Crop Diversity and Ecologization of the Common Agricultural Policy

Various studies have shown the agro-economic and agro-ecological benefits of crop diversification. However, to take the best advantage of it, crop diversification should apply to a single plot year after year, but also on a higher area scale, to a given territory. Today, a minimum degree of diversification of farm cropping patterns is part of the good agricultural and environmental practices (GAP) which determine access to Common Agricultural Policy (CAP) aid. The CAP reform under discussion for the new programming period (2014-2020) includes a first “greening” pillar by making 30% of the aid given conditional on the implementation of environmental practices going beyond GAP. One of these measures concerns the diversification of farm cropping patterns. The current study explores the impact of the first Commission proposal, as well as of several variations. On the basis of the characteristics for 2009, analyses show that nearly a quarter of French farms would become non eligible. This result is improved when a territorial approach to crop diversity criteria is adopted, which could be an alternative to an individual approach (per farm), in the form of collective commitments.

Temporary cereals and meadows dominate French cultivated acreage with pronounced regional specializations

At the initiative of the General Commission for Sustainable Development (GCSD) of the French Ministry for Ecology, Sustainable Development, Transports and Energy, an inventory of plot diversity and crop sequences in France was made by the INRA Agrosystèmes and Agricultures, Management of Resources, Innovation and Ruralities (AGIR) joint-unit and the INRA Observatory of Sustainable Development (INRA-ODR) (Fuzeau et al., 2012) from CAP declarations from farmers (French cartographic field pattern register (RPG), anonymous public version). The results show that just seven categories of crops cover nearly 90% of French cultivated acreage. Straw cereals (like soft wheat, barley and durum wheat) and maize occupy 60% of arable land. Temporary meadows cover almost 20% of the cultivated acreage. Oleaginous crops cover around 10%, of which two thirds of rape and one third of sunflower (see figure 1). This observation reflects the increasing simplification of cropping patterns in France over the past 30 years, as demonstrated by the Solagro method on the basis of the 1970, 2000 and 2010 data from the agricultural census (Schaller, 2012). This low diversity at national level is even more pronounced at regional level (see map1). Maize covers 62% of the acreage cultivated in Alsace and 41% in Aquitaine. The Mediterranean region is mainly cultivated in durum wheat (38%). The French “Grand Ouest” is characterized by the trio of temporary meadows, maize and soft wheat. The Limousin and Auvergne areas are dominated by temporary meadows. The three areas specialized in crops in the Parisian Basin have a large share of straw cereals, and in particular soft wheat (36%) as well as a broad range of diversification crops.
Use of cultivated area in France (average 2006-2009)
Map 1: Regional average cropping patterns
Figure 1: National average cropping pattern

Note: Straw cereals (42%), maize (17%), temporary meadows (19%), rapeseed and sunflower (11%), other cultures (11%)

CAP “greening” criteria would not be fulfilled by a quarter of the French farms

As part of CAP reform for 2014-2020, in autumn 2011 the European Commission presented a proposal for a European regulation establishing rules relating to direct payments. Article 30 of the proposal determines the crop diversification criterion for “greening” as follows:

“When farmers' arable lands cover more than 3 hectares and that they are not fully dedicated to grass production, or fully put into fallow or fully dedicated to crops under water during a great part of the year, the cultivation on these arable lands consists at least in three various crops. None of the three crops covers less than 5% of arable lands, and the main one does not exceed 70% of the arable land”.

The system is built to be applied to farms producing mainly in open fields with a minimum threshold of 3 ha of cultivated land. The criteria of minimum and maximum crop cover allows the integration of the notion of dominance of a crop in the crop pattern and avoids imbalances, such as a crop covering more than 95% of the cultivated acreage alongside two other, almost inexistnt crops.

On a stable basis over the three years studied (2007-2009), and out of nearly 37,200 farms in France (CAP declarations), more than 75% respect the criterion of crop diversification as it is defined (called here after “reference criterion”). Four types of categories can be distinguished:

- More than 25% of the farms respect the criterion since they are not within the scope of diversification: for example, 80,000 farms (21%) have a cultivated acreage of less than 3 hectares and 14,350 farms (4%) have 100% grassland acreage.
- More than 50% of the farms have three crops and respect the suggested thresholds.
- About 9% of the farms (35,000) present 3 different crops but do not respect the minimum and maximum threshold of 5% and 70%.
- And 14% of the farms (52,500) do not respect the criterion of 3 various crops.

The size of the acreage cultivated within the farm is one of the main explanations for the failure to comply with the diversification criterion: one third of the farms which are in this case have a cultivated acreage of less than 12ha. There is a positive relationship between the size of the current cultivated farm area and the current number of crops. Farms of more than 50 hectares of arable land which do not meet the diversification criteria have more than 3 crops on average. For these farms, the thresholds and the maximum share (70%) dedicated to the main crop explain their non-compliance with crop diversification criterion.

A second factor explaining non-compliance with the diversification criterion is grassland specialization for livestock. Nearly a third of the grassland farms which do not meet the criterion have a cultivated acreage occupied by more than 70% of temporary meadow. Nearly a fifth of grassland farms do not reach the threshold of three crops. They are farms with a single cereal crop, mainly maize in addition to meadows. For non-grassland farms, cereal specialisations, particularly in maize, explain their non-compliance with the crop diversification criterion (figure 2).

These observations elicit to two types of questions.

- What are the margins for progress, their costs and the strategies conceivable by the farms which do not meet the greening reference criterion?
- What is the pertinence of the selection criterion? (Do the farms which meet diversification criteria have better performances as far as the environment is concerned?)
Figure 2: Typology of French farms not meeting the crop diversification criterion proposed within the CAP reform

![Figure 2: Typologie des exploitations françaises ne respectant pas le critère de diversification des cultures proposé dans le cadre de la réforme de la PAC](image)

Note: 1- one culture (or class of culture) is more than 70% of the acreage cultivated within the farm temporary meadows (31%), maize (22%), soft wheat (7%), other cereals (5%), others (9%)
2- two main cultures are more than 95% of the acreage cultivated within the farm (17%)
3- Other case (3rd culture is less than 5% of the acreage cultivated within the farm (9%)

It seems to be reasonable to think that a single criterion probably cannot be perfect as far as equity and efficacy are concerned, and we are should note that several adjustments of the rules initially suggested by the European Commission have been proposed. Thanks to the data available via the ODR, the rest of this paper examines the impacts on criterion selectivity of several adaptations, either thresholds or exemption conditions for farms referred to as “green” by definition.

Impact of several adaptations of the system of crop diversification

We examined various assumptions of adaptations of the regulatory scheme proposed by the Commission. First, we tested an increase in the diversity condition exemption threshold (from 3 to 12 ha of arable land) combined with application of the 70% threshold only to annual crops, therefore excluding temporary meadows (scenario 1). Second, we looked into an adaptation of the criterion of the number of crops for grassland farms (scenario 2). In both cases, the aim is to consider the positive agro-environmental impact of meadows. We have also tested the criteria proposed by the “Stockholm group” (scenario 3) to consider some agricultural systems de facto as “green”.

Both of the latter scenarios introduce original approaches which could modify the conception of the crop diversification scheme. Scenario 4 attempts to analyse “greening” implementation through a collective and territorial approach taking de facto the spatial distributions of crops at municipality scale into account, and not at farm scale. Scenario 5 introduces the pluri-annual dimension of crop diversity by the inclusion of a single-cropping presence criterion in the cultivated farmland.

Scenario 1: increase in the minimum threshold of arable land area

Switching from the minimum arable land area threshold of 3 ha to 12 ha enables 31,500 additional farms (as compared to the reference criterion) to meet the diversification criterion (maps 2 and 3). The application of the 70% maximum threshold only to annual crops enables 8,800 additional farms to meet this criterion. These two modifications bring the share of farms which do not meet the crop diversification criterion down to 12.5%, of which:

- 6.7% of farms (25,200) have three various crops but do not respect the maximum and minimum thresholds of 70 and 5%:
- 5.8% of farms (21,700) do not respect the criterion of three various crops.

Maps 2 and 3: Geographical distribution of Farms not respecting crop diversification

![Maps 2 and 3: Répartition géographique des exploitations ne respectant pas le critère de diversification des cultures](image)

Note: Scenario 1 – The application of the 70% maximum threshold only to annual crops (except meadows) and increasing the minimum threshold of arable land area to 12 ha enable to divide by 2 the number of French farms which do not respect the crop diversification criterion.
**Scenario 2: switching from three to four crops, except for grassland farms**

Second, we tested the impact of switching to four crops instead of three, in order to come closer to the diversification of the cropping pattern implemented by France within the CAP health check (article 68) in 2010. We combined this criterion with a reduction of the number of crops required for grassland farms, as follows:

- For farms which have less than 10% of temporary meadows, the number required is four. The aim is to take account of the fact that the farms with the most cereals can meet an increased requirement as to the diversification of crop patterns relatively easily;
- For farms which have more than 70% of temporary meadow, the number required is reduced to two.

In this case, 92,200 farms do not meet the criterion of crop diversification, making a net increase of 4,700 farms compared with the reference criterion (table 1). The following trends can be observed (figure 3).

- 28,000 farms, mainly with livestock or mixed activities, characterized by a small share of temporary meadows (exceeding 70% of the cultivated acreage), a source of biodiversity, and cereal crops for animal feed, now meet the criterion of crop diversity.
- 32,700 farms, characterized by a small share of temporary meadows (<10% in the cultivated acreage) do not meet the criterion of four various crops.

Up to 70% of these 32,700 farms have less than four crops. They correspond to a specialisation of the cultivated acreage (mainly cereals). For the other 30%, at least four various crops are present, but at least one of them does not respect the 5 or 70% thresholds.

The addition of the modifications made by scenario 1 and 2 reduces the number of farms which do not meet the criterion to 16%. The location and typology of these farms are presented in figure 3 and map 4. Unlike with the reference criterion, it can be seen that most areas of mountain and grasslands meet this criterion. This alternative allows more effective targeting of cereal farms, to make the measure more efficient. An agro-economic assessment of the adaptation capacity of farms was not conducted here: however nearly 11,000 farms do not meet the criterion as their fourth crop represents less than 5% of the cultivated acreage; a small increase in the share of that crop in their cropping pattern would help them meet the criterion.

**Map 4: Geographical distribution of farms not meeting the modified criterion (Cases 1 and 2 cumulated)**

**Figure 3: Typology of French farms not meeting the criterion**

Note: Scenarios 1+2 – Area threshold of 12 ha and number of crops depends on temporary meadows (TM) in cultivated acreage (CA):
- 4 crops where TM < 10% of CA
- 3 crops where 10% < TM < 70% of CA
- 2 crops where TM > 70% of CA
Given the available data, we consider meadows. The Commission has not yet been adopted by the European Council and Parliament.

The UAA meadowland cover criterion is the least restrictive. For a threshold fixed at 50% of the UAA of the farm, there are more than 167,000 farms (close to 45% of French farms) which meet this criterion. The mountainous areas, the Grand Ouest region and the bocage regions appear to be almost entirely “green”. More than 90% of the farms in these regions are “green by definition” (map5).

- The organic farming criterion appears marginal in terms of the numbers of farms concerned (less than 1%) given the data used.
- The Natura 2000 criterion concerns more than 11,300 farms (more than 3% which are located in areas not covered by the other farming which does not exist in the anonymous version of the RGP, but only some information on plots involved in the conversion to or maintenance of AB by contractualization in the current second pillar. This limitation severely reduces the number of farms concerned.

### Table 1: Number of farms not meeting the cropping pattern diversity criterion and share of the global population (Impacts of scenarios 1 and 2)

<table>
<thead>
<tr>
<th>Typology of farms not respecting crop diversification</th>
<th>Main crop (or type of crop) &gt; 70% of the cultivated acreage (CA)</th>
<th>Main crop &lt; 70% of the cultivated acreage</th>
<th>Other cases</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temporary meadows (TM)</td>
<td>Maize</td>
<td>Soft wheat</td>
<td>Other cereals (durum wheat, …)</td>
<td>Other specializations (barley, rape or sunflower…)</td>
</tr>
<tr>
<td>Initial diversification criterion (reference)</td>
<td>28,106</td>
<td>18,946</td>
<td>5,874</td>
<td>4,239</td>
</tr>
<tr>
<td>Maximum threshold of 70% cultivated acreage applied only to annual crops (except TM)</td>
<td>18,362</td>
<td>18,946</td>
<td>5,874</td>
<td>4,239</td>
</tr>
<tr>
<td>Area threshold of 3 hectares raised to 12 ha</td>
<td>24,084</td>
<td>12,307</td>
<td>2,427</td>
<td>1,640</td>
</tr>
<tr>
<td>Scenario n°1: combining both modifications above</td>
<td>14,915</td>
<td>12,307</td>
<td>2,427</td>
<td>1,640</td>
</tr>
<tr>
<td>Reduction in number of crops to 2 if TM &gt; 70%</td>
<td>0</td>
<td>18,946</td>
<td>5,874</td>
<td>4,239</td>
</tr>
<tr>
<td>Increase in number of crops to 4 if TM &lt; 10%</td>
<td>28,106</td>
<td>18,946</td>
<td>5,874</td>
<td>4,239</td>
</tr>
<tr>
<td>Scenario n°2: combining both modifications above</td>
<td>0</td>
<td>18,946</td>
<td>5,874</td>
<td>4,239</td>
</tr>
<tr>
<td>COMBINING both Scenarios</td>
<td>0</td>
<td>12,307</td>
<td>2,427</td>
<td>1,640</td>
</tr>
</tbody>
</table>

### Scenario 3: considering “green” farms by their structure or orientation

15 member States meeting within the “Stockholm group” suggested several variations for greening and particularly an exemption for farms committed to some agro-environmental measures or having an environmental certification. The Commission adapted its proposal in that direction, but the final proposals have not yet been adopted by the European Council and Parliament.

In scenario 3, given the available data, we consider the farms respecting at least one of the following criteria to be “green by definition” (figure 4): (i) they participate in processes to convert to organic (AB) or maintain organic farming (a measure only adopted in some regions and mainly contractualized in Brittany), (ii) they have the majority of their area located in a Natura 2000 zone, (iii) they have more than 50% of the UAA covered by meadows. The Commission suggests exempting the farms which are completely in organic farming. However, the ODR does not have information on the cultivated lands in organic farms.
criterion, such as Sologne in the Centre region (map 5).

Scenario 3: Map 5 and fig 4: Development and geographical distribution of farms that are “green by definition” according to the UAA share in AB, Natura 2000 or covered with meadows

On a stable basis between 2007 and 2009, more than 45% of the farms (172,424 in 2009) can be defined de facto as “green”, each one meeting at least one of the previous criteria (the spatial distribution of farms for all the criteria and thresholds presented is available on the ODR platform at this address: http://odr.supagro.inra. 45,801 farms that are not eligible according to the reference criterion are “green by definition” (table 2). These farms are usually located in the big grassland regions which are therefore predominantly exempted from the diversification criterion (maps 6 and 7). More than the modifications assessed in scenario 2, the exemption of 50% of meadows (scenario criterion which has the most impact) allows the eligibility of mixed crop-livestock farms that are ineligible according to the reference criterion.

Collective and territorial approach to “greening” implementation

Crop diversity and spatial distribution within the landscape matrix reduce bio-aggressor pressure. However, to meet this purpose, it is advisable that the crop diversification should apply to the same plot year after year, as well as also on a larger spatial scale for a given territory. We analysed the impact of introducing a crop diversification criterion no longer on the farm scale, but on that of the local territory. The territorial unit that we chose is the municipality; although it does not necessarily constitute a good operational level, the objective here is to show the effect induced by this change of scale. To compare results, the territorial indicator used is the area of blocks (cumulated at the district level) meeting the crop diversification requirements, calculated on the basis of the farms or municipalities meeting the same criterion. The same criteria are mobilised in the two approaches except for the minimum area of cultivated crop in the case of the calculation at municipality scale.

Maps 6 and 7: Geographical distribution of farms not respecting the diversity criterion of cropping pattern proposed within the CAP reform after consideration Stockholm group proposal and alternate scenario

Note: reference criterion 23% of farms, case-study n°3 11% of farms
Table 2: Number of farms the cropping pattern diversity criterion

<table>
<thead>
<tr>
<th>Typology of farms not meeting the criterion of crop diversification</th>
<th>Main crop (or type of crop) &gt; 70 % of the cultivated acreage (CA)</th>
<th>Main crop &lt; 70% of the CA</th>
<th>Other cases</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temporary meadows</td>
<td>Maize</td>
<td>Soft wheat</td>
<td>Other cereals</td>
<td>Other specializations (barley, rape or sunflower…)</td>
</tr>
<tr>
<td>Initial diversification criterion (baseline)</td>
<td>28,106</td>
<td>18,946</td>
<td>5,874</td>
<td>4,239</td>
</tr>
<tr>
<td>Impact of Scenario 3 Farms “green by definition” at the 50% threshold</td>
<td>-27,331</td>
<td>-4,054</td>
<td>-805</td>
<td>-1,206</td>
</tr>
<tr>
<td>Farms not meeting the criterion of crop diversification</td>
<td>775</td>
<td>14,892</td>
<td>5,069</td>
<td>3,033</td>
</tr>
</tbody>
</table>

Source: ODR – RPG 2009

Indicator calculated at farm scale

Block percentage (area) per district respecting the CAP diversification criterion of crops, calculated at farm scale

Maps 8 to 10:

<table>
<thead>
<tr>
<th>% of blocks respecting the criterion</th>
</tr>
</thead>
<tbody>
<tr>
<td>78.7%</td>
</tr>
<tr>
<td>57.1%</td>
</tr>
<tr>
<td>80.8%</td>
</tr>
</tbody>
</table>

Indicator calculated at municipality scale

Block percentage (area) per district respecting the diversification criterion of reference crops, calculated at municipality scale

Maps 11 to 13:

<table>
<thead>
<tr>
<th>% of blocks respecting the criterion</th>
</tr>
</thead>
<tbody>
<tr>
<td>70.7%</td>
</tr>
<tr>
<td>49.3%</td>
</tr>
<tr>
<td>82.9%</td>
</tr>
</tbody>
</table>

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For France as a whole, the calculation at municipality scale leads to a reduction (from 78.7% to 70.7%) in the percentage of blocks meeting the reference diversification criterion. Like in the results presented previously, arable crop territories would meet the criterion in their great majority, unlike regions dominated by grasslands. Assessment of the criteria at local territory level amplifies the contrasts between regions and reduces the transition areas (maps 8 and 11). The territorial approach to the diversification criterion leads to a weakening of the measure in the arable crop territories, because by working on the basis of territories which are of municipality size, much larger than that of the farms, statistically there is an increase in the number of crops, but this approach without any modification of the criteria would be more discriminant for livestock and mountain areas.

**Scenario 4: tighter cover ceiling and diversification requirements**

In this scenario we tested tightening the maximum cover requirement applied to the main crop, bringing it down from 70 to 60 % and increasing the number of various crops present on the cultivated acreage, requiring four or more. This assumption leads to a reduction in the number of blocks eligible by about 20 points for both approaches, based on the farm and municipality (maps 9 and 12). On the other hand, considering “green by definition” farms or territories enables the number of eligible blocks to be brought back to similar levels (80.8%) and 82.9%) (Maps 10 and 13). The effects of the two approaches (farm and municipality) are distinguished by their geographical location. The municipality approach leads to a net reduction in the mixed areas from the point of view of the diversification criterion. Such as it is implemented in this simulation, it penalizes not only cereal mono-cropping but also the wine areas.

**Pluri-annual approach to diversification**

Map 14 locates the plots cultivated with soft wheat in 2009 and already cultivated with the same crop the previous year (here we use results of the method of crop sequence reconstitution of the RPG 2006-2010, developed by the MAGE team from the INRA AGIR Unit). The greater Parisian Basin is mainly concerned. The main precedents of soft wheat are colza (32%), maize (26%) and soft wheat itself (17%) (See figure 5). This return of wheat on wheat generates an increased risk in terms of illness (take-all of cereals) and reinforced phyto-sanitary protection is recommended. To answer the issues raised by the INRA Ecophyto R&D study (Butault et al., 2010), it is advisable to introduce a pluri-annual diversification criterion, restricting the sequence practices encouraged by the rise in wheat prices.

**Scenario 5: inclusion of a pluri-annual diversification criterion**

Here we assess the impact of including a 5% of UAA maximum cover requirement in the event of a soft-wheat on soft-wheat sequence on farm eligibility for the diversification criterion. The soft-wheat on soft-wheat sequence (2008-2009) is used as an example. Other crop sequences remarkable for their failure to comply with recommended crop return times could be penalized (for instance durum wheat on durum wheat, maize mono-cropping).

In 2009, there were almost 36,778 farms for which the UAA was covered by at least 5 % of soft wheat covering a soft wheat crop in 2008. The 5% requirement would lead to the non-eligibility of 10,000 farms that were previously eligible within the reference criterion or within scenario 3 (“green by definition”). These are mainly located in the cereal-growing Greater Parisian Basin (Parisian Basin, East and North of France, see map 15).

Map 14: 17% of soft wheat areas in 2009 show a soft wheat-on-soft wheat succession

**Figure 6: precedent crops of soft wheat in France from 2006 to 2009**

Note: rapeseed – soft wheat (32%), maize – soft wheat (26%), soft wheat – soft wheat (17%), Sunflower – soft wheat (10%), other cereals – soft wheat (6%), others (9%)
Map 15: percentage of farm per municipality respecting the “greening” (green by definition, or respecting the reference criterion) where at least 5% of the UAA is covered by plots presenting a soft wheat-on-soft wheat succession, calculated at municipality scale.

To sum up, on the basis of the initial proposal of the European Commission, the crop diversification criterion would lead to the non-eligibility of 23% of the French farms. Nearly two-thirds of these farms have a grass speciality or a small cultivated area. We assessed the effects of a reform of the Commission proposals as regards diversification. Scenarios 1 and 2 take account of the positive impact of meadows, as a source of biodiversity, and place the impacts of farms with a small cultivated acreage into perspective. The combination of both these proposals reduces the number of non-eligible farms to 16% of the 372,500 farms in the study. The group of Stockholm proposal presented in scenario 3 introduces an exemption criterion for farms considered “green by definition”. This proposal would reduce non-eligibility to only 11% of the farms. The territorial approach developed in scenario 4 enables a more demanding system of crop diversification, but has the particularity of leading to a net reduction in the transition area between eligible and non-eligible territories. Use of the RGP data permitted us to test the inclusion of a pluri-annual diversity criterion in the scheme, presented in scenario 5. In France, in 2009, almost 17% of soft wheat areas have a succession of soft-wheat on soft-wheat. At farm scale, a maximum 5% maximum UAA cover requirement leads to the non-eligibility of nearly 10,000 farms that were previously eligible within the reference criterion.

The various criteria simulated in this study allow more effective targeting of the impact of a crop diversification measure. By connecting to ODR (“programme RGP”), it is possible (through an interactive interface) to simulate other variations in the diversification criterion: http://odr.supagro.inra.fr

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For further information


