

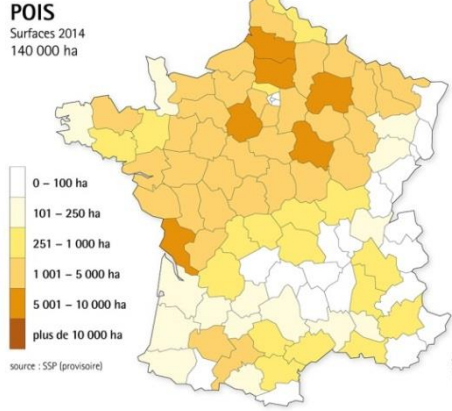
The yield gap to overcome: the French case

*Benoît Carrouée (UNIP),
Françoise Labalette (ONIDOL)
Pierre Jouffret, Etienne Pilorgé, Anne Schneider (CETIOM)*

*Workshop « profitability of protein crops »
26-27 November 2014, Budapest*

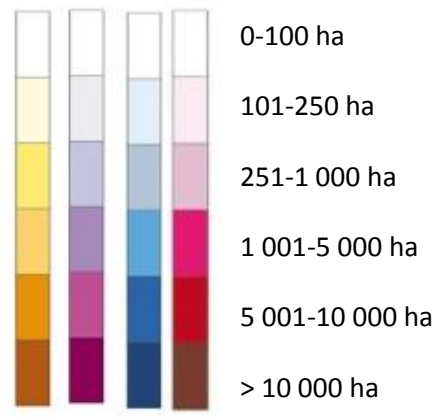
A panel of 4 grain legume species in France enabling the right development options at the regional scale

Pea 140 000 ha

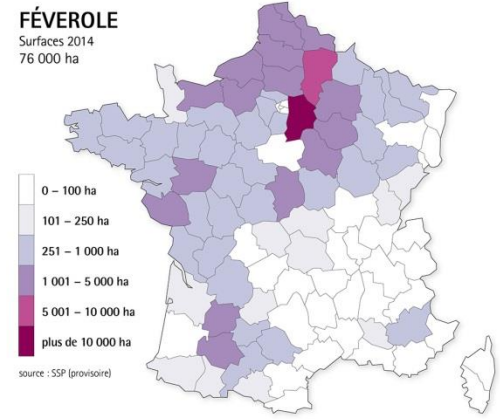


2014 estimates

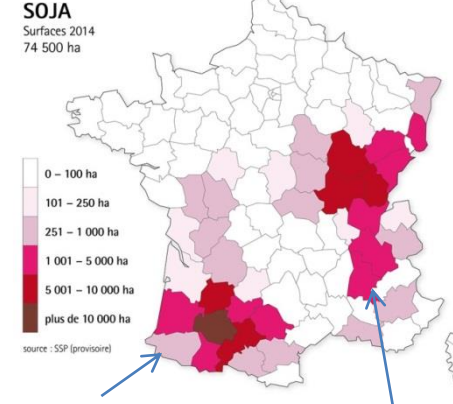
(Data source: SSP)



Faba bean 76 000 ha

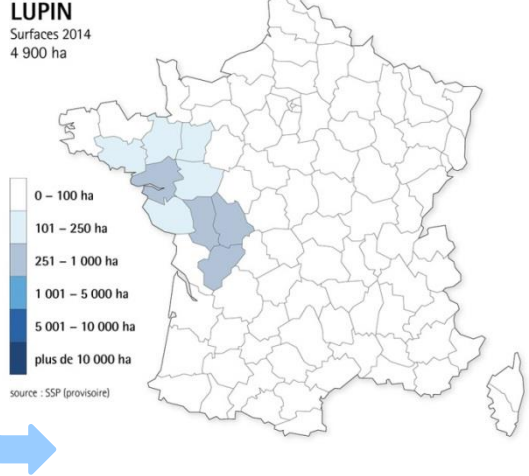


Soybean 74 500 ha



Necessity to take advantage of the diversity of the plant characteristics /agro-climatic conditions, rotation at farm scale, market demands - > complementary developing areas in France

Lupin 4 900 ha



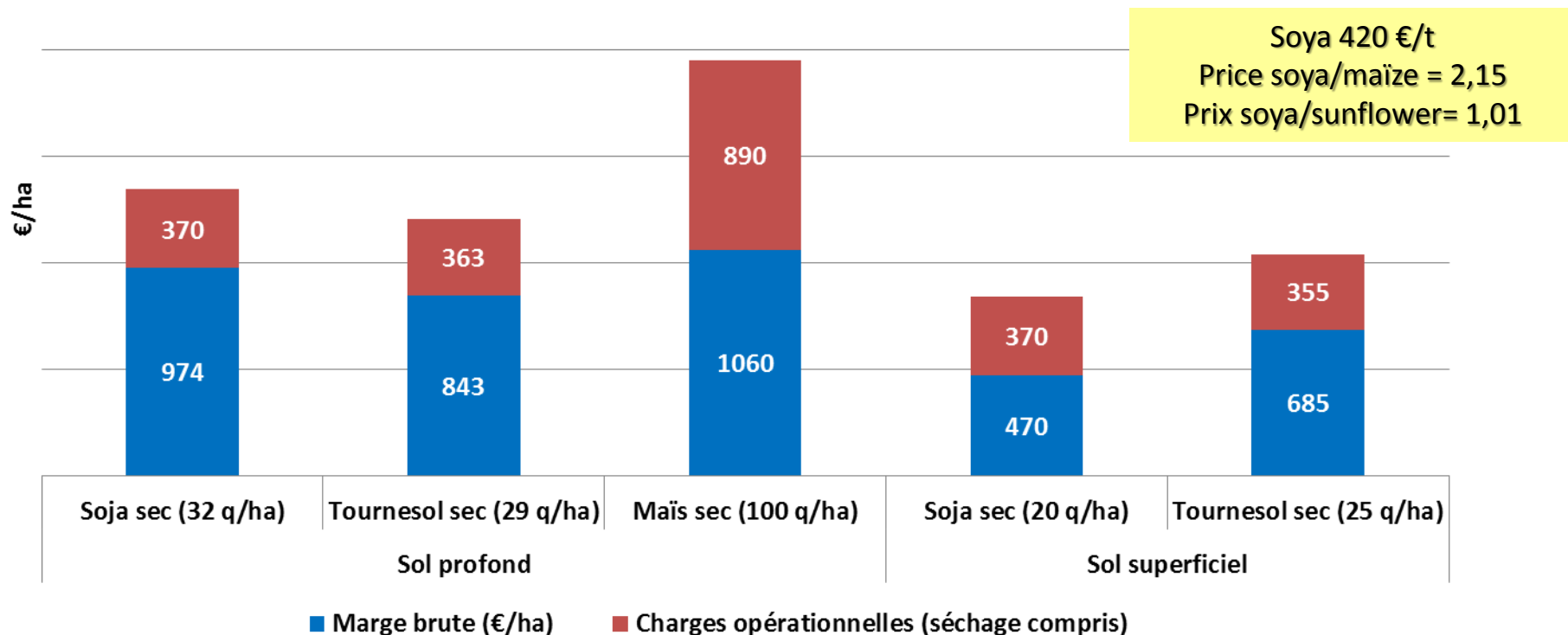
60% of Soy acreage
Mainly irrigated
Groups I and II
1/3 organic

40% of Soy acreage
Mainly rain-fed
Groups 00 to I
10% organic

Source : ONIDOL, UNIP

Good performances of rainfed **Soybean** are possible in deep soils

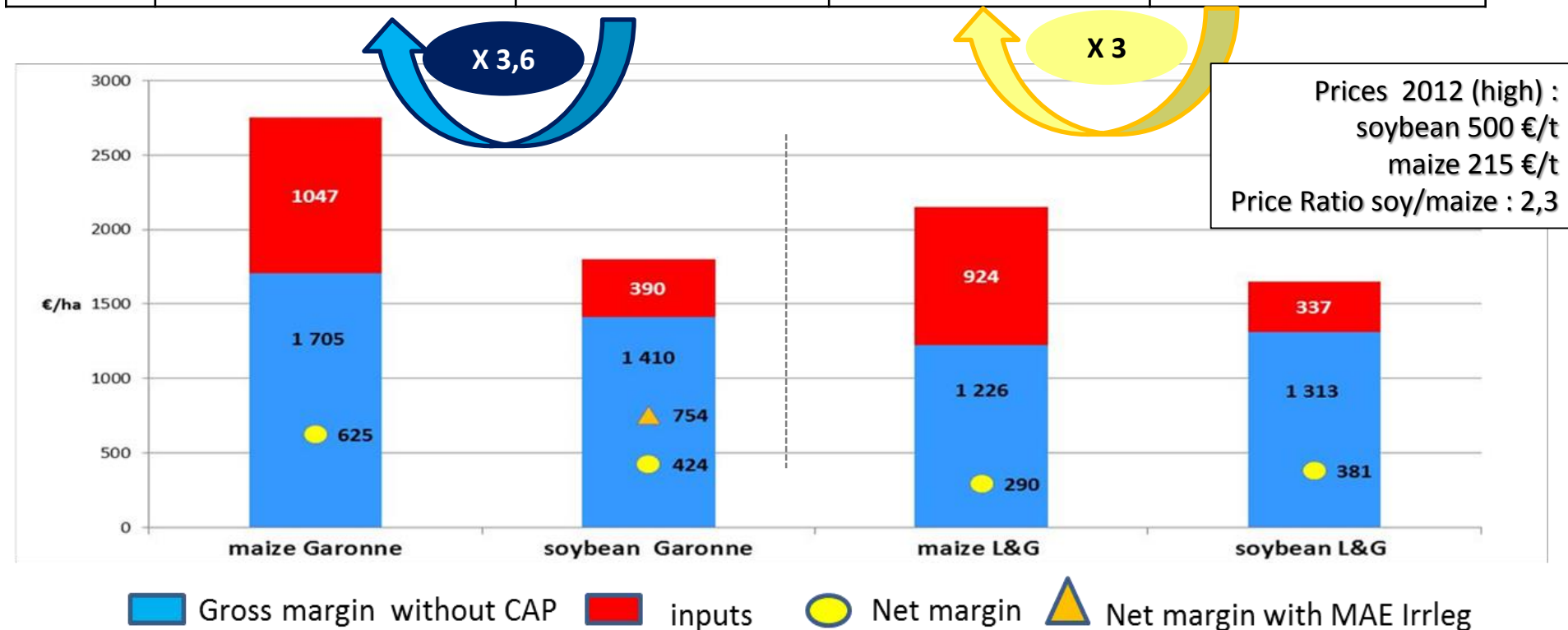
- Competitiveness of rainfed soybean depends on the water availability (rainfall, climatic demand, water soil capacity) and on the type of production (organic/conventional).
- Representative example for conventional soybean if the Dijon plain (Burgundy, eastern France) :



Simulation study based on the CETIOM expertise and agronomic practices survey

Good performances of Soybean versus maize in moderated irrigation situation or moderate water stressed conditions

| | Sajous GAEC Farm in Garonne Valley high water availability | | Farm of Mr Le Bugne in Northern L&G Hill moderate water stressed conditions | |
|------------|---|----------|--|----------|
| | maize | soybean | maize | soybean |
| Irrigation | 190 mm | 150 mm | 100 mm | 75 mm |
| yield | 12,8 t/ha | 3,6 t/ha | 10 t/ha | 3,3 t/ha |



A gap between crops still to compensate so as to secure the **soybean extension acreage in France**

- In many conditions, a significant competitiveness gap remains between soybean and summer crops like maize :
 - The gap varies according to the pedo-climatic conditions and the yield performance of soybean vs maize : gross margins gaps from 0 until more than 400 €/ha
 - In average the gap is about 150/200 € /ha (for the 2007-2013 period)
 - >Increasing the soybean yield by $\approx 15\%$ (0,4-0,5 t/ha) would secure the soybean extension in France

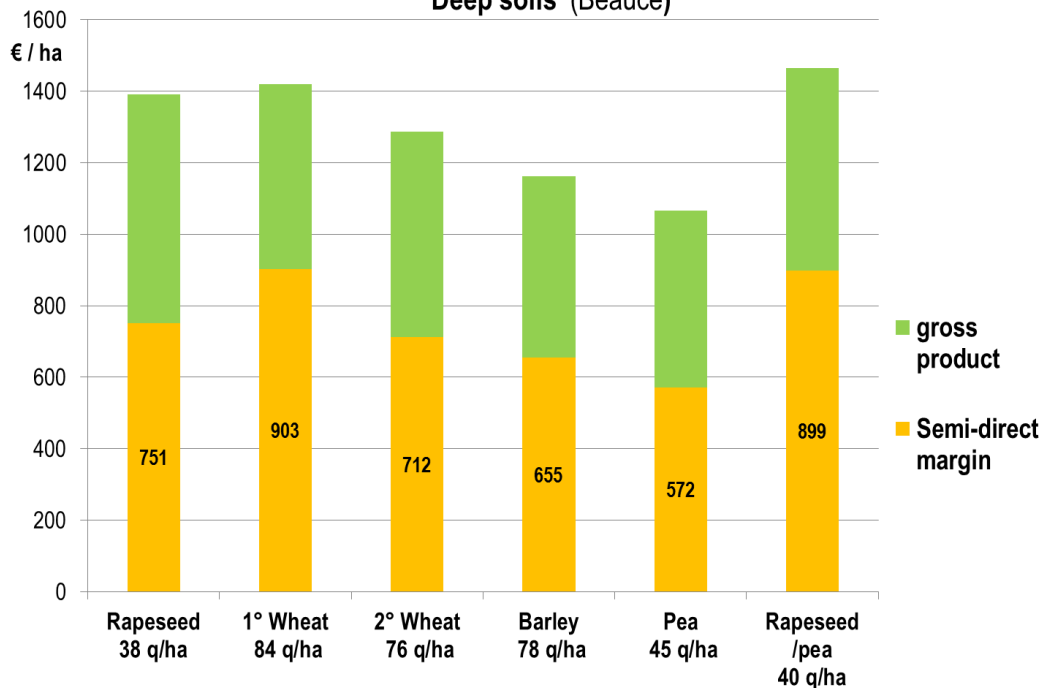
2 examples for pea in region « Centre » in France

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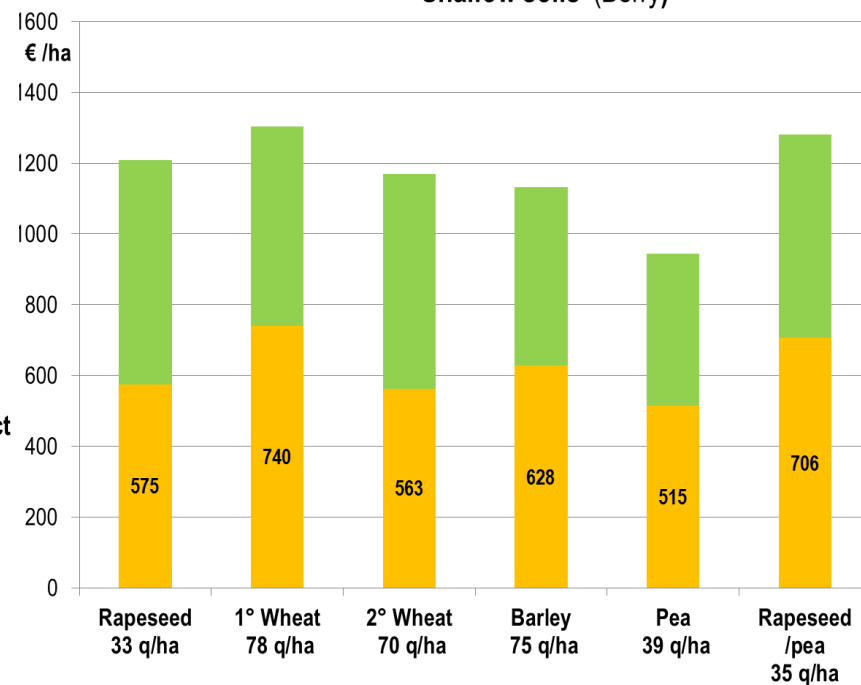
Average results 2009-2013 in Beauce (Deep soils) and Berry (shallow soils)

Dominant crops : Winter wheat, oilseed rape and barley (> 30 % of wheat after a first wheat)

Deep soils (Beauce)



Shallow soils (Berry)



- The pea crop has the lowest margin (and by far the lowest gross product) in both cases :
 - In deep soils : - 330 €/ha / 1° Wheat and - 180 €/ha / Rapeseed (= needs + 9 q/ha / 45)
 - In shallow soils : - 225 €/ha / 1° Wheat and - 60 €/ha / Rapeseed (= needs + 3 q/ha / 39)

NB : *without the coupled aid* for protein crops (160 €/ha on average from 2009-2013), the « yield déficit » would have been greater by 8 q/ha !! → *necessary yield increase: +20 to 37%*



The protein crops paradox

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In spite of this lowest gross margin, to introduce pea in Beauce and Berry can be neutral or profitable in cropping systems with Oilseed Rape, Wheat and Barley (Region Centre, average yields and prices 2009-2013, with a coupled aid of 160 €/ha)

| Effect of introducing pea on semi direct margin €/ha/year at the farm scale | Deep soils | Shallow soils |
|---|------------|---------------|
| To insert pea between the 2 wheats in a OSR / 1°W / 2°W / B rotation (1 pea / 5 years = 20 % of the area) | +1 | +13 |
| To replace rapeseed by pea once over two in a OSR / W / B rotation (1 pea / 6 years = 17 % of the area) | -30 | -10 |
| To insert pea before rapeseed once over two in a OSR / W / B rotation (1 pea / 7 years = 14 % of the area) | -7 | 0 |

Conclusion : never try to replace one crop by pea, but to insert pea in order to enlarge the rotation and to valorise the positive effects of pea on the following crops : more yield (for wheat), less nitrogen fertilizer, and better weed control

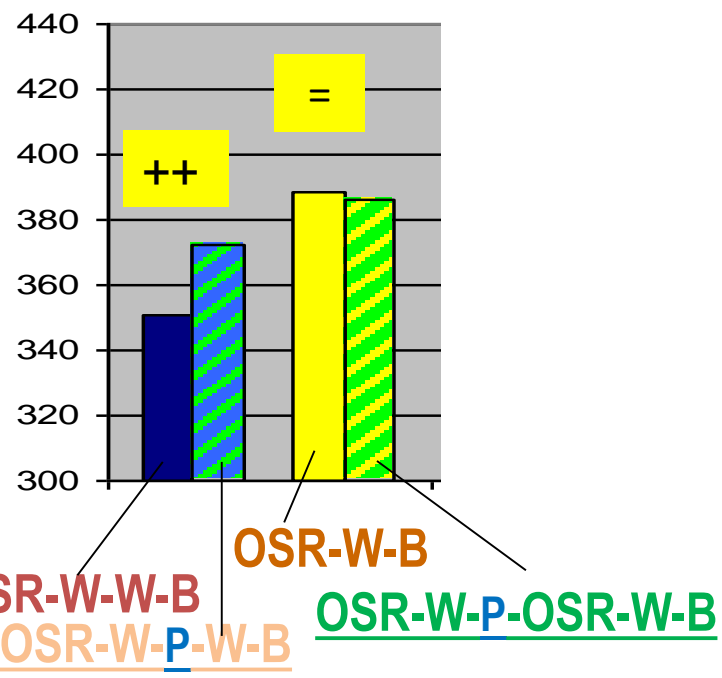


Burgundy case: introducing pea in rotations

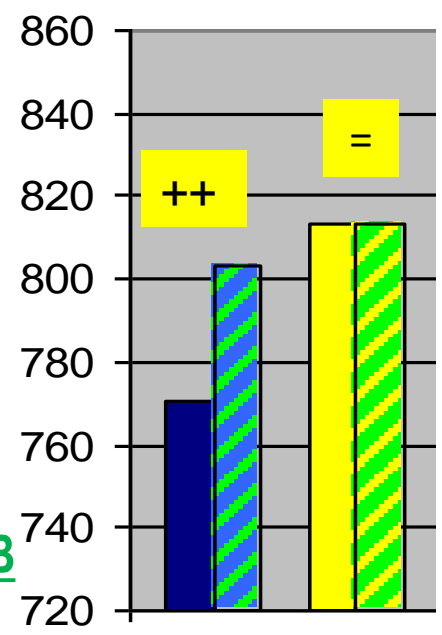
Nearly-direct margins of crop systems

€/ha/year in two contexts of grain prices in conventional agriculture

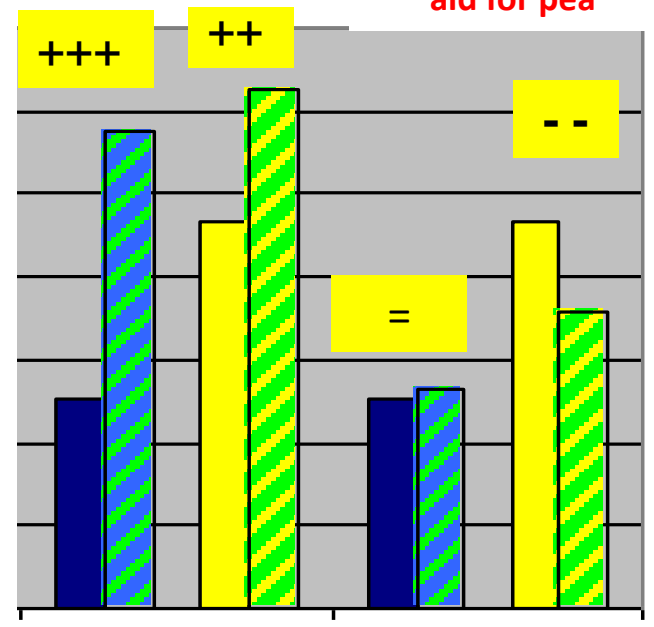
Average prices



High prices



High prices + rotation MAE



High prices, without coupled aid for pea

The protein crops paradox: In spite of a lowest gross margin, to introduce pea in these crop rotations can be neutral or profitable in cropping systems with Oilseed Rape, Wheat and Barley: Without coupled aid, pea remains possible only in the case of insertion between two wheats

With representative data of each region
(regional statistics + national survey for prices + experts' inputs)

Study made
in 2010-11

Differences of nearly-direct margins : values and % of reference without pea (OSR-W-B or W-W based rotation) in conventional agriculture in **2 contexts of grain prices (with aids) in 4 cases** (and taking into account **ONLY** the short term preceding effects).

Green colour = increase >= 3%

| €/ha/an et % respective reference | Add pea between two wheats: OSR-W-(P)-W-OSR (1/5) | | Add pea before OSR : OSR-W-B-(P)-OSR-W-B (1/7) | | Replace 1barley by pea: OSR-W-B(orP)-OSR-W-B (1/6) | |
|--|--|-------------------|---|-------------------|---|--------------------------|
| | Average 2005-09 * | Higher prices** | Average 2005-09 * | Higher prices** | Average 2005-09 * | Higher prices 2011-12 ** |
| Beauce with Spring Barley, Winter pea, Hard wheat | + 14 (+2,9 %) | + 35 (+3,7 %) | -1 (-0,3 %) | +5 (+0,5 %) | +2 (+0,4 %) | -9 (-1 %) |
| Thymerais avec SP, WB brass or SB | 0 | + 14 (+ 1,5 %) | -16 (-3,3 %) | -3 (-0,3 %) | -11 (-2,4 %) | +4 (+0,4 %) |
| Bourgogne with WB brass., Winter pea | +21 (+6 %) | + 32 (+ 4,2 %) | - 2 (-0,6 %) | 0 | -3 (-0,6 %) | -1 (-0,1 %) |
| Plateau lorrain with WB forrage., SP | + 22 (+6 %) | + 44 (+ 5,6 %) | + 9 (+2,3 %) | + 21 (+ 2,6 %) | +12 (+3 %) | +29 (+3,6 %) |

*average: wheat: 126€/t; pea: 150 €/t**Higher prices (2010-11): wheat: 200€/t; pea: 225 €/t

II.b.

DEPHY farms network coordinated by InVivo

farms withouts / with legumes crops

Conventional agriculture on 3 campaigns

| farms | Surfaces |
|---------------------|-------------------|
| 77 / 41 en 2010-11 | 6 809 / 4 094 ha |
| 126 / 60 en 2011-12 | 13 069 / 6 684 ha |
| 64 / 42 en 2012-13 | 6 873 / 3 883 ha |

(13 à 24 cooperatives, 8 à 12 regions)

Réseau DEPHY coordonné par



Avec Meryll Pasquet et Guillaume Py
et Mickael Pourcelot

Analyses des données du réseau
pour comparer avec et sans leg
menée avec



- **Analysis of the network data:** crops acreages and agricultural practices of DEPHY improved cropping systems compared to a regional référence

19 / 20 / 23 Pea (maj S, some W)
11 / 8 / 5 field bean
15 / 28 / 37 alfalfa
5 / 11 / 4 Soya
2 clover

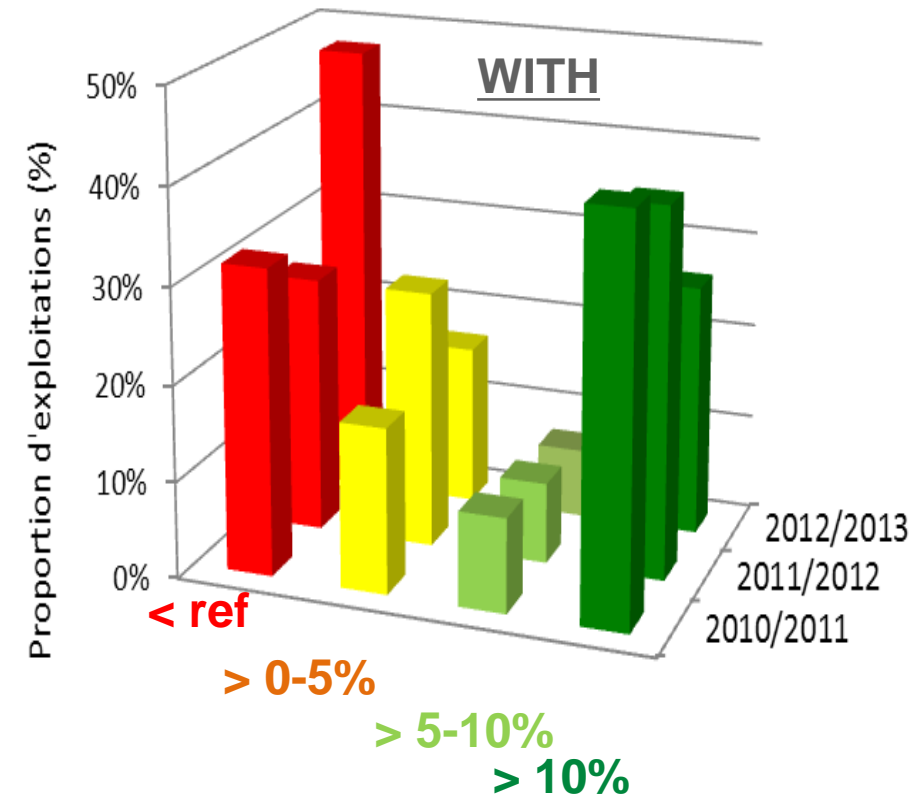
- **Conclusion :**

Within the heterogeneity in performances of the farms of a same region, it is possible to manage cropping systems with legumes and combine **both economic interests and environmental benefits.**

II.b.

Crop yields of the farm

in % compared with the reference yield



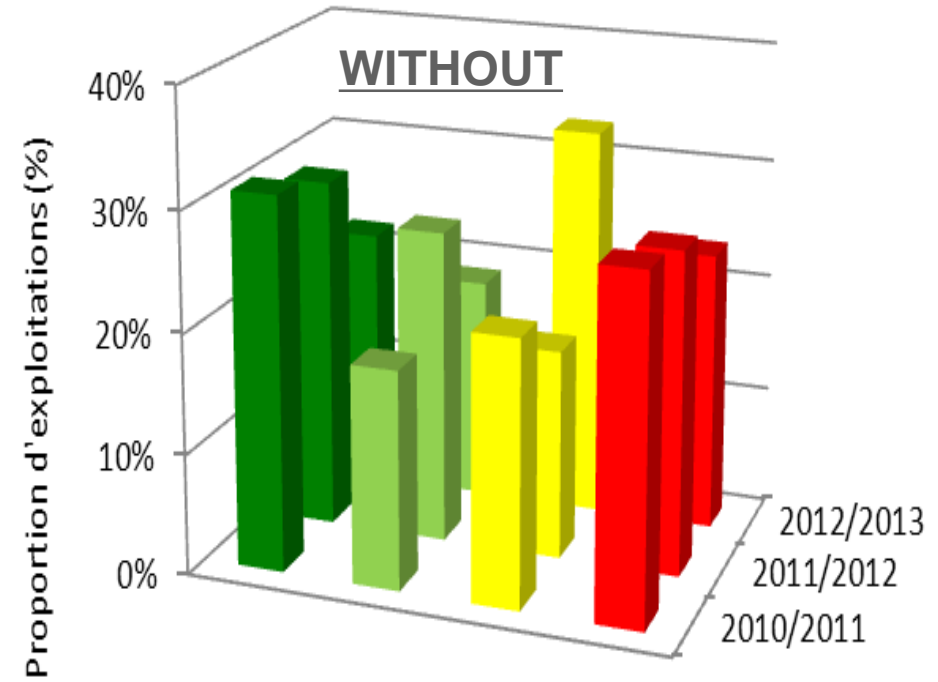
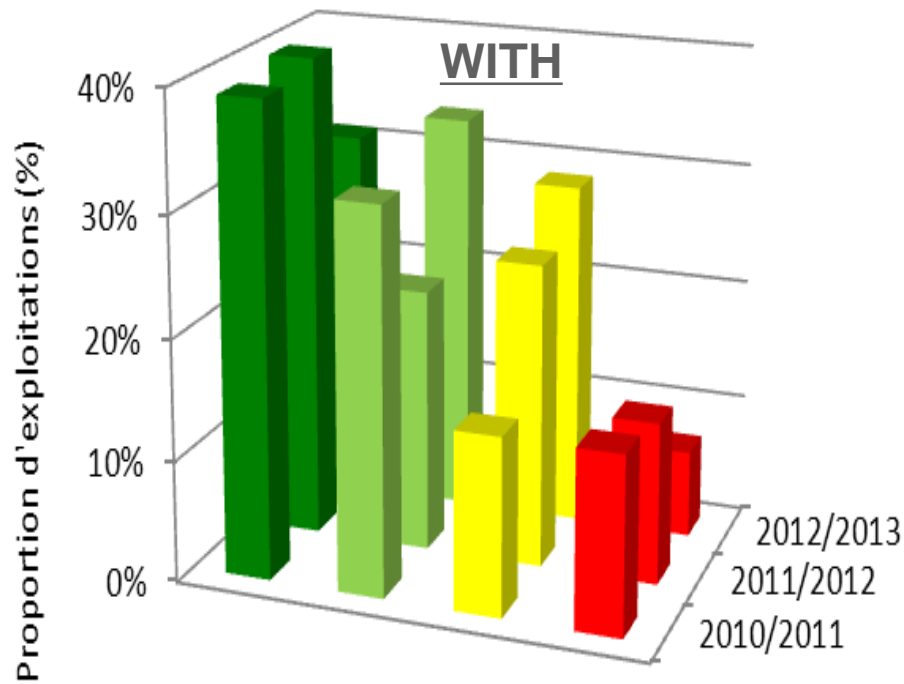
Farms with legumes are slightly more profitable for the 2010/11 campaign (+6%) and 2011/12 campaign (+2%) but not in 2012/13 (-2%).

➤ **At least as « productive »** (/ the sum of regional reference yield in each crop)

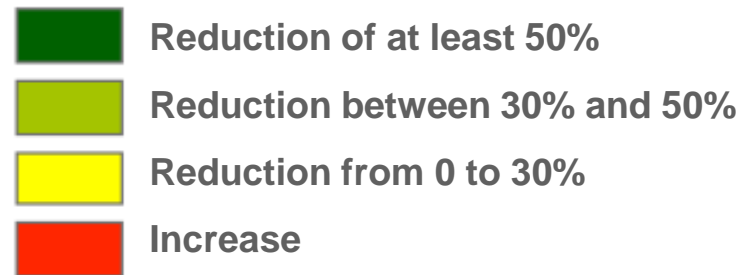
II.b.

Average value of « non herbicide IFT »

Compared with the regional reference IFT



There are more cases in 'good' categories for the group of crop systems including legumes



➤ **Reduced input pressure**

II. Conclusions

of a *posteriori* evaluation of crop systems
with /without legume crops

Case studies of existing farm groups (independant studies in different situations*)

► **It IS POSSIBLE to get crop systems including legumes which are performant both** at the economic and environmental levels in past and current farms in France

► **there is a GAP with the average of the observed practices** and with the general viewpoint which is bound to the dominant farm system

* **Exemples of 3 sources:**

- **INRA study** « *FermEcophyto 2010 (Phase test)* » **on 124 farms** of arable crops with rotations from 4 to 13 years (41% with legumes) in 5 regions
- **InVivo study** on series of **50 to 120 farms** over 3 campaigns (2010-2013) (DEPHY)
- **CIVAM based study** on **56 farms** (including several farms with both crops and monogastric animals) in the Ouest part of France, which tested low input target between 2008 and 2012 (what issued to the MAE systems in CAP 2015).

Conclusions / French conditions

- ***Without coupled aids, the yield gap*** to balance crops gross margins ranges by 0 to 30%. A yield increase of 10 to 20% for soya or pea is needed to open a significant number of situations.
- But **there is a legume crops paradox**: in spite of a low gross margin, to introduce legumes in crop rotations may be neutral or profitable in cropping systems with short rotations, specially in case of wheat-wheat succession, due to short term preceding effects.
 - ***It is POSSIBLE to get cropping systems including legumes which are both economically and environmentally performant.***
- There is a **gap between the simulated and observed performance of some cropping systems with legume crops and the average results of the French farms, and so the opinion** of a majority of farmers.
- In fact, **the calculation at the rotation scale is generally not adopted**. Then, **the simple parity of income is probably not sufficient to motivate** the farmers to complexify their practices: a bonus (+20€/ha in rotation?) would be needed.
- **There is a wide diversity of situations**: need to identify the situations where legume crops are already competitive (and promote them in these situations) and the other situations.