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French Agriculture Addressing Climate Change

Report Categories:

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Grain and Feed

Livestock and Products

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Report Highlights:
Agriculture being a major source of greenhouse gas emissions and fossil fuel consumption in France, many research institutes have conducted programs to assess the impact of climate change on French agriculture and identify how agriculture can adapt to climate change. Climate change was identified as the major factor explaining the stagnation in wheat yields observed over the past decade in France. By contrast, corn yields have continued to increase gradually, and the same trend is expected in the next 30 years, actually benefitting from climate change. On cattle farms, reducing indirect energy consumption (consisting of fertilizer use and animal feed purchase) and increasingly producing and

consuming renewable energies (biogas to produce heat and electricity, photovoltaic electricity and biomass to produce heat) are recommended.

General Information:
This is a report of the proceedings of the work conceded to quantify the impact of climate change on French crop production and identify ways for animal breeders to adapt to climate change. A number of leading French research institutes presented their findings at conferences held on October 13 and 22. The institutes represented were the Animal Breeding Institute (in French, "Institut de l'Elevage"), the Crop Institute (Arvalis), the French Agency for Energy and Environment (ADEME), the National Research Institute for Agriculture (INRA), the National Research Institute for Agriculture (INRA), the French Research Center for Agriculture in Developing Countries (CIRAD) and the National Weather Forecast organization (Meteo France). The attendees of these conferences included members of the farming community and agricultural researchers.

- ## Impact of Climate Change on Crop Production: Winners and Losers

In France, agriculture is a major source of greenhouse gas emissions and fossil fuel consumption, and the French government has taken a number of policy initiatives to increase energy independence on the farm and develop bioenergy production (see GAIN report FR9022 [1]). Also, many research programs have been conducted to assess the impact of climate change on French agriculture and identify how agriculture can adapt to climate change.

INRA/CIRAD observed that in the French Mediterranean area, temperatures have increased faster than than normal since 1980, accelerating the development of plants, and causing species to mature earlier before. An expansion of the area covered by the Mediterranean climate in France was observed. The average water shortage has increased in summer and fall. According to ADEME, agriculture and forestry production will need to adapt to the reduction in water availability, increase in pest damage, modification in vegetative periods, and slow down in yield increase.

- **Wheat**

Arvalis and INRA have studied the stagnation of average wheat yields since 1980. They concluded that climate change, with drought and higher temperatures, is the major factor explaining this stagnation, particularly since 1995, more than genetic improvement, fertilizer use, crop protection, or crop rotation.

The French Animal Breeding Institute has recommended that wheat should be planted earlier, and earlier wheat varieties should be grown to avoid scalding, high temperatures, and strong water deficit. Arvalis noted that with warmer conditions and an earlier end to winter, farmers could begin planting earlier in the season.

Arvalis recommended that research on wheat varieties target shorter maturity than they do currently, so that grain test weight would not decline.

Author's perspective: As the largest producer of wheat in Europe and a major exporter of wheat on world markets, France is concerned by the stagnation of yields, and many agricultural specialists are currently analyzing the phenomenon. Given the recent statements made by U.S. wheat producers in favor of adopting biotech wheat, French farmers are expected to closely monitor trends in U.S. wheat vields in the next few years.

- **Corn**

Arvalis and INRA observed that, unlike wheat yields, average corn yields continued to increase in the past 20 years in France. This included higher yields in Northern France, where higher temperatures were more favorable to corn development, and a declining trend in Southern France, were drought affected corn yield potential. In fact, corn cultivation of earlier varieties in areas of water deficit benefitted from higher temperatures and limited drying costs. The area of corn infestation by pests has significantly expanded (including corn borers, sesamias, and wireworms), however.

Based on modeling and simulation, Arvalis and INRA concluded that perspectives for average corn yields are favorable in the medium term until 2050, due to production cycles adapting to climate change, and harvested corn having lower moisture content than the current average, therefore reducing drying costs. Until 2050, corn yields are expected to increase, benefitting from higher carbon dioxide concentration in the atmosphere. However, perspectives are negative in the longer-term (2070-2100), as summer droughts are expected to be more severe and temperatures significantly higher. Corn plantings would need to take place earlier than current practices. Corn varieties planted would need to be more resistant to drought and higher temperatures. Increased needs for irrigation are expected to require more water storage in winter.

For planting seeds, Arvalis and INRA recommended that research on corn seeds focus increased tolerance to high temperatures and drought, but also to low temperatures expected in the early stages of the developing cycle (as corn is anticipated to have to be planted as early as February), and to higher rates of carbon dioxide in the atmosphere.
Given the past and current expansion of pest infestation areas, Arvalis underlined crop protection was a key element to manage in the future.

Author's perspective: Although adaptation of crop protection to climate change was not surveyed in the research programs presented in these conferences, reinforcing crop protection against pest damages damages is obviously a key line of research for seed companies. French researchers have already observed a higher number of generations of the corn borer within one year, and an expansion of the infestation area on sesamia (another corn pest) in some areas. In this regards, it is important to note that the biotech corn event currently banned in France (MON810) protects corn against these two insects. The impossibility for French corn growers to plant this corn reduces the number of tools they can use to protect their crops.

• Dairy and Livestock Production Adapting to Climate Change

According to the French Animal Breeding Institute, GHG emissions by cattle production mainly include methane emission through enteric fermentation during cattle digestion (49 percent), followed

by nitrous oxide emission through fertilization and animal waste (37 percent), and carbon dioxide emission due to input purchases and fuel and electricity use (14 percent). Overall, energy consumption by cattle farms totals 15 percent of GHG emissions, of which 5 percent direct energy consumption and 10 percent indirect energy consumption through input use.

- **Reducing Energy Consumption**

The French Animal Breeding Institute studied the energy consumption of livestock and dairy farms, and concluded that indirect energy consumption (including fertilizer use and animal feed purchase) is where there is highest potential reduction, by contrast with direct energy consumption (including electricity and oil-derived products consumption).

To reduce indirect energy use, the research institute recommended mainly to reduce the use of imported animal feed and favored the use of locally-produced feed. It also recommended reducing the use of chemical fertilizers and using more organic fertilizers (legume cultivation, inter-crop cultivation, use of animal waste).

- **Producing and Consuming Renewable Energies**

<u>Biogas</u>

The French Animal Breeding Institute considers on-farm methanization can reduce methane emissions by 60 percent compared to traditional waste storage on cattle farms, and the biogas produced could replace fossil energies. A co-generation process produces 35 percent electricity (sold to the electricity company and injected on the public electrical network) and 50 percent heat (hot water, hot air, or fuel gas to be used on the farm).

The research institute believes on-farm methanization not only meets environmental objectives (GHG emission reduction, production of renewable energies), but also meets social and regional objectives (diversifying sources of farmers income, improving animal waste management by farmers, modernizing public perception of farmers as suppliers of "green energy"). However, biogas production represents high maintenance and high capital investment. This may require several farmers to join their efforts in starting such production.

<u>Photovoltaic Electricity</u>

Photovoltaic electricity production requires heavy investments like biogas production, but low maintenance. There are numerous French farmers currently investing in photovoltaic electricity production, despite the high investment in equipment needed to start such business. This results from the subsidized prices at which the electricity produced is purchased by the national electricity company "Electricite de France" (EDF) when injected in the public electricity network. Support prices are expected to be reduced to zero by 2020.

ADEME and the French Animal Breeding Institute consider that, with solar panels placed on the roof of farm buildings, the orientation of the buildings relative to sunlight, wind and land slope need to correspond to optimal electricity production and is adequate with animal breeding.

Biomass to Produce Heat

Straw and wood are the main sources of biomass available on farms. ADEME and the Animal Breeding Institute believe biomass-based energy is viable provided local biomass is used to produce heat to local customers. Like biogas production, biomass-based energy production represents an opportunity to add value to products usually wasted with no use, but is a new sector that needs to be built.

Author's perspective: While French renewable energy production has almost exclusively consisted of biofuel production (mainly biodiesel made from rapeseed and bioethnaol made from wheat and sugarbeet), the initiatives presented above tend to diversify France's bioenergy production. While crop producers had almost the monopoly on these technologies, livestock producers are now increasingly involved. This illustrates the fact that the whole French agriculture is now involved in fighting climate change.

- **R&D - Innovation**

CLIMATOR (2007-2010), funded by the French National Research Agency (ANR), and conducted by research institutes, universities, and Meteo France aims to supply methods, tools and references on the impact of climate change on various agricultural ecosystems located in the various climates of France.

The ADAGE project, funded by ANR, coordinated by INRA, and including 150 French scientific experts, industry and public authorities, aims to identify the needs for R&D and develop an ambitious national research strategy.

[1]

http://gain.fas.usda.gov/Recent%20GAIN%20Publications/French%20Agriculture%20and%20Climate%20Change_Paris_France_8-28-2009.pdf