with GA, retardation in enlargement, coloration, and softening of fruits resulted. GA sprayed only on fruits showed very slight response. GA which was sprayed on leaves of bearing shoots apparently was absorbed and translocated to the fruits as was observed by Crane (1) in peaches. Therefore, spraying foliage seemed to be an appropriate method of GA application.

Time and effect of GA application: It was found that GA increased storage life of fruit when it was sprayed on leaves before harvest, but also retarded fruit development. Therefore, it was thought that GA should be applied as late as possible after fruits had attained their full size and mature color and were ready to harvest.

GA spray greatly increased the storage life of fruits of both varieties (Table 1). In Hiratanenashi, GA sprayed fruits showed more than double the storage life of the unsprayed (0 ppm). Unsprayed fruits harvested 3 days after date of spraying tested 0.45 kg in 3.5 days after removal of astringency. Fruits receiving 50, 100, and 200 ppm GA sprays tested 0.45 kg in 8.6, 10.1, and 11.4 days, respectively.

Unsprayed fruits harvested 17 days after the date of spraying overripened on the tree and became soft during the treatment for removal of astringency. On the first day after the treatment they tested less than 0.45 kg and were unmarketable. However, GA sprayed fruits remained firm and their storage life was almost the same as those harvested 3 days and 10 days after spraying. Therefore, GA spray not only increased the storage life of fruits after harvest but also extended the period of harvest on the tree.

Delay of autumn leaf fall by GA spray: GA sprays markedly delayed autumn leaf fall of the trees (Table 2). Heavy frost occurred on Dec. 2 and 3 causing all GA sprayed leaves to defoliate. However, in a non-frost region a greater delay in defoliation might have been expected.

Other effects of GA spray: The quality of sprayed fruits was not impaired by GA spray when the spray was applied after fruits had matured. Sprouting of sprayed shoots in the following spring was delayed 1 or 2 days by 200 ppm of GA. However, no injurious effects were observed.

Table 2. The effect of GA sprays on delay of autumn leaf fall.

Variety	Conc. (ppm)	Date of defoliation
Hiratanenashi	200	Dec. 3 [a]
	100	Dec. 3
	50	Dec. 2
	0	Nov. 10
Fuyu	200	Dec. 3
	100	Dec. 3
	50	Dec. 3
	0	Nov. 18

[a] Heavy frost occurred on Dec. 2 and 3.

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A Gravity Penetrometer for Measuring Flesh Firmness in Citrus Fruits

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Table 1. Comparison of the results obtained with the gravity penetrometer with those obtained with a whole-fruit compression tester[a].

	Flesh penetration (mm)	
	Normal	Variant
1.	4.47	7.80*
2.	7.36	12.83*
3.	6.34	11.21*
4.	6.65	11.46*
5.	7.61	12.43*
	Whole-fruit compression (mm)	
	Normal	Variant
1.	3.56	4.56
2.	4.23	4.34
3.	3.18	3.52

[a] Average of 10 fruits from each of ten trees of each type in each planting.
* = Difference significant at the 1% level.

Investigations on a widely distributed variant Navel orange led to the need for reproducible, quantitative measurements of flesh firmness of orange fruits. Previous work using pressure devices on the surface of transversely-cut citrus fruits had resulted in erratic results. Whole fruit compression tests failed to show significant differences between samples of the variant and normal fruits (Table 1). In preliminary trials, dropping a pointed rod a given distance through a guide tube onto the transversely-cut fruit gave reproducible results. On the basis of the preliminary results, the present instrument, Fig. 1, was constructed and used in subsequent tests comparing variant Navel oranges with normal Navel oranges. In all plantings tested, the variant trees could be identified by means of the differences in the penetrometer measurement. The absolute values varied from planting to planting and on different sampling dates, but the differences between the two fruit types were always

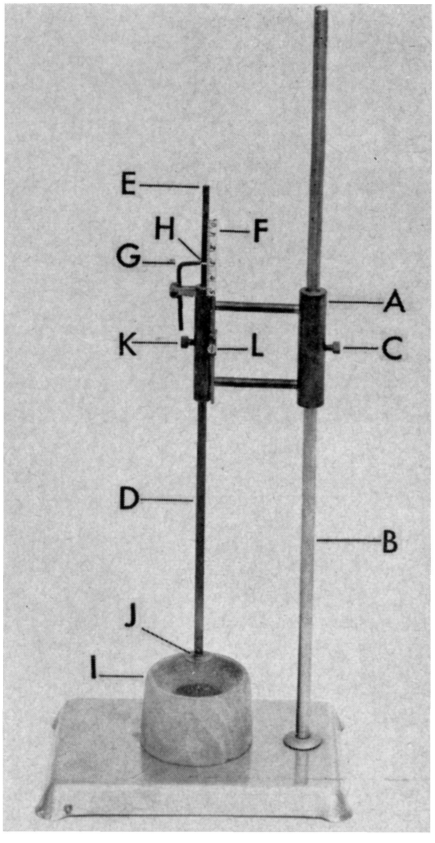

Fig. 1. Gravity penetrometer, side view.

detectable. Results from the first plantings sampled are given in Table 1.

The entire assembly (Fig. 1) slides freely in the vertical direction by means of a guide (A) that fits a standard ring stand (B). The assembly can be locked in place by a set screw (C). With the point of the drop-rod even with the base of the guide tube (D), the top of the rod (E) is zeroed on the measuring scale (F). After zeroing, the rod is pulled up until the trigger (G) engages the circular groove (H) in the rod. The entire assembly is raised, and the fruit, held in a concave base (I), is moved into position. The assembly is lowered so that the base of the guide tube (J) rests on the cut fruit. In positioning the tube base, segment membranes, central core, and peel are avoided. The rod is dropped by releasing the trigger, and the amount of penetration is read directly on the scale.

The guide tube (D) can be raised or lowered to increase or decrease the amount of drop. It is held in place by set screw (K). The measuring scale (F) is adjustable, so that the top of the drop rod can be zeroed for any drop that is used. Set screw (L) holds the scale in place.

The dimensions of the present instrument were determined by the materials available and a combination of rod length and diameter that gave a usable range of penetration with the fruits being tested. The 10-inch guide tube is one-quarter inch copper tubing. The 12-inch drop rod is a 3 16-inch brass rod. The point was formed by tapering the last five-eighths inch of the rod down to a 1 16-inch diameter tip. Points of different diameters and taper might be needed for testing fruits with different characteristics. Other parts were machined from standard brass rod stock.

The instrument has only been used for testing flesh firmness in seedless oranges. It would not be applicable to fruits with more than a few seeds, because of interference with the penetration of the rod. Using 10 fruits per tree, it has been possible to identify trees of two selections of Navel orange that differ in pulp softness.

Abortion of Flower Buds in Chrysanthemum After Application of a Selected Petroleum Fraction of High Aromatic Content

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Abstract: Alkylnaphthalenes are used as solvents for chlorinated insecticides and herbicides. Johnson, Yeomans, and Smith (2) reported that these solvents could cause the death of the apical meristems of chrysanthemums when applied in concentrated solutions or in mechanically or thermally generated aerosols. Controlling the number of flowers and fruits on a stem is not only of academic interest but of practical importance. They are now controlled on chrysanthemums by removing the excess by hand. Research reported in this paper show that HAN,[R] a petroleum fraction containing a large percentage of alkylnaphthalenes, can be used to control the number of flowers borne by chrysanthemum plants.

The effect of HAN was detected in a survey of the various types of solvents used in the formulation of insecticides, reported in part in (2). Chrysanthemum plants were placed in large drums and exposed to oil aerosols atomized with air pressure of 10 psig. The aerosol treatments required exposure of the plants to the oil droplets for 1 to 2 hours in a closed drum. The paraffin-base oils, relatively non-toxic, were ineffective in causing the abortion of the flower buds. The petroleum fractions containing appreciable amounts of alkylated naphthalenes caused some distortion of the leaves (2), and (depending on the stage of development of plant) death of the apical meristem and abortion of the lateral flower buds. The heavy aromatic naphthas were particularly active in the tests.

Spray applications were also tested. Cuttings of *C. morifolium* cv. Fred Shoesmith (9), were propagated on July 15, 1965 and potted on August 5, 1965. The plants were grown in 4-inch pots on natural days with an interruption of 10 ft-c incandescent-filament lamps from 10 pm to 2 am nightly. The greenhouse was maintained at a minimum night temperature of 17°C. The plants were transferred to 8-hour days on September 1, 1965. On September 10, 13, 14, 15, 16, and

Figure 1. Plants of *C. morifolium* cv. Fred Shoesmith, propagated July 15, 1965, potted August 5; growing point removed August 19, and 8-hour days at 17°C from September 1. Plant on left sprayed with 1% HAN, 0.1% Triton X-100 on September 15. Plant in center sprayed with 0.1% Triton X-100 on September 15. Plant on right had the lateral flower buds removed by hand on October 6 (two flower buds developed subsequently). Photographed November 17, 1965.

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