Tillage strategies to optimize rapeseed establishment:
a method to support decision making

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Context

- Rapeseed in France = 2nd arable crop for :
  - ✓ Cultivated area ≈ 1,5 Mha
  - ✓ TFI = 5.6 on average (AGRESTE 2014)
- Ability of rapeseed to withstand the presence of pests provided a successful establishment (see Robert *et al.*, this conference: pest control, Monday 15h30-17h15)
- Key role of tillage but antagonistic effects:
  - ☺ Improves soil structure, controls soil pests and residues
  - ☹ Dries the soil, increases sensitivity to slaking, stimulates weed germination

?

Aim and approach

- Aim: to develop a method to support farmers in choosing adapted tillage practices
- Based on:
  - ✓ A **soil structure diagnosis** using a spade method derived from ISARA-Lyon (2016), updated for soil structure description (Boizard *et al.* 2017) and simplified for a quick use by farmers
  - ✓ Completed by expertise to integrate and prioritize the other criteria to be considered in tillage decision-making and propose a **decision tree**
  - ✓ Approach tested and improved over 4 years with a group of 15 farmers in the Berry region, Central France

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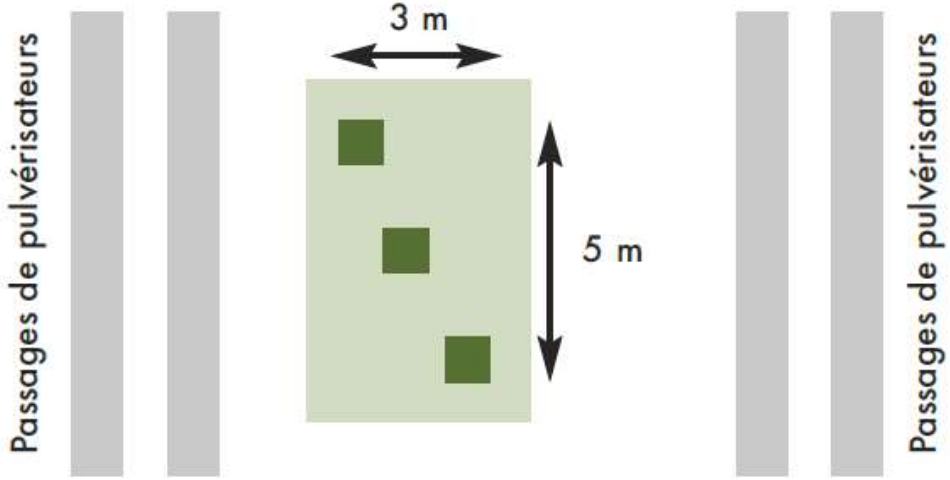
Soil sampling

- When: in **spring in the preceding crop**
- How: **3 samples** per homogeneous area



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Soil sampling

- Removal of the soil block (20*20*25cm):

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Soil structure diagnosis

- Two steps:

  1- Morphological description of the soil block

  2- Description of the dominant type of porosity of clods defined after breaking morphological units

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1-Morphological description

Behaviour of the block	Corresponding state	Visual example
Fine aggregates that do not hold on the spade	**Open (O)**	
Separation into **decimetric clods**	**Block (B)**	
Massive soil block	**Continuous (C)**	

2-Type of porosity of clods

Clods description	Corresponding state	Visual example
high structural porosity with visible aggregates and rough surface	**Gamma (Γ)**	
no visible macropores (resulting from delta structure) with **cracks** and sharp edges	**Phy (Φ)**	
no visible macropores and smooth surface	**Delta (Δ)**	

Tillage advice regarding soil structure

		Type of porosity of clods		
		Γ	Φ	Δ
State of the soil block	O	No-till possible	No-till possible	unlikely to occur
	B	No-till possible	-On 10-20cm only => No-till possible	- On 0-10cm only => Tillage advised on 0-10cm -On 10-20cm => Tillage advised on 0-20cm
			- On 0-10cm => Tillage advised on 0-10cm	
	C	No-till possible	- On 0-10cm only => Tillage advised on 0-10cm -On 10-20cm => Tillage advised on 0-20cm	

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Building decision trees

- 2 other criteria than soil structure considered
  - ✓ Amount of **residues** from the preceding crop:
    - small
    - or large
  - ✓ **Main weed/pest risk** to be managed by tillage:
    - broadleaf weeds
    - or grass volunteers / slugs / small rodents
- 2 trees for 2 soil types with distinct problems
  - ✓ Clayey soils (risk of clods being created)
  - ✓ Other soils

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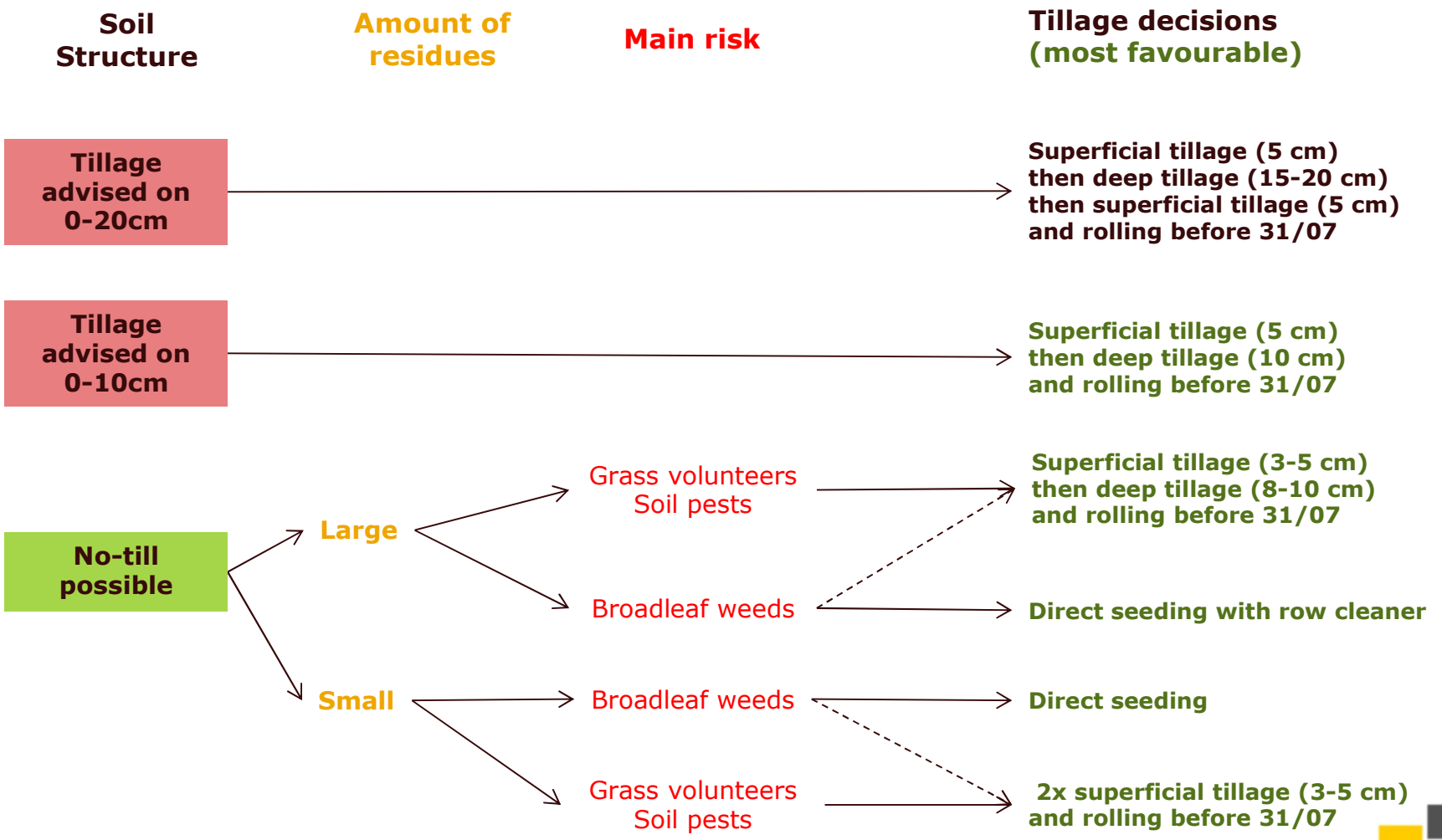
Decision tree (clay > 22-25%)



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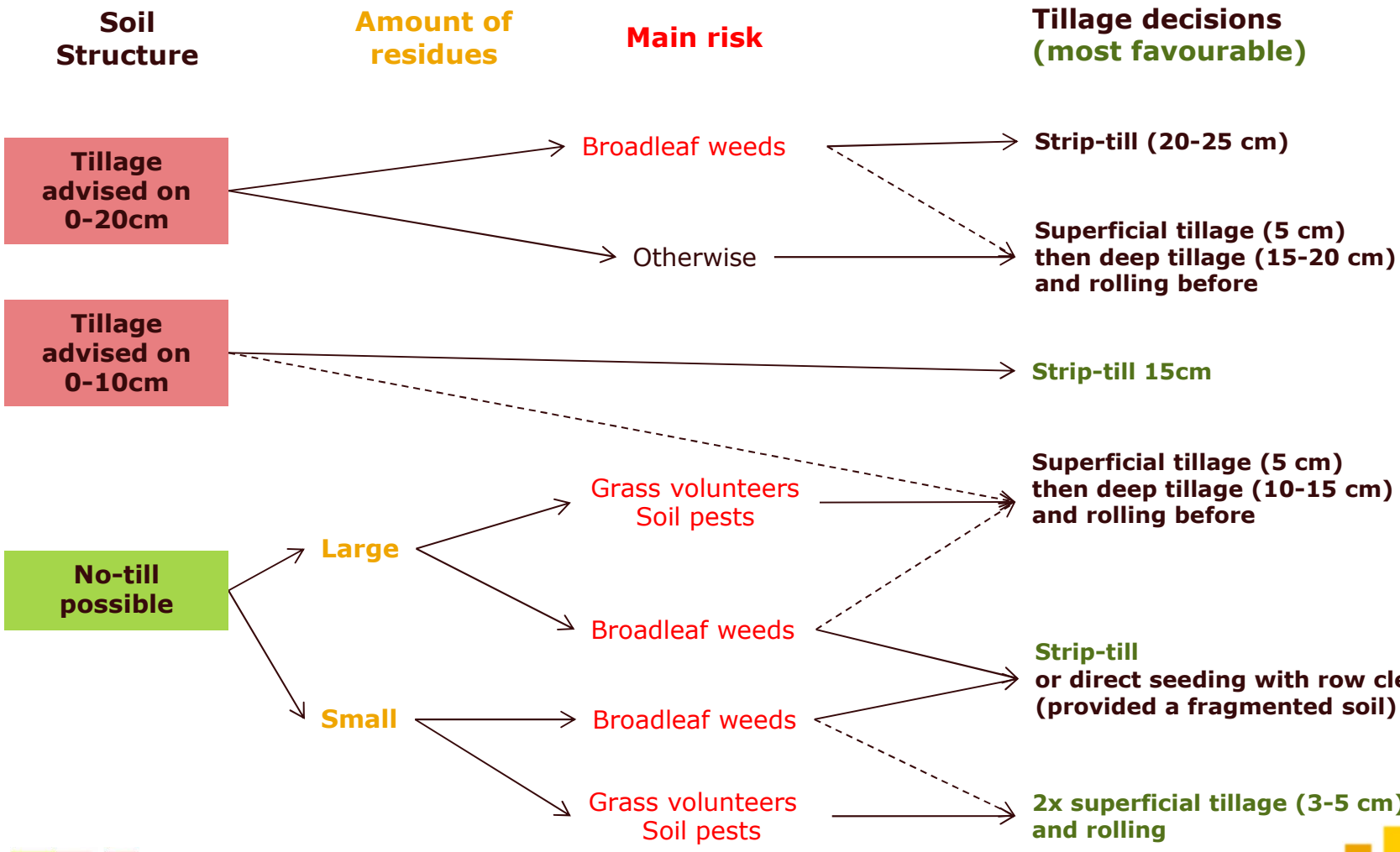
Decision tree (clay < 22-25%)



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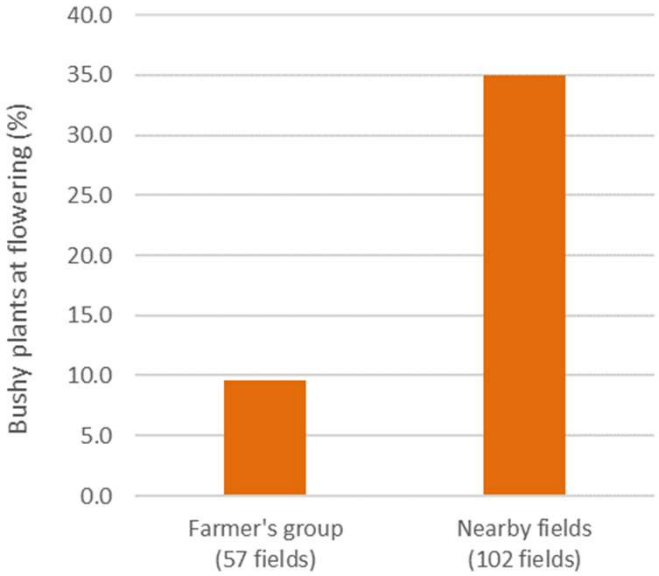
Results of implementation

- Implemented since 2016 with a group of farmers
- In 2018 comparison of results with nearby fields:

  => Better establishment and less damage caused by autumn insects in the fields of the farmer's group



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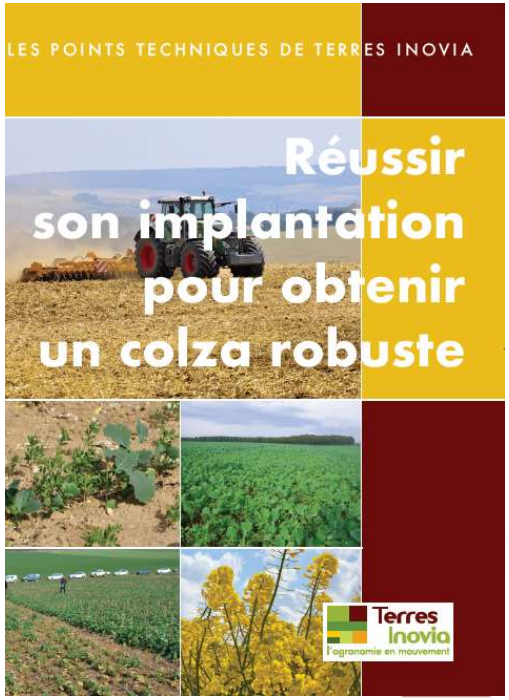
Conclusion

- An expert method co-designed with farmers and bringing them positive results
- Formalized in a technical guide for French farmers and advisors on how to successfully establish rapeseed to make it robust (www.terresinovia.fr)



References:
-ISARA Lyon, 2016. Test Bêche, guide d'utilisation
-Boizard *et al.* 2017. *Soil Tillage Res.* 173, 92-103
-Robert *et al.* 2019. This conference (311).

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