Hemp, a Novel Food Crop for Scottish Agriculture: A Report Comparing the Nutritional Profile of Several Harvests of Hemp Seed from North-East Scotland

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Background: Increasing agricultural diversity by inclusion of sustainable and environmentally beneficial food crops is a strategic response from the agricultural sector towards mitigation of greenhouse gas emissions to support Scotland in achieving its net-zero targets. Hemp can produce sustainable and greener alternatives to wood, paper, textile, plastic and construction materials, being historically grown (from 1000 AD) in Scotland for fibre. Hemp's environmental qualities are mainly due to its capacity for carbon sequestration, requirement for lower inputs and its contribution to land recovery and remediation.

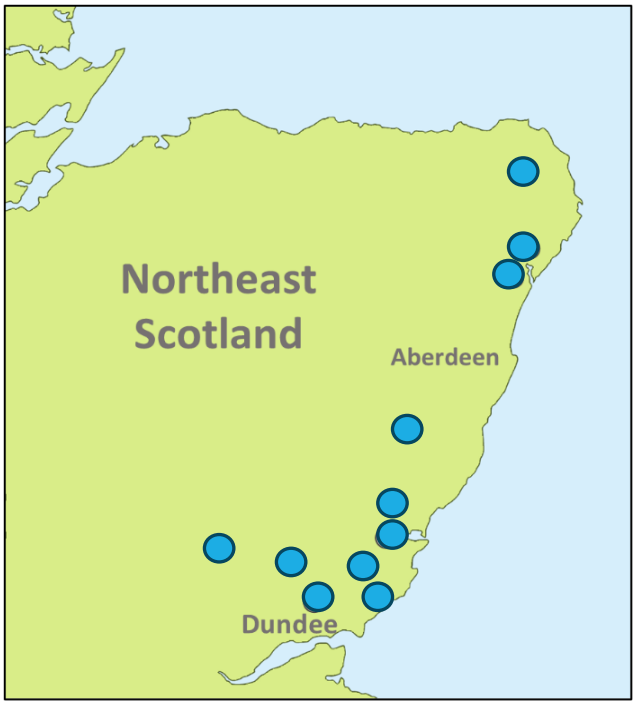


Figure 1: The map of the locations growing hemp in Scotland.

Key Points

In Scotland, changes in primary food production could be part of the strategic solutions to meet the ambitious target of net-zero GHG emissions by 2045.

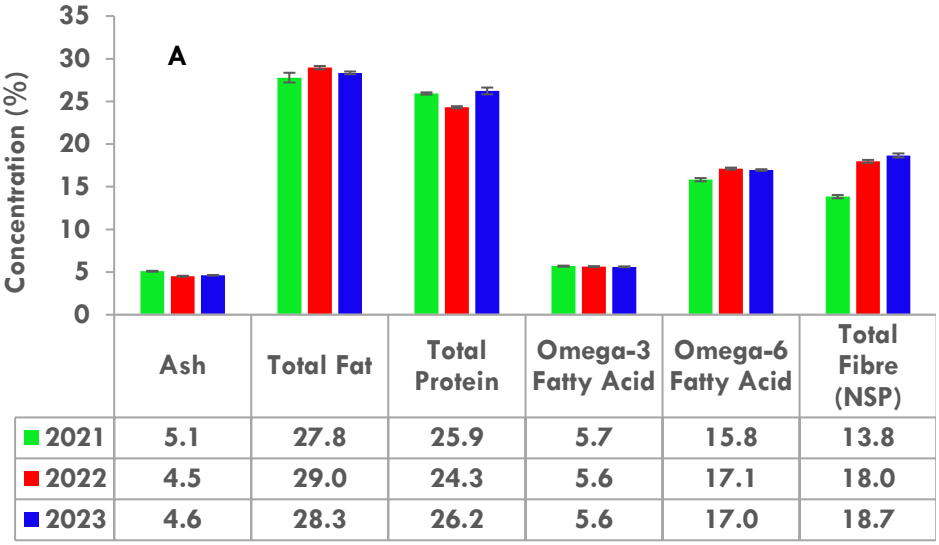
Hemp seed has an excellent nutritional profile and can contribute to dietary macronutrient diversification (i.e. protein, fat and fibre) and to contribute to meeting the Scottish populations dietary needs and recommendations. Moreover, hemp seeds represent a much-needed sustainable feed replacement for soyabean.

Several agricultural hemp varieties were successfully grown in Scotland, with an average of 131 growing days, in various locations with different altitudes and soil types.

Agricultural hemp could become a new 'cash-crop' for Scottish agriculture and play a key role in the development and expansion of a low carbon environmentally friendly industry.

The aim of this study is to assess the nutritional and phytochemical composition of the hemp seeds grown in Scotland for three consecutive years (2021, 2022 and 2023) and to correlate them with agronomic, geographical location and harvest parameters. Moreover, to identify which is the best variety of hemp to grow as a food crop in Scotland.

Research at the Rowett Institute was pivotal for reintroducing hemp to Scottish agriculture and for the first time, to produce hemp for food production. This report summarises the main findings from the first research on Scottish-grown hemp, investigating how agricultural practices impact on the nutritional quality of the seeds.



	Ash	Total Fat	Total Protein	Omega-3 Fatty Acid	Omega-6 Fatty Acid	Total Fibre (NSP)
2021	5.1	27.8	25.9	5.7	15.8	13.8
2022	4.5	29.0	24.3	5.6	17.1	18.0
2023	4.6	28.3	26.2	5.6	17.0	18.7

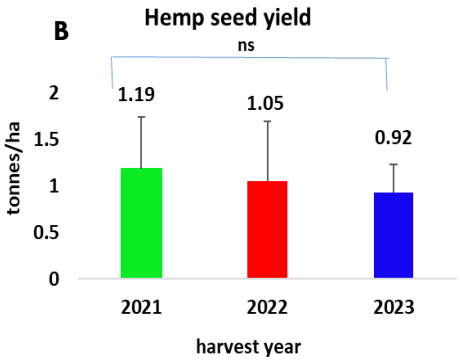


Figure 2: Nutrient content of hemp seeds (A) and harvest yield (B) of Finola variety harvested over 3 years in NE Scotland (as average n=9 farms for 2021, n=8 farms for 2022 and n=3 farms for 2023)

Main preliminary findings:

- Our study has informed Scottish farmers that Finola hemp seed is the best variety to grow in Scotland for oil production, as it was significantly higher in fat content then the other varieties trialled (Finola vs Henola trialled in 2021and respectively Finola vs Estica, trialled in 2023).

-On average the growing period for hemp seeds to reach maturity in Scotland was 131 days, varying from 125 days to 153 days across all the farms trialled and the yield was around 1 tonne/ha across all the farms and years of harvest.

-Hemp seeds (Finola) grown in Scotland are a rich source of protein (24 to 26%), fat (28 to 29%), and non-starch polysaccharides (13 to 19%).

- The protein content of the hemp seeds grown over the three years is significantly affected by sowing date, finding a positive correlation between the protein content and the sowing date.

- The number of growing days is positively correlated with the fibre content (soluble and insoluble non-starch polysaccharides). The insoluble NSP content has been negatively correlated with the sowing date, finding significant correlations between this type of fibre content and sowing date.

- The minerals content of the seeds showed a strong variability over the three harvest years but are not affected by the farm location and soil type. The calcium content of the hemp seeds grown over the three years is significantly affected by sowing date, with a negative correlation between this mineral content and the sowing date.

- Hemp seeds were rich in several phytochemicals with syringaresinol being the most abundant metabolite measured across all the harvests. Syringaresinol is a phytochemical with strong antioxidant properties.

Recommendations:

- Based of the results obtained in this study we recommend the cultivation of the hemp Finola variety for oil production in Scotland.

- In Scotland, the hemp seeds should be sown towards the end of April and harvested by mid-October with a minimum growing period of 120 days to reach seed maturity. A later sowing date yields higher protein content and lower contents of dietary fibre and calcium in the seeds.

-Hemp can grow without the use of pesticides and fertilisers in Scotland. Further, larger and longer dedicated agronomic trials are necessary to better understand the relation between nutritional quality of hemp seeds and agricultural practices in Scotland.