

# Long-read sequencing uncovers genome structural variations associated with protein content in *Brassica napus*

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**University  
of Manitoba**

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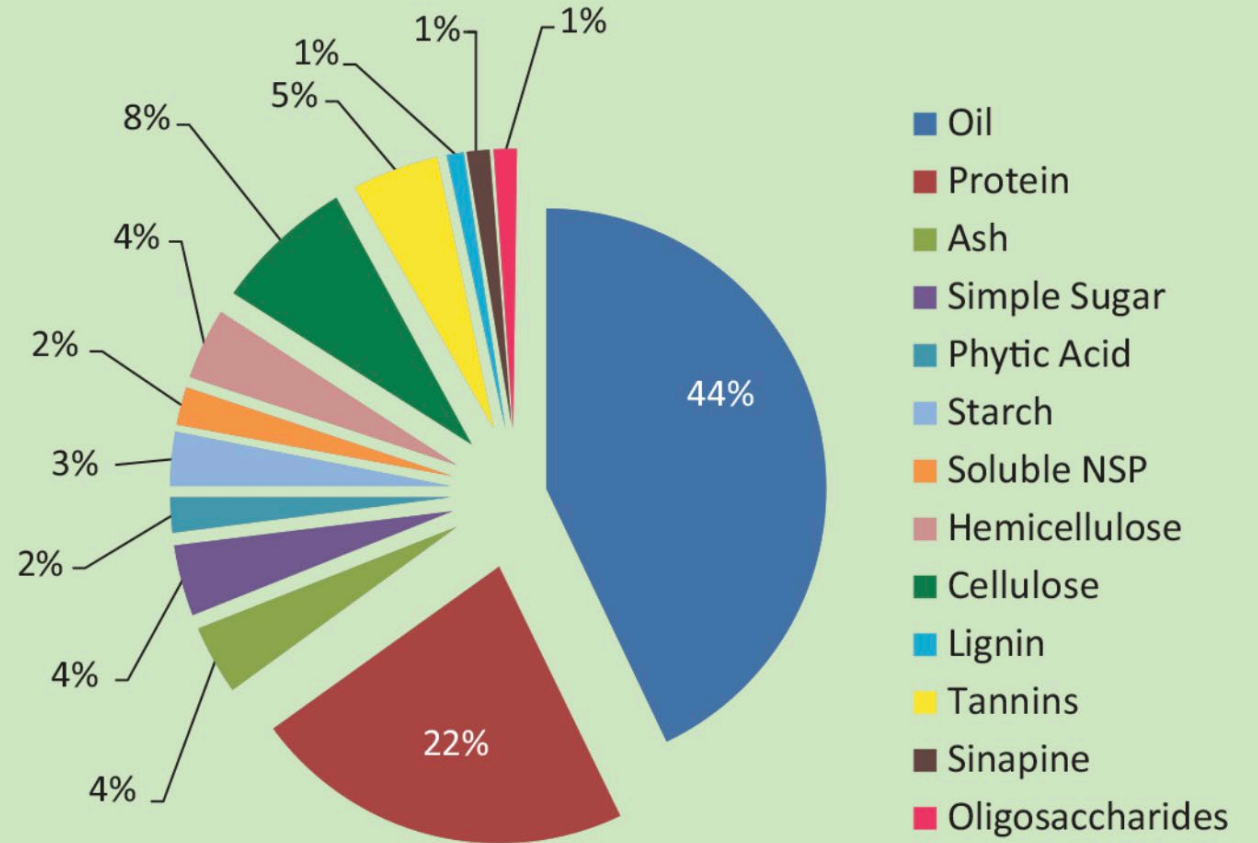
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# Canola protein

Canola seed consists of 40-45% oil and **22-25% protein**

*This information comes from David Dzisiak (Corteva), Janitha Wanasundara (AAFC Saskatoon), Marcus Samuel (University of Calgary) and Logan Skori (Ph.D. student with Marcus Samuel, U of C).*



# Uses for Canola protein



Animal feed



Fish feed



Poultry feed



Human consumption

# Uses for Canola protein



But why care about about  
Canola protein now?



Human consumption

# A lot more canola meal

## U.S. EPA finalizes recognition of canola's GHG emissions reduction in advanced biofuels

**December 1, 2022** – Today, canola's role in helping reduce greenhouse gas (GHG) emissions took another step forward, with the final rule to create a pathway for canola oil to be used in advanced biofuels under the Renewable Fuel Standard (RFS) program in the United States.

The U.S. Environmental Protection Agency (EPA) delivered the final rule that canola oil-derived renewable diesel (RD), sustainable aviation fuel (SAF) and other biofuels qualify as “advanced biofuels” under the RFS program. The EPA's assessment confirmed that GHG emissions from RD, SAF and other fuels derived from canola oil far exceeded the 50 per cent reduction threshold when compared to fossil-based fuels.

<https://www.canolacouncil.org/news/u-s-epa-finalizes-recognition-of-canolas-ghg-emissions-reduction-in-advanced-biofuels/>

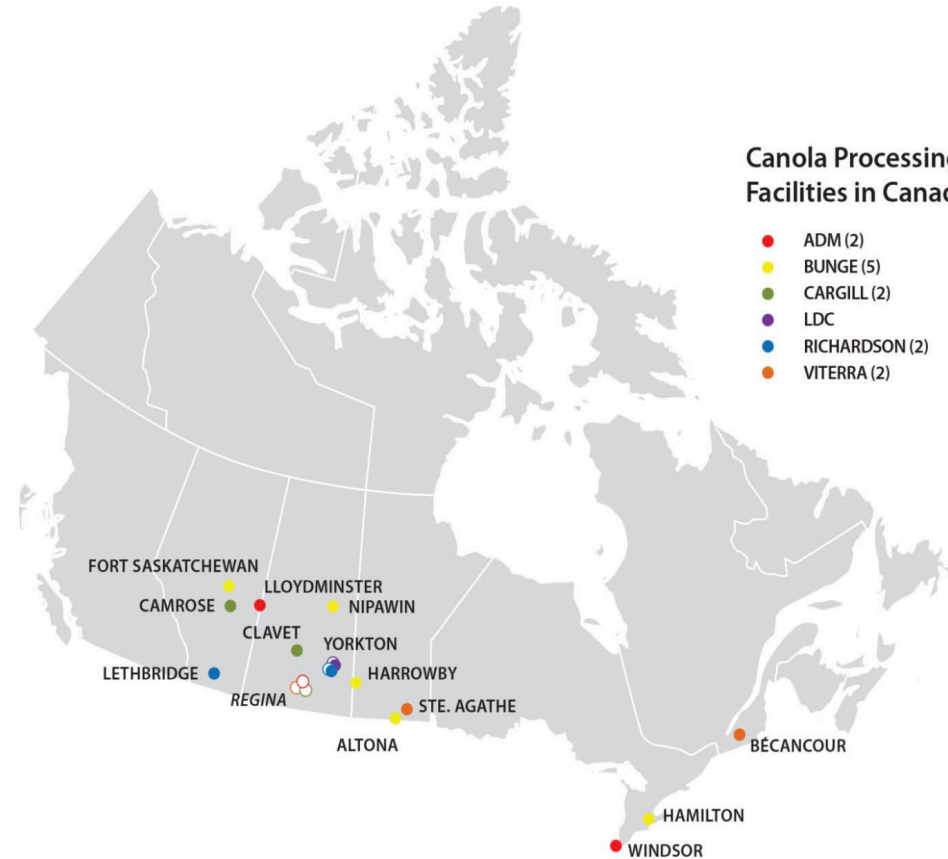
# New canola crushing facilities

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### Canola Processing Facilities in Canada

- ADM (2)
- BUNGE (5)
- CARGILL (2)
- LDC
- RICHARDSON (2)
- VITERRA (2)

### ANNOUNCED NEW PROCESSING INVESTMENTS

- CARGILL
- FCL AND AGT FOODS
- LDC
- RICHARDSON
- VITERRA

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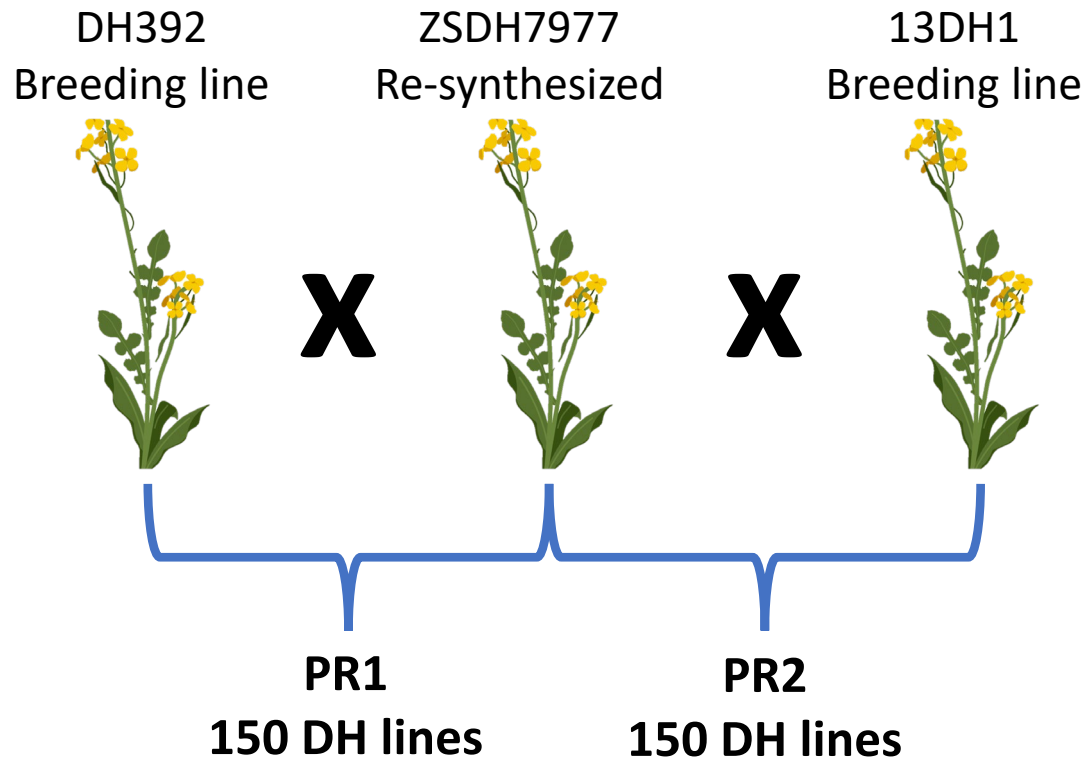
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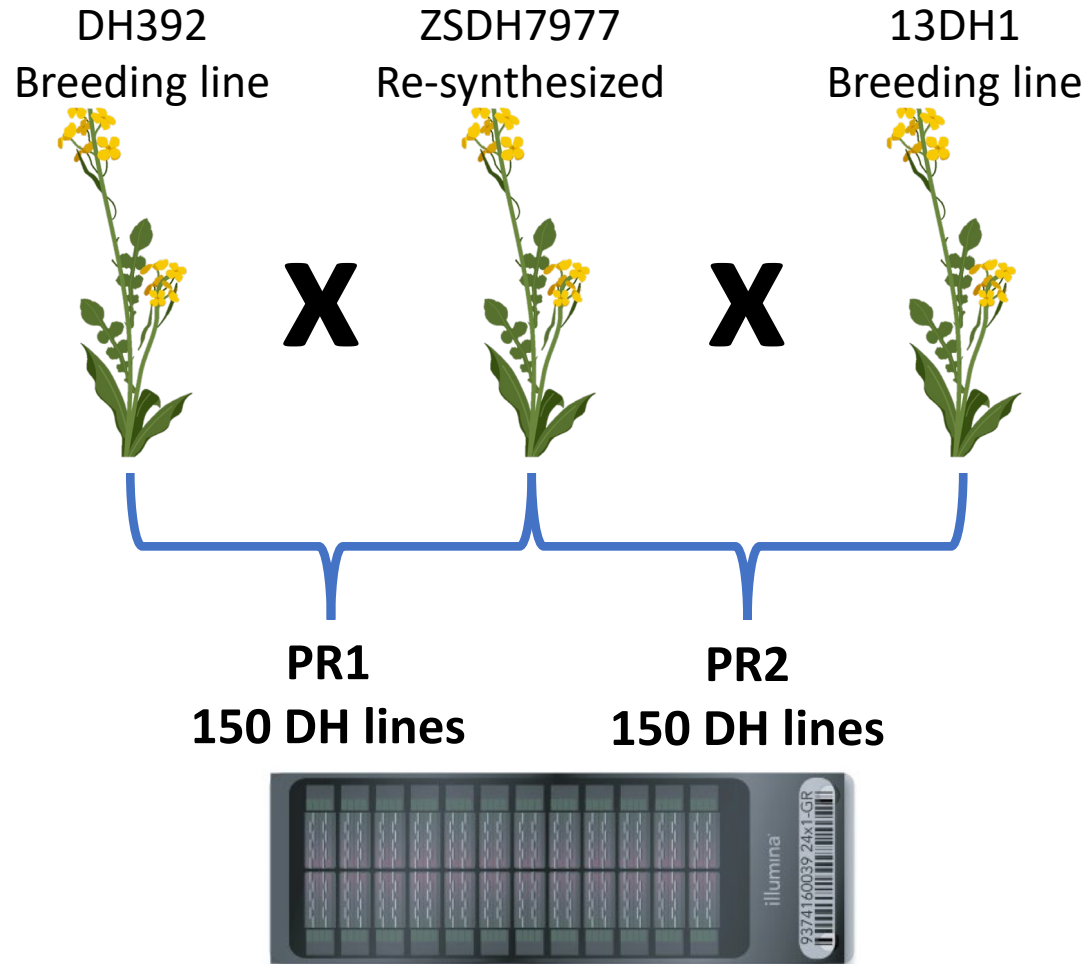
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Conclusion

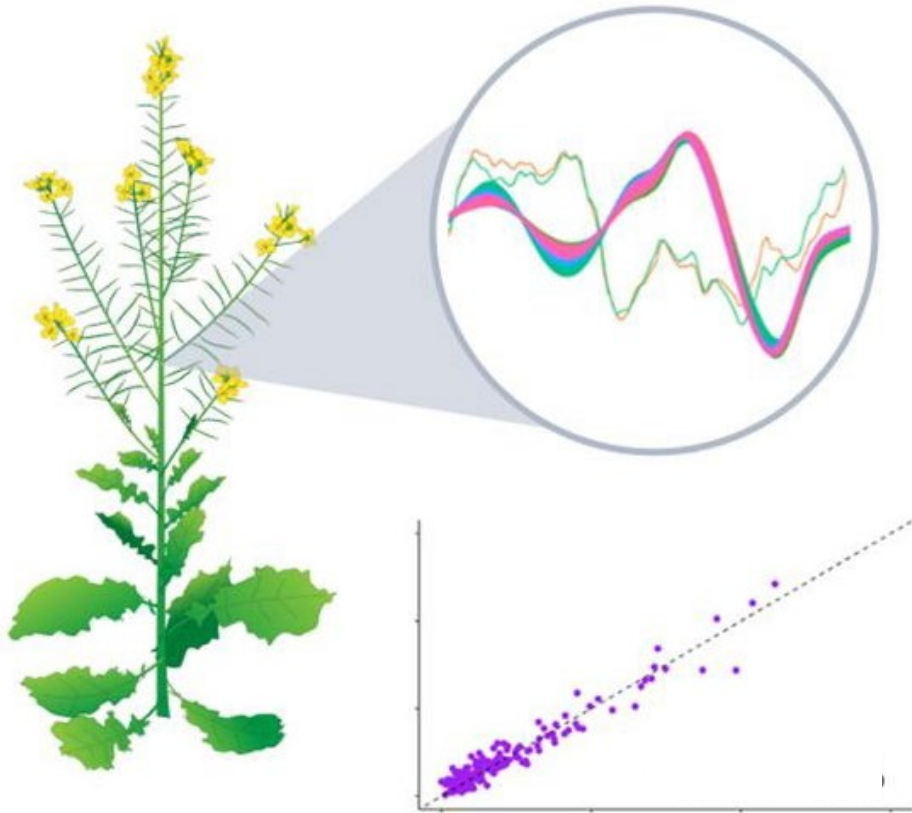
# Two doubled haploid (DH) populations



# Genotyping with 90k Brassica array



# Protein content estimation using NIRS



- 300 DH lines in RCBD
- 3 replicates
- Across 6 site years

# Overview

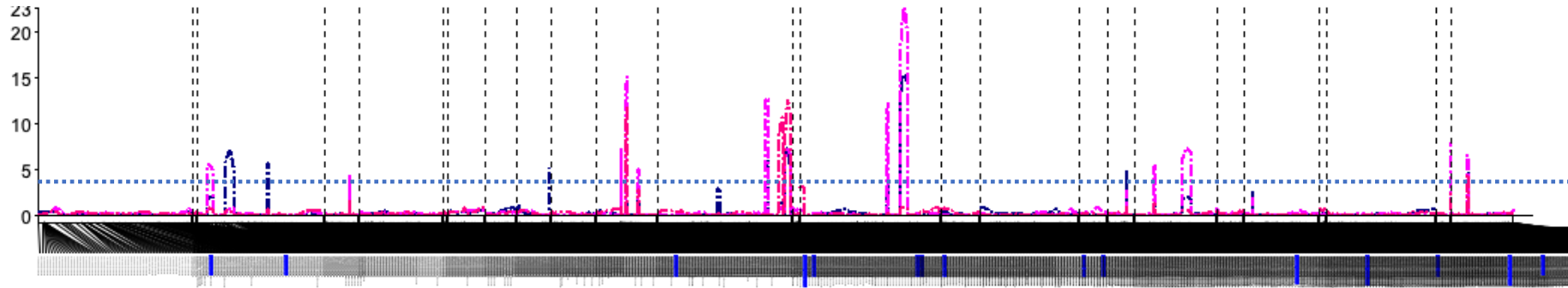
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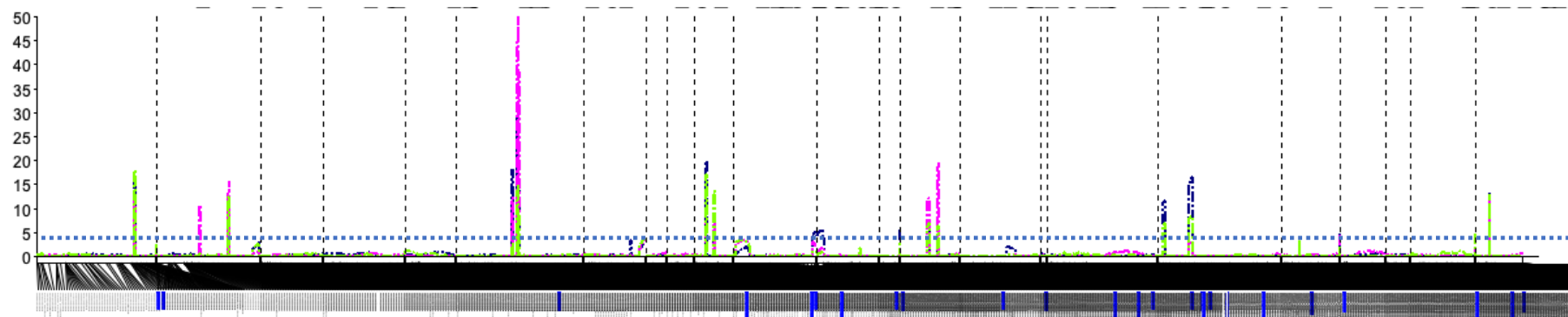
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# Protein content is a highly quantitative trait

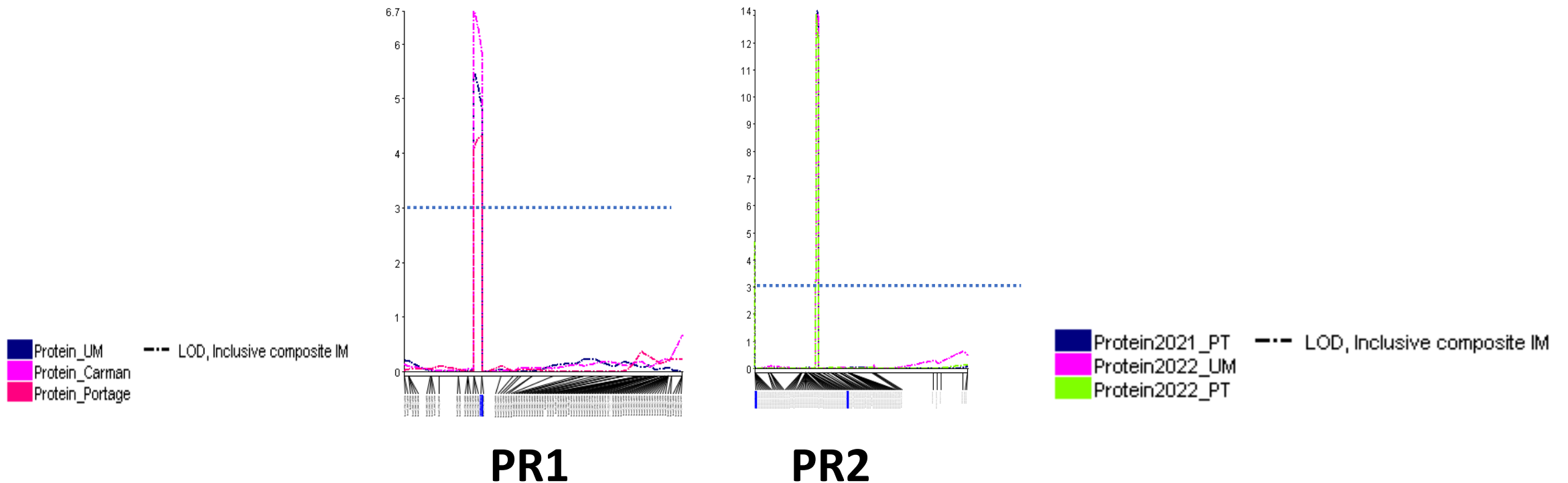


**PR1**

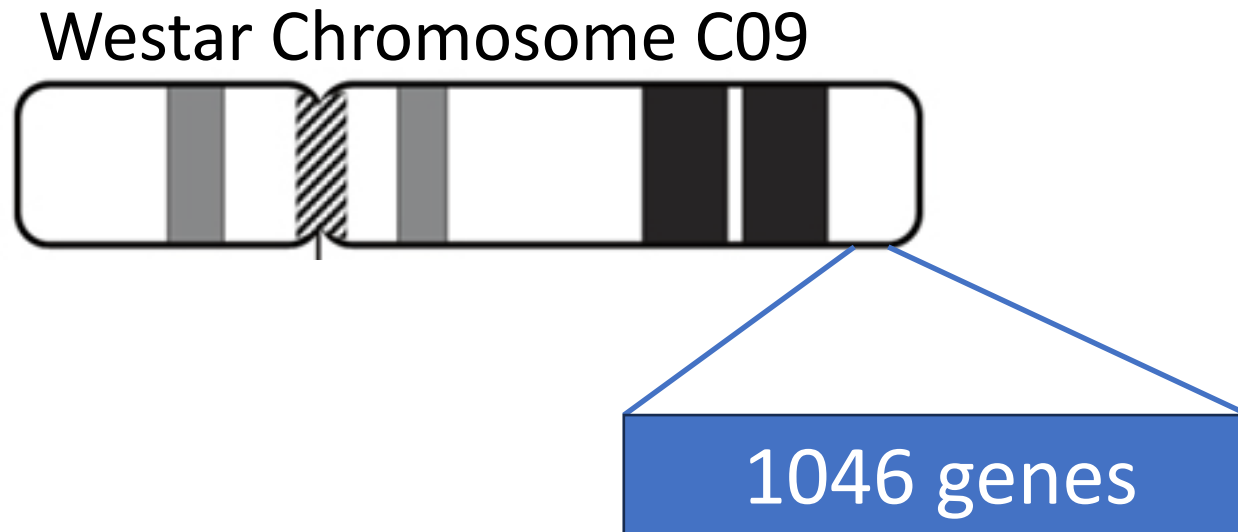


**PR2**

# Consensus QTL on ChrC09 mapping for protein content in all 6 site years

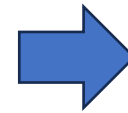


# 7 Mb region on ChrC09 Westar genome



# Long-read sequencing of parents

DH392 ZSDH7977 13DH1



## Structural variations (SVs)

Reference



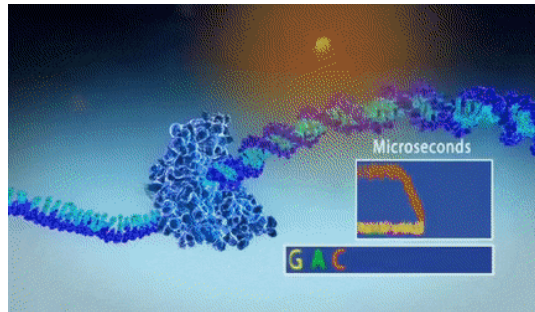
Insertions



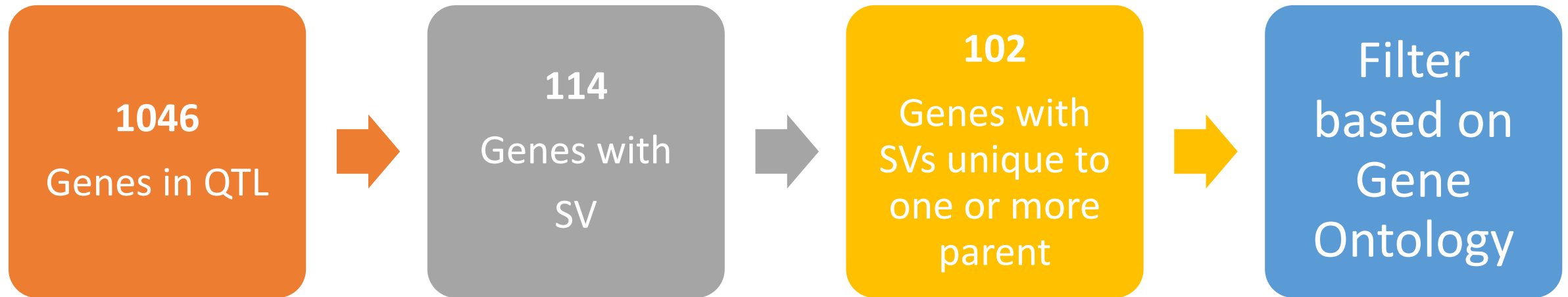
Deletion



Copy Number Variations

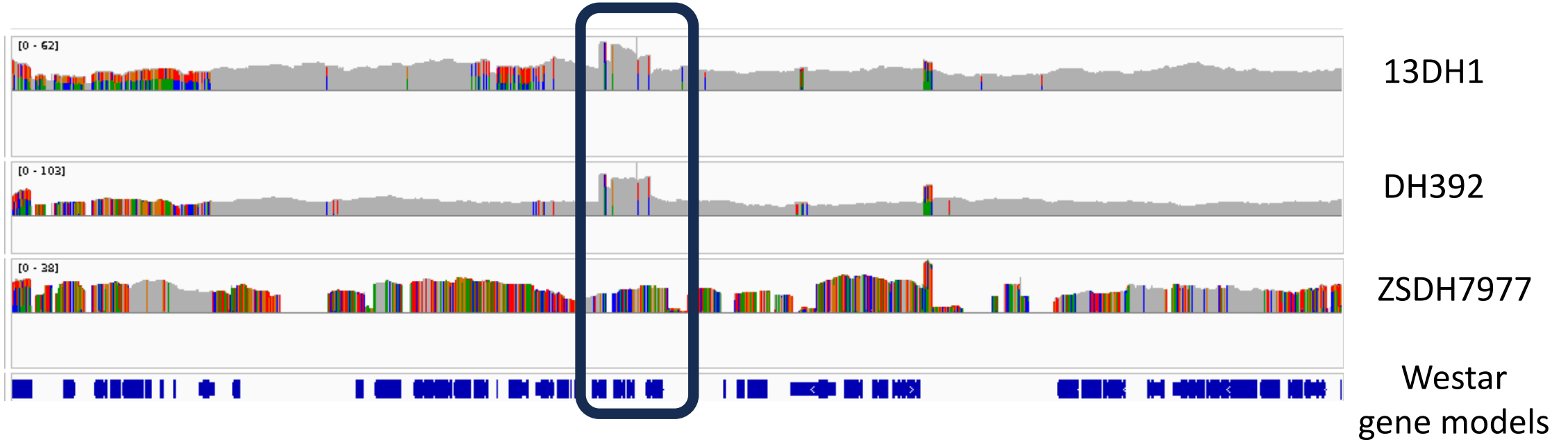


# SVs associated with protein content



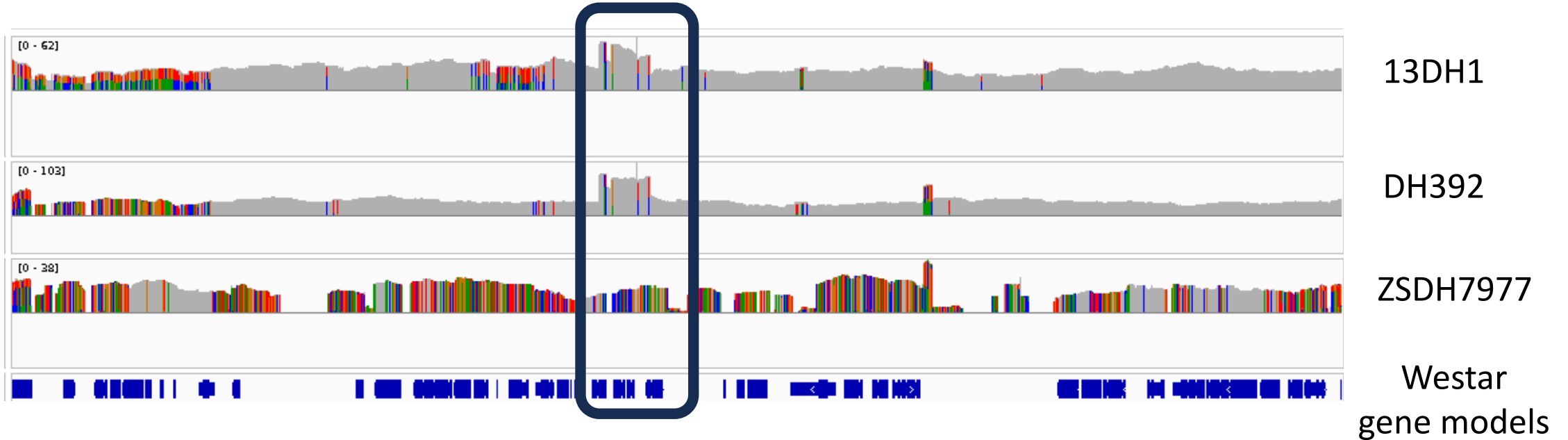
# 6.8 kb duplication in ChrC09 QTL

Duplication

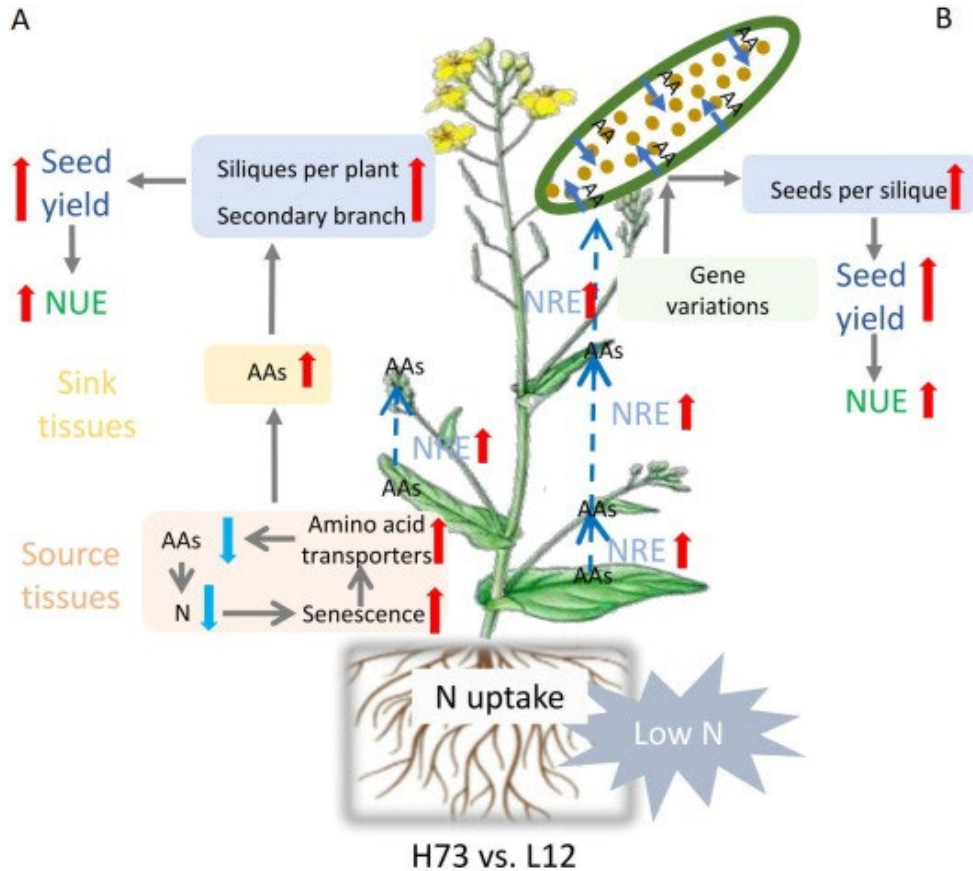


# 6.8 kb duplication effects *BnaAAP* (*Amino acid permease*)

Duplication



# Amino acid permease



**1. Amino Acid Uptake:** These proteins are responsible for the uptake of amino acids from the soil into the root cells.

**2. Long-Distance Transport:** They facilitate the long-distance transport of amino acids between different plant tissues, such as from leaves to seeds.

**3. Cellular Redistribution:** Within a tissue, they help in redistributing amino acids between different cell types.

**4. Response to Nutrient Conditions:** Their activity can be modulated in response to nutrient conditions, affecting the availability of amino acids for growth and development.

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- Enhancing protein content in canola would be critical as more canola meal becomes available
- **24 QTL** underlining protein content
- QTL at chromosome **C09** appears in all 6 site-years
- **6.8 kb duplication** on chromosome C09 associated **protein content**
- **Amino acid permease gene** could be a good candidate gene

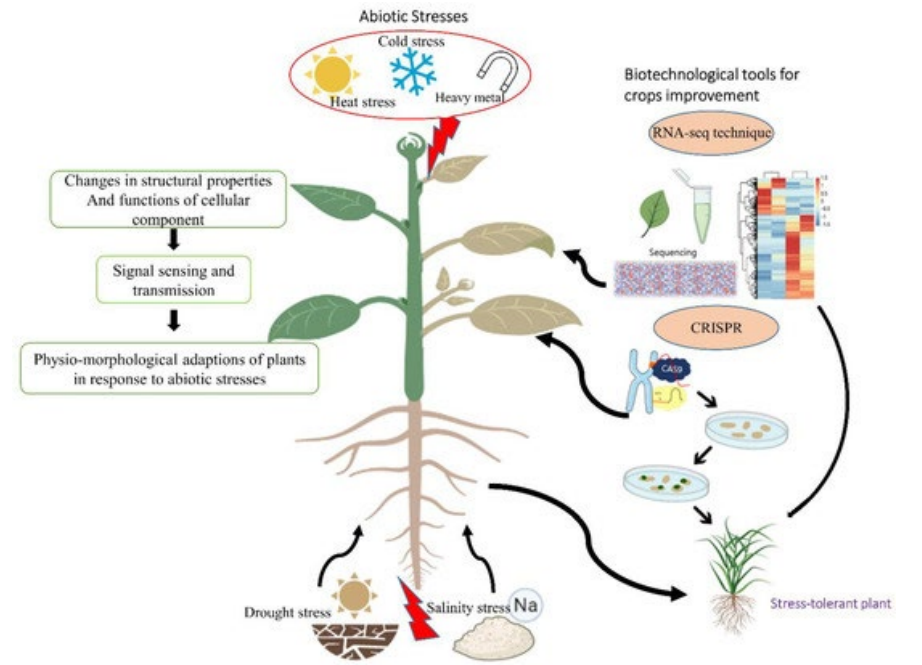
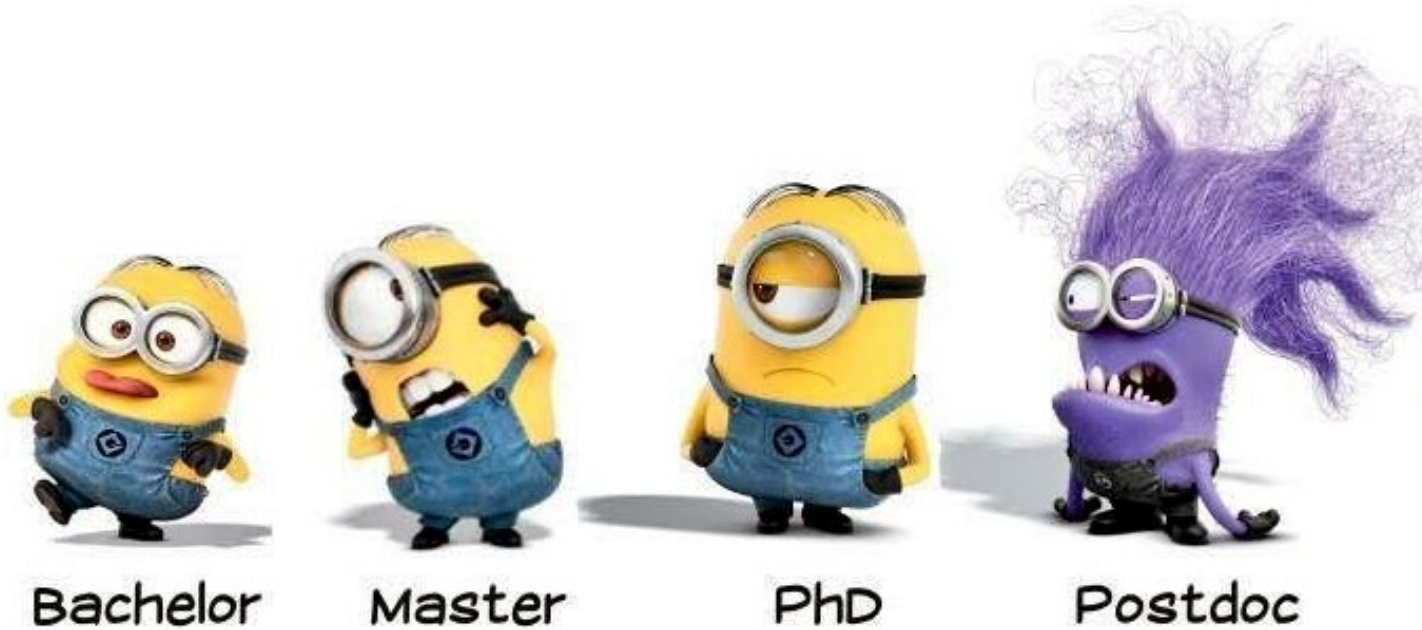
# Acknowledgements



GenomePrairie



# We are hiring



<https://doi.org/10.3390/agronomy11081579>

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