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Overview of Tillage Practices and Correlations with Other Agricultural Practices in France: an Analysis of the Agreste Survey (2011)

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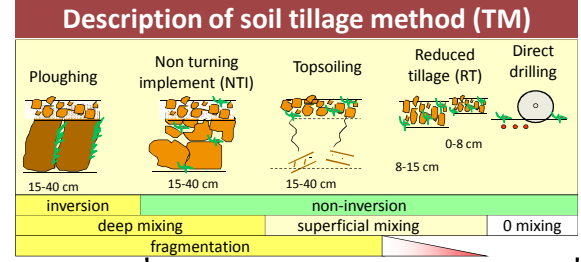
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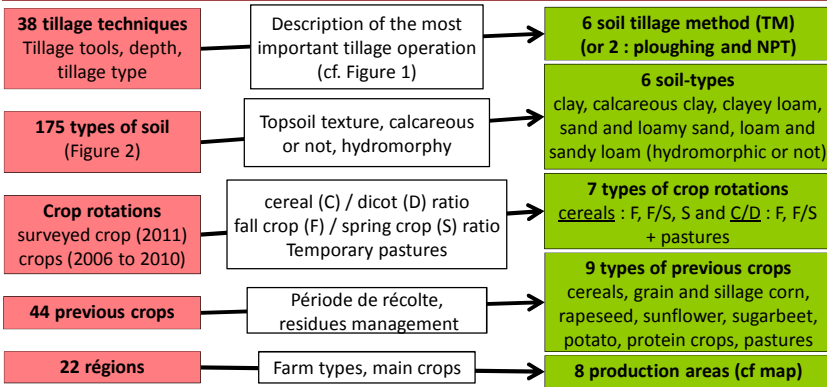
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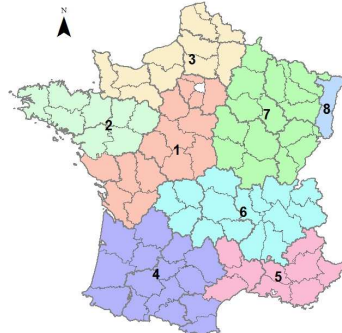
The survey Agreste – Pratiques culturales 2011, led by the French Ministry of Agriculture, is based on 20 827 fields of tillage crops. Made every five years, it is a very precise survey on these type of crops and the 2011 survey is the first one containing data on soils of surveyed fields (based on the set of soil types created by ARVALIS – Institut du végétal : BaseSol). The survey provides description of the complete crop sequence in 2010-2011, some components of crop sequences from 2006 to 2010 (crop, yield, fertilization, etc.) and elements of pedoclimatic context. These data are used to i) study the repartition of soil tillage methods in 2010-2011 and soil tillage strategies (from 2006 to 2011) as a function of these qualitative factors : crop, previous crop, type of rotation, type of soil and production area ii) study correlations between soil tillage systems and other practices of crop sequences.



Definition of the agro-pedoclimatic (AP) context : creation of typologies



Production areas (for tillage crops)
Source : ARVALIS – Institut du végétal

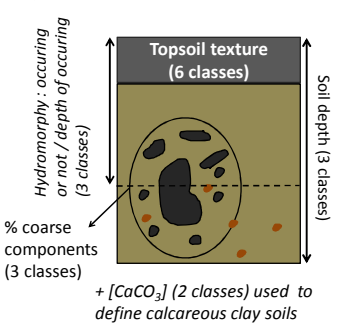


No-ploughing techniques (NPT)

Definition of soil-types

The types of soil defined by ARVALIS – Institut du végétal are described with the following variables:

Figure 2:



20827 surveyed fields → **300 millions possible agro-pedoclimatic contexts**

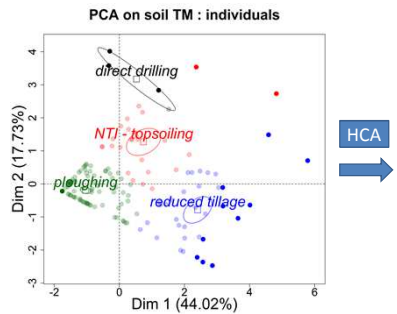
Around 6 000 possible AP contexts, 52 AP contexts (3157 fields) to compare ploughing / NPT crop sequences

Repartition of soil tillage methods and strategies in France

Principal Component Analysis + Hierarchical Cluster Analysis:

- **Individuals:** groups of fields with common characteristics
- **Variables:** % UAL by tillage method / tillage strategy

Loss of recorded data:
Work on **10848** fields for TM
Work on **8947** fields for TS



One excluded group (direct drilling: 15%) : durum wheat after sunflower in area 4 on calcareous clay soil

	Mean	ploughing	NTI and topsoiling	RT
number of individuals	163	99	26	34
Crop				
winter wheat	10,4%			20,6%
rapeseed	11,0%	0,0%		41,2%
silage corn ¹	14,7%	23,2%		0,0%
Sunflower	8,0%		19,2%	0,0%
Prod. area				
area 3 ¹	18,4%	24,2%		
area 4	11,7%		30,8%	
area 6 ¹	8,6%	12,1%		
Previous crop				
rapeseed ¹	3,1%			11,8%
pasture ²	4,9%	8,1%		
Soil-type				
calcareous clay	19,6%	14,1%		38,2%

In the cluster « direct drilling » (4 groups), this TM represents 3.2% of surfaces. No significant correlation with any factor.

For tillage strategies:

- the main factor is **crop rotations**:
 - all-ploughing strategy linked to cereal-based rotations
 - all-NPT more used on cereal/dicot rotations
- **Production area**:
 - area 3 to all-ploughing
 - area 7 to all-NPT
- **Calcareous clay soil**: all-NPT alternate use of NPT/ploughing

Correlations between soil TM and other practices

List of variables:

Each group of fields is described by variables with two values : a mean for ploughing and for NPT fields. They are used to describe the following agronomic subjects:

- Intercropping period management (crop residues, cover crop)
- Soil tillage operations,
- Crop sowing,
- Fertilization N,
- Fertilization P and K
- Use of plant protection products (herbicides and others)
- Crop performances.

Mean differences analyses : t test of Student on the 52 AP contexts

Utilised Agricultural Land (UAL): + 30 ha

Sowing
Variety, date, number of varieties, Use of certified seed + 4 %

Use of cover crops
% land covered
Chosen species: + 22% mustard
Sowing date
Destruction date: + 19,3 days

Organic fertiliser
+ 19,3 days

Residues management
Destruction method: 29 % mechanical + 26 % chemical + 12 % autre

Plant protection products
+ 0,2 FTI_{Total}
Herbicides: + 0,4 FTI
Weed control: + 0,37 FTI
Glyphosate: + 0,17 FTI
Non-herbicides: + 0,22 FTI
Fungicides: + 0,16 FTI
Molluscicides
Insecticides

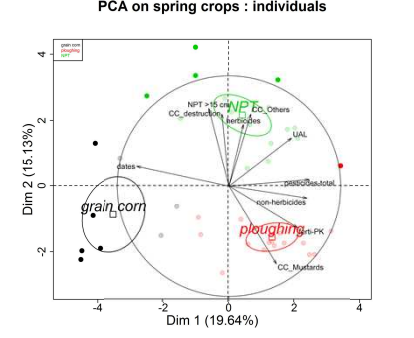
Fertilization
N: + 7,8 kg/ha
P: + 5,6 kg/ha
K: + 9,2 kg/ha

Harvest
Date
Yield: + 2,7 q/ha
Protein content

Full crop sequence of the 2010-2011 crop season

Legend : + 22%: mean of the variable significantly higher in ploughed fields ; + 19,3: mean of the variable significantly higher in NPT fields ; FTI : Frequency of treatment index (no unit)

Similar results with PCA + CAH on spring crops



Conclusion : In 2011, NPT represented around 35 % of tillage crops surfaces (and 46 % of surfaces were characterized by an alternance between ploughing and NPT between 2006 and 2011). The main factors correlated to tillage methods and strategies are respectively the crop (reduced tillage on wheat and rapeseed) and the crop rotation (all-NPT on cereal/dicot rotations, opposed to cereal-based rotations). In the North-East and the South-West of France, NPT are more frequently used, and reduced tillage is more used on calcareous-clay soils. This analysis allowed NPT are correlated to a greater use of herbicides for weed management (opposed to non-herbicides and fertilisers more used in ploughed fields), and ploughing is usually replaced by other NPT operations. Those TM seems to be used on bigger farms.