

AVOCADO SEED GERMINATION STUDIES

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Abstract. "Waldin" avocado (*Persea americana* Mill.) seeds were soaked for 24 hours in concentrations of 0, 250 and 500 ppm gibberellic acid (GA) in lots of 784 seeds each. Moreover, half of the seeds in each lot were left intact and the other half had the apical and basal ends cut off prior to soaking. Cumulative seed germination was recorded 19, 23, 34, 44 and 54 days after planting. Cut seeds at each and all concentraaion(s) of GA showed higher initial germination than uncut seeds, but the differences disappeared by 34 days after planting. Cut seeds receiving 250 ppm GA showed higher initial germination, but this difference also was eliminated in subsequent measurements. Overall, GA treatment caused no practical differences in total germination. Cutting of seeds reduced total germination significantly, probably as a result of embryo damage due to cotyledon separation during cutting, soaking and planting.

Nurseries have traditionally experienced problems with avocado propagation caused by a variable germination period of rootstock seeds, which frequently forces the nurseries to extend the propagation period as they wait for late-germinating seedlings to achieve graftable size. The preferred method is to be able to graft everything at one time without having to go back over the propagation beds.

Some nurseries cope with this problem by germinating the seeds in seedbeds, then transplanting the seedlings to containers soon after emergence. Thus, propagation can be conducted in sequence on relatively uniform stocks. However, the use of a seedbed and transplanting is more labor intensive than seeding directly into containers.

Research was initiated in Florida and other areas to enhance the rate of germination of avocado seeds and thus increase seedling uniformity to facilitate once-over propagation. Early results indicated that removal of the seed coat of some types of avocados would enhance germination and uniformity (3, 4). However, seed coat removal is difficult and time consuming on many types of avocados and is little used today.

Subsequent research showed that cutting off the apical (and sometimes basal) end of the seed facilitated germination. Cutting the seed is commonly practiced in avocado propagation today. Work by Leal et al. (4) in Florida centered on the use of gibberellic acid (GA) imbibition of of avocado seeds, with and without the seed coat. 'Waldin' seeds, with and without seed coats, imbibed for 12, 24 and 48 hours in various concentrations of GA, showed enhanced germination and seedling uniformity under laboratory/greenhouse conditions. Similar results in seedling size and uniformity have been noted in other research with avocados (1, 2, 5).

This study was undertaken to ascertain if these results would be applicable in a commercial nursery, using larger numbers of seeds.

Materials and Methods

The experiment was conducted at Calusa Nursery in Homestead, FL. 'Waldin' avocado seeds were collected in October from a Homestead packinghouse and held under refrigeration (50°F) until use. The experiment was designed to measure the influence of cut vs. intact seeds imbibed for 24 hours in 0, 250 and 500 ppm GA on the rate of seed germination. There were 4 replications of 98 seed each in each treatment, with a total of 2,352 seeds.

GA treatments were made on October 16-17, 1979, in field bins lined with polyethylene and containing 72 l of aqueous solution of 0, 250 or 500 ppm GA prepared from Pro-Gibb. Half of the seeds in each bin were left intact; the balance were prepared by cutting away approximately 10 mm of the apex and 5 mm of the base of each seed.

The seeds were planted October 17, 1979, 1-1.5 cm below the surface in beds of a medium composed of wood shavings and perlite. Adequate moisture was maintained by frequent use of overhead sprinklers. Germination was recorded when shoots emerged above the surface of the medium. Numbers of seed having germinated in each treatment were recorded 19, 23, 34, 44 and 54 days after planting. Subsequent records could not be taken as many of the seedlings were ready to be transplanted to polyethylene bags and grafted, which fact disrupted the experimental design too much to continue monitoring germination. This also eliminated actual growth measurements.

The data were subjected to statistical analysis.

Results

The first visible germination occurred 19 days after planting, when 3 shoots were visible in the entire experiment. Subsequent germination results are presented in Figs. 1 and 2. Each factor is presented as the sum of the other factor due to the lack of significant statistical interaction between factors. GA at 250 ppm significantly enhanced avocado seed germination after 23 days, but this enhancement was lost by 34 days and subsequently (Fig. 1). GA at 500 ppm actually depressed germination at 34 days, but had no effect at any other time.

Cutting the seed enhanced early germination at 23 days, was not effective at 34 days, and significantly reduced germination at 44 and 54 days (Fig. 2). Only 3 seeds had germinated after 19 days, so these data were not included in the analysis or figures.

Growth responses were observed and noted as a response to GA treatment. The control plants (0 ppm GA) had the smallest leaves and were the shortest plants, both in cut and uncut seeds. Plants receiving 250 ppm GA had the largest leaves, were the tallest, had thicker stems and had the most branching. Plants receiving 500 ppm GA were intermediate between 0 and 250 ppm GA for size, leaf number and branching. Actual measurements could not be taken due to early termination of the experiment.

Total recorded germination for the duration of the experiment was 65.9%.

Discussion

GA at 250 ppm did significantly enhance early germina-

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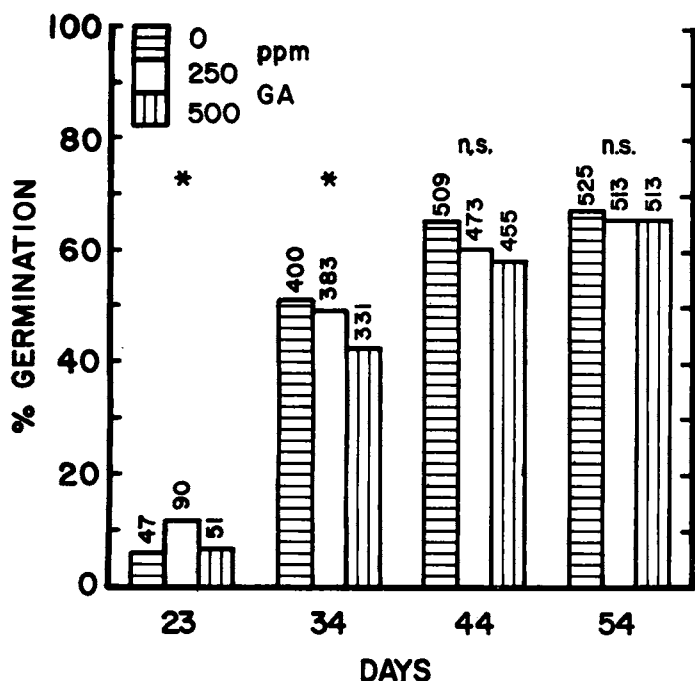


Fig. 1. Effects of GA on 'Waldin' avocado seed germination. Numbers above each column represent the total germination of 784 seed. Statistical significance at the .05 level is indicated above each group of columns.

tion of 'Waldin' avocado seeds. However, the effect was only a small one and would not prove of practical value in avocado propagation. Total germination was not affected by GA treatment. The fact that 250 ppm GA did increase final size of the seedlings could prove relevant in that graftable-size seedlings may be obtained earlier than non-treated seedlings.

Seed cutting significantly increased germination at 23 days over intact seeds, but actually resulted in a lower germination total at 44 and 54 days as 14% of the cut seeds had emerged at 23 days as compared to only 2% of the intact seeds. The lower germination of cut seeds may have had an adverse effect on the GA treatment results.

Only 57% of the cut seeds germinated during the test, whereas 75% of the intact seeds germinated. The possibility of embryo damage due to GA treatment is unlikely, as the same relationship was true for seeds receiving 0 ppm GA. The probable cause for lowered germination of cut seeds is embryo damage due to splitting of the cotyledons during cutting, soaking, planting and the generally rough handling during those operations. It is expected that less drastic cutting, more careful handling and smaller seeds would reduce this problem.

Total germination was only 65.9% at the end of the test, which is somewhat lower than anticipated. However, the experiment was terminated by transplanting the largest seedlings, but seedlings continued to emerge subsequently. Nonetheless, total germination was only slightly less than Calusa Nursery expects to obtain from lots of avocado seeds held under refrigeration.

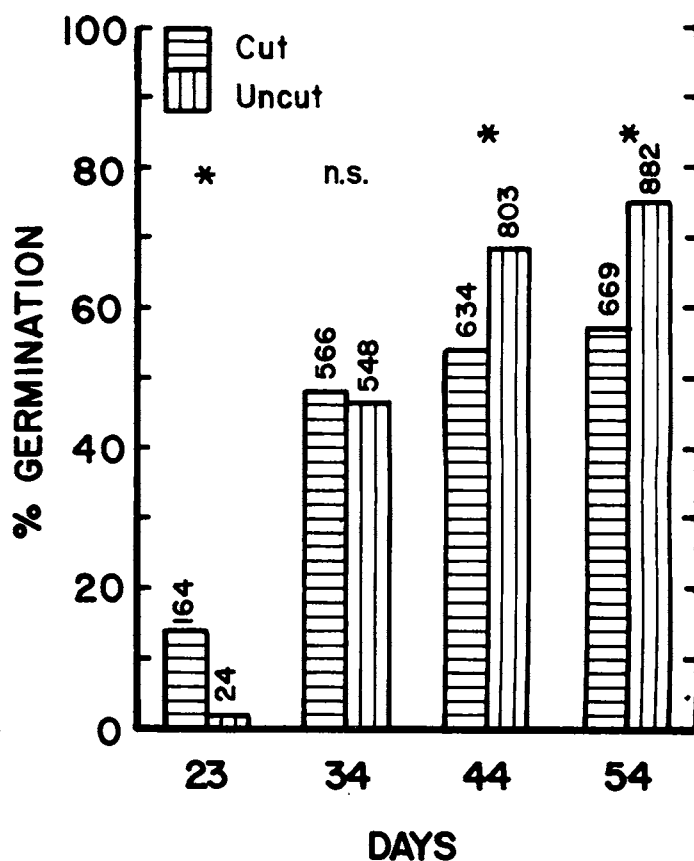


Fig. 2. Effects of seed cutting on 'Waldin' avocado seed germination. Numbers above each column represent the total germination of 1176 seed. Statistical significance at the .05 level is indicated above each pair of columns.

Conclusions

'Waldin' avocado seeds imbibed for 24 hours with 250 and 500 ppm GA under nursery conditions showed no practical effect of increased early germination, but 250 ppm GA did result in significant, early germination and did increase seedling size. The increased seedling size may be of merit to avocado propagators.

Cutting the seeds prior to imbibition also enhanced early germination, although overall germination was reduced, probably due to damage to the embryos. Careful handling during cutting and planting in conjunction with low levels of GA may be advisable in avocado nurseries.

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