Terres Inovia
l'agronomie en mouvement

R2D2
Agronomie et insectes auxiliaires au service d'une agriculture durable

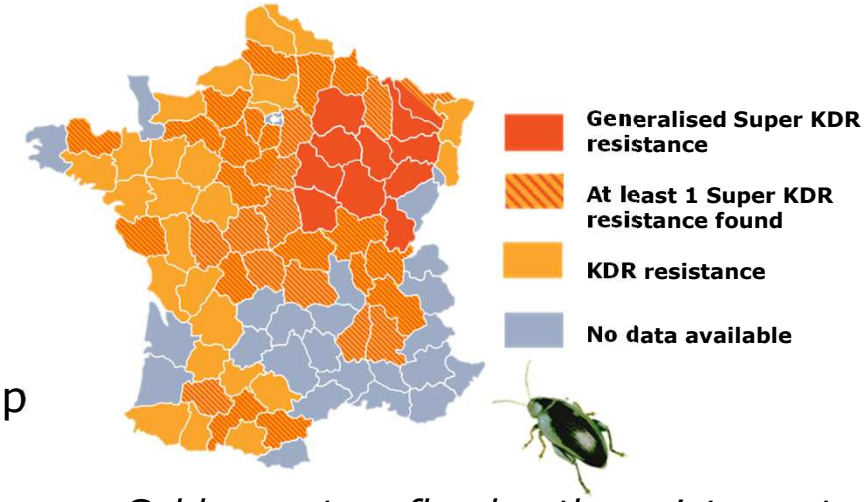
Improving oilseed rape performance through the implementation of an agroecological management strategy for cabbage stem flea beetle

Nicolas CERRUTTI, Sylvie CLERGET, Michael GELOEN, Domitille JAMET, Antoine LAUVERNAY, Céline ROBERT and Stéphane CADOUX

Terres Inovia l'agronomie en mouvement · INRAE · ARVALIS Institut du végétal · Dijon Céréales · SeineYonne · Agricultures & Territoires Chambre d'agriculture Yonne · soufflet agriculture

From technical deadlock to collective action

- Cabbage stem flea beetle (CSFB) in a major issue for oilseed rape (OSR) growers
- 15 years ago, pyrethroids resistance led to unprecedent outbreaks
- OSR acreage was reduced drastically
- Economic balance of farms was strongly affected, particularly those located on shallow soils with low crop diversity
- These difficulties in addition to climate change, provided a fertile ground for initiating changes in farming practices and insect management strategies
- Terres Inovia was focused on the search for solutions to combine at different scales
- R2D2 project was born to implement and refine those solutions in real life conditions :
  - Project area : 1300 ha
  - -10 farmers

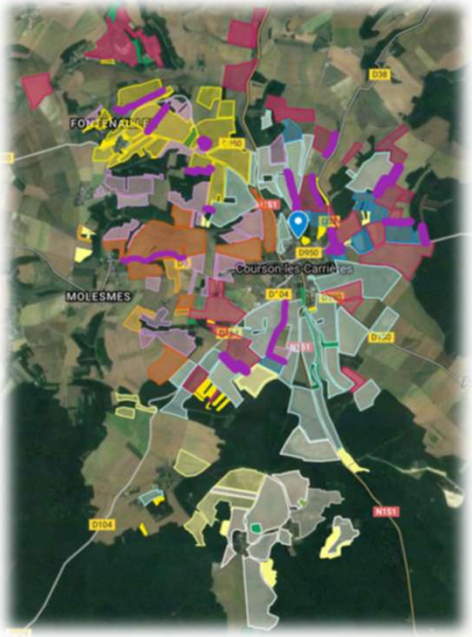


Cabbage stem flea beetle resistance to pyrethroids in France (2023)

Terres Inovia
l'agronomie en mouvement

Relying on biological processes to do without insecticides

- An ambitious long-term target: Resilient and performant systems including OSR, no insecticide
  - -OSR acreage reaching 200 ha across the entire territory
  - -OSR yield stabilised around 3 t/ha
- Support to farmers (workshops, technical knowledge exchange days, study trips) to create conditions conducive to change
- Scientific monitoring of key indicators (parasitism rates, pest populations, plant damage) to assess the strategy' effectiveness and refine it

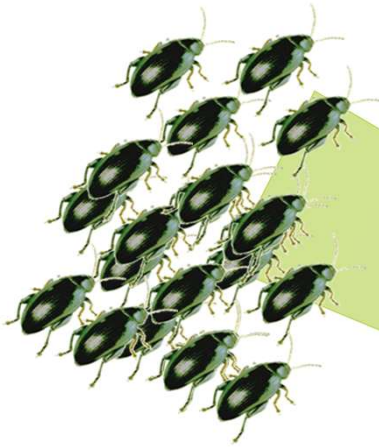


Terres Inovia
l'agronomie en mouvement

CSFB agroecological management

1 Enhancing biological control of pests (territorial scale)

- Increase nectar/pollen resources
- Increase undisturbed habitats area, their diversity and connectivity
- Reduce insecticide applications
- Reduce soil tillage



Cabbage stem flea beetle initial population

2 Behaviour manipulation of pests (territorial scale)

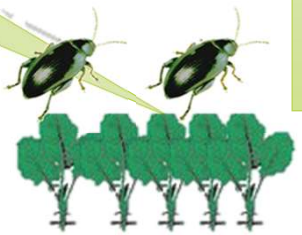
Trap cover crops

Cover crop including radish

3 Mitigating plant damages (field scale)

-avoiding pests' presence during sensitivity stages
-increasing plant "robustness"

- Sowing dates
- Genetics
- Soil fertility/crop nutrition
- Companion plants



WOSR field

Terres Inovia
l'agronomie en mouvement

Significant changes in practices

CATEGORY	LEVER	2019	2021	2023
Improving biological control	Flower strips	0 ha	8 ha 4 farms	8.3 ha 4 farms
	Fallow land	32.2 ha 4 farms	45.2 ha 6 farms	47.2 ha 6 farms
Creating an unfavourable environment for pests	Managed trap cover crops	0 ha	272 ha	195 ha (80% of long intercropping periods, 100% for 4 farmers)
Crop robustness: Focus on oilseed rape	Early sowing	0	60 ha (45% of oilseed rape area)	97 ha (65% of oilseed rape area)
	Fertilisation at sowing	63 ha (100%)	128 ha (100%)	148 ha (100%)
	Oilseed rape intercropping with frost-sensitive legumes	22 ha (33%)	83 ha (65%)	43 ha (29%)
	Rapid early-growth varieties	0 ha	60 ha (45%)	148 ha (100%)

concerted actions at the landscape-scale have been implemented :

- Flower strips → increasing beneficial insects
- Trap cover crops → reducing CSFB populations/damage with non-chemical methods

Agronomic practices deployed over large areas

Terres Inovia
l'agronomie en mouvement

1 Enhancing biological control

- **Increasing floral resources** available for beneficial insects and particularly parasitoid wasps
- **Nectar available and accessible :**
  - Provides energy for hosts finding
  - Influence egg-laying activity and thus parasitism rates
- **Flower mix**: *Melilotus officinalis, Daucus carota, Borago officinalis, Foeniculum vulgare, Anethum graveolens, Coriandrum sativum, Trifolium repens, Centaurea cyanus, Anthemis tinctoria, Leucanthemum vulgare, Medicago sativa, Phacelia tanacetifolia*
- **5-meter-wide flower strips**
- **Testing maintenance practices: removal of mowing residues**

Terres Inovia
l'agronomie en mouvement

2 Pest manipulations through managed trap cover crop technique

If the trap cover crop technique had not been implemented in 2021

➔ At the territorial scale, the only resource available for CSFB in autumn would have been 128 ha of OSR

CSFB

OSR

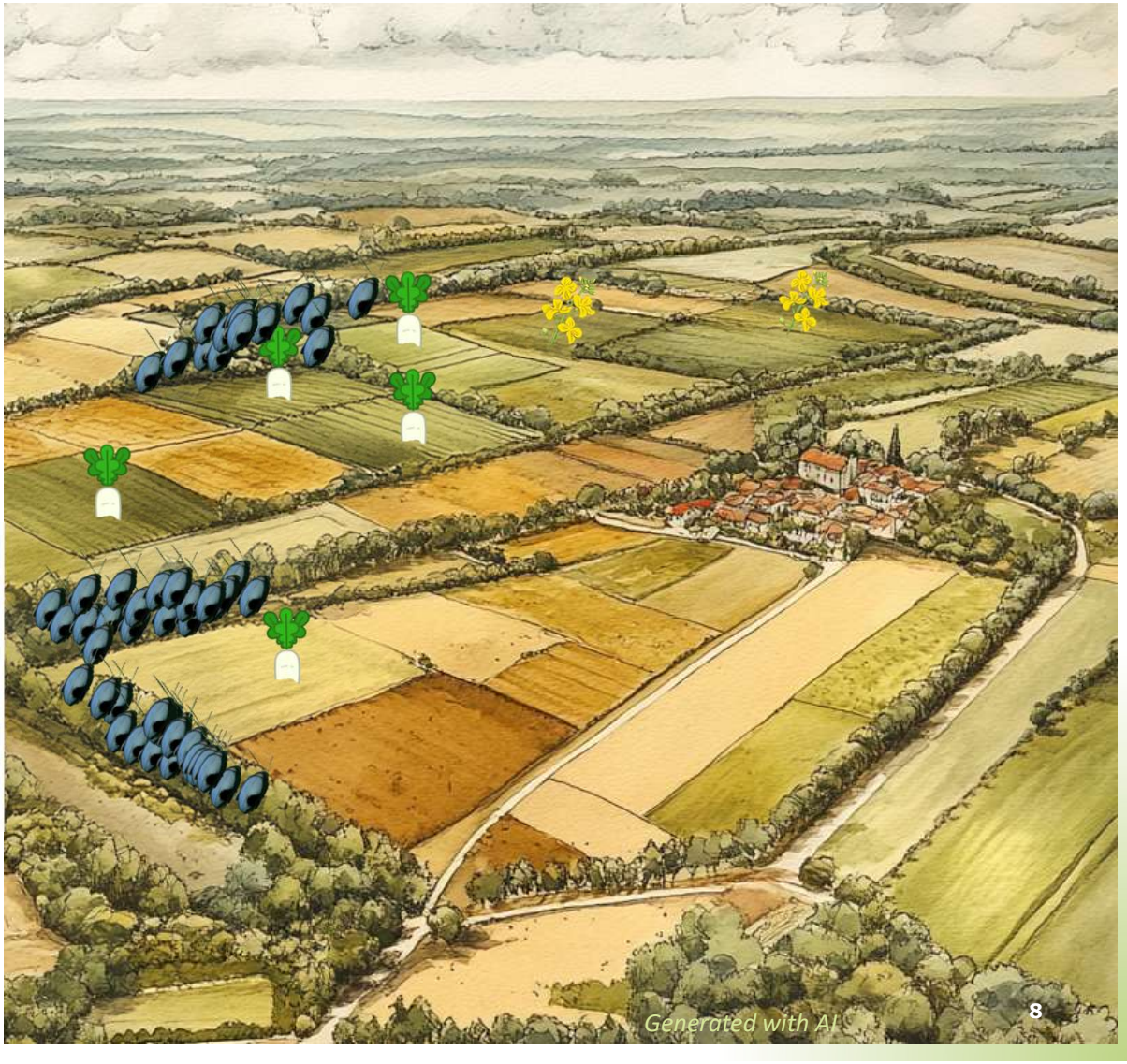
Cover crop including raddish

Terres Inovia
l'agronomie en mouvement

2 Pest manipulations through managed trap cover crop technique

In reality, the trap cover crop technique has been implemented in 2021

➔ At the territorial scale, the total acreage attractive to CSFB is 128 ha of OSR + 272 ha of cover crops with radish equalling 400 ha in total



CSFB

OSR

Cover crop including raddish

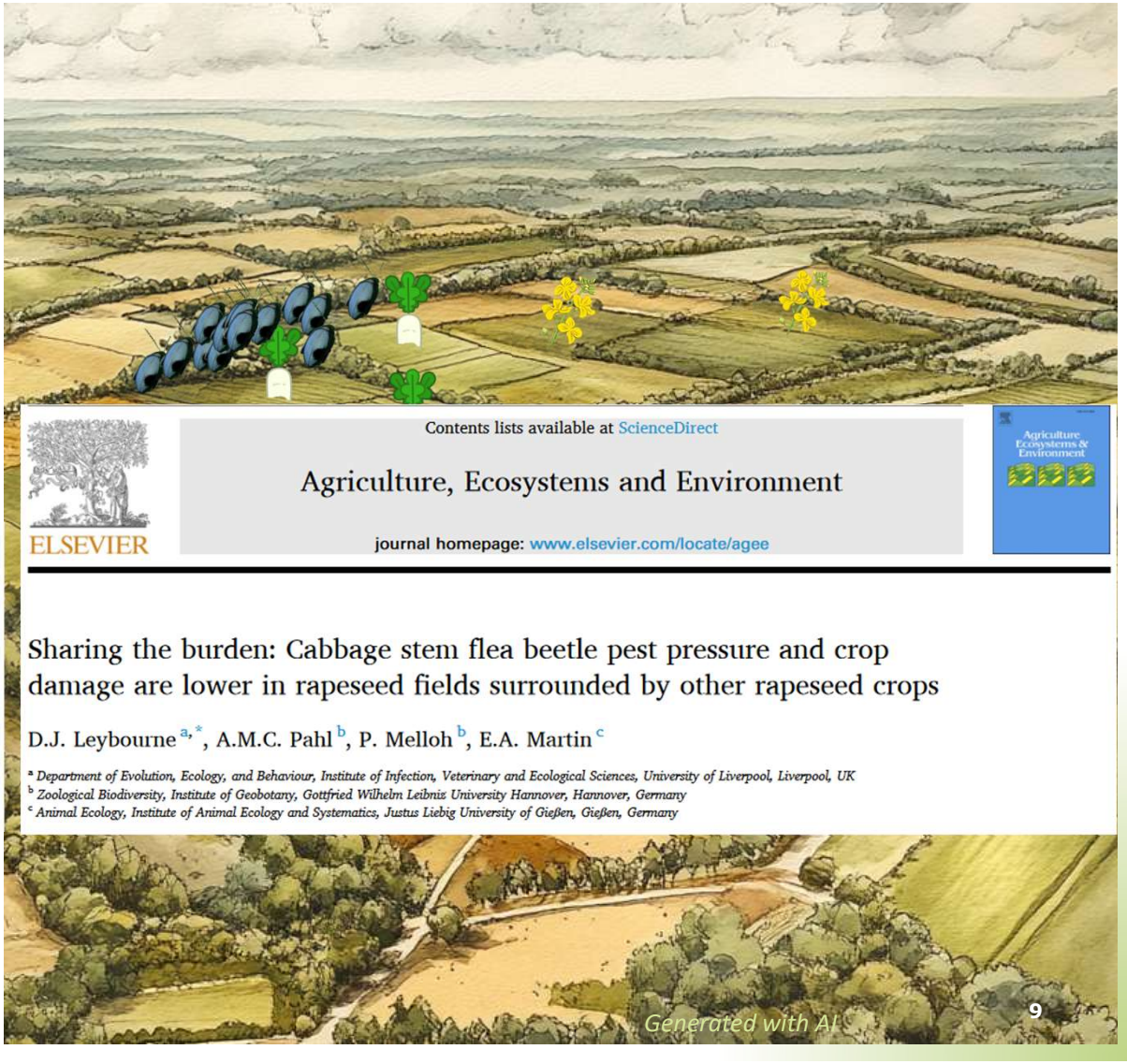
Terres Inovia
l'agronomie en mouvement

2 Pest manipulations through managed trap cover crop technique

- ✓ **In our concrete example, the technique allowed to triple the area attractive to CSFB !**

Expected effect :

- ✓ In 2021 : less CSFB adult on OSR : dilution effect
- ✓ In 2022 and beyond : reduction of CSFB population with cover crops mechanical destruction



CSFB

OSR

Cover crop including raddish

Terres Inovia
l'agronomie en mouvement

3 Reducing plant damage

Achieve a robust OSR with continuous and dynamic growth in autumn to avoid CSFB attacks

- Early sowing, before mid-august
- Vigorous-growing varieties
- Frost-sensitive legumes as companion plants
- Fertilization at sowing

Terres Inovia
l'agronomie en mouvement

Increasing performances on OSR

- Increasing OSR acreage on the territory : +120%
- Increasing and stabilizing OSR yields close the areas' potential : 3t/ha
- Insecticide TFI reduction : -29% (mean$_{2019\text{-}2020}$ vs mean$_{2021\text{-}2022\text{-}2023}$
- the support helped improve the rationale behind insecticide applications: total elimination of systemic treatments since 2019.

OILSEED RAPE	2018 - 2019	2019 - 2020	2020 - 2021	2021 - 2022	2022 - 2023
Surface area (ha)	67	83	128	215	148
Total TFI excluding seed treatment	4.51	5.97	4.40	3.92	5.34
Herbicide TFI	1.86	2.62	2.48	2.00	2.31
Herbicide TFI Crop	1.86	2.52	2.45	1.80	2.12
Fungicide TFI	0.38	0.70	0.65	0.48	0.74
Insecticide TFI	2.00 -24 %*	2.66 +59 %*	1.27 - 57 %*	1.44	2.29
Yield (t/ha)	1.52 -48 %*	2.12 - 8 %*	2.71 -13 %*	2.64	2.45
Direct margin with aids (€/ha)	261	438	978	1010	270

* Deviation from the reference value for DEPHY farms in the Burgundy region

Terres Inovia
l'agronomie en mouvement

Conclusion

- Strong mobilization of farmers to optimize their systems
- Significant changes in practices
- Concerted large-scale actions: combination of levers with partial effects
- Improved performance on oilseed rape
- The project has laid the foundations for a coordinated agroecological pest management strategy for autumn oilseed rape pests at the territorial scale

Terres Inovia
l'agronomie en mouvement

Thanks a lot for your attention !

R2D2 Project: « **R**estaurer la **R**égulation naturelle et améliorer la robustesse des cultures pour réduire **D**urablement la **D**épendance aux insecticides sur les plateaux de Bourgogne »

Many thanks to :

- **Farmers**

- **Partners** :

- **Financial support** :

Terres Inovia
l'agronomie en mouvement