Barriers and enablers to crop diversification: a case study from France

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ABSTRACT BOOK

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Canola Rotation Effects on Subsequent Wheat in the Dryland Pacific Northwest, USA

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Abstract: Winter canola (WC) is considered the most promising, domestically-produced oilseed feedstock for biodiesel production and for diversifying wheat-based cropping systems in the Inland Pacific Northwest, USA. Canola serves as a break or non-host crop for many important soil-borne pathogens of wheat and helps farmers control weeds. Most studies in the literature on wheat-based cropping systems report that canola has a positive effective on subsequent cereal crop yield. We conducted a 6-year rainfed field experiment near Davenport, WA to measure the effects of WC versus winter wheat (WW) on the subsequent production of spring wheat (SW). No previous brassica or other broadleaf crop had ever been grown on this farm in 140 years. Averaged over the years, there were no differences between WC and WW in soil water use or water recharge into the soil over the winter. High yields of WC and WW were achieved. Subsequent SW had excellent plant stands, was weed free, was adequately fertilized, and had no foliar or root diseases. Root lesion nematodes were not a factor. Average SW grain yield following WC was 3292 kg/ha versus 3897 kg/ha following WW; a 17% difference ($p<0.001$). Visual differences in SW treatments were also apparent. Soil cores from SW were obtained each year in 5-cm increments to a depth of 15 cm. Comprehensive laboratory analysis of these cores was conducted each year to determine any soil microbial differences using phospholipid fatty acid analysis for biomarker groups of fungi, mycorrhizae, Gram-positive, and Gram-negative bacteria. The abundance of these fungi and bacteria were significantly reduced after WC versus after WW. This study provides novel information on efforts to enhance oilseed production in the Inland Pacific Northwest and the influence of brassica crops on soil microbiology and subsequent performance of wheat.

Keywords: Canola, Rotation effects, Soil microbiology, Wheat

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Barriers and Enablers to Crop Diversification: a Case Study From France

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Abstract: Rural areas and farms in France have become more and more specialized, while there is evidence that crop diversification can largely contribute to reducing input use in agriculture (pesticides, fertilizer, irrigation) and related negative environmental impacts. This study analysed potential obstacles to crop diversification at various levels of the supply chains through two approaches:

- Interviews with stakeholders, to conduct a cross-cutting analysis of impediments to the development of various diversification crops;
- A detailed study of the value-chains and of their modes of coordination, focusing on three case studies: pea and linseed for animal feeding, hemp for insulation and biomaterials.

A lock-in was identified around the dominant species, such as wheat, rapeseed, and maize, which are more and more profitable with increasing investments in genetics, agronomic references, markets... This situation has been favoring short rotations over time. This lock-in caused several inter-connected impediments hindering crop diversification, such as:

- the lack of availability of crop varieties and methods of crop protection for minor crops,
- the scarcity of data on performances of minor crops at the crop rotation level,
- the complexity of the knowledge to be acquired by farmers,
- logistical constraints to harvest minor crops, and
- the lack of coordination within the emerging supply chains.

The simultaneous and coordinated implementation of two major categories of levers was proposed to help actors incorporate greater crop diversity into their productive systems and foster agroecological transition:

1. Support the development of innovative niches and develop learning-for-innovation processes through e.g. long-term partnership between supply chain actors, research and development, advisory and decision-makers, labelling systems, investment in technological innovations for minor crops, management of crop diversification at landscape level;
2. Encourage the standard sociotechnical system to evolve and make it more disposed to crop diversification, through public policies, including the Common Agricultural Policy, regulation and promotion of diversified value chains via public contracts.

All recommendations have to be considered simultaneously and on the long-term, as sectorial measures, which target only one component of the value-chain, have proven to fail.

This study was a direct source of inspiration for the ongoing H2020 project DiverIMPACTS (Diversification through Rotation, Intercropping, Multiple Cropping, Promoted with Actors and Value Chains towards Sustainability, http://www.diverimpacts.net/), which uses the same theoretical framework, further extends the case studies to intercropping, multiple cropping and crop rotation strategies across Europe, goes beyond the identification of barriers to co-design practical solutions together with value chains' actors and makes recommendations for institutional changes.

Keywords: crop diversification, lock-in, value chain, arable crops

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Teaming Up for Increased and Sustainable Productivity: Who, When and Why?

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Abstract: There is overwhelming evidence from academic research in different ecosystems supporting the hypothesis that plant biomass production for food, feed and biomass can be increased by enhancing the number of plant species, varieties or genotypes grown in the stand. Despite the evidence from this research, most land users in agriculture are hesitating to adopt more diverse cropping systems, and monocultures still remain the main source for food and fiber worldwide. There are various reasons for the reluctance of growers to use more diverse cropping systems, including the complex biological interactions in space and time that are difficult to predict; but also management issues and grower attitudes. We here focus on the biological interactions, addressing the identity of cropping system components ("who"), different time scales ("when") and mechanisms ("why") that may be