

# Engineering Apomixis Into Crops



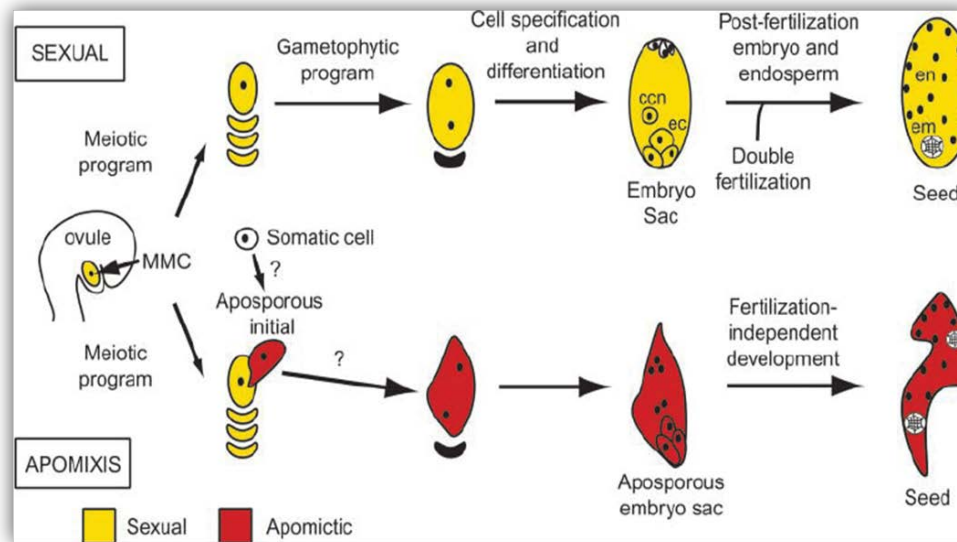
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# What is Apomixis?

- 🌲 Apomixis is asexual seed formation.
- 🌲 Bypasses meiosis (apomeiosis).
- 🌲 Develops embryo without fertilization (parthenogenesis).
- 🌲 Identical to maternal plant.



# Apomixis Applications

🌱 Crops (fixing hybrid vigor)

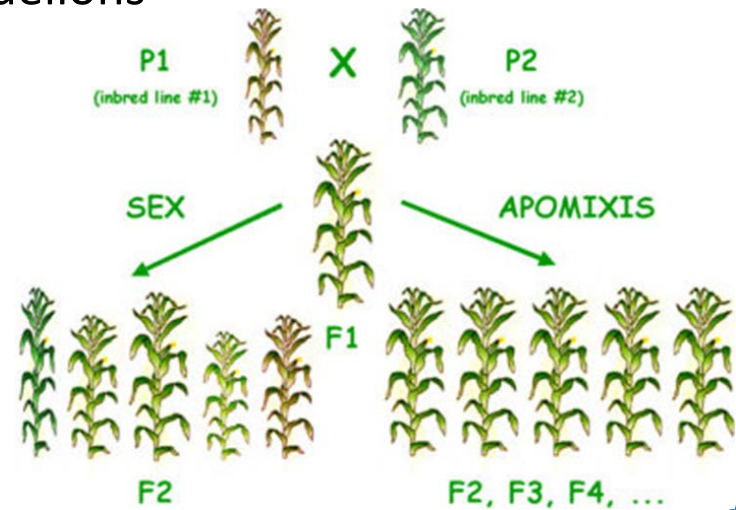
🌱 **Naturally occurring apomicts:**

🌱 Kentucky bluegrass & dandelions

🌱 Aphids/daphnia

🌱 **Other applications:**

🌱 Aquafarming/aquaculture



# What Controls Apomixis?

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## 🌲 Research Questions:

- 🌲 What causes apomixis?
- 🌲 How does apomeiosis differ from meiosis?
- 🌲 How can we induce apomixis to occur in sexual plants?

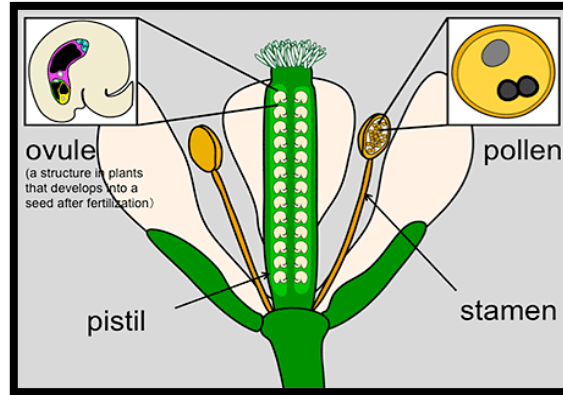
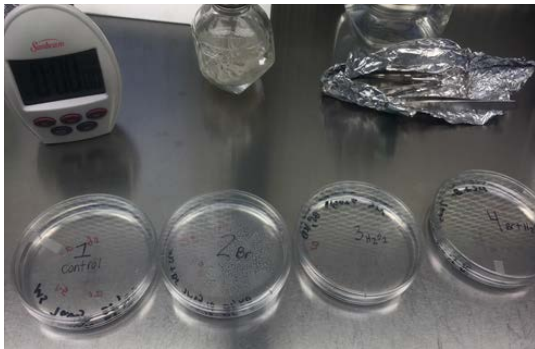
## 🌲 Hypotheses based on results of pharmacological studies in lab:

- 🌲 Oxidative stress induced meiosis (sex) in apomicts.
- 🌲 Removal of oxidative stress induced apomixis in sexual plants.

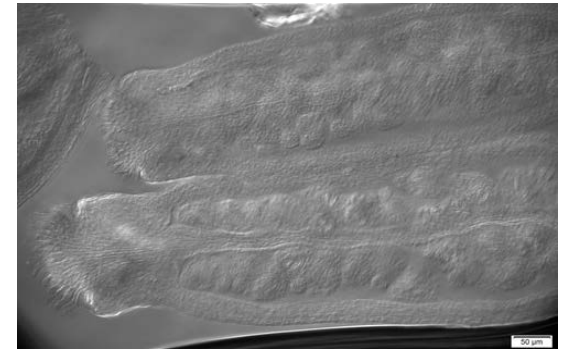


# Using Plant Tissue Culture to Increase/Reduce Oxidative Stress

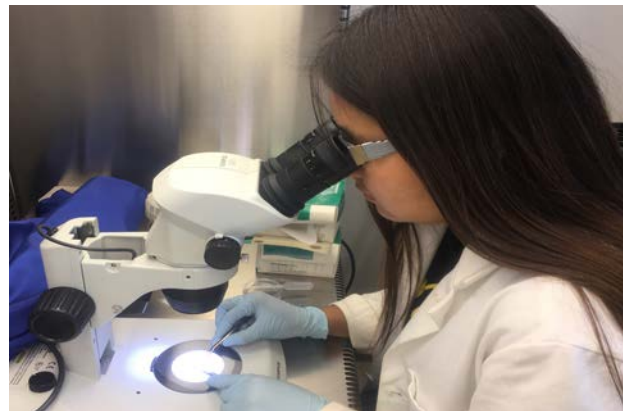
## Media Prep



## Microscopic Observations



## Dissection/Treatment





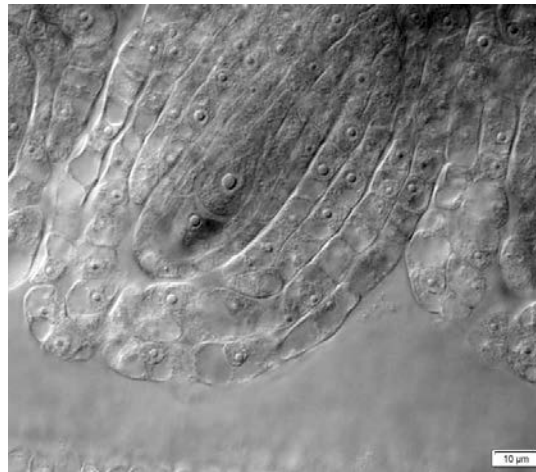
# Versions of Apomixis

## Sexual

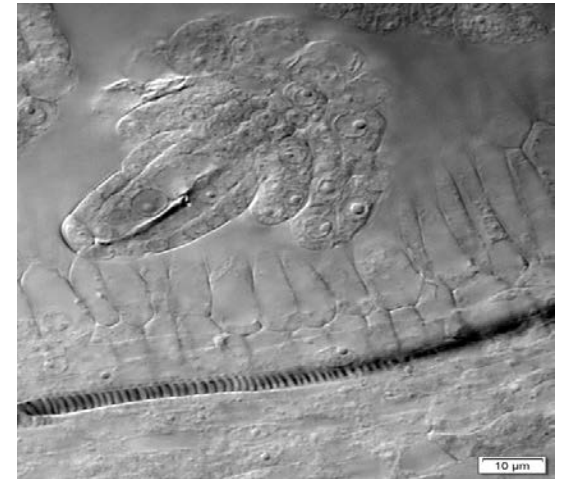


**Tetrad**- Germline cells completed both meiosis divisions.

## Apomixis



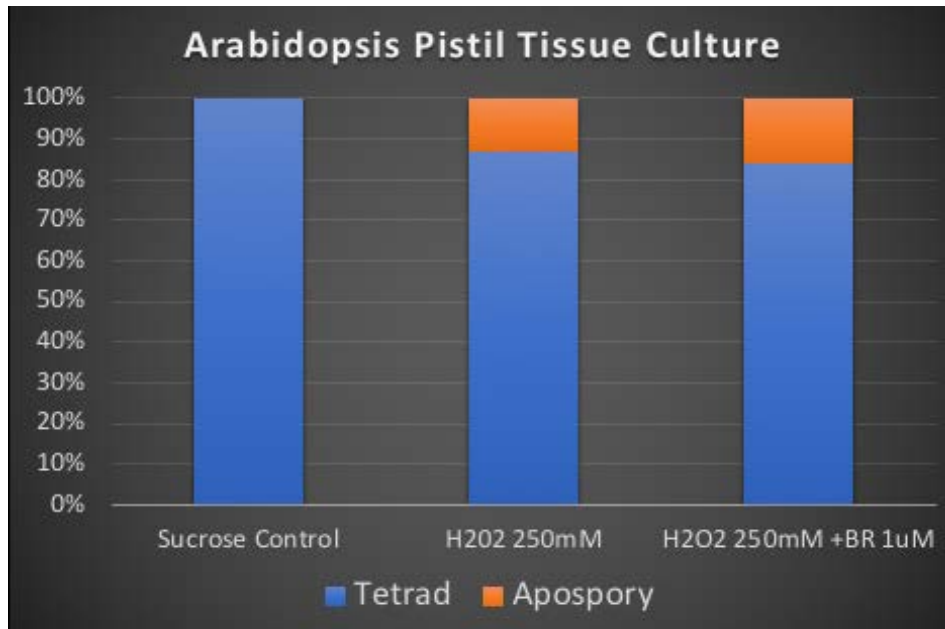
**Dyad**- Skips first division of meiosis.



**Apospory**- Somatic cell develops into embryo sac.



# Results From Tissue Culture



- 🪵 Low levels of Hydrogen Peroxide induced antioxidant responses.
- 🪵 Brassinosteroid (BR) triggered stress resistance (including antioxidant activity).
- 🪵 Conclusion- Antioxidant activity and other stress removers induce apomixis.



# Flow Chart of Genetic Engineering

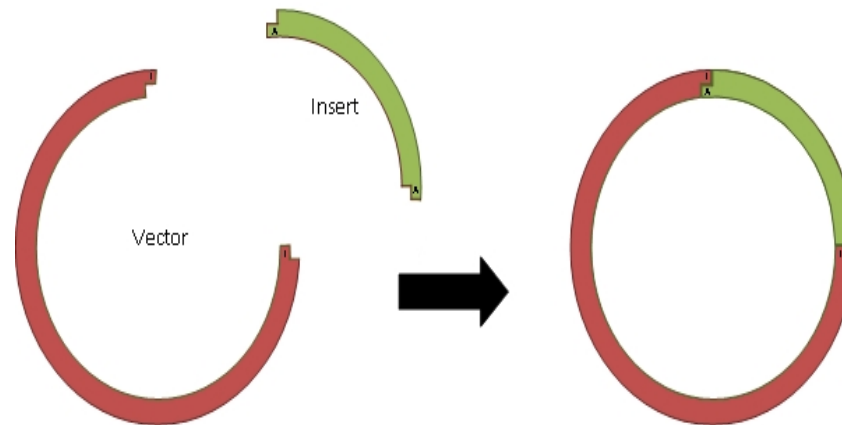
Plasmid Preparation

Obtaining RAP2.4A Gene

Ligation

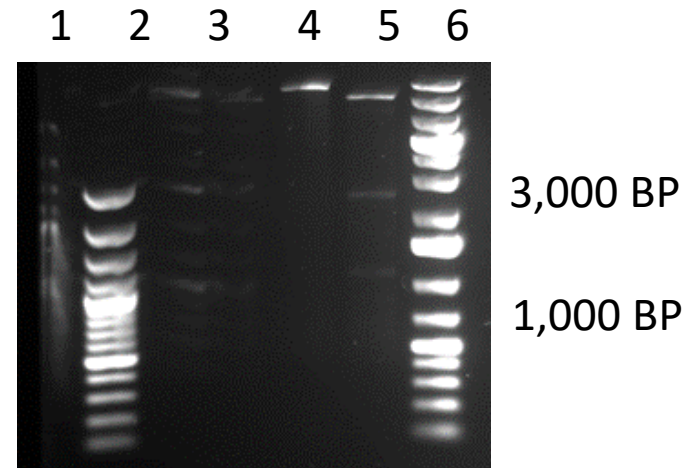
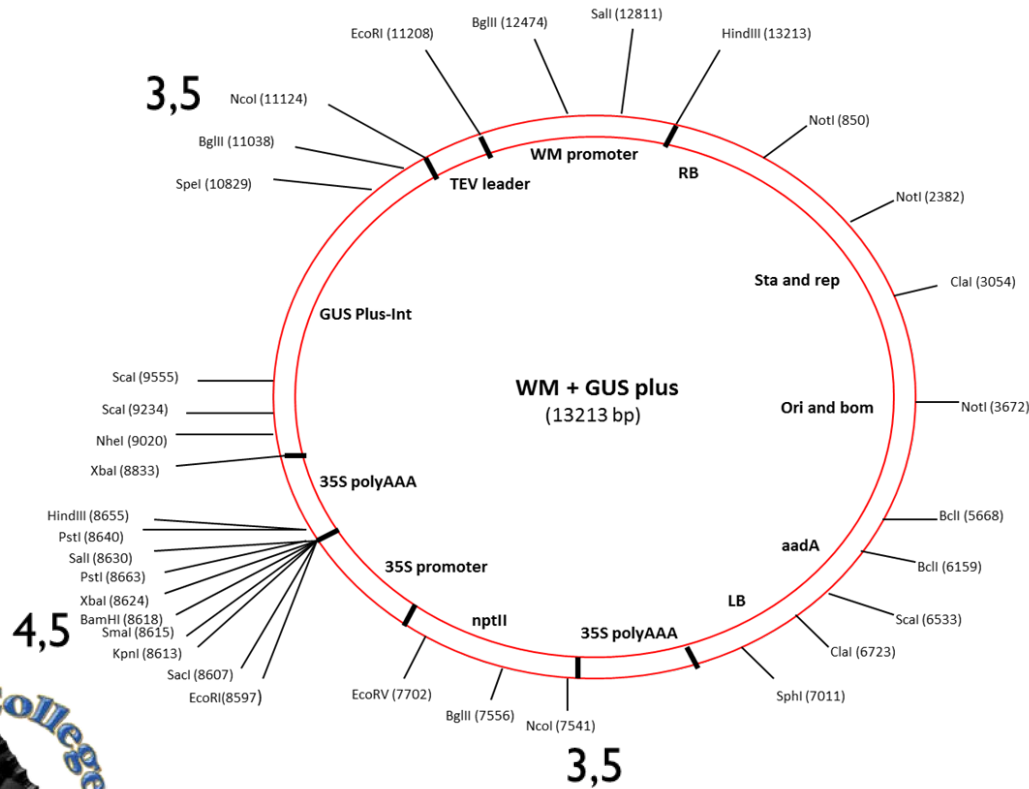
Transformation of Agrobacterium

Floral Dip Transformation of Arabidopsis





# Restriction Digest



- 1&6- Ladder
- 2- Control
- 3- NcoI
- 4- BamHI
- 5- Double Digest



# Future Outcomes

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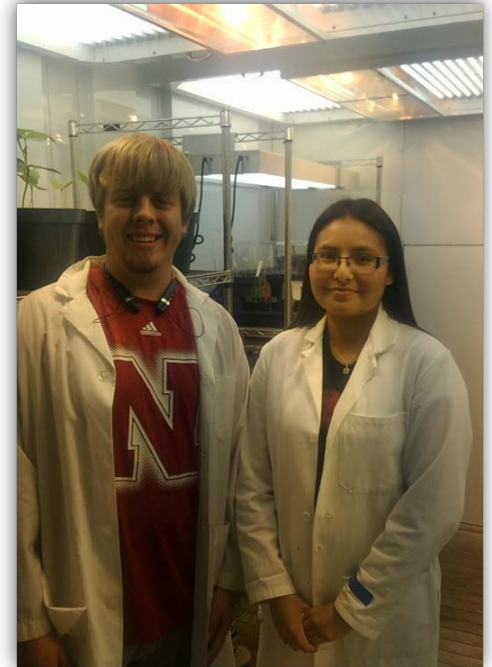
- 🌲 Expect to see Arabidopsis convert to apomixis.
- 🌲 Lack of meiosis in Arabidopsis.
- 🌲 Potential transformations into organisms.



# Personal Experience

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- 📌 Gained new outlook on research.
- 📌 Learned how to be patient.
- 📌 Learned how to use certain lab equipment.
- 📌 Built communication skills and made friendships.
- 📌 Opened up a new door in agriculture.



# Acknowledgements

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- 🌲 Diné College
- 🌲 Land Grant Office of Diné College
- 🌲 Utah State University
- 🌲 USDA/APHIS



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Thank You FALCON 2018!

Any Questions?

