infected buds were used for inoculation. No infections could be attributed to inoculating the plants by adding spores to the flood irrigation water nor could any infection be attributed to growing the plants in soil known to be infested with the *Verticillium* fungus.

### Diseased budwood

Although the possibility of the fungus gaining entrance through the pruning wound or the lopping wound was demonstrated, no infection was observed in any of the other plants in the experiment—indicating that, under field practices, the fungus does not infect plants in these ways. Although infested soil is frequently blamed as a source of infection, plants grown for one year in such soil did not become infected in these experiments. Thus, the results of the experiment indicate that the main means of infection is through the use of diseased budwood.

This conclusion also helps explain why the disease is more serious in greenhouse roses than in field-grown roses. Although both are propagated the same way, greenhouse rose varieties do not change as much as those used by home gardeners. By being in use longer, there is more chance for *Verticillium* to build up in a variety. Also, since greenhouse roses are forced the whole time they are grown for flower production, the tissues are growing continuously and tend to be more succulent—causing the plants to be more susceptible and the fungus to be more active throughout the life of a greenhouse planting. Since budwood for propagation of greenhouse varieties is taken from greenhouses producing cut flowers (while budwood for home varieties is taken from outdoor plantings), there is more chance that infected canes will be used as a source of budwood in the greenhouse. The experiments also showed considerable differences as to the susceptibility of the five rootstock varieties. The percentages of infected plants are given in the table.

Although Manetti is extremely resistant to *Verticillium*, budding an infected bud into a Manetti rootstock can result in an infected plant. In view of these findings, control should be sought by the use of *Verticillium*-free budwood in the propagation of greenhouse roses.

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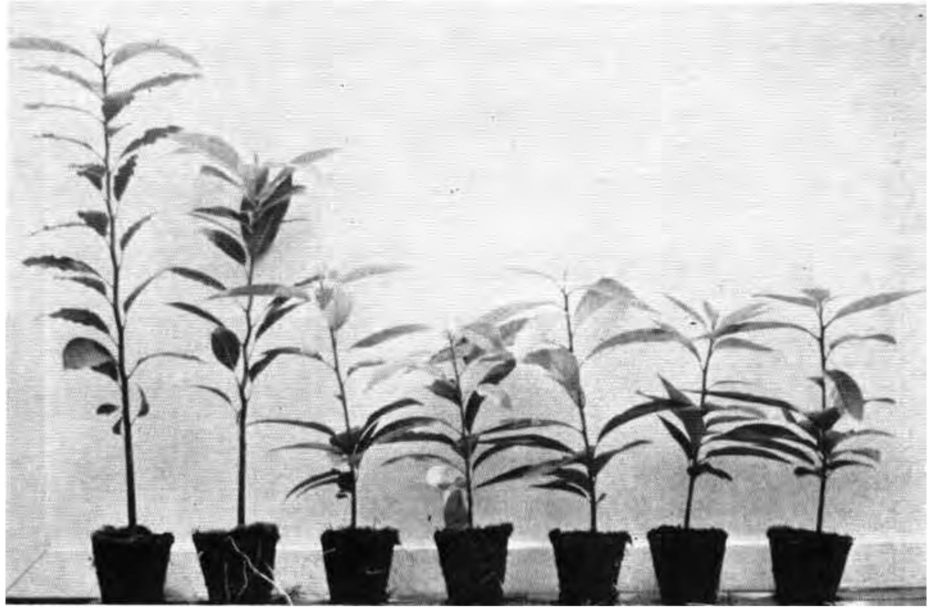
*Robert D. Raabe is Associate Professor, and Associate Plant Pathologist in the Experiment Station, and Stephen Wilhelm is Professor, and Plant Pathologist in the Experiment Station, University of California, Berkeley.*



Duke avocado seedlings 5½ months after seed was soaked in gibberellin. Left to right: 10,000 ppm, 1,000 ppm, 100 ppm, 10 ppm, 1 ppm, 0—water only, and no soaking. (Note crooked internode areas of two plants at left.)

R. M. BURNS · S. M. MIRCETICH
C. W. COGGINS, JR. · G. A. ZENTMYER

**Soaking Duke variety avocado seeds in high concentrations of gibberellic acid for 24 hours prior to planting increased the rate of germination, seedling height, and stem diameter.**

THE DUKE AVOCADO has been known in California since the early 1920's, when many trees were planted because it has considerable cold-hardiness and wind resistance. The fruit is green, medium-sized, and early maturing. However, propagation has not been continued (except for an occasional tree) because the fruit is mediocre in quality and has a tendency to develop

#### EFFECTS OF GIBBERELLIN TREATMENTS ON AVOCADO SEEDLING EMERGENCE AND HEIGHT

TABLE 1.

| | SEEDLING EMERGENCE COUNTS* | | | | | | |
|---|---|---|---|---|---|---|---|
| Treatments | A | B | C | D | E | F | G |
| Date evaluated (1966) | | | | | | | |
| Jan. 1 | 1 | 1 | 2 | 0 | 1 | 8 | 5 |
| Jan. 28 | 8 | 6 | 7 | 2 | 9 | 10 | 15 |
| Feb. 4 | 12 | 11 | 16 | 5 | 12 | 12 | 18 |
| Feb. 11 | 14 | 13 | 18 | 13 | 17 | 13 | 19 |
| Feb. 18 | 17 | 15 | 20 | 15 | 18 | 15 | 19 |
| Mar. 22 | 20 | 19 | 20 | 19 | 20 | 20 | 20 |
| May 18 | 20 | 20 | 20 | 20 | 20 | 20 | 20 |

* Total of 20 seeds in each treatment, planted Dec. 21, 1965.

TABLE 2.

| | AVERAGE HEIGHT OF SEEDLINGS IN CENTIMETERS* | | | | | | |
|---|---|---|---|---|---|---|---|
| Treatments | A | B | C | D | E | F | G |
| Date measured (1966) | | | | | | | |
| Jan. 1 | 0.7 | 2.0 | 0.7 | 0.0 | 2.2 | 2.8 | 2.7 |
| Jan. 28 | 1.7 | 2.5 | 2.3 | 3.0 | 1.4 | 4.8 | 3.6 |
| Feb. 4 | 3.6 | 4.2 | 3.1 | 3.2 | 3.6 | 8.1 | 7.4 |
| Feb. 11 | 5.4 | 6.1 | 4.7 | 2.6 | 4.7 | 11.6 | 10.8 |
| Feb. 18 | 5.8 | 6.8 | 5.2 | 4.4 | 6.4 | 13.8 | 16.3 |
| Mar. 22† | 9.1 | 9.4 | 8.4 | 8.0 | 10.5 | 23.4 | 31.1 |
| May 18 | 28.8 | 29.5 | 28.7 | 26.6 | 32.5 | 44.2 | 54.4 |

(See table 1 for number of plants used for these averages)
* 1 cm = .3937 inch.
† Seedling height of plants in treatments F & G on March 22 & May 18 were significantly higher (1% level).

# GIBBERELLIN INCREASES GROWTH OF DUKE AVOCADO SEEDLINGS

cracks when mature, and the trees are somewhat erratic in production.

In the last few years, growers and nurserymen have shown interest in Duke as a rootstock, since it is known to have more tolerance to the avocado root rot fungus, *Phytophthora cinnamomi,* than some of the other popular avocados such as the Mexican types including Topa Topa, Mexicola, and Ganter. Unfortunately, Duke seed germination is usually slower and less uniform than that of other rootstocks, so nurserymen have not used Duke extensively.

An experiment aimed at increasing seed germination, seedling growth, and uniformity was established at Riverside to test effects of the growth regulator gibberellic acid, $GA_3$. This growth regulator has been used successfully to stimulate the growth of many plants through elongation of the internodes. Seeds used in the tests were obtained from an isolated Duke tree on the Howard Nursery property east of Hemet. The fruit was picked in November, 1965, and 140 seeds were extracted and stored at 38°F. On December 20, each seed was cut at top and bottom in a manner often used by nurserymen, and the seed coats were removed.

### Treatments

The following treatments were then initiated, using 20 seeds per treatment:

A. (Check): no soaking
B. Soaked in deionized water only*
C. Soaked in 1 ppm $GA_3$ (as K salt)
D. Soaked in 10 ppm $GA_3$
E. Soaked in 100 ppm $GA_3$
F. Soaked in 1,000 ppm $GA_3$
G. Soaked in 10,000 ppm $GA_3$

* Deionized water was used to dilute the gibberellic acid; volumes were made to 990 ml for each treatment.

The treated seeds were completely immersed for 24 hours. Each treatment of 20 seeds, weighed before and after soaking, averaged an increase of 3.2 grams per seed. The amount of liquid remaining after the seeds were removed showed a decrease of 80 ml. or an average decrease of 4 ml per seed—indicating an appreciable amount of liquid absorption by the treated seeds.

After 24 hours the seeds were removed from the various soak treatments and planted individually in 3-inch-square peat "Jiffy Pots" (see photo). U.C. soil mix was used consisting of peat, sand, and a soil containing some clay. Each treatment of 20 pots was separated into regular nursery flats and placed in the greenhouse.

### First seedlings

At the end of two weeks the first seedlings emerged and counts and measurements were started. Table 1 shows that from the first evaluation, the seedlings soaked in 1,000 and 10,000 ppm $GA_3$ were both earlier to germinate and taller (see photo).

On May 18, 1966, the stem diameters of all seedlings, measured in centimeters at the top of the seeds for each treatment, averaged as follows: A, .59; B, .57; C, .55; D, .53; E, .59; F, .70; and G, .77. Treatments F and G had significantly larger stem diameters than the other treatments (F at the 5% level and G at the 1% level). Most plants in these two treatments could have been topworked at this time. One of the growth patterns included crooked, or zig-zag, internodes at the higher concentrations of $GA_3$ (see photo). The abnormal internode growth was generally restricted to an area from 5 inches to 12 inches above the soil level. Subsequent new growth was normal. Also obvious in the photo is the undulating appearance of the leaf margins of the plant on the extreme left, which had been treated with 10,000 ppm $GA_3$.

### Plants moved

In late June the plants were moved from the greenhouse in Riverside to Ventura and allowed to harden-off under partial shade. On July 20 the seedlings were transplanted into tar paper containers (5 inches in diameter by 14 inches in height) in the nursery. Average height measurements (inches) taken at this time were as follows: A, 16.0; B, 16.6; C, 16.0; D, 15.5; E, 17.3; F, 21.7; and G, 24.9. The plants receiving the 1,000 and 10,000 ppm $GA_3$ seed soak (F and G treatments) were significantly larger than those of any of the other treatments.

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*Robert M. Burns is Farm Advisor, Ventura County; Srecko M. Mircetich is Plant Pathologist, USDA, Beltsville, Maryland (formerly with the Department of Plant Pathology, University of California Citrus Research Center, Riverside); Charles W. Coggins, Jr., is Associate Plant Physiologist and Lecturer, Department of Horticultural Science, and George A. Zentmyer is Professor, Department of Plant Pathology, U.C., Riverside.*

*A. H. Krezdorn, Chairman, Department of Fruit Crops, University of Florida, Gainesville, assisted with helpful suggestions on this project; W. A. Thorn, Orchard Management Service, Eadington Fruit Company, Fallbrook (formerly Laboratory Technician. Department of Plant Pathology, U.C. Riverside), and W. H. Brokaw, Avocado and Citrus Nurseryman, Ventura, assisted with growing the plants; and T. A. Little, Extension Biometrician, University of California, Riverside, provided statistical advice.*