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## **CAN A FULL VALUE CHAIN BE ESTABLISHED FROM THE FIELD TO THE FIBRES FOR THE PRODUCTION OF FINE GARMENT TEXTILES FROM HEMP FIBRES**

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### **ABSTRACT**

This work discusses the potential of hemp fibre for the establishment of a complementary value chain for the production of fine garment textiles. The work seeks to demonstrate that sufficient dew-retted straw can be produced and high fibre yields obtained at the output of the scutching/hackling processes together with a high fibre quality in terms of morphological (fineness) and mechanical potential for the production high added value fine yarns. The possibility to establish a complementary value chain to flax is analysed.

### **INTRODUCTION**

At the present time the main income for the hemp farmers is constituted by the seeds and the surfaces cultivated with this goal are in constant rise. However, the historical resource constituted by the fibres and in a lower extent by the shives (woody part of the plant) should not be neglected in the frame of a long-term valorisation of this plant (Tang 2016). Nowadays, the fibres are used (after the harvest of the seeds) for paper manufacturing or for short fibre reinforcement in polymer composites. In the meantime, the demand for flax long line fibres for fine garment textile is always increasing. However, the land available in traditional European production areas is globally used at its maximum potential and an alternative source of long fibres that could be used for the textile industry for fine garment product would be welcome. Traditionally used for this purpose before its ban in mid-20<sup>th</sup> century, hemp fibres could be complementary to the flax ones and the cultivation of hemp plant introduced within the flax rotation in traditional production zones. In Normandy, because of its wet weather in the autumn, it is difficult to imagine harvesting hemp at seed maturity if one wants to conduct a dew-retting step in good conditions and bale dry straws in October. The harvest should therefore take place early in the summer close to the flowering period and the crop is therefore dedicated to fibre production (and shives as a by-product).

Several challenges at the harvesting step and at the fibre extraction step using the scutching process have to be tackled. At the harvesting step, new harvesting machines now exist on the market and are improved every year to reach the requirements of an industrial production. The management of dew-retting was also very much studied and can be successfully conducted by the experimented farmers in the traditional flax production zone.

For a new value chain to develop, sufficient fibre yields and particularly the long line fibre which constitutes the highest income for a fibre dedicated crop should be reached.

This work therefore proposes to discuss the straw production yields for different varieties cultivated in France and Italy and then discuss the fibre production yields and the amounts of fibres that can be expected at the end of the scutching/hackling industrial processes.

## RESULTS AND CONCLUSIONS

During her PhD, (Grégoire 2021) showed that high long line hackled fibre yields could be reached using a laboratory scale scutching/hackling device. Hackling yields of up to 18% of the hemp stem mass was reached and the quality of the fibres was equivalent to the one obtained using an industrial device. Until recently, very low fibre yields were obtained at the output of the scutching/hackling processes (Musio 2018), but improvements suggested following the lab scale results conducted with specific process parameters were obtained and fibre yields were globally doubled to reach values close to 20% for the scutching yields and 10% after the hackling process.

The morphological and mechanical properties of the technical fibres obtained at the end of the hackling process were determined for different hemp varieties and analysed in relation to their potential for fine yarn transformation. Beyond the lab scale analysis, the fibre produced were analysed and qualified by the spinning industry buyers and judged for the best batches as high potential for fine yarn production, confirming the lab morphological and mechanical tests results.

Straw yields of three dew-retted hemp cultivars in different places coming from different places in Europe are discussed and the fibre yields obtained are also compared to the amounts of flax fibre obtained per hectare. The possible source of income of textile dedicated hemp is discussed, analysed and compared to the ones provided by traditional crops such as wheat for example so that to estimate if hemp can be at the source of a complementary value chain to the flax one.

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