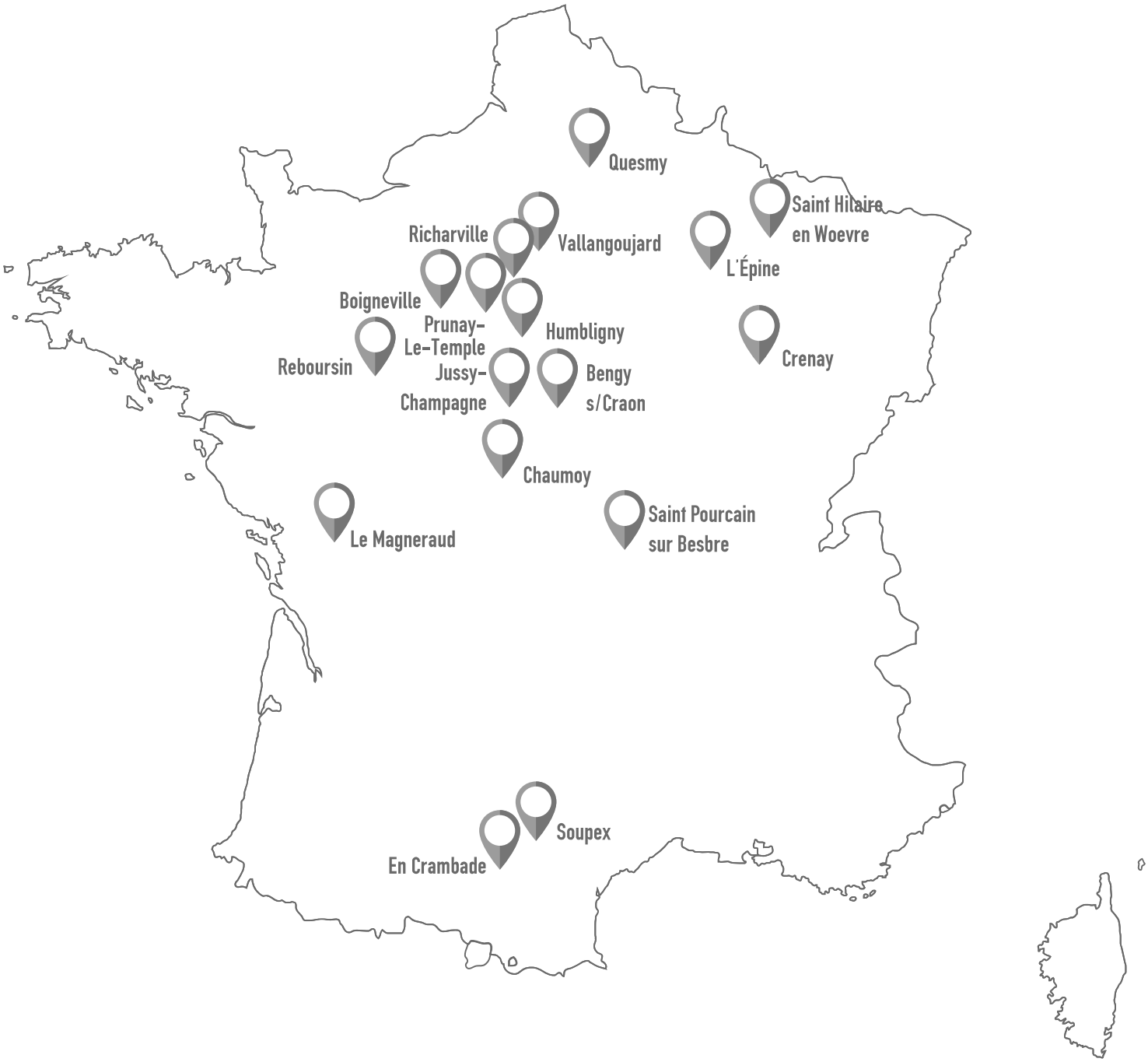
FRANCE


Quesmy
Saint Hilaire
en Woevre
Richarville
Vallangoujard
L'Épine
Boigneville
Prunay-
Le-Temple
Humbligny
Reboursin
Crenay
Jussy-
Champagne
Bengy
s/Craon
Chaumoy
Le Magneraud
Saint Pourcain
sur Besbre
Soupex
En Crambade

During this first trial campaign, several themes were studied in the French cluster trials, namely sowing dates, mechanical weeding, and the importance of cultivated plant cover in limiting weeds.

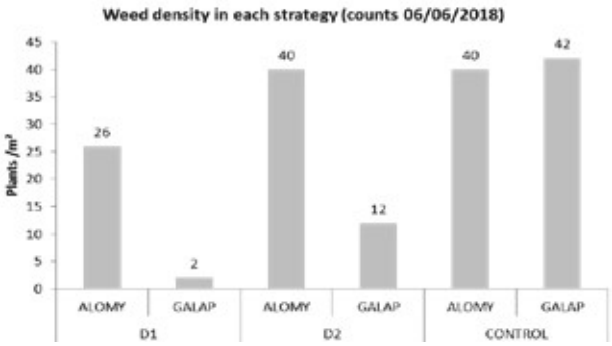
WP3 – EXPERIMENTAL TRIALS ON SOWING DATES OF WINTER WHEAT AND BARLEY

The subject of sowing dates and their impact on weeds was widely studied in the 2017-2018 season. It is a relatively easy method to implement and has immediate results for farmers. Most of these trials were implemented on-farm and were visited during open field days.
Fourteen experimental trials on the theme of delayed sowing, with and without other agronomic methods, were set up by various partners. This method is particularly effective for grassweed management (black-grass, ryegrass), with over 80% efficacy when compared with a conventional sowing date. In addition, a few trials with yield measurement and appropriate herbicide applications show that the return on investment is real and the technique profitable.
Difficulties may remain, particularly with regard to "feasibility" due to planting periods in unfavourable autumn conditions. Nevertheless, in a context of herbicide reduction, delayed sowing seems to be a major step in the right direction and does not jeopardize the economic viability of the farm.

PARTNER: FDGEDA 18

The objective of this trial was to compare two sowing dates, with modulated herbicide lines for Date 2, and to validate whether Date 2, which was less dependent on herbicides, could do as well as Date 1 (Reference).

The initial results are shown in the figures below. Date 2 limited the presence of weeds a little, but had a limited effect on the loss of yield. Other later dates should be studied to see whether they further limit the presence of weeds.



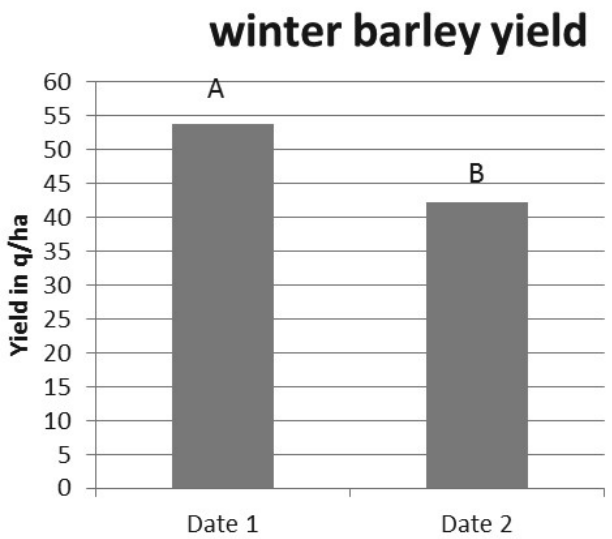
Legend - Weeds
ALOMY = *Alopecurus myosuroides*
GALAP = *Galium aparine*

PROTOCOL

One trial on winter barley (clay and limestone soil)
Date 1: 16/10/2017
Date 2: 30/10/2017

Experimental site: Jussy-Champagne
GPS coordinates: 46°58'46.013"N 2°39'55.721"E
Contact: Jean Gilet j.gilet@cher.chambagri.fr

Herbicides on Date 1:
Avadex 3L/ha (16/10/2017 incorporated)
Bofix 3L/ha (24/04/2018)
Herbicides on Date 2:
Bofix 3L/ha (24/04/2018)



PARTNER: ARVALIS-INSTITUT DU VÉGÉTAL

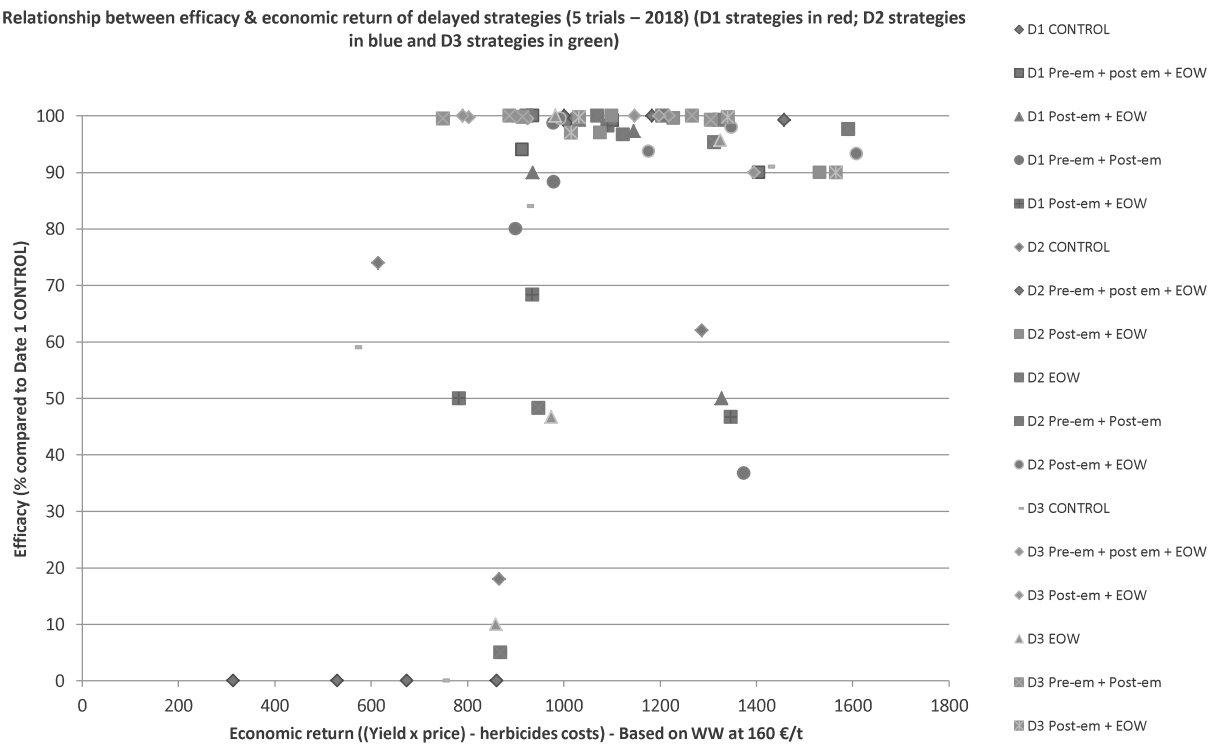
PROTOCOL

Six trials on winter wheat
The sowing dates were chosen according to regional practices. The weeds chosen were blackgrass (5 trials) and rye grass (1 trial). Only 5 trials are usable up to yield.

Date 1: early sowing (generally, beginning of October)
Date 2: intermediate sowing (D1 + 15 days)
Date 3: late sowing (D1 + 25 days to 1 month)

A range of herbicide programmes were evaluated in each strategy: the "Reference" programme; the "Light" programme; and no herbicides. The evaluation is also based on the economic return of each strategy (yield X wheat price – herbicide costs)

Experimental sites: Saint Pourcain sur Besbre (46°29'11.0"N 3°37'37.6"E), L'Épine (48°57'49.0"N 4°27'02.9"E), Le Magneraud (46°08'48.4"N 0°41'40.2"W), Quesmy (49°38'08.8"N 3°03'21.8"E), Crenay (48°01'0.41"N 5°09'42.8"E), Saint Hilaire en Woevre (49°04'21.1"N 5°42'10.6"E)
Contact: Ludovic Bonin l.bonin@arvalis.fr



Legend - Herbicide strategies
Pre-em = Pre-emergence
Post-em = Post-emergence
EOW = Herbicide in spring (end of winter)

Early sowing dates, which were frequently employed by farmers, were the most penalized, as they resulted in weed competition and/or the need for expensive weed-control programmes to control blackgrass populations effectively. The efficacy of sowing dates D2 and D3 were the most regular, but also made it possible to reduce herbicide programmes by gaining one or even two passages at most. Moreover, control plots in D2 and D3 did better in terms of efficiency and economic return than methods with herbicides in D1.

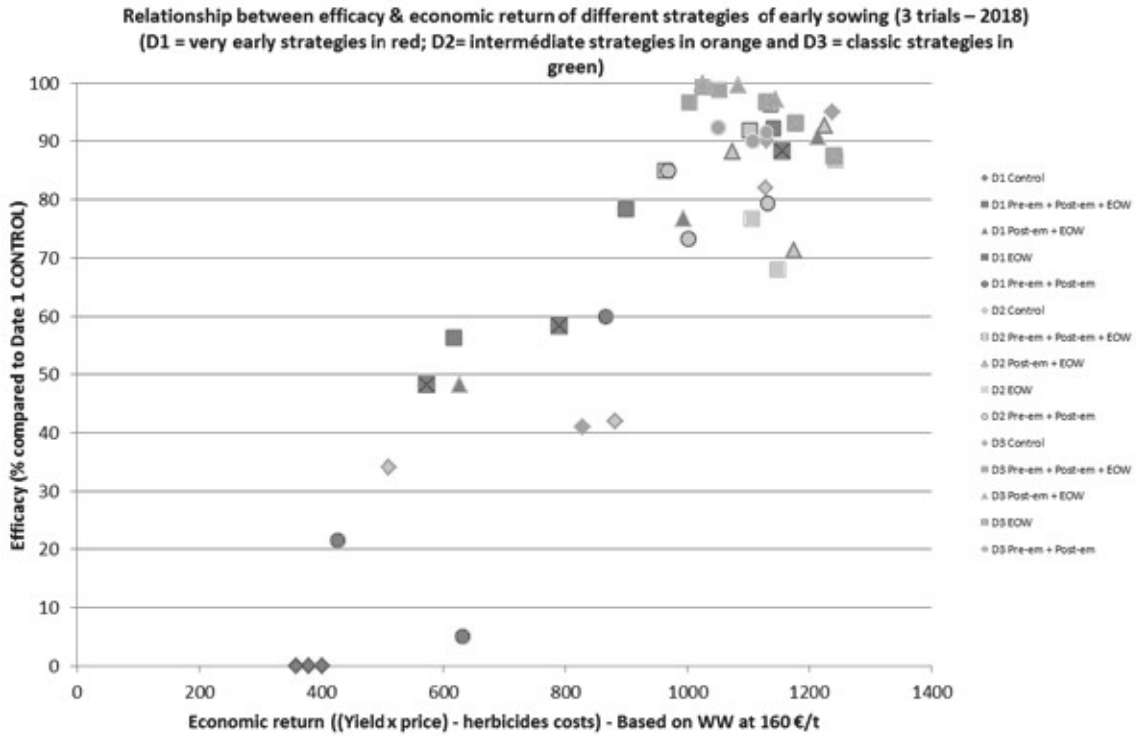
PROTOCOL

Three trials on winter wheat, with very early sowing dates
The objective was to evaluate the impact of very early sowing dates on weeds due to the competitive effect of the crop.

Date 1: early sowing (generally, beginning of October)

Date 2: intermediate sowing (D1 + 15 days)
Date 3: late sowing (D1 + 25 days to 1 month)

A range of herbicide programmes was evaluated in each strategy: the "Reference" programme; the "Light" programme; and no herbicides. The evaluation was also based on the economic return of each strategy (yield X wheat price – herbicides costs)



Legend - Herbicide strategies
Pre-em = Pre-emergence
Post-em = Post-emergence
EOW = Herbicide in spring (end of winter)

Contrary to the initial hypotheses, very early sowings are the most unfavourable for crop competitiveness on weeds. They require substantial herbicide programmes to control weeds, while late sowings, with fewer herbicides, are more economically viable. Moreover, in a context of reduced insecticides (aphids in autumn), early sowings are more exposed.

PARTNER: CHAMBRE AGRICULTURE D'INDRE-ET-LOIRE

PROTOCOL

One trial on winter wheat
Comparison of very early sowing with late drilling
→ Impact on weeds (nb /m²)
→ Impact on yield
→ Reliance or not on herbicides

Contact: Bruno Chevalier bruno.chevalier@cda37.fr

					weeds /m² before herbicides		
	Very early drilling	05-Sept					
Wheat variety	**Yield 14.5% H_2O**	**PS**	**Proteins**	**Pl/m²**	***LOLSS***	**POAAN**	**Broadleaves weeds (VERPE, etc…)**
Syllon	**15.7**	68.8	14.6	51	**12**	**37**	**37**
	Late drilling	27-Nov					
Syllon	**41.6**	74.5	12.5	116	**3**	**34**	**4**

→ Very early sowings are the most unfavourable. They require substantial herbicide programmes to control weeds, while late sowings with fewer herbicides and better yield are more economically viable.
→ Early sowings are more dependent on herbicides. This strategy, in a context of reduced herbicides, is not viable.

Herbicides in early sowing	**Herbicides in late sowing**
Clortosint 3.6 l/ha => 9/10/2017 (chlortoluron)	Olblack 1 l + H => 26/03/2018 (mesosulfuron + iodosulfuron)
Archipel 0.25 + Actimum 1 + Actirob 1 => 12/01/2018 (mesosulfuron + iodosulfuron + ammonium sulfate + oil seed rape oil	Alkera 1.2 l => 27/04/2018 (pinoxaden + cloquintocet)
Alkera 1.2 l +Simplon25 g => 28/04/2018 (pinoxaden + cloquintocet + metsulfuron)	

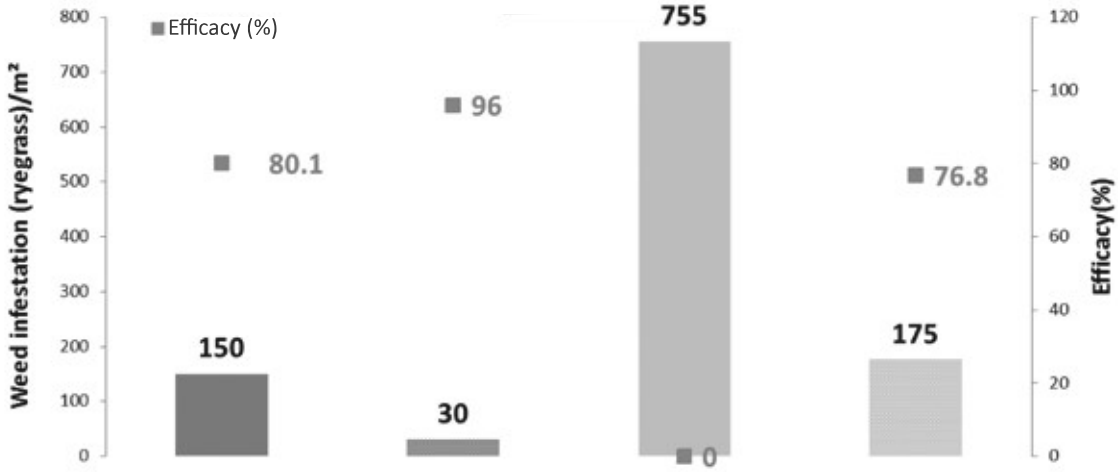
PARTNER: AGROSOLUTIONS

PROTOCOL

One trial on winter wheat
→ Impact of delayed sowing in winter wheat, with or without ploughing, on infestation by rye grass

Contact: Chloé Cantuel ccantuel@agrosolutions.com

Efficacy of ploughing and delayed sowing on infestation by ryegrass (LOLSS) (1 trial, 2018)



Soil tillage	Ploughing	Ploughing	No till	No till
Sowing date	12/10	Delayed (30/10)	12/10	Delayed (30/10)

First results
The difference between “Ploughing” and “No till” is quite significant (-605 plants/m²). Delayed sowing also allows a substantial decrease in weeds, i.e. between 75% and 80%.

PARTNER: CHAMBRE AGRICULTURE ILE-DE-FRANCE

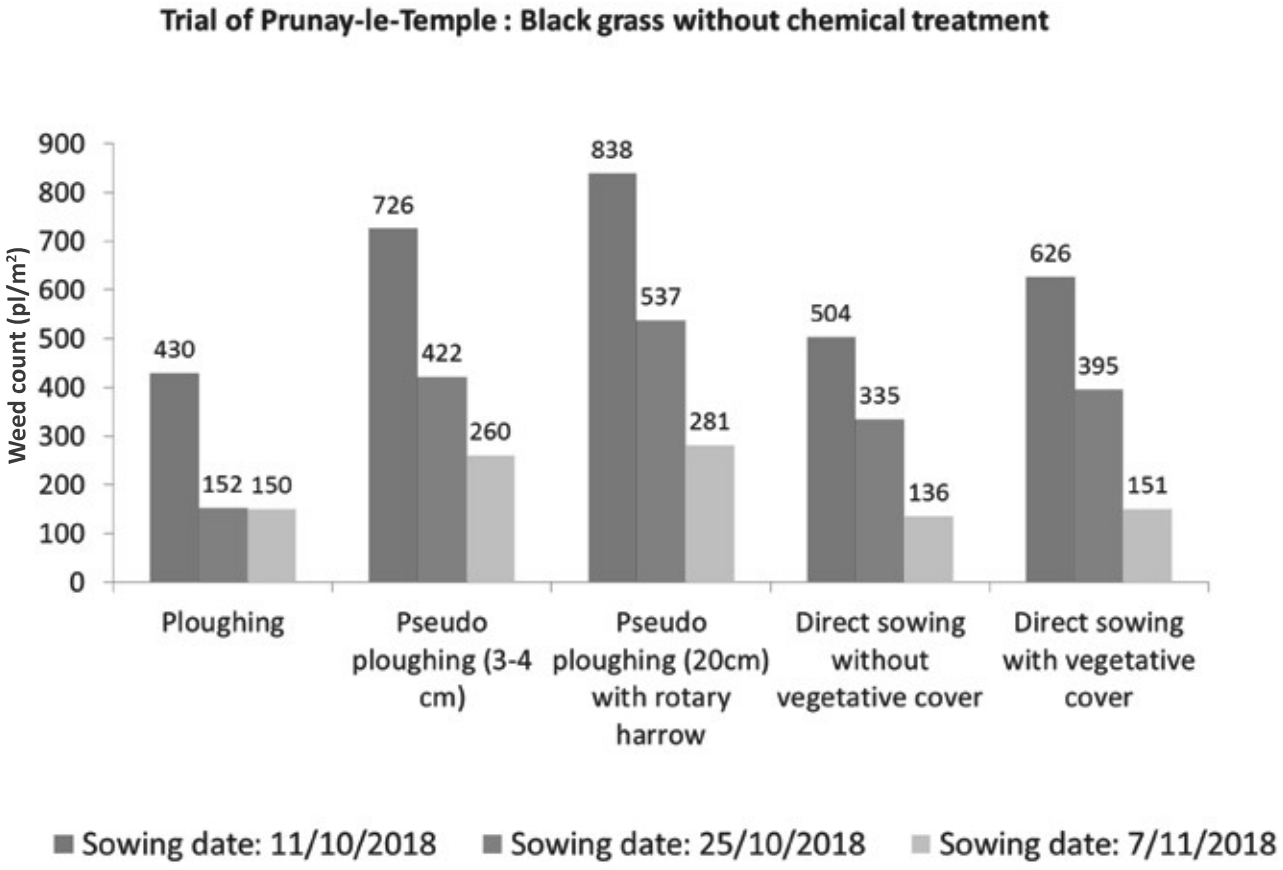
PROTOCOL

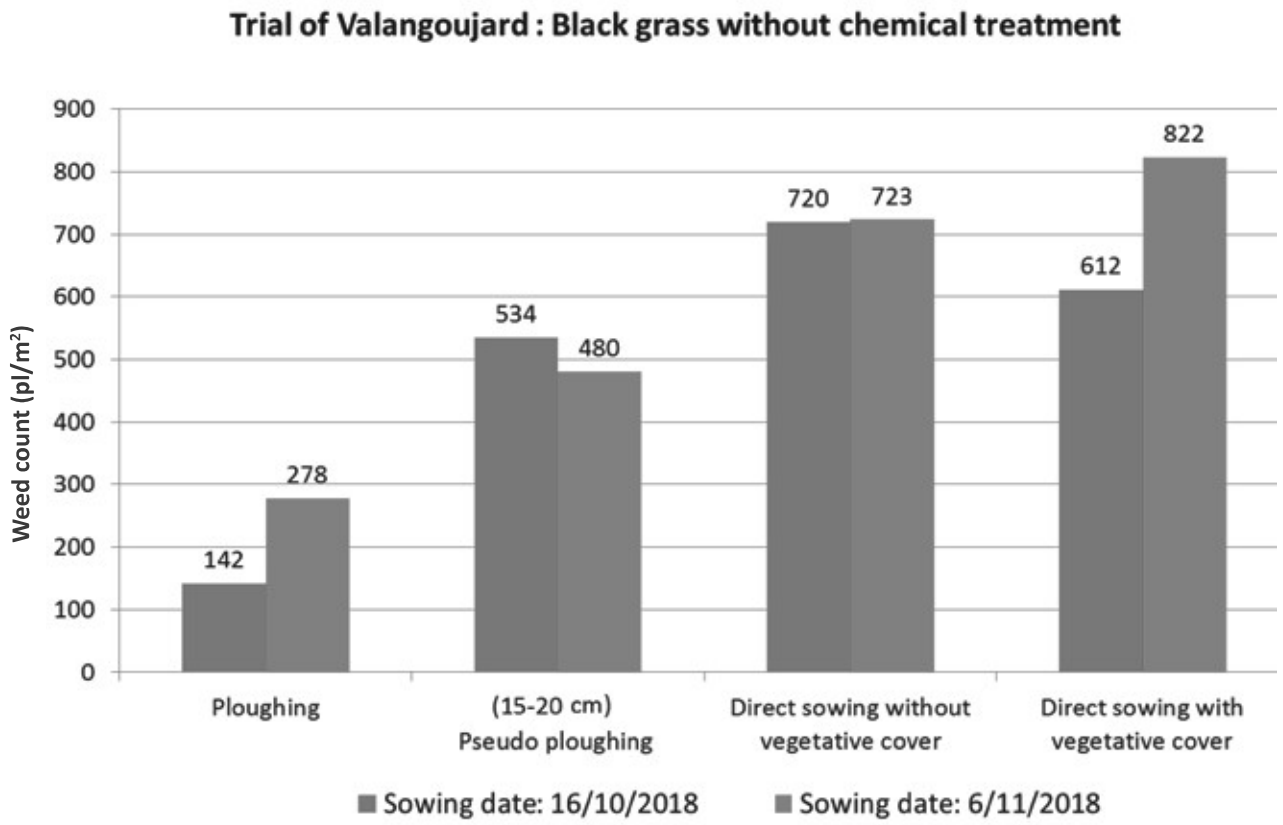
Two experimental weed-management trials on wheat were conducted at two sites located west (Prunay le Temple) and north (Vallangoujard) of Paris. Neither field had been ploughed for 20 years. The following table summarizes the tested protocol. At Prunay-le-Temple, the aim of the trial was to limit Black grass infestation, while at Vallangoujard, the purpose was to limit Ryegrass.

Experimental sites: Prunay-Le-Temple (48°51'51.8"N 1°40'16.3"E) and Vallangoujard (49°08'07.6"N 2°06'24.2"E)
Contacts: Christophe Daule christophe.daule@idf.chambagri.fr
Sabine Snyder sabine.snyder@idf.chambagri.fr

	1		2		3		4		5	
	Ploughing		**Pseudo ploughing**		**Pseudo ploughing without rotary harrow**		**Direct sowing without vegetative cover**		**Direct sowing with vegetative cover**	
Steps	Summer labour		Post harvest: 15-20 cm deep tillage		Post harvest: 15-20 cm deep tillage		4		Post harvest sowing of the vegetative cover (oat and pigeon bean mix)	
	False seed-bed with superficial rotary harrow		False seed-bed with superficial rotary harrow		False seed-bed with superficial rotary harrow					
	Rotary harrow and drill combined sowing		Rotary harrow and drill combined sowing		Rotary harrow free sowing (tillage free sowing)		Direct sowing with adapted drill		Direct sowing with adapted drill	
Sowing date	Mid-October sowing	Late sowing in mid-November*	Mid-October sowing	Late sowing in mid-November*	Mid-October sowing	Late sowing in mid-November*	Mid-October sowing	Late sowing in mid-November*	Mid-October sowing	Late sowing in mid-November*

* at least 3 weeks after the first sowing, adapt to the ongoing year conditions
Each modality is compared with an untreated control


Trial of Prunay-le-Temple : Black grass without chemical treatment
Weed count (pl/m²)
900
800
700
600
500
400
300
200
100
0
430
152
150
726
422
260
838
537
281
504
335
136
626
395
151
Ploughing
Pseudo ploughing (3-4 cm)
Pseudo ploughing (20cm) with rotary harrow
Direct sowing without vegetative cover
Direct sowing with vegetative cover
Sowing date: 11/10/2018
Sowing date: 25/10/2018
Sowing date: 7/11/2018


Trial of Valangoujard : Black grass without chemical treatment
Weed count (pl/m²)
900
800
700
600
500
400
300
200
100
0
142
278
534
480
720
723
612
822
Ploughing
(15-20 cm) Pseudo ploughing
Direct sowing without vegetative cover
Direct sowing with vegetative cover
Sowing date: 16/10/2018
Sowing date: 6/11/2018

First results

Late sowing seems to be the second most efficient way to limit infestation by blackgrass after ploughing. Pre- and post-emergent application of herbicide on wheat sown in November gave excellent results for all methods.

Ploughing was the most efficient solution against ryegrass (99% efficacy) because the trial involved deep ground that had not been ploughed for 20 years and was thus probably free of weed seed. Pseudo-ploughing seems to be a rather satisfactory solution (86% efficacy), but it is likely to postpone the problem for one or two years by burying weeds in shallow depths. Direct sowing gave very disappointing results, as the weed-removal rate was about 45%, with or without vegetative cover. At the end of winter, the corresponding plots seemed particularly clean, but heavy rain in spring caused the emergence of ryegrass.

WP3 – EXPERIMENTAL TRIALS ON MECHANICAL WEED CONTROL OF WINTER BARLEY AND WHEAT

Eight mechanical-weeding trials were set up, with and without additional agronomic methods. The results were very variable with efficiencies highly dependent on the context. The other methods studied in these trials were more effective. Nevertheless, mechanical weeding can be an interesting complement, but it does not replace more efficient non-chemical methods, such as tillage and delayed sowing.

PARTNER: FDGEDA 18

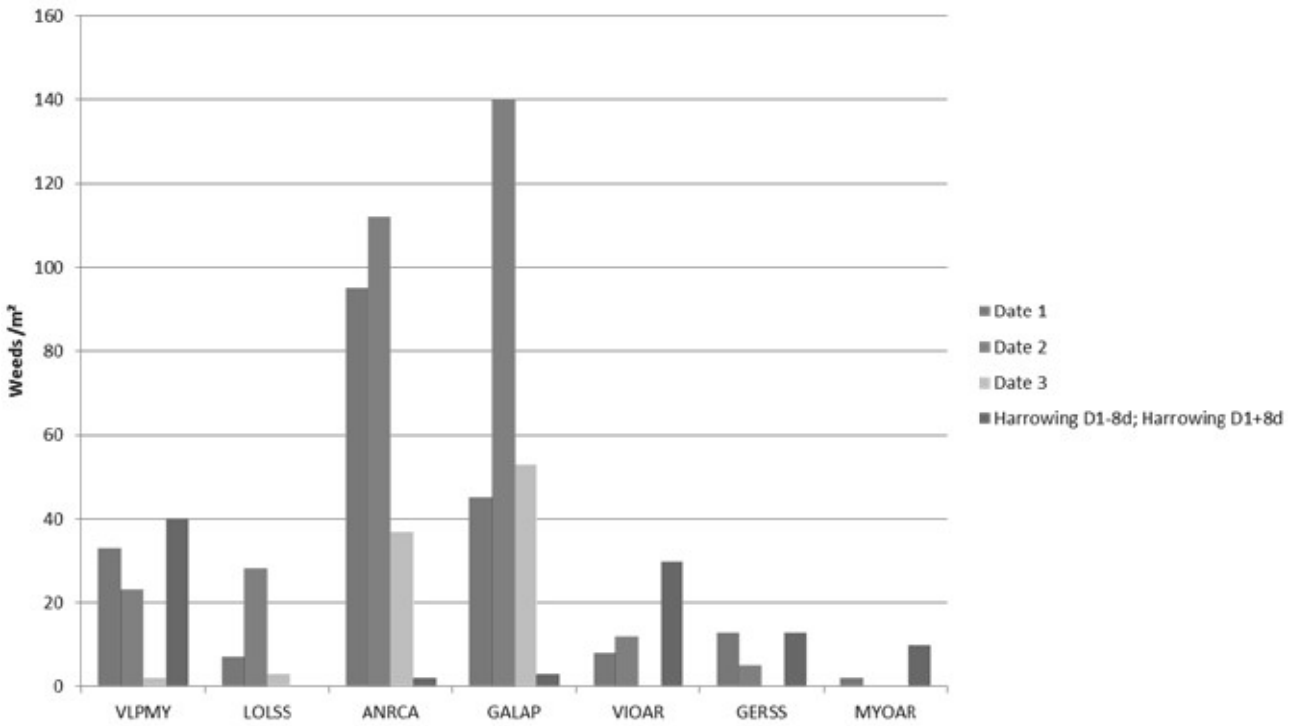
PROTOCOL

Trial on winter wheat (clay and limestone soil)
D1: 18/10
D2: 10/11
D3: 22/11

Introduction of tine harrowing, 8 days before D1, and 8 days after D1.
Comparison with D2 and D3.

Contact: Jean Gilet j.gilet@cher.chambagri.fr

Comparison of different strategies (delayed drilling and tine harrowing), on weed infestation (pl/m²) - countings on 30/03/2018



Legend - Weeds
ALOMY = *Alopecurus myosuroides*
GALAP = *Galium aparine*
LOSSL = *Lolium sp.*
VIOAR = *Viola arvensis*
ANRCA = *Anthriscus caucalis*
GERSS = *Geranium sp.*
MYOAR = *Myosotis arvensis*
VLPMY = *Vulpia myuros*

Initial results
Weed populations were lower in the third sowing date (D3) and when harrowing was performed twice. These methods were very effective on *Lolium* spp., *Vulpia Myuros, Viola arvensis, Geranium* spp. and *Myosotis arvensis*, but less so on *Anthriscus caucalis* and *Galium aparine*.
Date 2 seems to be the least favorable date for impact on *Lolium sp., Anthriscus caucalis* and *Galium aparine*, probably due to rainfall close to drilling. Harrowing in D1, compared with D1 alone, seems to be effective on *Lolium sp.*, *Anthriscus caucalis* and *Galium aparine*. Nevertheless, it seems to stimulate (or is ineffective on) other weeds (*Vulpia Myuros, Viola arvensis, Geranium* spp. and *Myosotis arvensis*).

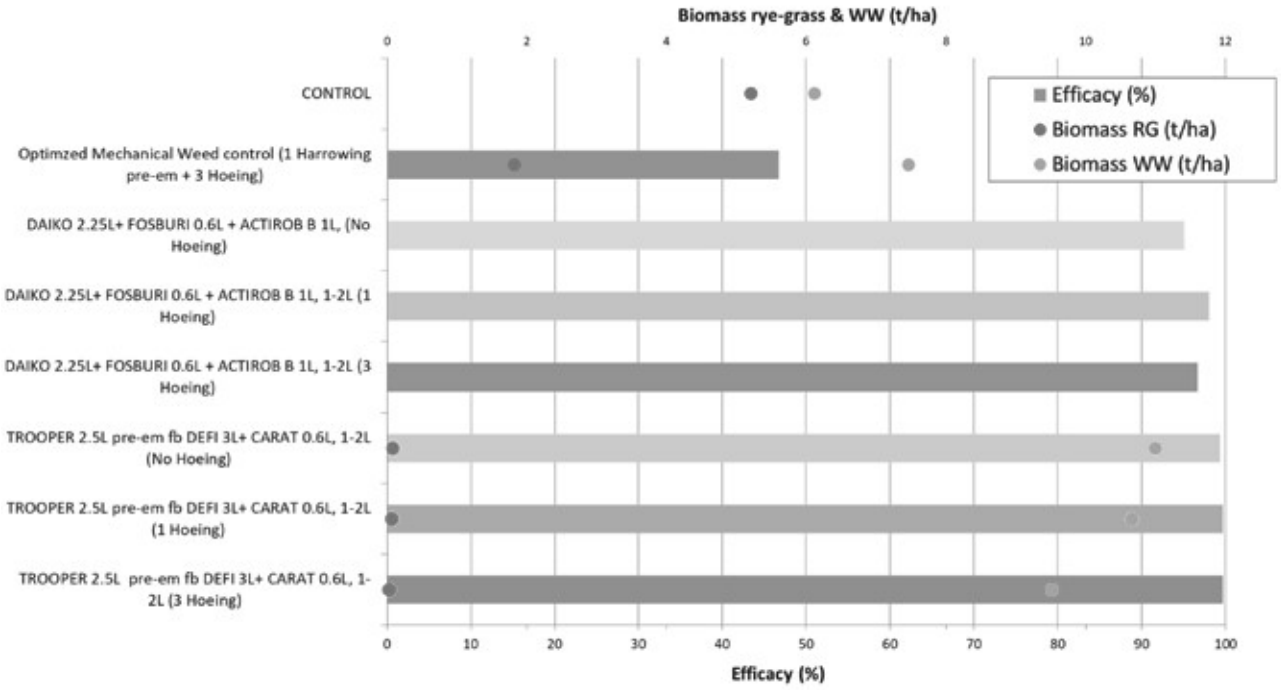
PARTNER: ARVALIS-INSTITUT DU VÉGÉTAL

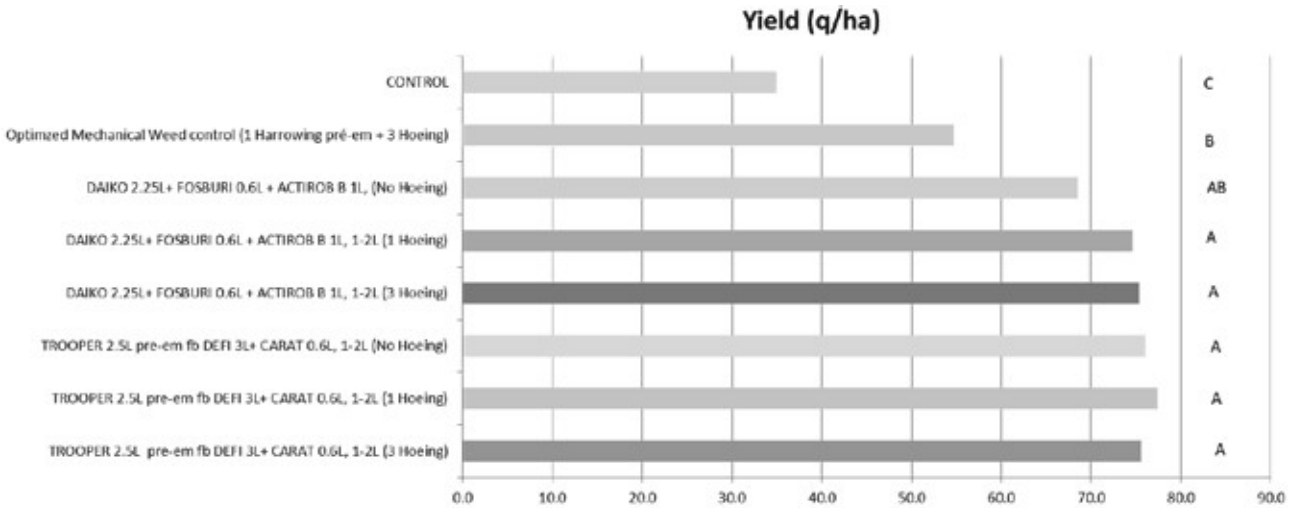
PROTOCOL

One trial on winter wheat
Comparison of different herbicide strategies (low input to high input) combined with hoeing in spring (no pass to multipass).

TROOPER 2.5L pre-em fb DEFI 3L+ CARAT 0.6L, 1-2L (3 Hoeing)
TROOPER 2.5L pre-em fb DEFI 3L+ CARAT 0.6L, 1-2L (1 Hoeing)
TROOPER 2.5L pre-em fb DEFI 3L+ CARAT 0.6L, 1-2L (No Hoeing)
DAIKO 2.25L+ FOSBURI 0.6L + ACTIROB B 1L, 1-2L (3 Hoeing)
DAIKO 2.25L+ FOSBURI 0.6L + ACTIROB B 1L, 1-2L (1 Hoeing)
DAIKO 2.25L+ FOSBURI 0.6L + ACTIROB B 1L, (No Hoeing)
Optimized Mechanical Weed control (1 Harrowing pre-em + 3 Hoeing)
CONTROL

Experimental site: Boigneville (48°19'26.4"N 2°23'11.4"E)
Contact: Ludovic Bonin l.bonin@arvalis.fr





Initial results

The effectiveness of herbicide programmes - including low-input strategies - did not allow us to verify the contribution of mechanical weeding in the spring. The measurement of ryegrass biomass and yield, however, made it possible to validate the value of mechanical weeding alone, with there being a yield gain of 2t/ha. Further studies are needed to validate the integration of mechanical weeding.

PARTNER: AGROSOLUTIONS

PROTOCOL

Six trials on winter crops (winter wheat & barley)
→ Impact of multiple or single harrowing in autumn, combined with soil tillage/or delayed sowing.
→ Ryegrass or blackgrass.

Experimental sites: Chaumoy (47°1'49.3"N 2°19'47.1"E), Reboursin (47°6'23.7"N 1°49'20.7"E) Humbligny (47°15'9.9"N 2°39'33.9"E), Bengy s/Craon (46°59'55.1"N 2°44'48.0"E)

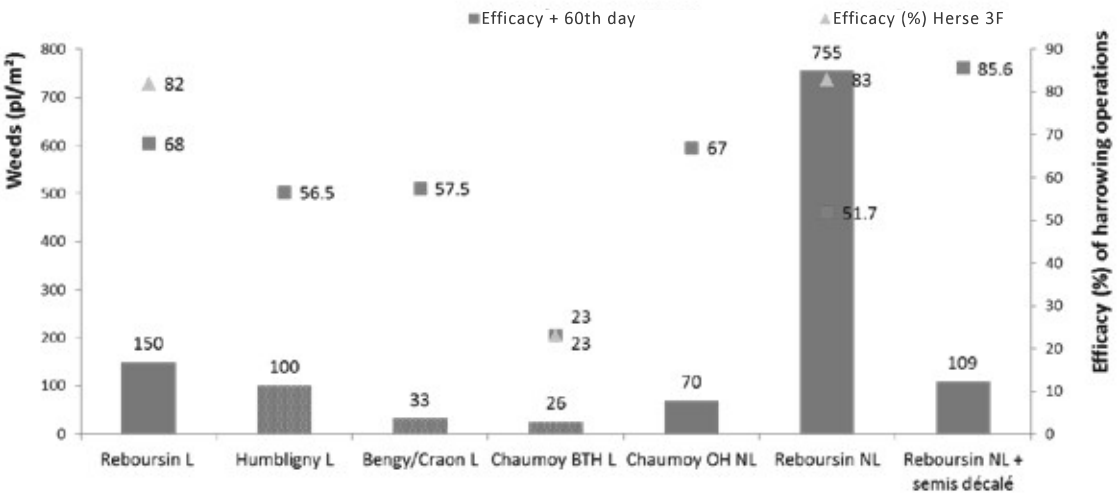
Contact: Chloé Cantuel ccantuel@agrosolutions.com

Location of the WP3 trials managed by Agrosolutions

Initial results
Harrowing after sowing led to a significant decrease in weed infestations, on average 60%. Delayed sowing also led to a substantial decrease in weeds (80% efficacy in Reboursin).
In the Reboursin trial, harrowing twice led to a significant reduction in the population (83% efficacy). However, the trials had to be stopped at the beginning of June because weed populations remained too high.

The weed harrow helped the other weed-management tools (e.g. ploughing, delayed sowing), as it compensated for the increase in the ryegrass population due to early sowing.

Efficacy (%) of multi or single pass of harrow (6 trials, 2018)



Legend - Harrowing
Green = efficacy of harrowing twice in autumn
Red = efficacy of harrowing once in autumn

WP3 – OTHER METHODS/TRIALS

PARTNER: CHAMBRE D'AGRICULTURE DU LOIRET

PROTOCOL

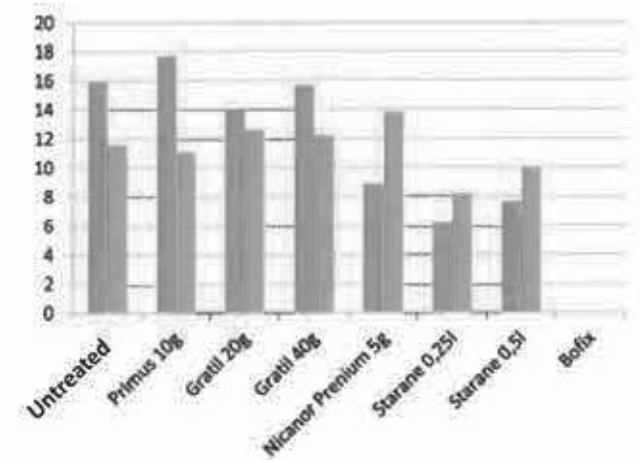
Screening trial of herbicide on a mix of spring barley + red clover.

→ The objective is to control weeds and be selective on red clover (3 reps x 3m x 10m)

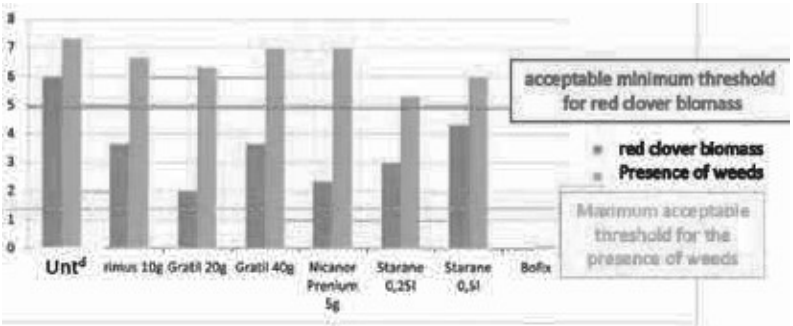
	Treatment	Dose/ha	TFI
T	Untreated		
1	Primus (florasulam)	10 g	0.3
2	Gratil (amidosulfuron)	20 g	0.5
3	Gratil (amidosulfuron)	40 g	1
4	Nicanor Premium (metsulfuron –me)	5 g	0.15
5	Starane 200 (fluroxypir)	0.5 L	0.5
6	Starane 200 (fluroxypir)	0.25 L	0.25
7	Bofix	2.5 L	0.6
3 Blocks x 3m x 10m			

Contact: Laurent Lejars laurent.lejars@loiret.chambagri.fr

Counts of red clover (in blue – pl/m²) and weeds (in orange - pl/m²)



Biomass of red clover (in blue –t/ha) and infestation note (in orange – /10) of weeds



Initial results
The technique of sowing red clover in spring barley is well know by researchers. However, the weed-control results of this combination are currently unsatisfactory. Product dosages will have to be reviewed. Clover density is impacted by herbicides, but is not totally destroyed. Weeds cannot be controlled without impact on red clover.

Adjustments for the next year
Delayed sowing and its combination with other non-chemical methods seems to be the best way to limit the use of herbicides while maintaining margins. Further trials will therefore be set up on this subject, in conjunction with aphid control.
Mechanical weeding will also be studied in order to consolidate data and to study the feasibility (days available) under French conditions.

WP4 – EXPERIMENTAL TRIALS ON IWM STRATEGIES FOR SUNFLOWER, MAIZE, SOYBEAN AND SUGAR BEET

PARTNER: TERRES INOVIA

PROTOCOL

Objectives: How to destroy weeds without glyphosate before the seeding of sunflower.
Four trials on the destruction of weeds after false seedbed and before the planting of sunflower. Comparison of the farm's tillage tool and glyphosate, evaluation of efficiency on weeds, and checking whether this tillage tool impacts crop quality.
Two trials were located in the centre of France and two trials in the south-west of France (2018).

Experimental sites: En Crambade (43°49'29.3"N 1°65'90.8"E), Soupex (43°22'43.0"N 1°53' 6.8"E)

Contact: Fanny Vuillemin f.vuillemin@terresinovia.fr

Location of the WP4 trials managed by Terres Inovia

Results
Various efficacies were recorded: with low infestations, there was no difference between tillage and glyphosate, but when the infestation was quite high, tillage was - unsurprisingly - much less effective than glyphosate.

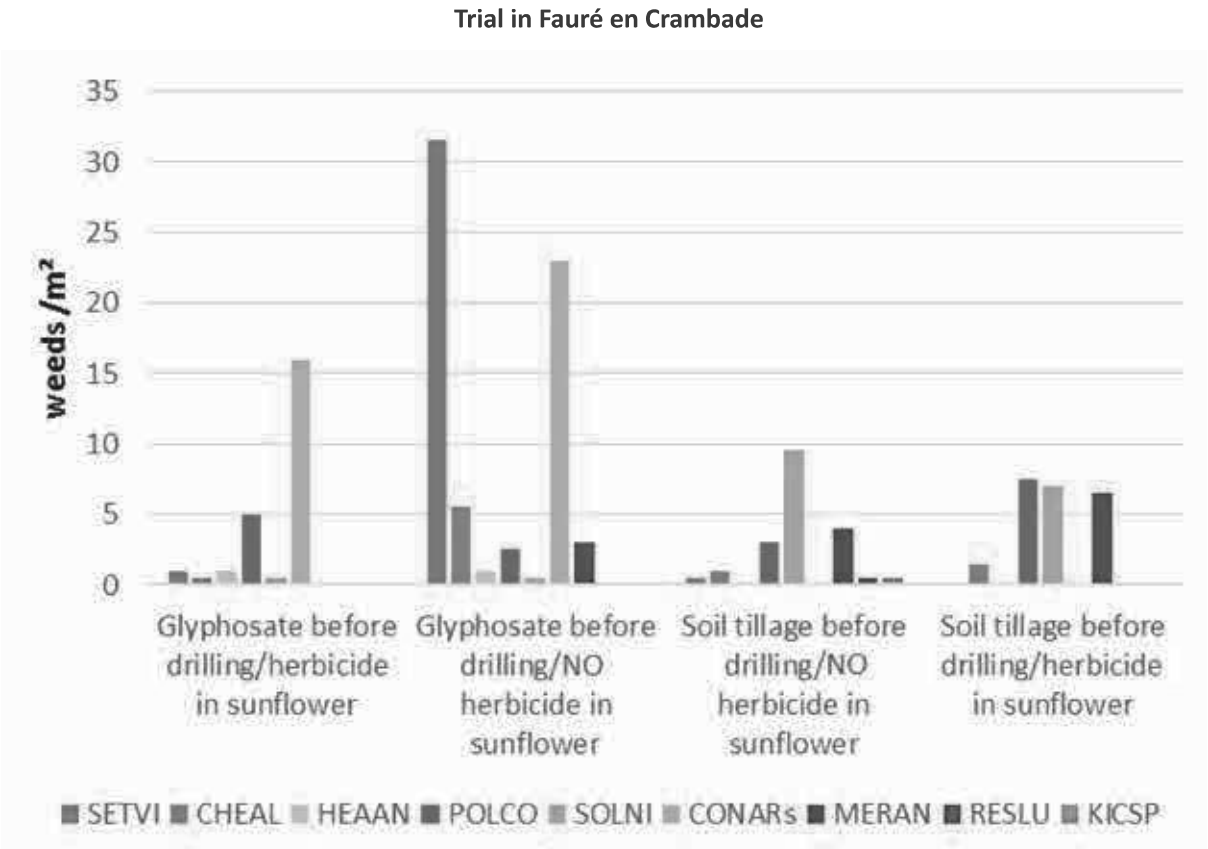


Figure 1 - Number of weeds according to the type of preparation before sunflower sowing. Counts in plots with herbicides and without treatments

Legend - Weeds
SETVI = *Setaria viridis*
ANGAR = *Anagallis arvense*
CIRARi = *Cirsium arvense*
CHEAL = *Chenopodium album*
MERAN = *Mercurialis annua*
SOLNI = *Solanum nigrum*
HEAAN = *Helianthemum angustatum*
SONAR = *Sonchus arvensis*
RESLU = *Reseda lutea*
POLCO = *Polygonum convolvulus*
KISCP = *Kickxia spuria*
CONARs = *Convolvulus arvensis*
AVEFA = *Avena fatua*

Trial 1 in south-west France
In this trial, tillage and glyphosate were both feasible this year. On some weed species (especially *Convolvulus arvensis* and *Setaria viridis*), tillage was more efficient than chemical treatment. This result shows that, in particular conditions, tillage is sufficient to destroy weeds and properly prepare for the sowing of sunflower.

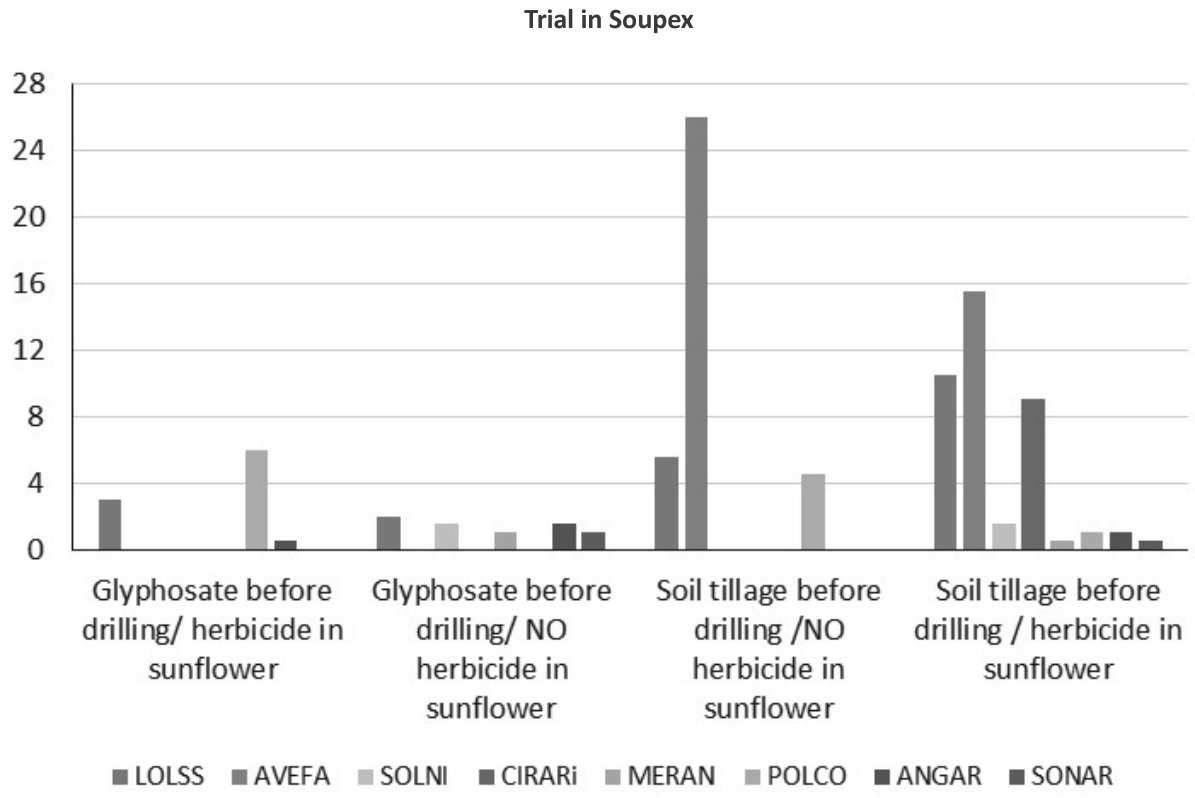


Figure 2 - Number of weeds according to the type of preparation before sunflower sowing. Counts in plots with herbicides and without treatments

PROTOCOL

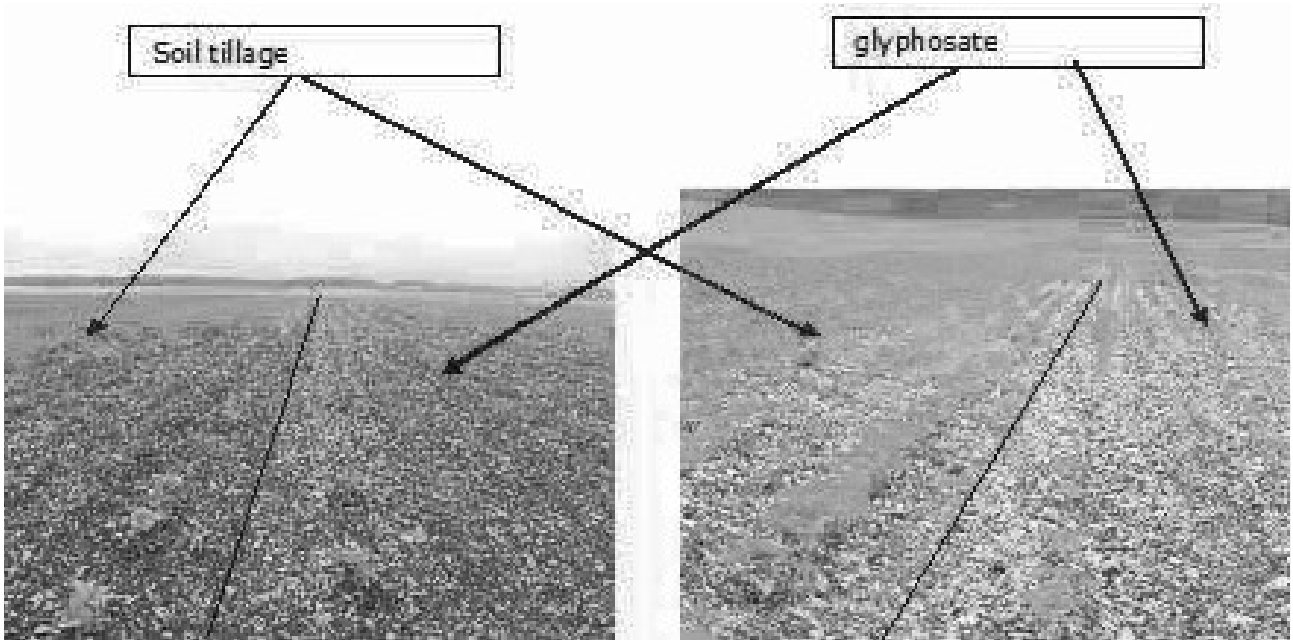
Objectives: How to destroy weeds without glyphosate before the seeding of sunflower.
Four trials on the destruction of weeds after false seedbed and before the planting of sunflower. Comparison of the farm's tillage tool and glyphosate, evaluation of efficiency on weeds, and checking whether this tillage tool impacts crop quality.
Two trials were located in the centre of France and two trials in the south-west of France (2018).

Experimental sites: En Crambade (43°49'29.3"N 1°65'90.8"E), Soupex (43°22'43.0"N 1°53' 6.8"E)

Contact: Fanny Vuillemin f.vuillemin@terresinovia.fr

Trial 2 in south-west France:
In this trial, tillage to destroy weeds and prepare for the sowing of sunflower proved to be difficult. Indeed, the field was tilled four times because grass species had developed, yet this was not sufficient to destroy them. In this case, glyphosate was more effective in terms of cost, efficiency, working time and more.

Fortunately, heavy rain between March and April allowed the sunflower to germinate and develop normally, otherwise the soil perturbations created by tilling four times would have prevented the sunflower being planted properly.



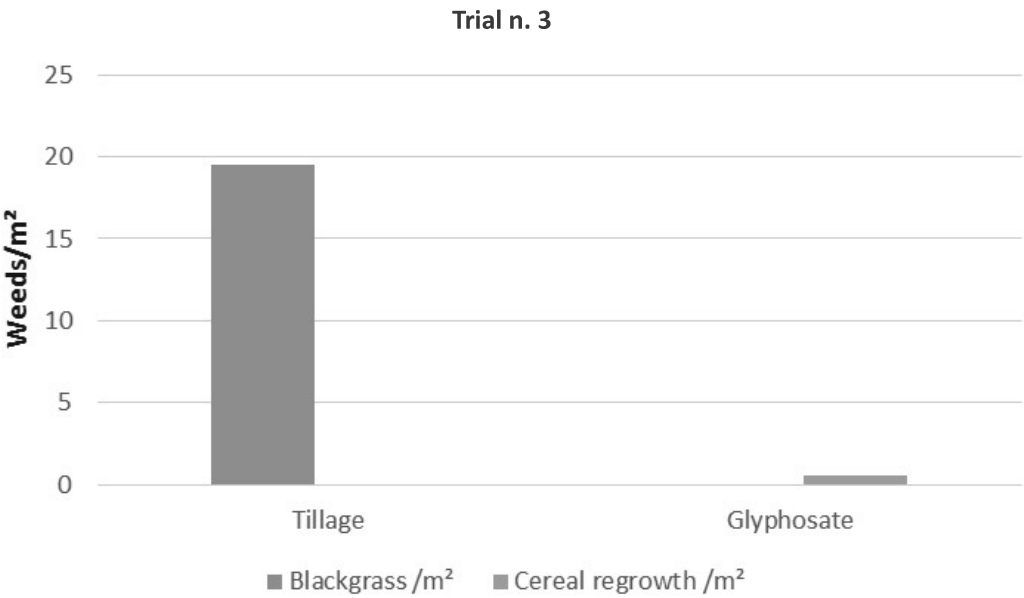


Figure 3 - Number of weeds according to the type of preparation before sunflower sowing. Counts in sunflower field

Trial 3 in central France:
The initial infestation mainly comprised *Alopecurus myosuroides* (around 15-20/m²) and *Polygonum* spp. After the intervention had been carried out and the sunflower sown, the results in sunflower (7 May) showed zero *Alopecurus myosuroides* in the glyphosate strip, but 19 *Alopecurus myosuroides*/m² in the tillage strip. Thus, with this type and level of flora, glyphosate was more efficient than tillage. However, we noticed that when tillage and glyphosate were employed in April, they destroyed all the weeds present. The infestation in the tillage strip was by new germinations of *Alopecurus myosuroides*. However, although tillage destroyed all of the weeds present, it moved the soil and thus caused other weeds to germinate, a problem compounded by the abundant rain during this period. We were therefore wondering whether a dry spring would make tillage as interesting an option as glyphosate. Its impact on the sowing of sunflower must not be forgotten, however, and our research is set to continue.

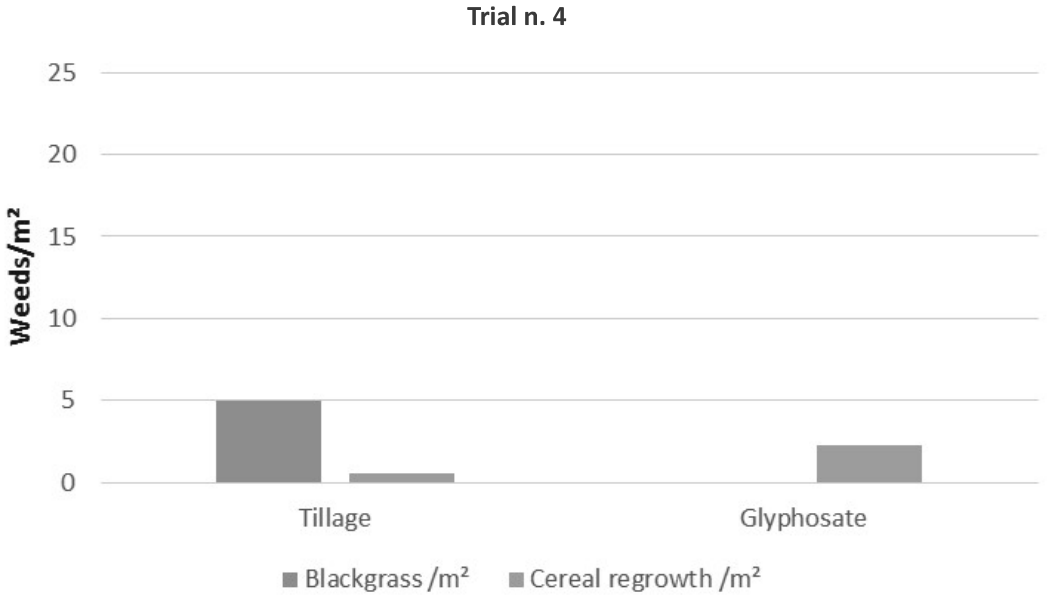


Figure 4 - Number of weeds according to the type of preparation before sunflower sowing. Counts in sunflower field.

Trial 4 in central France:
The initial infestation mainly comprised *Alopecurus myosuroides* (around 5-7/m²). After the intervention had been carried out and the sunflower sown, the results in sunflower (7 May) showed zero *Alopecurus myosuroides* in the glyphosate strip and five *Alopecurus myosuroides*/m² in the tillage strip. There was very little difference between tillage and glyphosate (five blackgrass/m²). Thus, in this case, tillage was almost as effective as glyphosate, a result probably due to the initial infestation level, and especially to the seedbank, being lower in this field than in the previous one. This is why the rainfall after tillage did not cause much germination in this field. These results provide encouragement that glyphosate can be replaced.

These four trials show that successfully replacing glyphosate with tillage depends on the conditions (e.g. seedbank, type of weed species, climate). We will continue these trials to discover more about the conditions that help and hinder glyphosate replacement in a bid to advise farmers better.

PROTOCOL

Objectives: how to destroy *Ambrosia atimisiifolia* **without glyphosate before the seeding of sunflower.**
One trial on the destruction of ragweed after a false seedbed and before the seeding of sunflower. Comparison of innovative tillage equipment designed to reduce herbicide usage called "glyphomulch", a classic tillage tool, and glyphosate. Evaluation of their efficiency on weeds and checks to decide whether this new tillage equipment impacts the quality of sunflower sowing. The trial was located in Cher, central France (2018).

Experimental site: Chaumoy (47°1'49.3"N 2°19'47.1"E)
Contact: Fanny Vuillemin f.vuillemin@terresinovia.fr

Results
An error was made by the farmer who owns the field, as he treated the entire field with glyphosate after sowing the sunflower. The trial was therefore abandoned, but will be proposed again next year. Before the weeds were terminated, some lessons were learnt: "glyphomulch", which is used to destroy biomass, including weeds, cover crop and straw, is not suitable for destroying young ragweeds and will not be applied in the next protocol. It is more suited to large cover crops with high quantities of biomass.

PROTOCOL

Objectives: manage *Ambrosia atimisiifolia* in a wheat-soybean rotation.

A long trial on the management of ragweed. Comparison of three strategies: repeated tillage in summer to reduce the soil seedbank of *Ambrosia*; ploughing to clean the field, but with the risk of seeds remaining in the soil; no-tillage and direct seeding of soybean to avoid an *Ambrosia* seedling emergency. This trial is located in south-west France and will last three years: from summer 2017 to summer 2020.

Experimental sites: Chaumoy (47°1'49.3"N 2°19'47.1"E)
Contact: Fanny Vuillemin f.vuillemin@terresinovia.fr

Results
This long-term trial was successfully implemented and is proceeding well. It was sown in soybean in spring 2018. At the beginning of June 2018, we saw differences between the types of ragweed infestation. A visit took place on July 2018. The future of this trial is now in question because some technical interventions were not carried out properly and we are wondering whether it would be better to restart the trial.

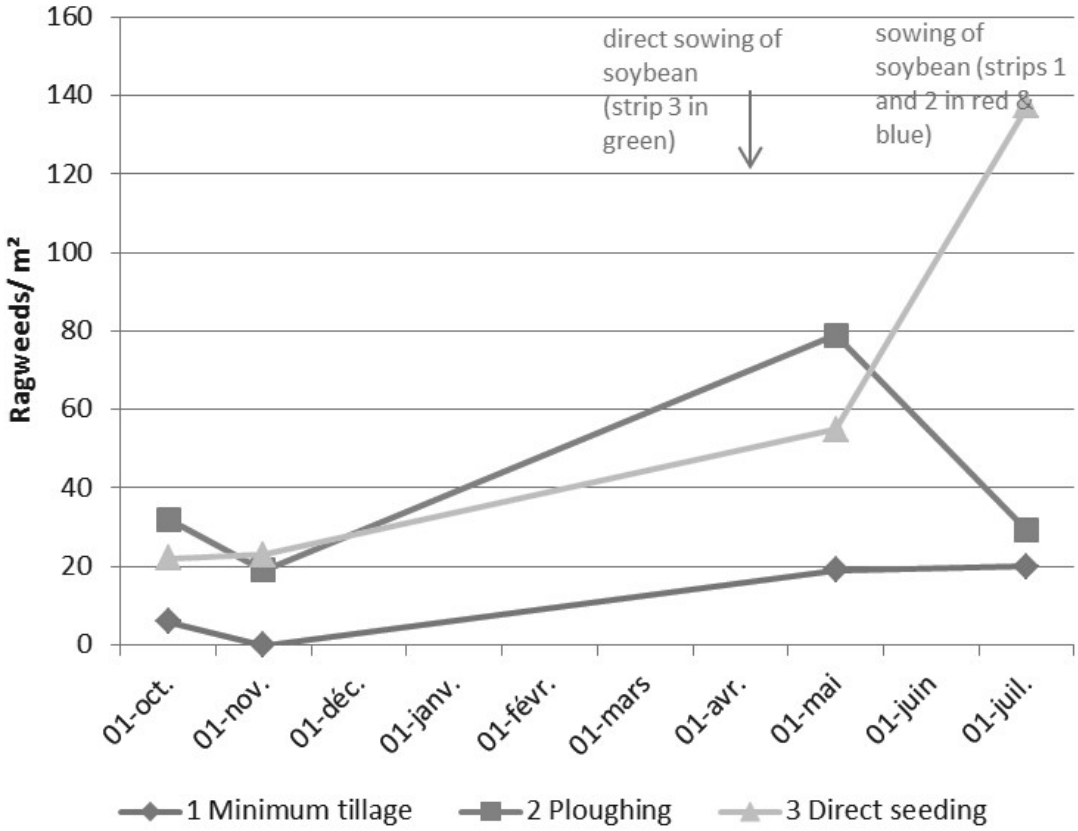


Figure 5 - Number of ragweeds according to the type of preparation

After the first year of this trial, we established that there were some trends that needed verifying at a later date, or tested with other trials. We already know that ploughing is not ideal for ragweed management because ragweed seeds are able to stay viable / can remain dormant in the soil, even after a long time. However, we wanted to see whether the elimination of ploughing would be useful. Now we need to observe the long-term effect on the ragweed population. As we moved the soybean sowing date for Strips 1 and 2, we will see the main impact of this practice on the ragweed population in summer 2018. The goal is to let the ragweed germinate and grow, after which it will be destroyed before sowing. If we sow earlier (as we did in Strip 3), the ragweed doesn't have time to germinate and grow, doing so inside the crop. As we want as little ragweed as possible in the soybean, we prefer to sow later. That is why the strip with direct sowing turned out to be the worst strategy. Indeed, the soil was touched when this strip was sown because the farmer performed tillage at the end of the winter to destroy any ryegrass without glyphosate. This intervention caused a considerable amount of ragweed to germinate, and we were unable to destroy it before sowing soybean because we wanted to touch the soil on this strip as little as possible. This management technique, however, is not efficient on ragweed (see Figure 5).

Between Strip 1 and Strip 2 we can suppose that the ploughing put up some old seeds of ragweed still viable. Next summer, after the wheat of 2018-2019, we will perform more tillage on Strip 1 than in summer 2017 to see the effect on ragweed populations.

The poor weather conditions of spring 2018 meant that the soybean population was far from optimal and regular.

PARTNER: ARVALIS-INSTITUT DU VÉGÉTAL

PROTOCOL

Screening trial of herbicide on a mix of spring barley + red clover.

→ The objective is to control weeds and be selective on red clover (3 reps x 3m x 10m)

	Pre-em	Post 3-4 L	Post 4-6 L	Results (efficacy /10) date: 19/06/2018
	Control			
1		Hoeing	Hoeing	**5**
2	Adengo Xtra 0.44			**7**
3	Camix 2.5	Elumis 0.75 + Peak 6g		**8**
4	Adengo Xtra 0.44	Elumis 0.75 + Peak 6g		**9**
5	Adengo Xtra 0.44 on row	Hoeing	Hoeing	**5**
6	Adengo Xtra 0.44 on row	Elumis 0.75 + Peak 6g full	Hoeing	**6**
7	Camix 2.5 on row	Elumis 0.75 + Peak 6g full	Hoeing	**7**

Contact: Laurent Lejars
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Results

The weed flora mainly comprised *Echinochloa crus-galli* and *Chenopodium album*. Regardless of the herbicides and their spectrum, hoeing combined with reduced herbicide does not manage weed flora fully. The main difficulty was caused by the soil lifting as the machinery was passed. Further trials will be needed in the next campaign to refine the strategies.

PARTNER: CHAMBRE D'AGRICULTURE ILE-DE-FRANCE

Objectives: Reducing the frequency - and then the quantity - of herbicides used by farmers thanks to mechanical treatment in sugar beet.
This experimental weed-management trial on beets was located in Richarville, south of Paris. The following diagram summarizes the original protocol.

6 meters	6 meters	6 meters	6 meters	6 meters	6 meters
Untreated control	Tilled control	Local practices	Local practices + hoeing	Reduced chemical treatment + hoeing	Reduced chemical treatment + harrow
		3 applicatons of herbicide	*3 applicatons of herbicide*	*2 applications of herbicide*	*2 applications of herbicide + 2 mechanical weeding steps*

Table 2 - Strategies studied in sugar beet

Experimental site: Richarville (48°28'13.2"N 2°00'19.7"E)

Contact: Caroline Roques
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Results

The following table summarizes the weed count in the beet field. In the "normal" plot, the farmer carried out only two applications of herbicides because two was enough to achieve the goal of 94% weed removal, with suitable weather conditions, enabling the beets to grow rapidly. Weed-removal efficiency reached 100% when herbicide applications were completed with rotary harrowing. Mechanical weeding only, without using herbicides, was only 69% efficient.

	Type of weed	**Untreated control**	**Tilled control**	**Farmer practices in year 2018** (2 applications of herbicide)	**Reduced chemical treatment** (2 applications of herbicide) **+ hoeing**	**Reduced chemical treatment** (2 applications of herbicide) **+ hoeing + harrow**
Number of plants/m²	Lamb's-quarters	7	2	1	0	0
	Knotweed	3	0	0	0	0
	Matricaria	4	2	0	1	0
	Ragwort	2	1	0	0	0
	Total	16	5	1	1	0
	Efficiency %		**68,75**	**93,75**	**93,75**	**100**

Table 3 - Efficacy of the various strategies in sugar beet

Figure 6 - Sugar-beet sowing machine

PARTNER: CHAMBRE D'AGRICULTURE DU LOIRET

Objectives: evaluation of a new robot for weed control in sugar beet (Ecorobotix)
Two trials to validate the accuracy of the robot (triggering in the presence of weeds, false positives with triggering on beet, etc.). The trials were carried out in two stages: one with a dye that validated application precision and the other with herbicides for operational implementation.


Testing the weed-control robot in sugar beet

Contact: Laurent Lejars
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Results
The tests experienced a number of technical hitches:
- the robot stopped unexpectedly (e.g. U-turns, shutdowns);
- nozzles clogged, priming problem;
- spraying did not activate;
- delay during advancement (non-recognition of beet rows);
- computer interface sometimes blocked, computer bug, viewing screen very difficult in sunlight.

The robot actually operated for a few metres, which allowed some precision evaluations to be made:

Notes for 2 m²	
Number of sugar beets (SB)	23
Number of SB sprayed	9
Number of weeds	95
Number of weeds totally sprayed	3
Number of weeds partially sprayed	2
Number of weeds non sprayed	90
False positives (e.g. stones sprayed, straw sprayed)	8
Weed-free/stone-free zone sprayed (close to weeds or not)	66

Table 4 - Parameters studied in the "usable" trial of the weed-control robot

There were a lot of bugs, which is unusual as this problem did not arise in other tests with ARVALIS in 2016.The robot was also highly inaccurate, which led to a high presence of uncontrolled weeds. Other material problems were also identified: when the ruts were too deep, the nozzles sometimes touched the ground, meaning that the nozzle holder was too low.

When the ground was clumpy, the robot sometimes had difficulty moving and maintaining a correct heading.
Further tests will be conducted on the next campaign.