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in agriculture and the agri-food industry**

Book of Abstracts



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Sunflower Seeds Innovation to Improve yield Stability in a changing Environment

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Extended Abstract

The world oilseed production will be faced to an increasing demand in the next thirty years catapulted by a combination of many factors such as the development of the biofuels industry and more specifically biodiesel around the world, the needs for green chemistry and of course the additional demand of edible oil. Sunflower represents a major renewable resource for food (oil), feed (meal), and green energy. It is one of the main two oil crops in Europe in term of acreage and production, with strong environmental advantages especially when it is included in rotation systems. Sunflower, apart from its multiple agronomic and environmental characteristics, presents also for farmers and for industry many market opportunities due to the various outlets that it presents. However, this crop seems to suffer severely from a competition with all the other massive crops and especially other oilseed crops. Thus, despite of many a priori advantages of this crop, its development seems to be rather moderate in many countries as it is the case in France. (Guinde et al., 2008) Sunflower has demonstrated sustained productivity gain over the last four decades, suggesting an important potential for further improvement. However, in the context of climatic change and of the increasing societal demand for an environmentally safe agricultural production, the next step in further improvement is expected from a better adaptation to limiting environmental conditions, which will lead to increase the stability of production and a better crop competitiveness for farmers and oilseed industry. The overall objective of the SUNRISE project is to contribute in the development of new sunflower varieties improving yield stability under limited water supply conditions.

Taking as an example the French sunflower industry, we tried to understand how the agricultural sector can be more sustainable (Bonneuil et al, 2006). The innovative varieties can serve different objectives. If the research of new varieties are mainly oriented towards to the "input traits" by improving the cultural criteria (disease resistance, herbicide, etc) other varietal innovations may have turned to "output traits", related to the quality of the final product (capacity for processing, nutritional quality, etc). Sunflower industry is interesting because it combines these two

objectives in order to create a homogenous framework for the adaption of the innovated seeds. Indeed, during 80's the sunflower industry developed an oleic chain by offering a richer ω_9 seed and as a result, opened new markets for sunflower production (energy, biochemistry, food industry). This innovation on output changed

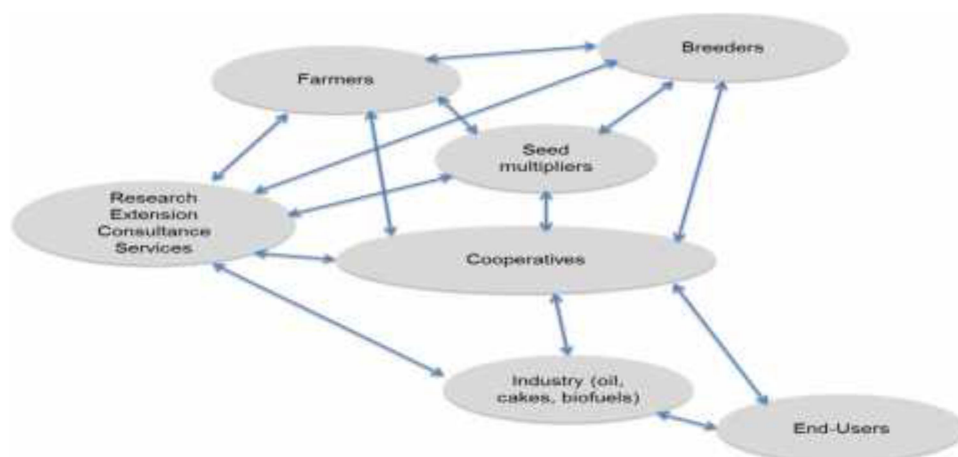
the target of innovative varieties and established new diffusion strategies, and France appeared to be the leader of this industry overtaking other producers such as Russia and Ukraine. This program allow us to produce a complete study of the innovative varieties markets and of the relations between the actors by determine the selection criteria of the innovative seed in order to examine the future and the opportunities of this industry. (Borredon et al, 2011;Jouffret et al, 2011)

The team of economists implied in the SUNRISE project research has been assigned a specific role. The purpose of our socioeconomic work is to analyze societal impacts of new sunflower ideotypes at different relevant scales (farms, supply chain(s), national or European etc). Our analysis is divided in two parts. Firstly, is farm-focused as individual unit of adoption of new practices. Secondly, is focused on the actors of agro-chains in order to identify coordination aspects which can enhance competitiveness and the conditions of acceptance of new hybrids. We will analyze impacts and diffusion conditions of such innovation in sectors and territories with specific focus on the collecting organizations, including agricultural cooperatives because of their role at the interface between farmers and the backing of the industry. Their capacity for organizing production and market appear predominant to enhance the sunflower production. Moreover, we aim to analyze the potential capacity of contractual relationships along the agro-industrial chains to adapt itself to the technological change linked with new hybrids. We will identify the nature of risks and uncertainties perceived by the sunflower trade and transformation actors and will analyze the potential lock-in and new needs in the coordination arrangements.

In order to accomplish our objectives we will mobilize a wide range of quantitative and qualitative methods to meet the objectives identified in this program such as field surveys and interviews with various stakeholders (cooperatives, industry, consumer associations, professional organizations, government officials, etc.), scenario-building method with multi-criteria analysis, bio-economic modelling and econometrics of individual data, including contracts. Significant investment is expected to get the data needed to implement the different methods (data available from statistical agencies, professionals and project partners, or survey data that will be collected by us).

A first analysis shows that an innovation is an essential lever for the evolution of the sector, only if its adequacy with outlets and economic -but also societal - objectives will insure its diffusion, relevance and sustainability. The analysis of the whole sector was a crucial part of our work and reveal the co-evolution of market and innovations (illustrated by reconversion of oleic innovation to biofuel outputs toward food industry's one). Furthermore, only the understanding of the respective importance of the three main sunflower outlets (oil, cakes, hull) reveals the interest for a higher protein rate in seed, which enable (while keeping the oil yields), to propose cakes richer in proteins (and so reusable in animal sector as poultry, which are strongly dependent on imported soya cakes). Our analysis also highlights the importance of external factors which consequently impacts this co-evolution of innovation/market and establishes a sustainable strategy.

Socio-economic analysis of the sunflower crop sector



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