to those of a farm. The current sites cover between 5 and 10 ha and compare the control systems (local reference systems) with innovative systems.
The experimental sites are a real testing ground for the proposed innovations, as well as a place to implement them within a systemic approach and to acquire reference data on their medium and long-term impact on the various environmental components. They are also places for exchanging with farmers, technicians and regional partners.

***Diagram 2: Description of the cropping systems trialled on the 5 experimental sites (details in appendix 1).***




## First useful results after 3 transitional seasons with innovative systems

By definition, focussing on performance across the board involves assessing multiple criteria, which in the Syppre initiative is expressed as a dashboard comprising 9 performance indicators (technical, productivity, economic and environmental). It is quite natural that all the objectives may not have been fulfilled in the short period of time covered by the Syppre experiments. The institutes involved accept those results, since we are in an experimental context and we can take risks that a farmer would not take. It is a prerequisite in order to draw lessons on what determines the success of innovative practices and systems, in terms of cost and learning time, and to produce technical innovations.

***Table 2: Summary of initial results obtained over 3 seasons (2017-2018-2019)***

| Challenges | Targets | PICARDIE | CHAMPAGNE | BERRY | LAURAGAIS | BÉARN- T3 | BÉARN- I1 |
|---|---|---|---|---|---|---|---|
| Practices and Environment | ↘ 20% mineral nitrogen | -30% | -29% | -27% | -18% | -42% | -5% |
| | ↘ 50% TFI reference | -27% | -14% | -27% | +12% | -4% | +28% |
| | ↘ 20% of GHG emissions | -20% | -22% | -22% | -13% | -24% | +1% |
| | ≥ Organic matter stocks | +2.2% | -0.2% | -5.2% | +10.8% | +1.5% | +1.4% |
| | ↘ 20% Energy consumption | -22% | -14% | -16% | +0% | -18% | -5% |
| | | | | | | | |
| Profitability | ≥ Direct margin / ha | -37% | -22% | -10% | -29% | +6% | -34% |
| | ≥ GOS / MPU | *The figure depends on the utilised agricultural area that it is possible to utilise given the cropping systems implemented, the local soil and weather conditions, and the throughput achieved by the equipment used. A study will be carried out after 5 trial seasons.* | | | | | |
| | | | | | | | |
| Productivity | ≥ Energy produced | -24% | -7% | -20% | -2% | -3% | -15% |
| | ≥ Energy efficiency | -3.3% | +8.7% | -5.2% | -2.9% | +18.3% | -10.8% |

*BÉARN I1: 3-year rotation – cover - maize/barley - soya/wheat-energy catch crop*
*BÉARN T3: 2-year rotation energy catch* crop - *maize/soybean cover crop*
*Key: For each of the experimental sites and each of the criteria, dark green indicates the innovative system met the targets that had been set, whereas light green expresses a trend towards reaching those targets. Dark red indicates that the results of the innovative system are not as good as those of the control system, and to a lesser extent for light red. No colour (white) indicates the results are not significant.*

On the whole, on all the experimental sites, the innovative systems improve **technical and environmental performance.** Ambitious input reduction targets are even met on several of the experimental sites: in 4 of the innovative systems (Picardie, Champagne, Berry, Béarn T3), the amount of mineral nitrogen used is reduced on average by over 20%, and in 3 of those (Champagne, Berry, Béarn T3), greenhouse gas emissions are also reduced by over 20%. In Picardie, the TFI is significantly reduced compared to the regional reference.

**The main difficulty resides in the TFI of 2 of the innovative systems** (Lauragais and Béarn), where it is not reduced compared to the reference TFI, and is even higher over the 3-year average. The reason is that when, historically, systems were based on crops that do not require much inputs (sunflower, maize), diversification leads to an increased TFI compared to the control system, at least in the short term. In the Lauragais region, the no tillage strategy, combined with the introduction of intermediate cover crops to reduce erosion on the hillsides, creates an additional problem in terms of weed control and does not allow a reduction in herbicide use. Conversely, on that experimental site, the innovative cropping system significantly improves soil carbon storage compared with its control system.

At the moment, **innovative systems do not meet set productivity and profitability targets** in the current pricing context. The good environmental performance does not necessarily explain the poor economic and productivity performance.
The diversification of the rotation reduces the part played by historical crops in the new cropping plan, which can have an impact on the productivity or profitability of the cropping system. It is the case in Picardie, with a reduced potato area at system level, which has an impact on the system's profitability. Therefore, the performance to date reflects a "mechanical" effect linked to various factors: the changes made to the rotation, involving a degree of risk taking (e.g. establishing potatoes and sugar beet without ploughing in Picardie); the learning curve associated with new crops (e.g. choice and management of the energy catch crop in the Lauragais region); and the implementation of strategies that are turning out to be unsatisfactory (e.g. maize chosen in the Berry region when summers have been particularly dry over the corresponding period).

**"*I never lose, I either win or I learn*," Nelson Mandela**
Three years into the experiments being carried out on the different Syppre experimental sites, it is still too early to gauge the **"system effect"**. Establishing a new plant/environment equilibrium (natural regulation, soil fertility, etc.) will take another few years.
What can be examined is the relevance of the **innovative systems** put in place, compared to the control systems. Indeed, some of the innovations that have been implemented may not be suitable for the context, and if that is the case, other avenues will have to be explored. For example, the introduction of fababeans was a failure in Picardie. Likewise, the pea-wheat intercropping in the Berry region, which was meant to give better ground cover in winter and help pea stalks to stand, failed because of issues with blackgrass and take-all control. Those examples show that it isn't a system as a whole that is unsuitable for a given context, but rather that some components must be adjusted or abandoned when they prove unsatisfactory. Other possibilities will then have to be tested, that are at least as far-reaching in terms of innovation.

In addition, **plant protection issues have put a significantly different complexion on things.** Some strategies need to be revised in order to address how to meet the 50% TFI reduction target. From the beginning, the pilots run on the experimental sites have been seeking and testing the equipment best suited to the different contexts, to carry out still fairly untested cultural operations, and to manage cover crops and mechanical weed control. Choosing agricultural equipment is a research field in its own right for Syppre.

We can suppose that climatic stress impact the innovative and control systems differently. An analysis will have to be carried out for each experimental site and we will need to indicate in what circumstances climatic stress may have exacerbated the performance gap between innovative and conventional systems. For example, the introduction of spring crops in the Berry region made the system more sensitive to dry summers.

It is therefore inevitable that the i**nnovative systems will need to be adjusted** along the way, and indeed this is already happening on most of the experimental sites.

## 3 Farmer networks to compare experiences, develop tools and support making changes to cropping systems

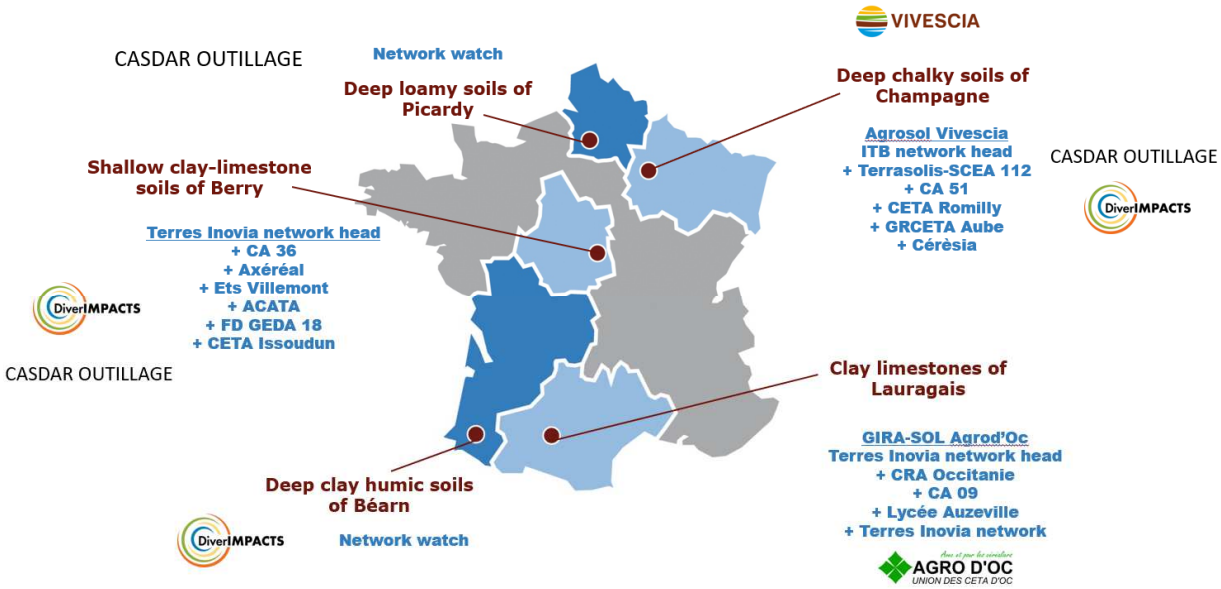
They are networks of local farmers who are committed to, or interested in, changing their cropping systems. They may be created from scratch (e.g. Syppre Lauragais) and/or are existing networks that can lend their support to the project (e.g. Syppre Berry).

The existing networks that were identified and approached are already focussing on innovation, and are generally led by an advisor, who is either working in the organisation in charge of the project, or is linked to one of the partners involved. They must facilitate idea sharing and transfer between the experimental sites, as well as communicate on what is being implemented in their fields. They must be involved in the monitoring of the experimental sites. They take part (i) in the co-designing workshops, upstream of any experiments or to adjust the systems being experimented; (ii) management committees where results are presented and

directions for the upcoming seasons are discussed; (iii) and field visits. Where possible, Syppre events combine visits to/discussions on the experimental sites and networks.

Among other things, they help to generate knowledge on the cropping systems and
to design new support tools to develop innovative systems on farms.
The networks, the farmers that are involved in them as well as the network leaders, are therefore considered as designers, local experts, innovators, testers, and communicators on their approach, results and the Syppre project on the whole.

***Map of the networks associated with Syppre as part of the 5 regional projects***



# Managing without glyphosate if possible, without penalising the other sustainability aspects

In 2018, the Directors of the three institutes decided that the Syppre initiative should undertake to seek alternatives to using glyphosate, and reaffirmed this commitment in 2020 in view of the possible ban of this product in the medium term: 2023 in France and 2025 in Europe. The objective is clear: to contribute to the emergence of effective solutions at cropping system level, and to quantify cost and benefits of their implementation.

This work mainly involves the five experimental sites. They are aiming for "zero glyphosate" without threatening plant protection, while limiting the impact on the cropping systems' technical, economic and environmental performance.

There are three levels of rules applied by all the teams:
1- establishing strategies that, in principle, make it possible to do without this herbicide for its three main uses (control of post-harvest volunteers, destruction of intermediate cover crops, and establishment of crops on clean soil)
2- if preventative strategies have been unsuccessful and if not using it threatens the systems' multicriteria performance or the long-term control of weeds, then it can be used as a last resort
this use as a last resort must follow the good practices recommended by the institutes, in order to maximise the efficacy of each input while reducing the impact.

Unsurprisingly, after 2 seasons, no credible alternative meeting the multiple performance criteria has emerged from the experimental sites yet.
The "zero glyphosate" target brought about some significant changes in the technical strategies, which on the whole helped to reduce or abandon the use of glyphosate, but with varying degrees of success and of repeatability.

Here is some of the feedback:
- In the Lauragais region's innovative system, the sunflower crop was able to be sown directly after the cover crop, without glyphosate, two years running. A tined tool had to be used to finish eliminating ryegrass that had developed throughout the faba bean/phacelia cover mixture and had survived the first roller pass. In spring 2019 and spring 2020, conditions were such that this alternative proved effective, without being able yet to judge the positive impact on soil structure and erosion. However, the reproducibility of this experiment remains to be verified. The cost of the mechanical alternative still needs to be calculated both from an economic and from a greenhouse gas emission point of view.

- In the Berry region's innovative system, the establishment of direct seeding winter crops without glyphosate was possible with dry conditions in the autumn and after fairly clean sunflower crops. However, this strategy proved impossible in the autumn of 2019 because of the presence of blackgrass and geranium and incessant rain which precluded mechanical destruction – besides, they would not have been effective anyway! Ploughing, which was carried out late as a result, was the only way to sow into clean soil, although it was a departure from the Syppre aim in the Berry region to limit deep soil tillage for economic and soil structure reasons (keeping organic matter in the soil's top layers).

Glyphosate also had to be used several times as a last resort elsewhere, including in the Béarn region where this herbicide remains essential for the feasibility of some alternatives to maize monoculture that are being tested by the experimental site's team with no ploughing.
A few additional seasons will help to expand this first outcome, which, as illustrated above, will need to be adapted according to the production context. New avenues need to be explored, with the support of the regional projects' management committees and innovative farmer networks.

# Focus on the Syppre initiative in the Berry region (central France)

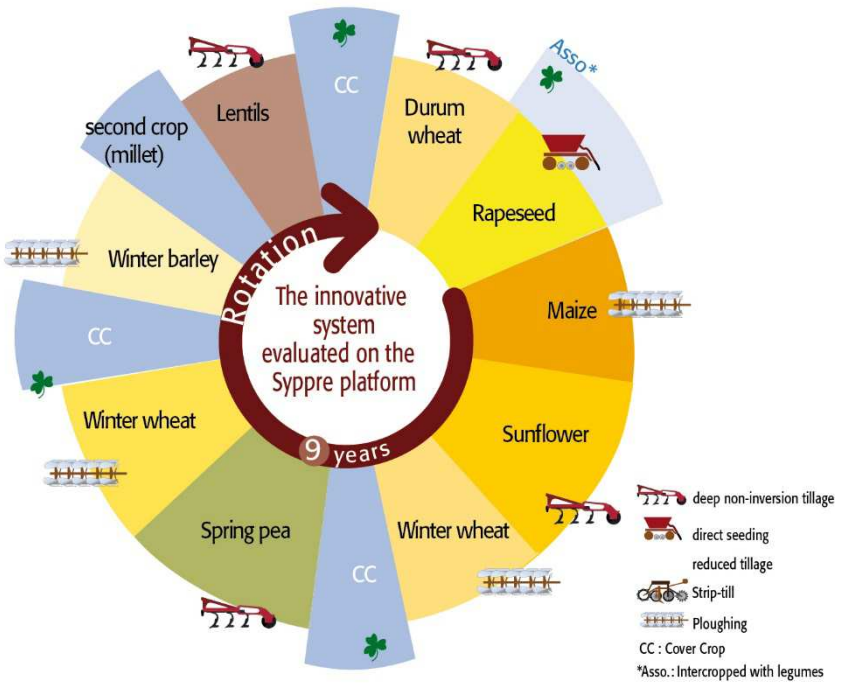
***The Syppre initiative aims to generate knowledge and tools to support the cropping systems' agroecological transition, by facilitating interactions between farmer networks, experimental site managers and the Syppre regional projects' management committees. Halfway through the initiative (2015-2025), the Syppre Berry regional project, like the other four, delivered its first results. The transition towards new systems that achieve high performance across the board is a long process, involving successes and failures that the institutes utilise as markers to help farms change their own systems.***

## Objectives: sustainable weed control and soil fertility

The Syppre project's objectives in the clayey-calcareous soils of the Berry region were determined in conjunction with the local partners and run to 2025. They focus on helping farmers to **"reduce inputs without impacting their economic margin, including by improving weed control and soil fertility in order to improve the robustness of their systems"**.

The innovative system that was put in place was built jointly with the network's farmers. It is essentially based on:

- diversifying the crops in the rotation and lengthening it,
- introducing legumes as main crops, companion crops and during the intercrop period, to bring nitrogen into the system,
- maintaining almost continuous soil cover, combined with simplified tillage,
- introducing spring crops that require few inputs (soybean, sorghum, sunflowers),
- introducing crop sequences that make it possible to have three crops over two years,
- introducing a crop with high added value (lentils),
- having two consecutive spring crops to reduce pressure from winter weeds,
- introducing maize to reduce weediness, and strip-tilling it to preserve soil quality.




***Innovative system put in place by the Syppre initiative in the Berry region***

Reduced tillage, or even no tillage at all, as well as the success of cover crops are important control levers to enable the project to reach its targets. In this type of environment, another crucial issue is the successful establishment of the cash crops, whatever they may be, to improve multicriteria performance.

## Reduction in inputs and environmental impact, but unsatisfactory technical and economic results

Over 4 seasons, the running of the innovative system has been mastered on the whole, including with regards to disease and pest control. But it is difficult to achieve yield targets and control weeds without glyphosate, despite significantly lengthening the rotation (table 3).

***Table 3: Assessment of the level of technical and agronomic expertise achieved in the innovative system*** (green = satisfactory, yellow = moderately satisfactory, red = unsatisfactory).

| | 2016 | 2017 | 2018 | 2019 |
|---|---|---|---|---|
| **Intercrop period/tillage** | | | | |
| **Establishment** | | | | |
| **Weeds** | | | | |
| **Pests** | | | | |
| **Diseases & lodging** | | | | |
| **Nutrition** | | | | |
| **Yield** | | | | |
| **Quality** | | | | |

Table 4, below, gives details of the annual performance of the Berry experimental site's innovative system (summarised for all 5 experimental sites in table 2 on page 6). It is very high as regards input and environmental impact reduction. Conversely, economic results are unsatisfactory and will lead to reassessing how to optimise the innovative practices involved, without discounting having to modify the system as a whole if that first step proves insufficient.

***Table 4: Innovative cropping system's performance and variation from targets (Syppre Berry experimental site)***

| Indicators | Targets | 2015-2016 | 2016-2017 | 2017-2018 | 2018-2019 |
|---|---|---|---|---|---|
| Raw energy production (MJ/ha) | ≥ control | **-26%** | **-15%** | **-26%** | **-20%** |
| Energy efficiency | ≥ control | **-18%** | **+9%** | **-1%** | **-22%** |
| Direct margin inc. subsidies (€/ha) | ≥ control | **-20%** | **+15%** | **-9%** | **-33%** |
| GOS (€/family MPU) | ≥ control | **-22%** | **+22%** | **-8%** | **-36%** |
| Total TFI | -50% / Reg. Ref.[1] | -21% *(-35% / control)* | -36% *(-48% / control)* | -31% *(-20% / control)* | -38% *(+7% / control)* |
| Mineral nitrogen input (kg/ha) | -20% / control | -22% | -35% | -34% | -2% |
| Total primary energy consumption (MJ/ha) | -20% / control | -10% | -22% | -25% | 1-2% |
| Total greenhouse gas emissions (kg CO2-eq/ha) | -20% / control | -20% | -27% | -30% | -5% |

1 Regional reference for the Centre region in 2012 calculated for the control system's rotation (rapeseed/wheat/barley) = 5.26. Remark: the regional reference is calculated on the basis of the minimum approved does whereas the Syppre TFI calculation (SYSTERRE) is based on the target.

*Key: For each of the experimental sites and each of the criteria, dark green indicates the innovative system met the targets that had been set, whereas light green expresses a trend towards reaching those targets. Dark red indicates that the results of the innovative system are not as good as those of the control system, and to a lesser extent for light red*

Whether the results are positive or negative, those first 4 years of innovative system experimentation have produced useful findings for all those wishing to undertake an agroecological transition in average clayey-calcareous soils.

***Table 5: Findings from the first 4 years of innovative system experimentation in the Berry region***

| **Findings regarding what needs to be promoted** | **Findings regarding what needs to be avoided** |
|---|---|
| - Positive impact of the rapeseed-maize-sunflower sequence on blackgrass control and the following wheat's performance<br>- Nitrogen utilisation and performance of the intercropped rapeseed direct seeded and positioned after lentils-durum wheat<br>- Very significant reduction in the use of nitrogen and plant<br>protection products<br>-Very moderate use of insecticides to control insects in rapeseed between 2015 and 2019: on average, 0.5 in the autumn and 0.7 in the spring with satisfactory results<br>- 4 years out of 5, very good performance of intermediate cover crops (3 to 4 tonnes of dry matter with long intercrop period) sown in July<br>- Good performance of cover crops comprising phacelia, fenugreek, nyger, radishes and buckwheat over a short intercrop period, and faba bean-phacelia over a long intercrop period<br>- Advantages and robustness of lentils and sunflowers as diversification crops<br>- The pea-winter wheat intercropping reduces the development of diseases in peas | - Poor blackgrass control with 4 consecutive winter crops<br>- The pea-wheat intercropping makes blackgrass control more difficult and maintains take-all inoculum between 2 wheat crops<br>- Maize and soybean not robust enough, which penalises system performance and robustness<br>- Not using glyphosate exacerbates the issue of weed control and the poor effectiveness of stale seedbeds |
| **Unresolved issues** | |
| - In the medium term, will the "system effect" help to improve and stabilise the innovative system's performance?<br>- What changes can be made to the innovative system to improve the system's economic results and robustness, while maintaining the level of environmental performance? | |

## Farmers at the centre of this approach: example of rapeseed intercropping

The Berry network, created in 2005 at the initiative of five farmers from the Indre département (central France) and chaired by Gilles Sauzet (Terres Inovia), now includes around 15 farms as well local development players: ARVALIS – Institut du végétal, the Indre Chamber of Agriculture, the cooperative Axéréal, the company Villemont, UCATA, the association FD GEDA of the Cher département and the Issoudun CETA (agricultural training).

Farmers drive the creation and testing of innovations, and decisions are made jointly, during design meetings. The board does not operate a top-down system. The network's chairperson carries out diagnostic activities, supports the reflection and evaluation processes and summarises results. Then, idea and experience group sharing stimulates creativity and helps to test a greater number of innovations or of implementation conditions, and therefore to progress more rapidly and more securely.

For instance, the network's farmers have been considering the issue of soil fertility in connection with traditional systems based on a rapeseed/wheat/barley rotation. As a result, direct seeding and cover crops were the first topics on which this group has been working. Having discovered the benefits of direct seeding, as well as the difficulties associated with its implementation, they deduced that cover crops were essential to maintain soil porosity and to put carbon and nitrogen back into it. They have also confirmed the pivotal role played by rapeseed. Its success being considered as uncertain, farmers combined it with frost sensitive legumes to produce and put nitrogen back into the ground. In 2018, 12% of the rapeseed surface area in France is grown

intercropped with legumes, and this goes up to between 15% and 18% in historical production areas.

The Berry network and its farmers are involved in a research and development project entitled "Outillage" (tools). Its aim is to design support tools to help farmers and their advisors to imagine, test, assess and constantly improve innovations. As part of this project, the Berry network is helping to design a dashboard to identify the key stages to obtaining robust rapeseed. The network also designed a decision support approach based on a "spade test" to optimise the choice of tillage operations depending on soil structure and other existing constraints.

## Understanding the systems, their performance and their development thanks to the observatory

The observatory collects and processes data and information on practices used in the Berry region. It helps to understand the cropping systems implemented and the production systems in place, as well as their performance, and to monitor how they are evolving over time.

The pilot project run in 2019 in partnership with the Regional Chamber of the Centre Val de Loire area produced some findings. The changes made to the cropping systems involved include a very significant reduction of the winter rapeseed surface area over the last five years, which is a structural phenomenon that has been amplified by weather conditions; good resistance from the rapeseed - wheat - barley trio, at least until 2016; a fairly steady cereal surface area, although there is currently a slight trend towards diversification (lentils, maize, sunflowers); and an increased use of rapeseed intercropped with a frost-sensitive legume. Those observations may help to adjust the direction taken by the Syppre Berry experimental site's control system.

The observatory's monitoring led to the subsequent creation within SYSTERRE® of a typical 160-ha "dry Berry" farm. This was achieved by combining various pieces of information and by integrating the innovations identified and consolidated on the experimental site and by the Syppre farmer network. It has been used to test various development scenarios.

# Syppre "Building tomorrow's cropping systems together"

The creation of the Syppre initiative in 2013 was the result of ARVALIS - Institut du végétal, the Institut Technique de la Betterave - ITB and Terres Inovia's intention to meet the agricultural industry's challenges at French, European and international levels. For the first time on that scale, 3 agricultural technical institutes are pooling their expertise and are working together on a systemic approach.

**Key figures:**

- 3 technical institutes: ARVALIS - Institut du végétal, the Institut Technique de la Betterave
  - ITB and Terres Inovia
- Annual budget of 1.2 million euros
- 5 regional projects: Béarn, Berry, Champagne, Lauragais, Picardie
- 40 hectares of experimentation: 182 parcels from 800 m² to 2900 m²
- 17 species grown as main crop, intermediate cover crops and energy catch crop
- 40 farmers involved at regional level
- 40 regional partner organisations
- 53 staff involved at national level

## The objective: helping farmers achieve multicriteria performance

Syppre's aim is to develop, by 2025, innovative arable cropping systems that are optimised compared to the existing ones, in order to ensure the viability of farms and of the processing sectors.
This requires solving a complex equation by reconciling sustainability criteria and agronomy:


Syppre's objective is to achieve a triple performance:

- **Physical productivity**: maximising production while fulfilling the quality criteria required by the markets
- **Economic profitability**: being profitable and competitive, ensuring work and capital investments are remunerated
- **Environmental excellence**: reducing the environmental impact of farming practices (fertiliser, plant protection products), and addressing climatic challenges

*"The Syppre initiative is looking at cropping systems in their entirety, without preconceptions, daring all to achieve multicriteria performance to benefit the farm. The aim is to ensure the long-term economic viability of our sectors, while meeting societal expectations."*
Vincent LAUDINAT, General Director of the Institut Technique de la Betterave - ITB

## The approach: taking into account all the interactions occurring throughout the farm

The Syppre initiative is based on the principle that each crop on the farm must indeed see an uplift in multicriteria performance, but that this is not enough. Syppre follows a cross-sectional approach: the consideration of the cropping system includes the interactions between soil, plant and weather conditions, as well as the farm's production system in its economic and geographical context.

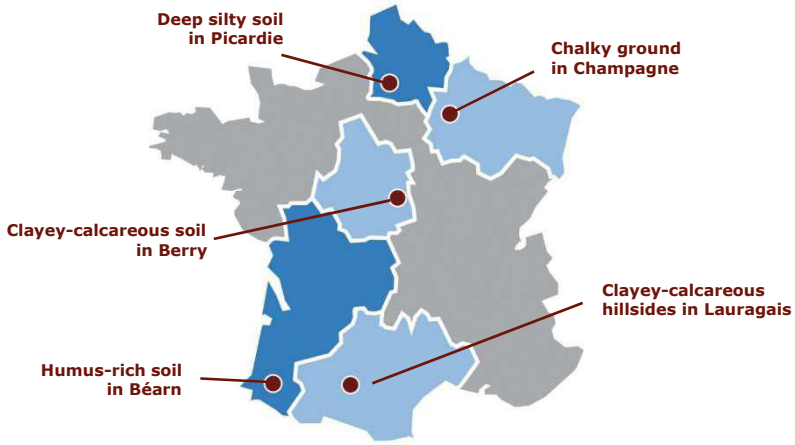
*"The cropping system is at the core of any study focussing on how to develop agriculture to meet environmental and societal challenges."*
Pascale GAILLOT, Regional Advisor for Eastern France, and Vice-president of Agriculture et Ruralité

## The methodology: combining 3 tools to engage farmers

The Syppre initiative uses an original holistic approach based on a trio of methodological tools that involves farmers in the design and dissemination of the new cropping systems:

### 1. An observatory to monitor practices

The Syppre observatory helps ascertain what cropping systems are being used on farms, to assess their multicriteria performance and to measure how they are evolving over time. This observatory helped to select the appropriate production contexts in which to site the Syppre regional projects in 5 contrasting arable farming environments:




### 2. Experimental sites

The Syppre experimental sites are based on 5 to 10 ha parcels in which innovative cropping systems are tested under real field conditions (with working conditions very close to those of farmers), and compared with a control system.

Those "system" experimentations constitute a new way of practising R&D in agriculture. They focus on outcomes departing from those of the existing system, and therefore generate innovations (new practices, innovative combinations of control levers, new decision/management rules) through an approach based on joint designing of each experimental site's programme by:

- the farmers on whose farms they are sited and who manage them
- their advisors
- the upstream and downstream context
- the regional partners

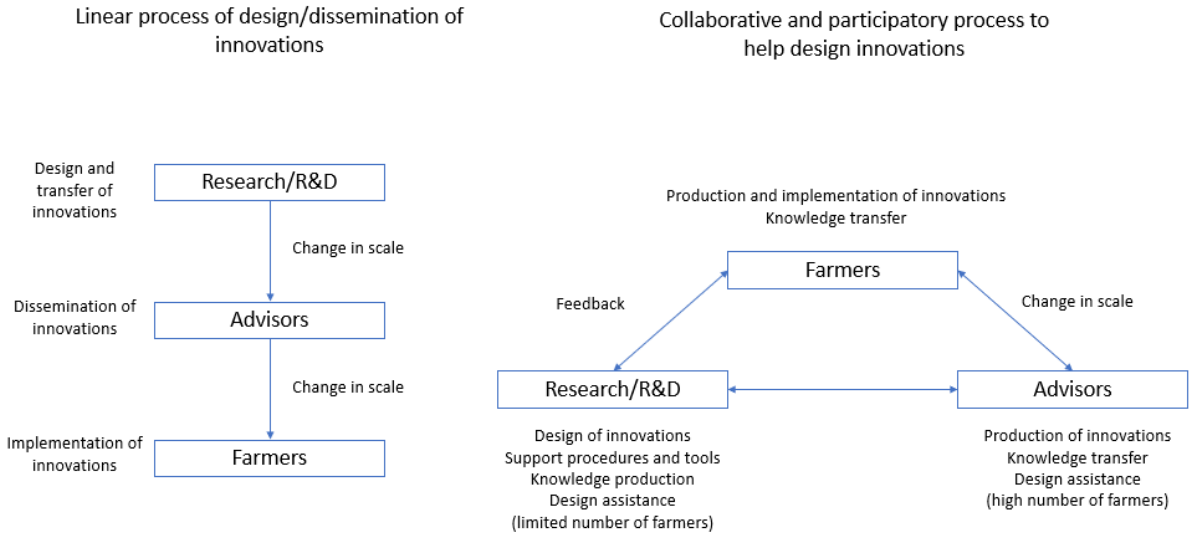
### 3. Farmer networks

The farmer networks contribute to the innovations and act as referents, evaluators, and spokespersons of the project.

"*We require more precise, more operational information, relating to day-to-day activity, for economically viable systems. What I am interested in is to understand a wider reality than what we experience at an institutional level, with very concrete examples.*"
Cécile COSTES, Head of the DRAAF Centre –Val-de-Loire agronomy/water/environment Hub

## A paradigm shift: evolving towards collaborative agricultural R&D

The Syppre initiative is a concrete application of the paradigm shift occurring in the field of agricultural R&D. Syppre is helping to get from a linear innovation design/dissemination process to a collaborative process, in which the research work's end users, i.e. farmers and agricultural advisors, are instrumental in the design and evaluation of innovations.




Adapted from Le Gal *et al.* 2011

### The 3 technical institutes that founded Syppre:

ARVALIS – Institut du végétal is an applied research organisation whose work focusses on cereals, maize, sorghum, potatoes, forage, flax and tobacco. It dedicates its expertise to facilitating the emergence of production systems that combine economic performance, adaptability to markets and a positive impact on environmental issues, throughout the whole of France. ARVALIS studies crops at every level – gene, plant, parcel, farm, production area – and draws on numerous fields of expertise and partnerships.

**www.arvalisinstitutduvegetal.fr**

The ITB, an applied agricultural research organisation for sugar beet, is the whole of that sector's technical referent, from producers to sugar, alcohol and ethanol manufacturers. In accordance with societal and environmental expectations, it is leading studies on 4 main themes: genetics and varieties, weed control, diseases and pests, and agronomy and agricultural equipment.

**ITB in figures:** 8 regional delegations - 1 experimental hub in Griffon (northern France) - 40 staff over half of whom are decentralised, acting regionally in close contact with beet producers

**www.itbfr.org**

The technical institute Terres Inovia is the reference for all the professionals of the vegetable oil and protein sector, as well as of the hemp sector. Its mission is to improve oilseed, protein and hemp crops' competitiveness, through innovation and independent expertise, by adapting agricultural production and the way value is added to products according to the economic context and societal demands.

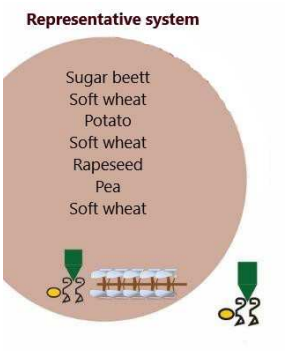
**www.terresinovia.fr**

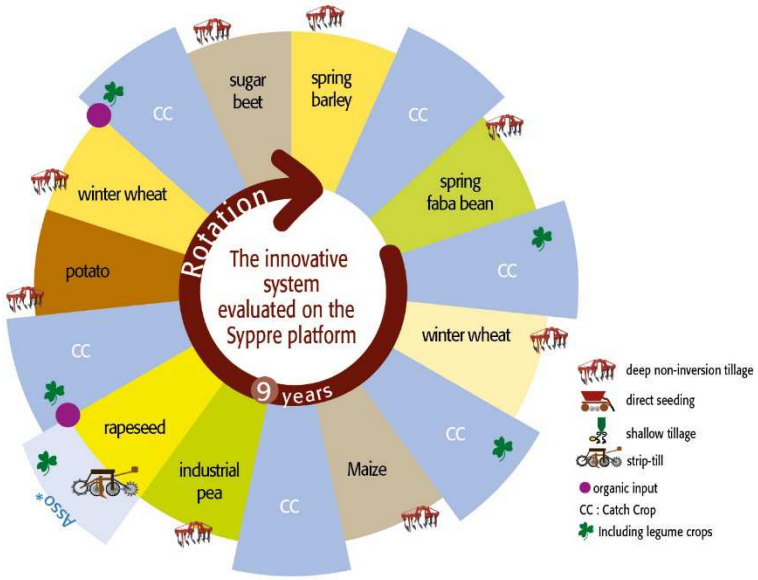
# Appendix 1

## Description of the innovative systems studied in 2020 on the 5 regional Syppre experimental sites

## Picardie

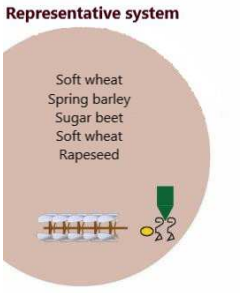
The Syppre project's objectives up to 2025 for the deep silty soils of Picardie were determined in conjunction with the local partners. They focus on helping farmers to produce food raw materials and biomass, high in quality and quantity, while preserving soil fertility and limiting dependency on mineral nitrogen fertilisers to reduce greenhouse gas emissions.

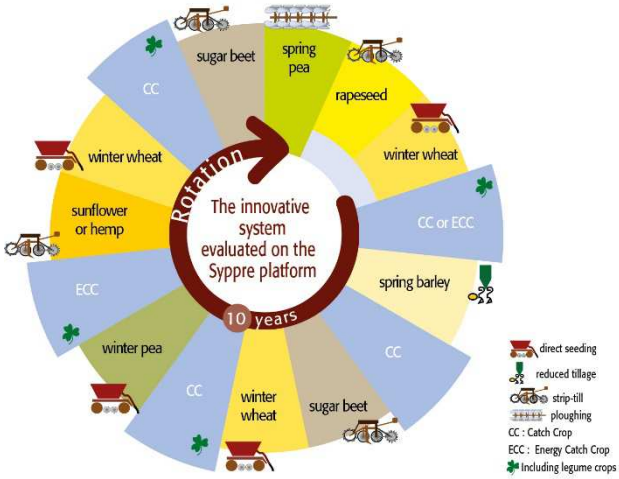


# Champagne

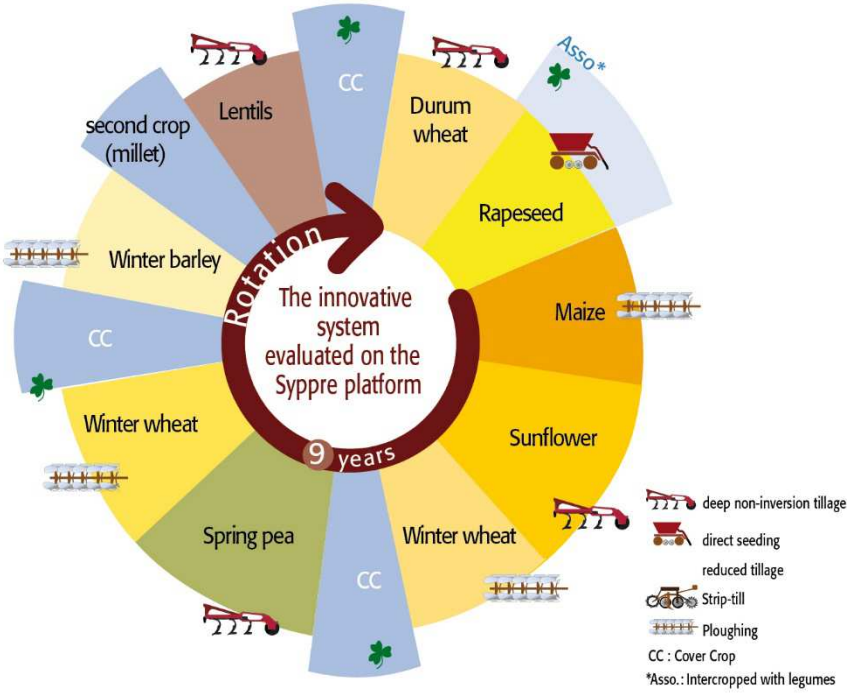
The Syppre project's objectives up to 2025 for the chalky soils of the Champagne region were determined in conjunction with the local partners. They focus on helping farmers to produce food raw materials and biomass, high in quality and quantity, while limiting dependency on mineral nitrogen fertilisers to reduce greenhouse gas emissions, and preserving soil fertility.



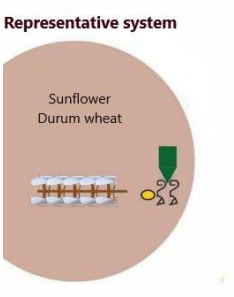

# Berry

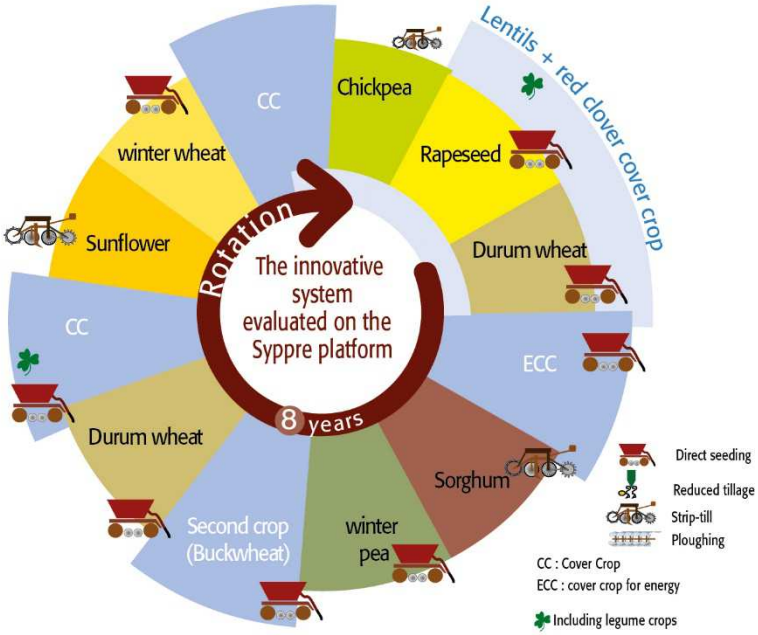
The Syppre project's objectives up to 2025 for the clayey-calcareous soils of the Berry region were determined in conjunction with the local partners. They focus on helping farmers to reduce inputs without impacting their economic margin, including by improving weed control and soil fertility in order to make their business more robust.

# Lauragais

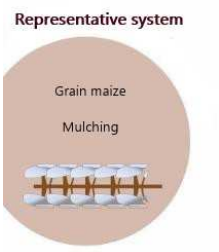
The Syppre project's objectives up to 2025 for the clayey-calcareous hillsides of the Lauragais region were determined in conjunction with the local partners. They focus on helping farmers to improve soil fertility and protection against erosion, to maintain production quality in the two dominant sectors, and to enhance the system's economic robustness, in situations where there is no irrigation.

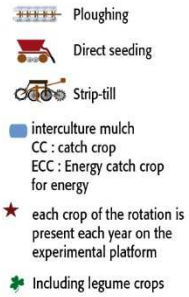


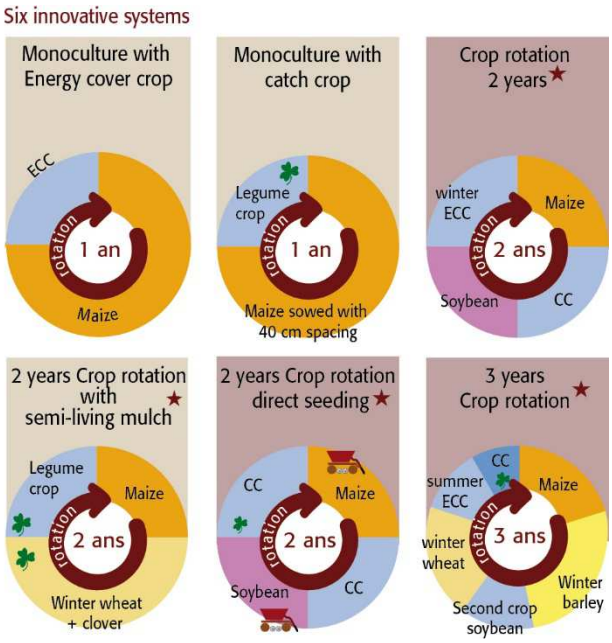




# Béarn

The Syppre project's objectives up to 2025 for the humus-rich soils of the Béarn region were determined in conjunction with local partners. They focus on helping farmers to adapt their maize-specific system to technical and regulatory constraints while maintaining the systems' profitability.



# Appendix 2

## List of regional partners

**Béarn**
Chambre d'agriculture des Pyrénées Atlantiques, Euralis, FDCUMA 640.
ARVALIS - Institut du végétal, Institut Technique de la Betterave, Terres Inovia

**Berry**
Chambre d'agriculture de l'Indre, AXEREAL, ETS Villemont.
ARVALIS - Institut du végétal, Institut Technique de la Betterave, Terres Inovia.

**Champagne**
Chambre régionale d'agriculture Grand-Est, Chambre d'agriculture de la Marne, Chambre d'agriculture de l'Aube, Cristal Union, Vivescia, Cérésia, Soufflet, CETA de Romilly, FNAMS, Agro-Transfert, Terralab, Terrasolis.
ARVALIS - Institut du végétal, Institut Technique de la Betterave, Terres Inovia.

**Lauragais**
Chambre régionale d'agriculture d'Occitanie, Chambre d'agriculture de la Haute-Garonne, Conseil départemental de la Haute-Garonne, Agro d'Oc, Arterris, Val de Gascogne, Lycée d'Enseignement Général et Technologique (LEGTA) de Toulouse-Auzeville.
ARVALIS - Institut du végétal, Institut Technique de la Betterave, Terres Inovia.

**Picardie**
Chambre régionale d'agriculture des Hauts de France, Chambres d'agriculture de l'Aisne, de l'Oise, de la Somme, du Nord - Pas de Calais, CETA des Hauts de Somme, Bonduelle, Ceresia, Noriap, Nord Négoce, Tereos, Uneal, Agro-Transfert, INRAE d'Estrées Mons, Unilet, Terres des abeilles.
ARVALIS - Institut du végétal, Institut Technique de la Betterave, Terres Inovia.

# Appendix 3

## Main contacts

**Syppre initiative's management committee**

Clotilde TOQUE - ARVALIS - Institut du végétal – c.toque@arvalis.fr
Remy DUVAL - Institut Technique de la Betterave – r.duval@itbfr.org
Francis FLENET - Terres Inovia – f.flenet@terresinovia.fr

**Heads of the regional projects**

**Béarn**
Clémence ALIAGA - ARVALIS - Institut du végétal - c.aliaga@arvalis.fr

**Berry**
Gilles SAUZET _ Terres Inovia -g.sauzet@terresinovia.fr

**Champagne**
Ghislain MALATESTA - Institut Technique de la Betterave - malatesta@itbfr.org

**Lauragais**
Jean Luc VERDIER - ARVALIS - Institut du végétal - jl.verdier@arvalis.fr

**Picardie**
Nicolas LATRAYE - Terres Inovia – n.latraye@terresinovia.fr

**Media contacts**

Xavier Gautier – Head of communication at ARVALIS–Institut du végétal - x.gautier@arvalis.fr
Hélène Dorchies – Head of communication at ITB - h.dorchies@itbfr.org
Thiphaine de Belloy, agence Droit Devant - Media Relations Terres Inovia - belloy@droitdevant.fr