# Increasing okra seed oil content by natural breeding and identifying the related genetic markers

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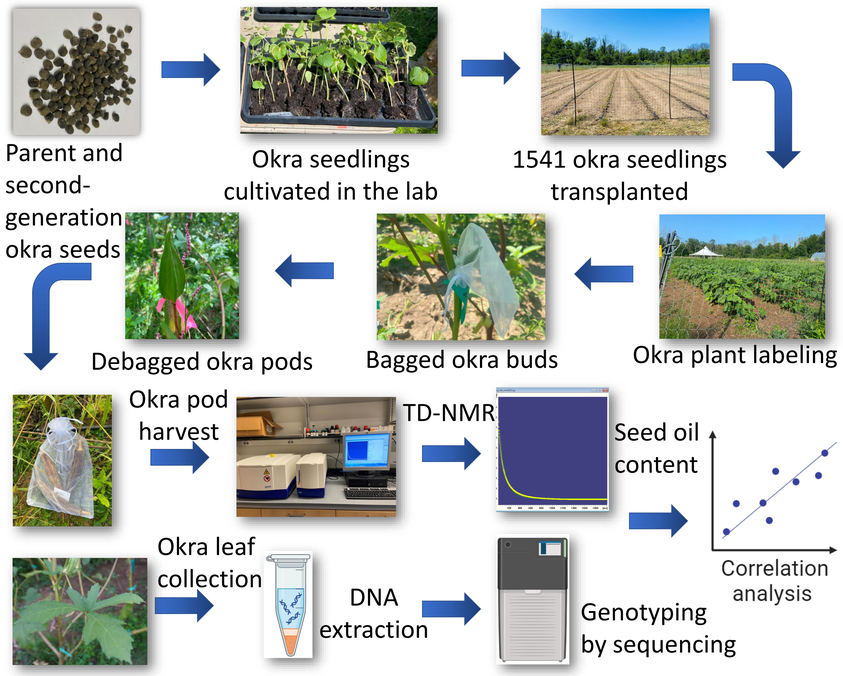
## Introduction

- Okra (*Abelmoschus esculentus*) is a heat-loving plant with reported seed oil content ranging from ~15% - 40% [1,2].
- Okra seed oil mainly consists of linoleic acid (up to 47.4%), which can benefit reducing cardiovascular diseases, cerebrovascular diseases, and cancer mortality [1].
- Time-domain nuclear magnetic resonance (TD-NMR) has been widely used as a nondestructive and rapid method to measure seed oil content based on measuring the resonance amplitude of hydrogen in the liquid content of samples [3].
- Genes such as *GmABI3b*, *GmNFYA*, and *GmFAD2-1B* in soybeans have been identified to be associated with seed oil accumulation. However, there is limited information available on specific oil-content-related genes in okra [4].
- Due to climate change, okra can be widely used as an alternative plant to support food and energy. The aim of this study was to elevate okra seed oil content through natural breeding, followed by genotyping of the okra to correlate seed oil content phenotypes to genetic markers.

## Materials and Methods




## Results

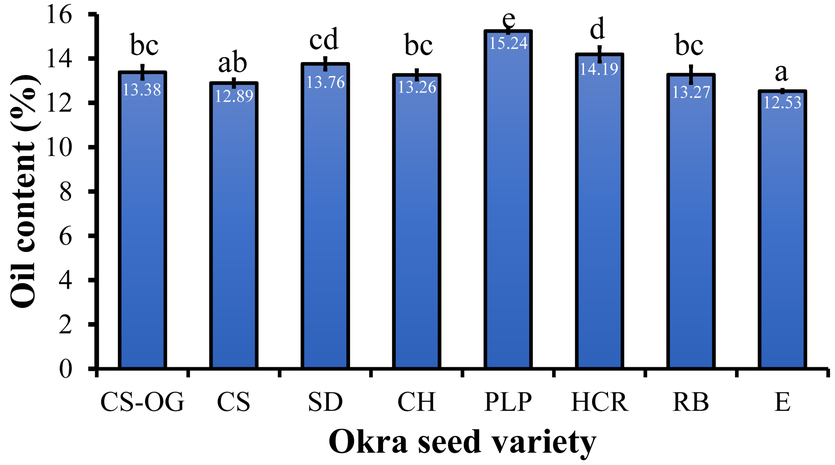



**Figure 1.** The oil content of eight varieties of commercial okra seeds on a wet basis was determined by a TD-NMR spectrometer with 10 grams of seeds. CS-OG: Clemson spineless organic; CS: Clemson spineless; SD: Star of David; CH: Cow Horn; PLP: Perkins Long Pod; HCR: Hill Country Red; RB: Red Burgundy; E: Enerald. The numbers in the bars show the average oil content. Different lowercase letters above bars represent statistically significant differences ($P < 0.05$) in oil content among the eight varieties of okra seeds. One-way ANOVA with Tukey HSD test was applied to analyze the statistical pairwise comparisons.

**Figure 2.** Photos of 10 selected phenotypes of okra pods from the 1541 okra plants.

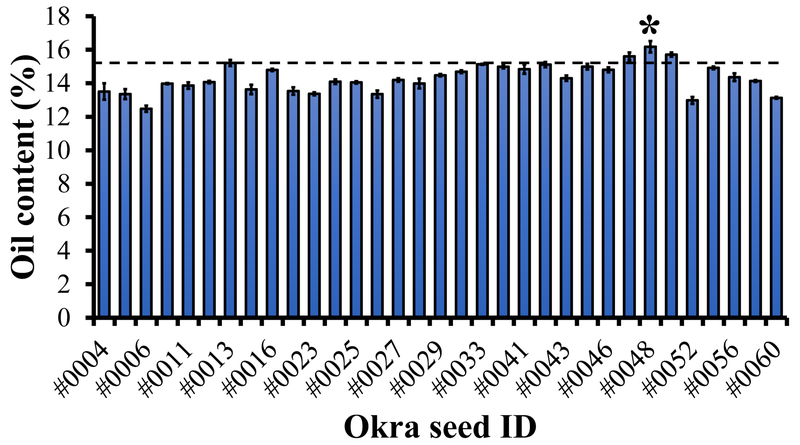



**Figure 3.** The seed oil content of 33 harvested okras from the first batch on a wet basis was measured by a TD-NMR spectrometer with 10 grams of seeds. The dashed line represents the highest oil content of the commercial okra seeds, PLP (15.24 ± 0.086 %). The "*" above the bar represents the sample contains significantly higher ($P < 0.05$) seed oil content than that in PLP. One-way ANOVA with Tukey HSD test was applied to analyze the statistical pairwise comparisons.

## Conclusion

- Among the preliminary eight varieties of commercial okra seeds, the PLP okra seeds showed the highest oil content measured by TD-NMR, which was 15.24 ± 0.086 %.
- Compared to the PLP okra seeds, #0048 harvested okra seeds in the first batch of NMR measurements presented significantly higher oil content, which was 16.18 ± 0.34 %.
- Okra leaves from each plant were collected for DNA extraction. The DNA from parent okra will be used for whole genome sequencing as reference genomes, and that from the second-generation okra will be used for genotyping by sequencing.
- Genetic variant analysis will be conducted between okra with remarkably higher seed oil content and parent okra to identify the potential oil-content-related genes.

## References

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2. Gemede, H.F., Ratta, N., Haki, G.D., Woldegiorgis, A.Z. and Beyene, F., 2015. Nutritional quality and health benefits of okra (*Abelmoschus esculentus*): A review. J Food Process Technol, 6(458), p.2.