



# Variability in fatty acid concentration in hemp (*Cannabis Sativa L.*) seeds depending on soil conditions

Michaela Kotsiou

Supervisors: Doc. Annelie Damerou<sup>1</sup>, Doc. Benjamin Fuchs<sup>2</sup>, Prof. Baoru Yang<sup>1</sup>

<sup>1</sup>Department of Life Technologies, University of Turku, <sup>2</sup>Biodiversity Unit, University of Turku

FOOD DEVELOPMENT( TECH.)

## Introduction and Aim

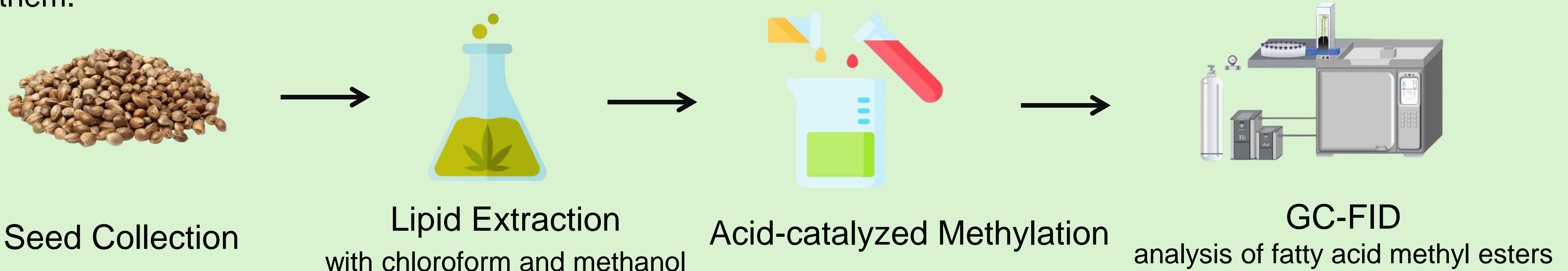
Hemp (*Cannabis Sativa L.*) belongs to the *Cannabaceae* family and the *Cannabis* genus. Hemp seeds consist of 25–35% lipids, 20–25% protein, 20–30% carbohydrates, and 10–15% insoluble fibers and minerals. The high concentration of polyunsaturated fatty acids (PUFAs) in hemp seeds is mostly responsible for their benefits on human health and depends on plant growth conditions [1].

This study aims to investigate the effects that different soil conditions, in particular processing with *Arbuscular Mycorrhizal Fungi* (AMF) and glyphosate residues, have on the lipid content and the fatty acid composition of hemp seeds.



## Materials and Methods

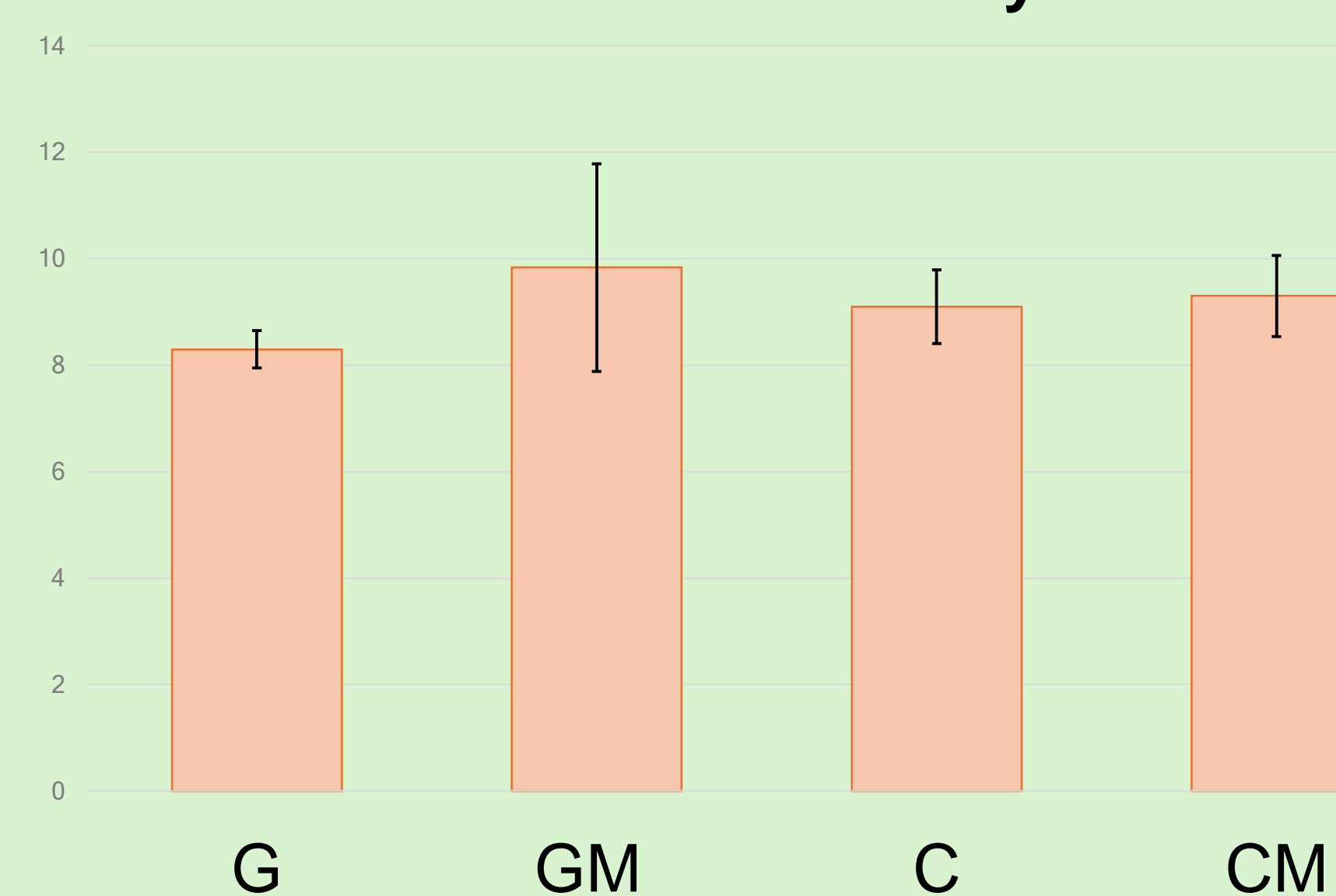
The plants were cultivated at research greenhouses at the Botanical Garden of the University of Turku. Four different soil treatments were used including control soil (C), control soil with the addition of mycorrhizal fungi (CM), soil that contains glyphosate residues (G), and soil with glyphosate residues and mycorrhizal fungi (GM). The total number of samples was 44, including 5 biological replicates for CM, G, and GM, 7 biological replicates for C, and 2 analytical replicates for each of them.



## Results and Discussion

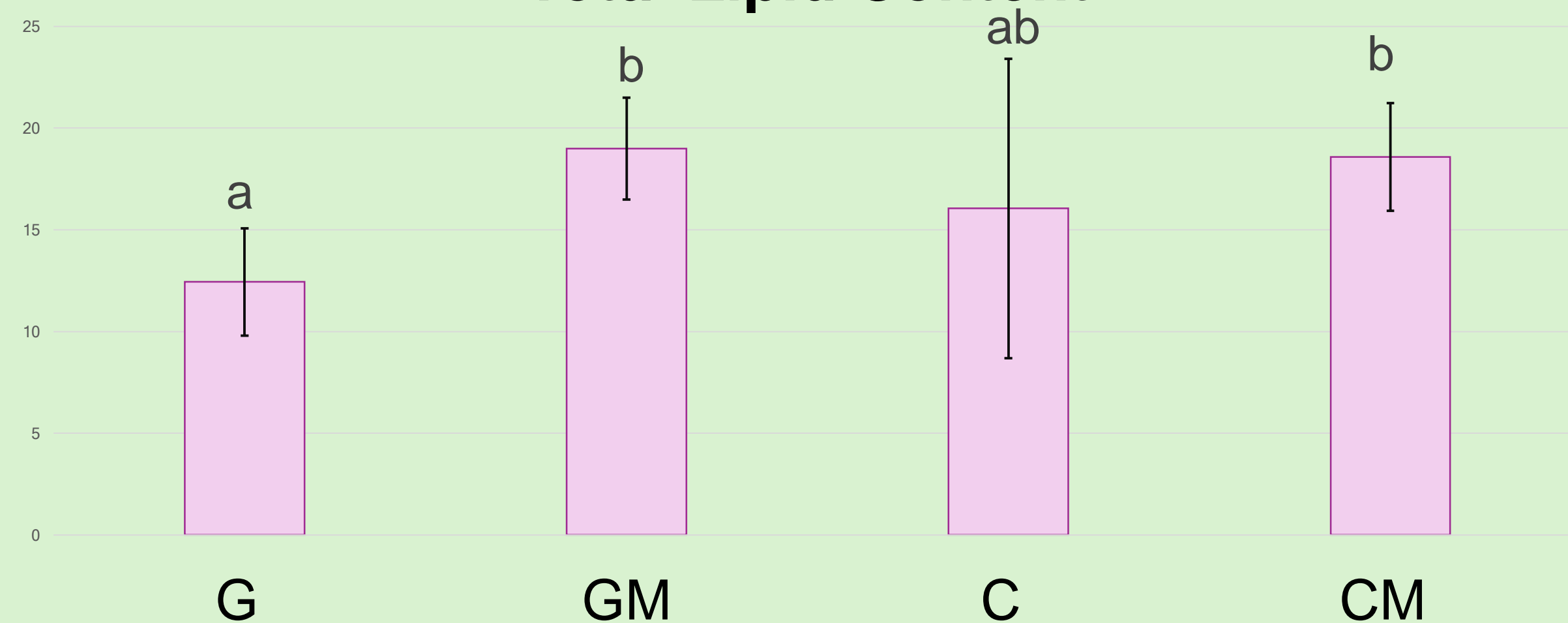
Name	C:D ratio	Concentration(%)
Palmitic acid	16:0	5.26-5.40
Stearic acid	18:0	2.33-2.40
Oleic acid	18:1(n-9)	7.06-8.68
Linoleic acid	18:2(n-6)	50.00-50.83
α-linoleic acid	18:3(n-6)	4.65-5.38
γ-linoleic acid	18:3(n-3)	19.70-21.43

### Monounsaturated Fatty Acids



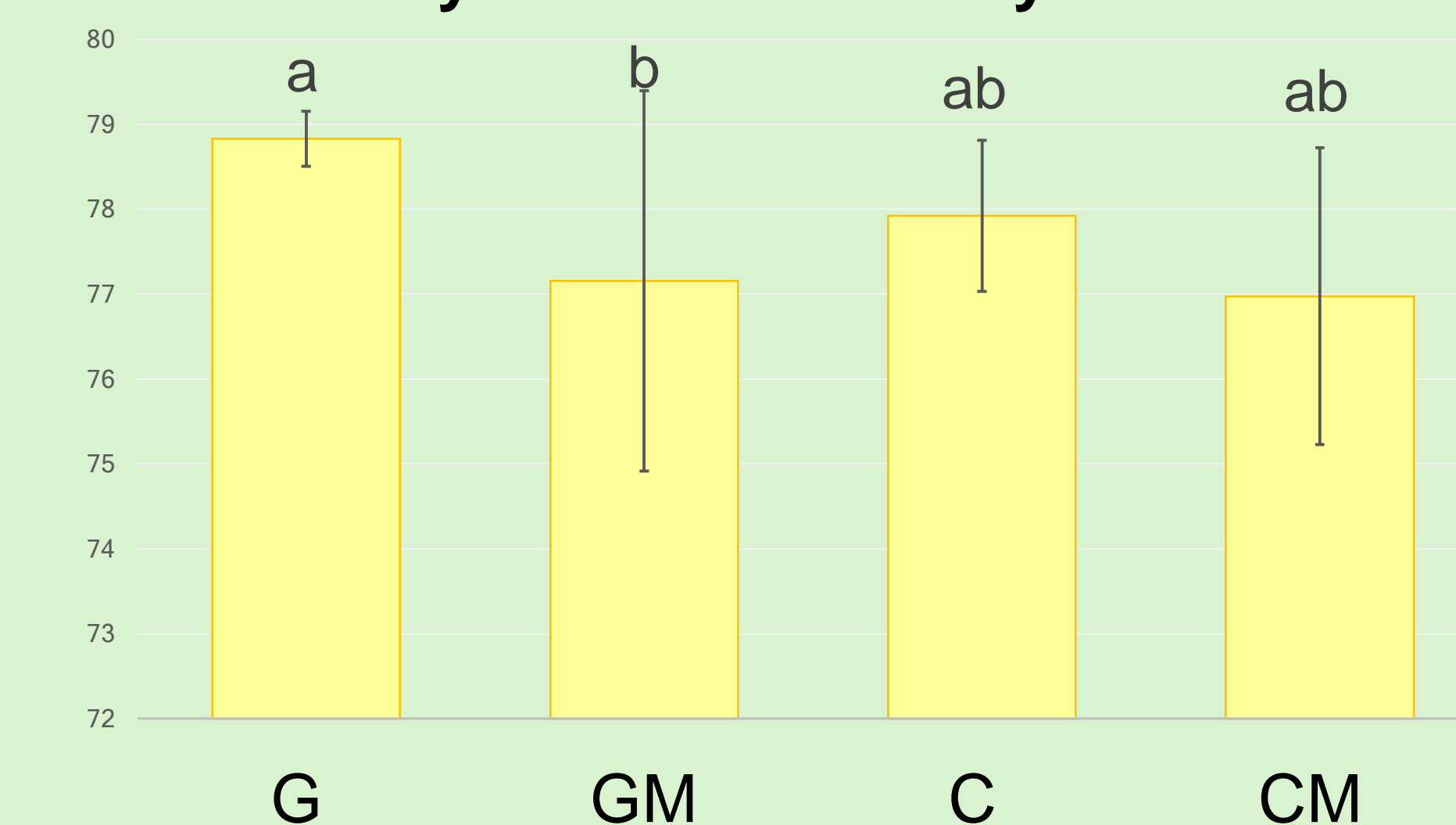
The content (in %) of monounsaturated fatty acids increased by the addition of AMF. The MUFA with the highest concentration was oleic acid.

### Total Lipid Content



The total lipid content is increased by the addition of AMF. Previous studies showed that AMF has positive impacts on the oil content and oil quality by increasing the availability of precursor compounds involved in fatty acid biosynthesis [2].

### Polyunsaturated Fatty Acids



The content (in %) of polyunsaturated fatty acids decreased by the addition of AMF. The PUFAs with the highest concentration were linoleic acid, α-linoleic acid, and γ-linoleic acid.

## Conclusion

The addition of mycorrhizal fungi had a positive effect on total lipid content and both positive and negative effects on the fatty acid composition since polyunsaturated fatty acids are the most important factor in regard to human nutrition for hemp seeds.

## References

- [1] Rehman, M., Fahad, S., Du, G., Cheng, X., Yang, Y., Tang, K., Liu, L., Liu, F.-H., & Deng, G. (2021). Evaluation of hemp (*Cannabis sativa L.*) as an industrial crop: A review. *Environmental Science and Pollution Research*, 28(38), 52832–52843. <https://doi.org/10.1007/s11356-021-16264-5>
- [2] Amani Machiani, M., Javanmard, A., Habibi Machiani, R., & Sadeghpour, A. (2022). Arbuscular mycorrhizal Fungi and Changes in Primary and Secondary Metabolites. *Plants*, 11(17), Article 17. <https://doi.org/10.3390/plants11172183>