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Studying the genes and conditions that influence root development

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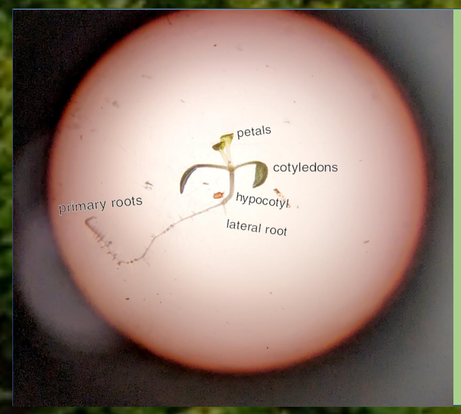
Root development in plants is essential for their survival and understanding how hormones influence their development can explain how plants grow under different circumstances. Researching how Indole-3-butyric acid (IBA), a hormone that induces root production, affects the plant model *Arabidopsis thaliana* helps explain the hormone's effect in agricultural crop systems. To understand root pathways, we performed assays on mutant lines of Arabidopsis by growing plants on varying concentrations of IBA. For wild-type and mutant lines, phenotyping experiments like branching of roots, lengths of stems, and root length were conducted along with PCR and restriction digest genotyping experiments to compare their genetic differences. The root length experiment indicates that mutant lines grow longer roots than wild-type, suggesting these genes are involved in the normal responses. IBA concentrations have an influential effect on root development in all experimental conditions. The results from these experiments give insight into the genes that are disrupted by these mutations. This research explains how the roots behave in varying conditions and hormone concentrations that can translate to agriculture. With the climate changing rapidly in the world, our research gives insight on how roots of plants can be influenced to best support growth in a variety of environments.

Model Organism: *Arabidopsis*

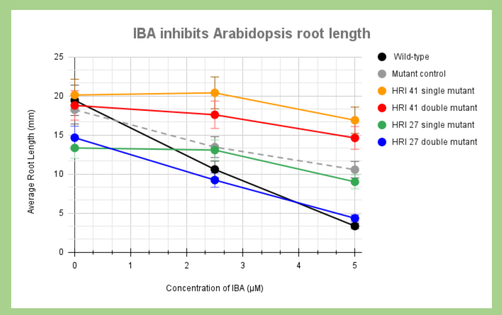
- First plant to have its genome sequenced
- Relatively short life cycle
- Research enhances our understanding of all flowering plants in agriculture

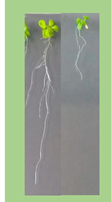
Questions

- How do mutants root development pathways compare to normal pathways?
- In what conditions does *Arabidopsis* use its energy to elongate or branch roots?
- Does IBA concentration influence root development in mutant lines?
- Where is the mutation within the *Arabidopsis*' genome?



Anatomy of *Arabidopsis*





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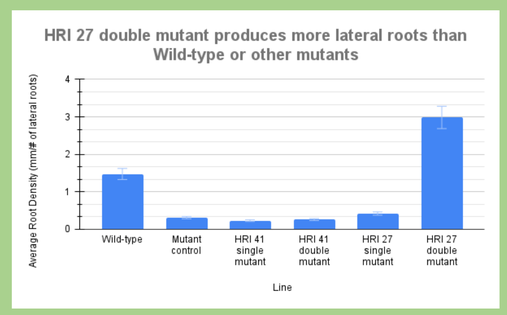

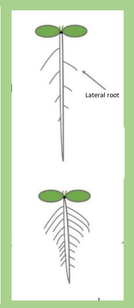

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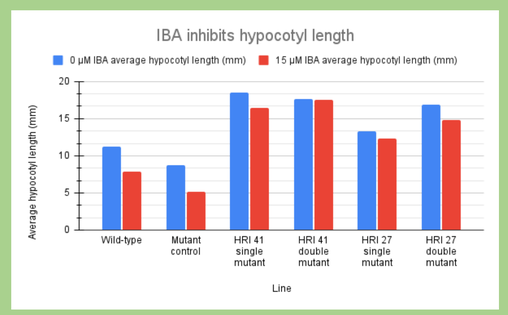
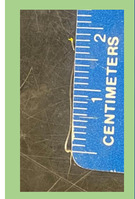
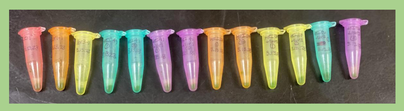
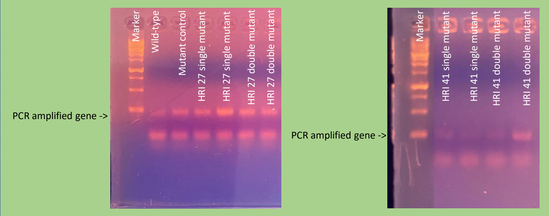






DNA was extracted from *Arabidopsis* plants and genes with expected mutations were amplified through PCR. After PCR amplification of genes, a restriction enzyme can be used to determine where the mutation is in the genome.

PCR Products for *IBR1* and *IBR3*



Next step: Restriction Digest

EcoNI Restriction site:

5′... CCTNNNNNAGG ...3′
3′... GGANNNNNTCC ...5′

Image from https://www.neb.com/products/r0521-econi#Product%20Information

PstI Restriction site:

5′... CTGCAG ...3′
3′... GACGTC ...5′

Image from https://www.neb.com/products/r0140-psti#Product%20Information

Conclusion

- These mutant lines have altered root development and can be used to better understand the genes and environments where root development changes
- Restriction digest, IBA concentrations, stress, sequencing

Background picture from https://vietnamwaterportal.com/news/agricultural-sector-in-vietnam.html