

Time travel with apples: Can you see an apple before time?



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Introduction

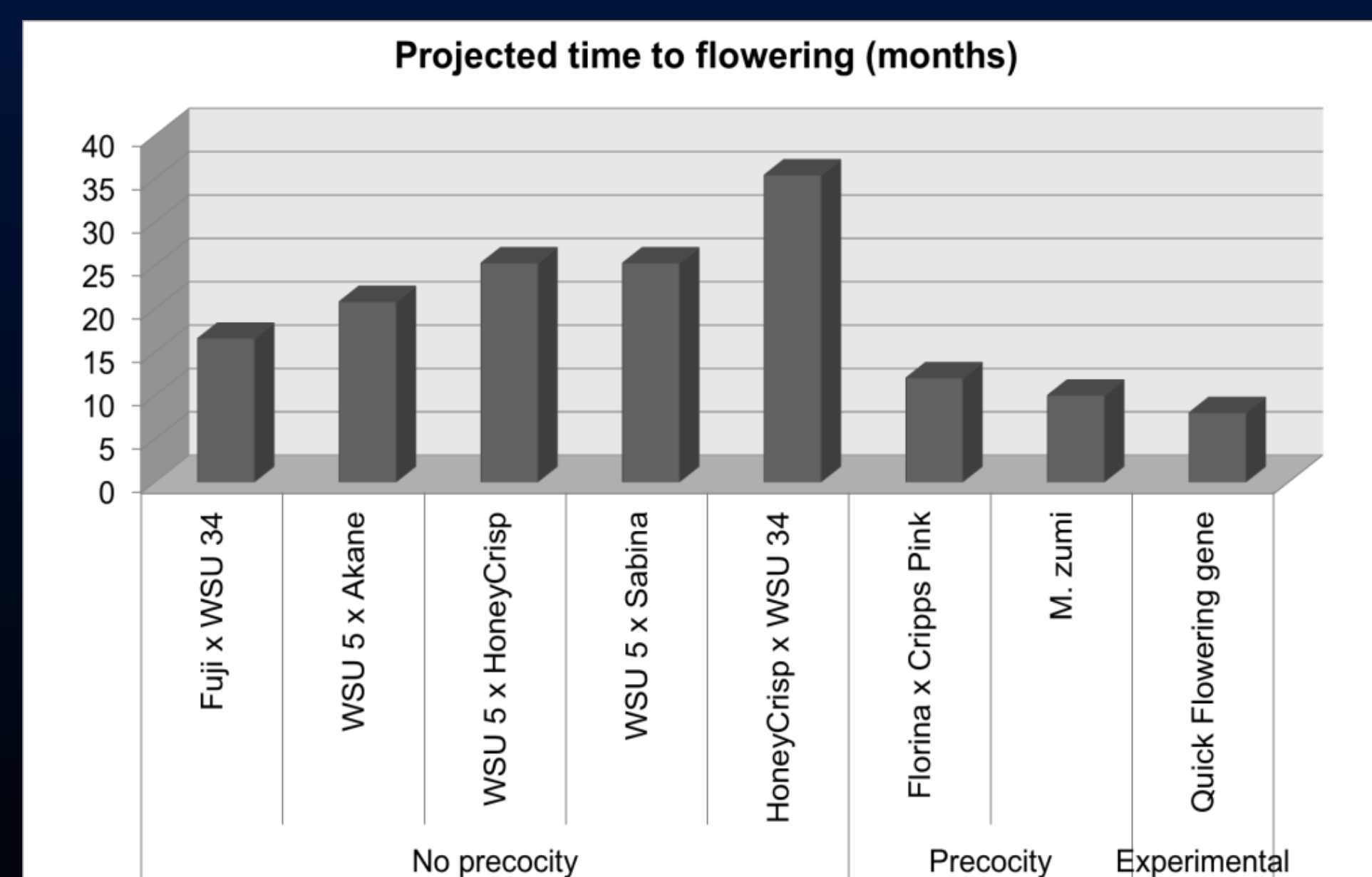
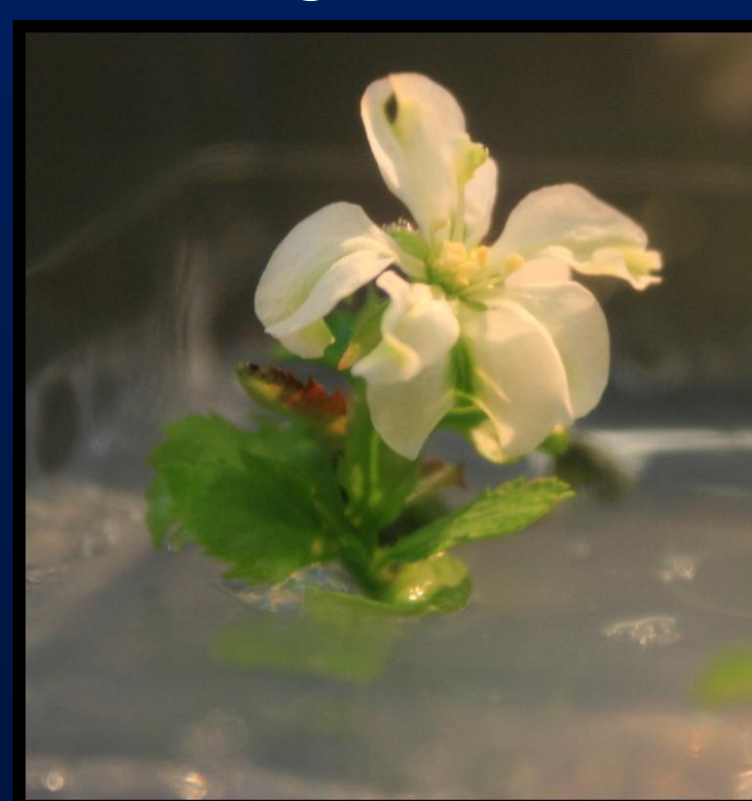
The scientific name for the apple is *Malus domestica*. Currently there are approximately 7,500 varieties of apples across the world. Naturally, apples take three to seven years to flower. They have prolonged juvenility or lack precocity. Apple can be genetically engineered to speed the flowering, and effectively reduce the time between generations. This allows researchers to “see into the future” or evaluate the fruit earlier than expected. Approximately twenty five years is the life span for a new variety to be produced and sent to the market. This project was designed to speed up the process of apple breeding to determine what the apples characteristics would be and if they were worth propagating. The ongoing objectives of this project are:

1. Establish reliable, reproducible agrobacterium-mediated transformation method for apple using ‘Royal Gala’ as a model variety
2. Established axenic tissue cultures of new apple hybrids and varieties that can then be genetically engineered for quick flowering

Background

Precocity or the fundamental property to bear flowers early is a genetic trait. The WSU apple breeding program is interested in utilizing genetic and transgenic sources of precocity to accelerate breeding.

The graph below displays the approximate time for the apple crosses to flower under different conditions. As is evident, the transgenic system has been experimentally proven to be the fastest.



Materials and Methods

- Royal Gala and elite cultivars from the WSU apple breeding program, apple tissue culture media, Agrobacterium strain with GUS or quick flowering plasmid.
- The starting plant material was obtained from the orchard or greenhouse. It was surface sterilized and inoculated in apple micropropagation media.
- Newly growing leaves were removed and placed onto leaf expansion media prior to co-cultivation with Agrobacterium carrying a Gus reporter gene and Kanamycin antibiotic selection gene.
- Excess Agrobacterium was washed off and explants were cultured on selection media in the dark.
- After a week, cultures were moved to the light to induce shoot development.
- Surviving shoot clumps are separated and cultured individually as they begin to appear.

Results

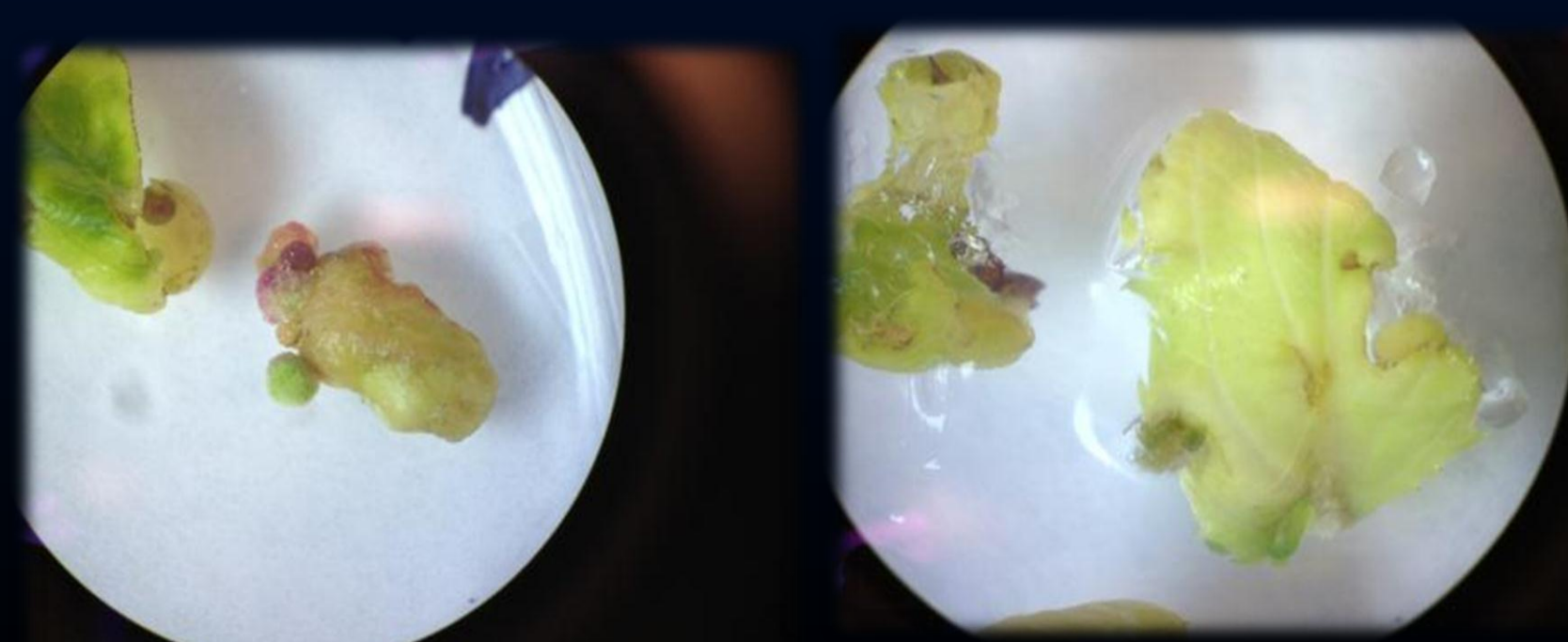
A. Explant material was successfully established in tissue culture media



B. Young emerging leaves were used for co-cultivation with Agrobacterium and placed on selection media



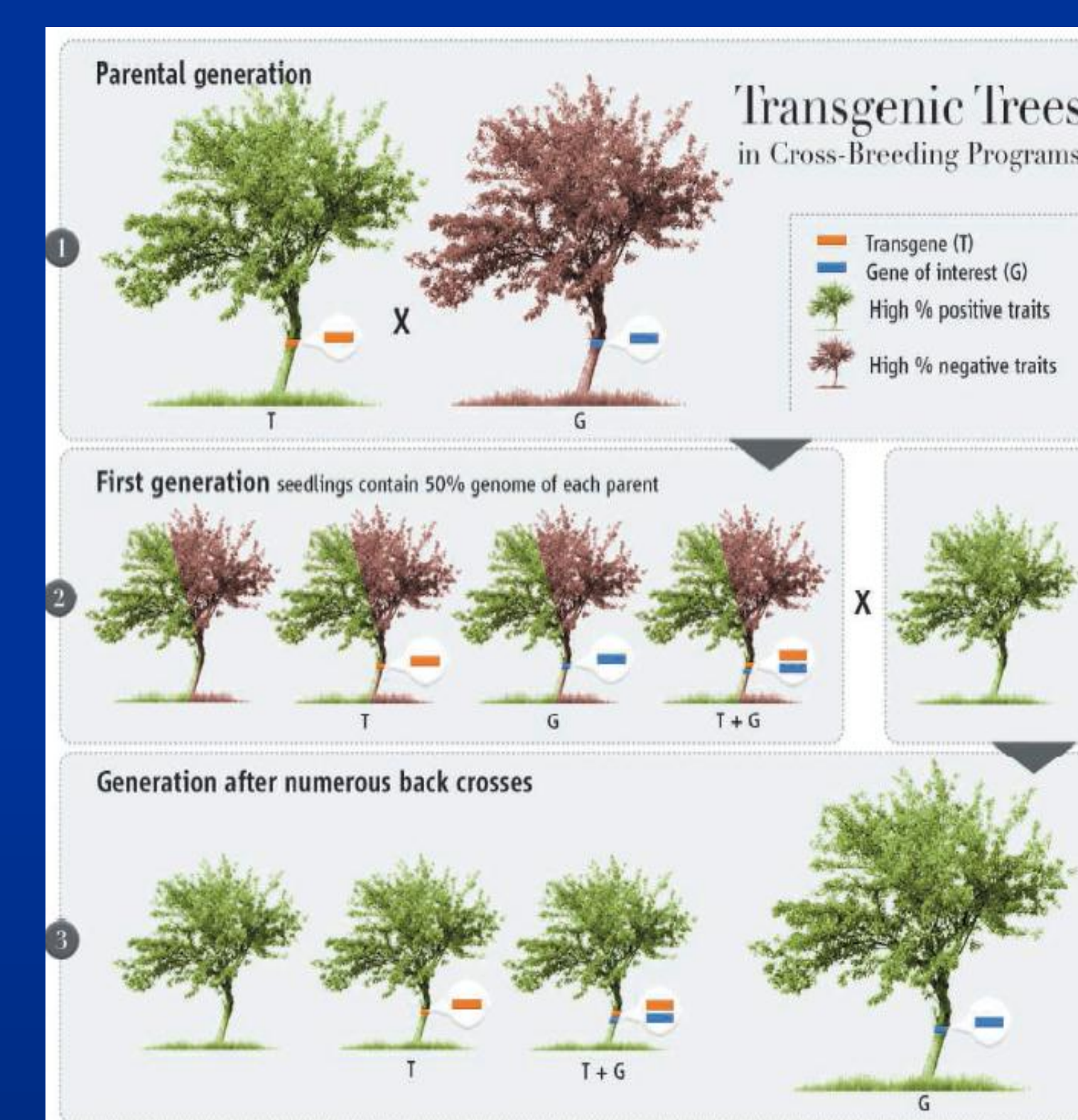
C. Putative transgenic primordia were observed after 6 weeks on approximately 10% of the explants



Future Work

Putative transgenic events will be propagated and analyzed first by performing GUS assay to observe blue color. Further, the transgenic events will be confirmed by using molecular techniques such as PCR and Southern hybridization to assess gene integration.

The image below shows how the quick flowering transgenic plant is used in introducing a unique trait and then the transgene is segregated out to obtain a non-transgenic desirable variety.



Conclusion

The project will assist farmers and fruit growers so that they are able to see an apple before its expected arrival date. They will be able to view the characteristics of the apples to determine if they are worthy enough of being placed on the market or even grown. It also will save growers time and money. The growers have the competitive advantage to invest in this technology to “see into the future.”

References

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