

Breeding for flavor: linking metabolomics and genomics for blueberry improvements

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Summary

- Blueberry (*Vaccinium* spp.): source of health-promoting compounds. Crop with some of the fastest rising consumer demand trends.
- Flavor: sum of inputs from multiple senses that inform our brain what we are eating.

Motivation

- What are the genetic basis underlying the variation of flavor chemicals?
- What is the importance of volatile organic acids (VOCs) on consumer perception?

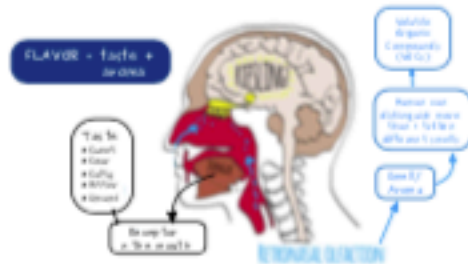


Figure 1: What is flavor?

Plant Material

Sensory Data

- 244 samples
- Sensory analysis (sweetness, sourness, flavor intensity, and overall liking)
- Sugar + Acids + 48 VOCs
- sensory ~ f(chemical)

mGWAS

- 886 genotypes
- Capture-Seq (71487 SNPs)
- updog package
- 17 volatile
- GWAS (Q+K model) + rrBLUP
- chemical ~ f(genomic)

VOCs and Consumer Preference

- Large influence of VOCs on sensory attributes, in particular, for overall liking.



Figure 2: Variation in sensory panel ratings explained per chemical groups of metabolites in blueberry

Metabolomic Selection

- Metabolomic profiling as a phenotyping assay can enable accurate characterization of flavor profiles



Figure 3: Schematic representation of metabolomic selection in a fruit breeding program

GWAS and Marker Assisted Selection

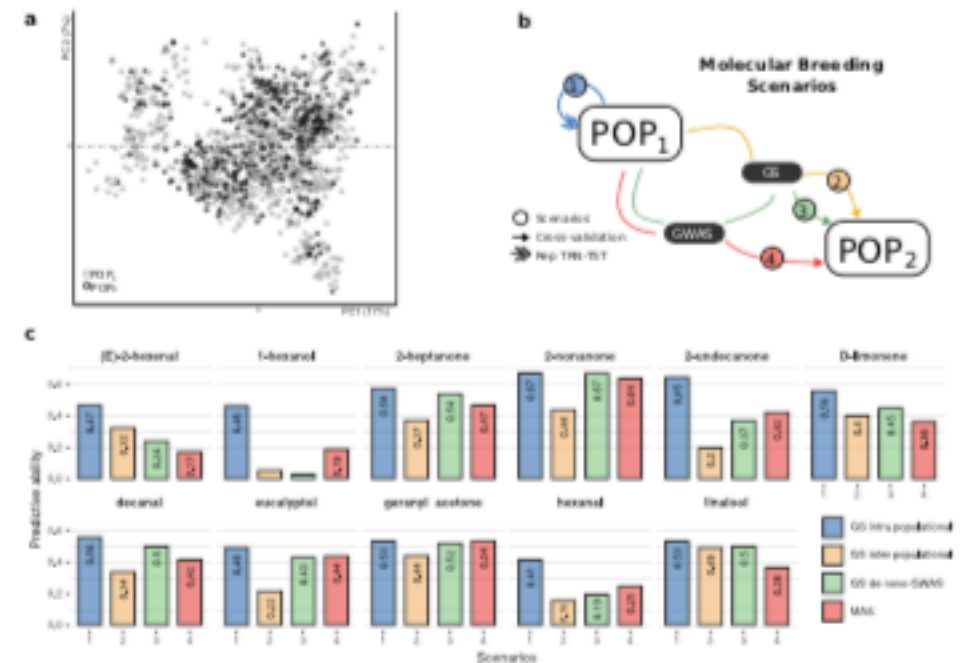


Figure 4: Phenotypic prediction. (a) Two blueberry populations (training and testing) (b) Four prediction scenarios using different approaches combining GWAS, GS and MAS, (c) Predictive ability for 17 VOCs across the four prediction scenarios.

Conclusions

- Most of the VOCs are regulated by few genes, which is important for **marker-assisted selection**.
- Metabolomics can be used to **explain and predict** consumer preference.
- Flavor-assisted selection**: a new step forward in fruit flavor research, showing the scientific basis needed for improving fruit quality combining **metabolomics and genomics**.

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References

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