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Gibberellin and Clipping Promote Germination in Fresh Grape Seeds

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Summary

An initial experiment was conducted to reduce or bypass the stratification requirement for dormancy release and germination in grape seed. By utilizing fresh seed from mature fruit that had not completed the final maturation drying stage of development was found to be induced to germinate after a 2000 ppm gibberellic acid treatment or after clipping the distal end of the seed. This effect was further enhanced by combining the gibberellin and clipping treatments yielding 100% germination in this preliminary study.

INTRODUCTION

Grape is commercially important both as a table fruit, a processed fruit for raisins, juice, and jams, as well as for wine production. Selected cultivars are commercially propagated by hardwood cuttings or grafted on resistant rootstocks (Davies et al., 2018). However, weather patterns around the world are changing and there is a need to breed and propagate new adapted selections of a variety of traditional crops including grape. For grape, there are predictions for dramatic reductions (up to 81% by the late 21st century) (White et al., 2006) of suitable wine grape acreage in the United States. Seed germination is an important step in traditional breeding programs as well as

those "accelerated crop breeding" programs utilizing novel genetic approaches.

Grape seed has physiological dormancy and requires three to four months of chilling stratification. A system that could bypass this stratification time to expedite seedling production could reduce breeding cycles and facilitate novel "accelerated breeding" programs. Therefore, the objective of this project was to investigate the impact of partial seed coat removal and gibberellin treatment on germination of freshly harvested grape seeds.

MATERIALS AND METHODS

Seeds were extracted from ripened grape (*Vitis* 'Cabernet Sauvignon') fruits from greenhouse grown plants. Fruits were physically crushed by hand and the pulp removed from seeds by rubbing with paper towels. Seeds were surface disinfested for 10 minutes in a 10% commercial bleach solution followed by three rinses in sterile distilled water. Half the seeds were left intact, and half were cut through the seed removing the distal rounded portion of the seed. Intact and cut seeds received a 24-hour soak in sterile distilled water or a 2,000 ppm filtered sterilized gibberellic acid (GA) solution. Seeds were then placed in Petri dishes on an in vitro Bacto-agar based Murashige and Skoog salts medium without sucrose (Figure 1). Germination was at 25^{o}C with 16-hr light.

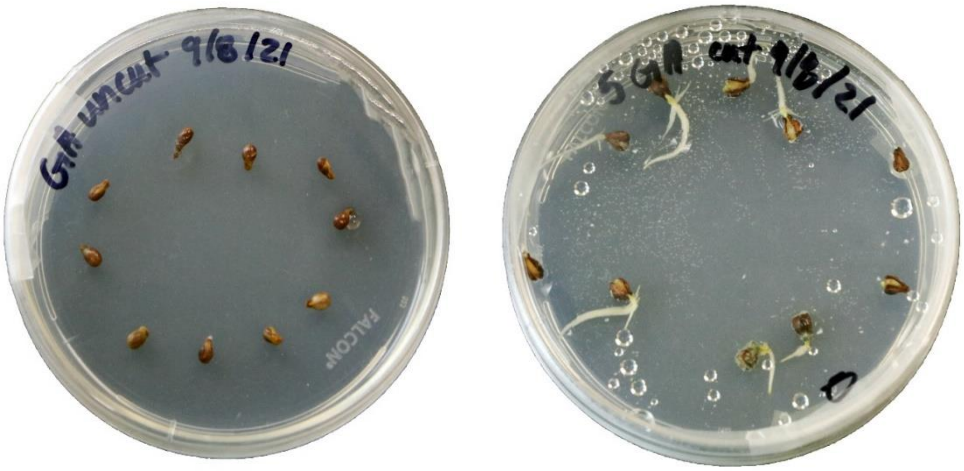

Figure 1. Seeds were sown on MS in vitro medium without sucrose.

RESULTS AND DISCUSSION

Untreated seeds failed to germinate (Figures 1 and 2). All seeds that were cut and treated with GA germinated after about 14 days. Intact seeds treated with GA or cut without GA germinated at 40% or 20 % respectively, but germination was slow taking between 20 and 40 days to initiate germination. Seeds germinated in vitro transitioned to produce seedlings, but further observation is necessary to ascertain the vigor of these seedlings (Figure 3).

There are several surgical methods to by-pass seed physiological dormancy including embryo removal from the seed or disrupting seed coat integrity (Geneve, 1991). Hormones, primarily GA, can also

substitute for chilling stratification to satisfy dormancy (Baskin and Baskin, 2014). There is also significant anecdotal evidence that utilizing fresh seed that has not gone through the desiccation process can show less dormancy compared to dried seeds in several woody perennials including alder (*Alnus*), persimmon (*Diospyros*) and eucalyptus (Schopmeyer, 1974).

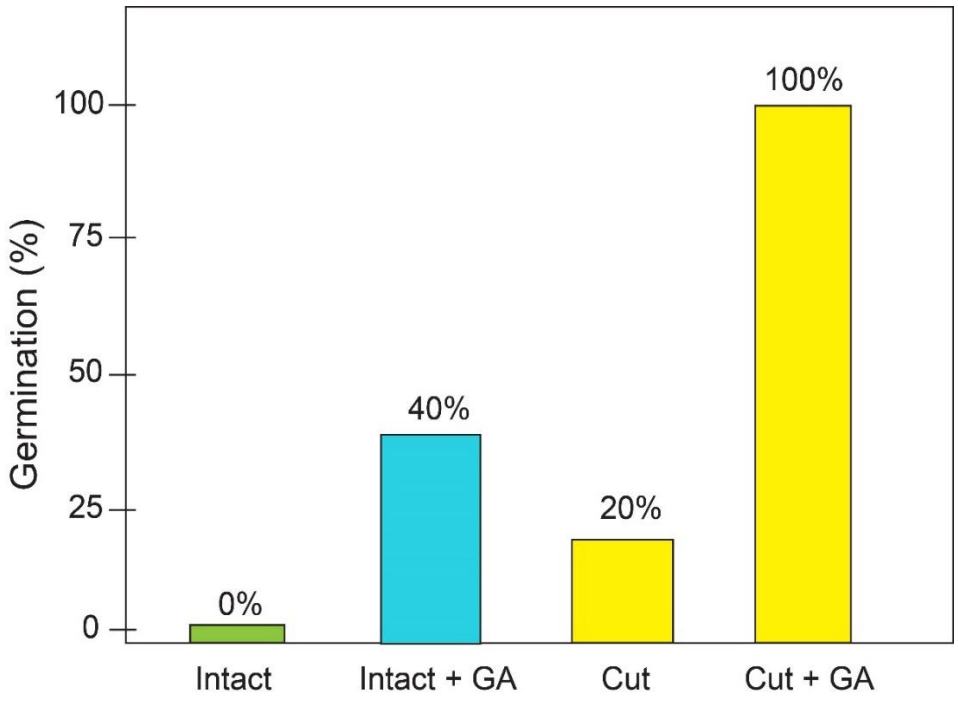

Figure 2. Germination in fresh grape seeds after being cut and treated with 2,000 ppm gibberellic acid.

Figure 3. Seedling from seed that was cut and treated with 2,000 ppm gibberellic acid.

The present preliminary study with grape demonstrated that seeds that have been cut and treated with GA could germinate and transition to seedlings thus reducing the time to produce a seedling compared to traditional stratification treatments. This study was done with fresh seed and additional studies are underway to see if the combination of cutting and GA treatment is only efficacious in fresh seeds or can also be applied to dried and stored seeds.

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