more growth layers, depending upon how many times the tree ceased and then resumed growth during a season.

It was found that the annual increments in the various specimens of Arizona cypress contained from one to five growth layers. In a certain branch of a western yellow pine the years 1936–1937 contained five growth layers. No clue existed whereby the end of 1936 and the start of 1937 could be identified. The difficulty was overcome in a second branch, where frost injury indicated the beginning of 1937 growth. Thus, 1936 contained two and 1937 three growth layers. It must be added that the growth layers of one branch corresponded in relative thicknesses with those of the other.

In brief, the forms of the layers may be classified roughly as lens and non-lens. A layer forms a lens if its late wood merges with that of the layer next inside, that is if it fails to form a completely independent ring. Both types were observed to have sharp outer margins in some cases, diffuse in others, or partially sharp and partially diffuse. In addition, the lens type as a rule did not constitute an entire annual increment. It is obvious that sharp layers could be mistaken for annual increments in trees devoid of frost injuries.

The following conclusions may be tabulated: (1) When present, frost injuries in the trees on the campus of Texas Technological College give a unique method of determining with exactness the amount of xylem formed each year. (2) Within the annual increments for 1932 to 1938 multiple growth layers are by no means uncommon—layers indistinguishable from a single annual increment under any magnification up to 400×. (3) A single radius, or even an entire section, may not be a safe guide to the correct age of a tree. (4) Under any ecologic conditions, complex as they are known to be, it would seem to be scientifically unsound to reason theoretically concerning the unity or multiplicity of growth layers in the annual increments. Thorough investigation and experiment by means of well-known botanical techniques are necessary for each general environment in order to determine the behavior of the cambium and the resultant anatomy of the annual increment. In the work here briefly reported, frost injuries fortunately gave the necessary accuracy to dating and thus have been used as a substitute for other more thorough types of investigation. (5) No ecologic interpretations are attempted. Suffice it to say that those conditions which cause the cessation of cambial division *at the end* of the growing season can operate equally well to cause cessation with like results *within* the growing season not only once but several times.

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SCIENTIFIC APPARATUS AND LABORATORY METHODS

A SIMPLE GRAVIMETRIC ALCOHOL CHECK FOR CALIBRATION OF METABOLISM APPARATUS

FOR alcohol checks of metabolism apparatus we have recently made two improvements on the standard procedures.[1] One improvement is the use of a small detachable lamp for weighing, which eliminates the use of a calibrated burette. The other is the elimination of the complicated water-cooled burner described by Barrett and Robertson.[2]

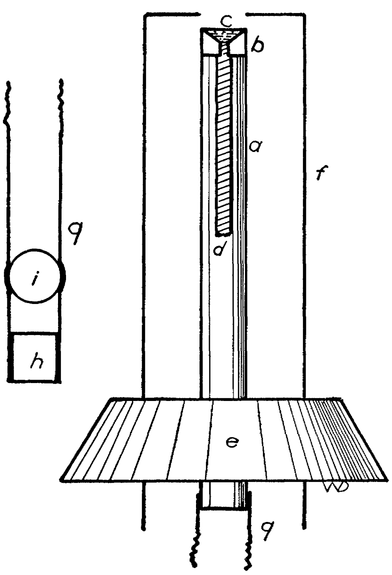

FIG. 1

As shown, the lamp consists of a pyrex glass tube (3/16″ by 5″), *a,* to which is fused a pyrex capillary tip, *b.* Asbestos fibers, *c,* prevent combustion of the wick, *d,* a piece of cotton binding cord. The large tube, *a,* by affording air insulation, eliminates boiling of the alcohol and the consequent loss due to sputtering. For weighing, a fine suspension wire (not shown) is attached to the No. 13 rubber stopper, *e.* Copper wires, *f,* for ignition connect to a spark coil. In Benedict-Roth machines the artificial circulation of air is perhaps most simply achieved by the method of Benedict.[1]

OPERATION

The thin-walled rubber tubing (3/16 inches by 6

[1] F. G. Benedict, *Boston Med. and Surg. Jour.,* 193: 807, 1925.

[2] J. F. Barrett and J. D. Robertson, *Jour. Path. and Bact.,* 45: 555, 1937.

inches), g, is detached, and the glass bead and plug, h, removed to facilitate filling. The weighed unit is inserted into a long cylindrical glass hood whose side arms connect to the metabolism system. By means of the bead, i, the level of the absolute methyl alcohol is maintained at the lower end of the wick, thus insuring a small, non-luminous flame. Near the end of the check, after the spark coil switch has been closed again to avoid escape of unburnt vapors, the supply is discontinued. When the flame dies out, to prevent evaporation, the alcohol in the tube is allowed to drop back into the reservoir created below the bead. Weighings are performed without delay. Used in testing a closed circuit respiratory metabolism apparatus, this method gave on seven checks values of 100 ± 0.5 per cent. for oxygen, carbon dioxide and water.

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DEFOLIATION OF ROSE PLANTS WITH ETHYLENE GAS[1]

INVESTIGATIONS by the Oregon Experiment Station have shown that ethylene gas can be used to remove the foliage from field-grown rose plants. The treatment is used after the roses have been dug for shipment or storage. One Oregon nurseryman has defoliated over 200,000 rose plants by this method this year; 50,000 of these were defoliated in a single room in four days' time. By other methods commonly used by the growers it would have taken several weeks to defoliate this same number of plants.

The fact that ethylene will defoliate rose plants is not new. Wilcox[2] in 1911 reported that illuminating gas would defoliate greenhouse roses. Since that time other workers have noted a similar effect on rose plants grown in greenhouses. In 1931 Zimmerman, Hitchcock and Crocker[3] demonstrated that ethylene present in illuminating gas or pure ethylene would cause epinasty and defoliation of potted rose plants. Roses thus treated would recover and show no effects of the treatment other than the forcing of more of the latent buds.

The above findings have been reinvestigated and procedures developed whereby this same principle can be used on a commercial scale to defoliate large numbers of nursery-grown rose plants. A fairly airtight room or chamber is provided, and ripe apples are used as the chief source of ethylene gas, although the hypanthia of the rose plants are known to produce some ethylene. One bushel of apples is sufficient for each 300 to 400 cubic feet of space. A temperature of 65° to 70° Fahrenheit is maintained during the treatment by electric or kerosene heaters. Where 50 per cent. or more of the space is filled with rose bushes the heat liberated by the rose plants, once the defoliation process has been started, is sufficient to maintain this temperature in insulated rooms. The plants can be stacked close together in large piles of single rows, but they must be kept in a moist condition to prevent wilting of the foliage. Defoliation with most varieties requires three to five days, but a few varieties require a longer treatment.

Numerous tests have been conducted to determine the behavior of rose plants following the treatment with ethylene. Treated and untreated lots of plants have been grown under field and greenhouse conditions. The treatment apparently has no significant effect upon the subsequent growth of the plants.

Preliminary trials with other plants suggests the possible application of the method to a number of nursery stocks other than roses.

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[1] Published as Technical Paper No. 328 with approval of Director, Oregon Agricultural Experiment Station, contribution from Departments of Horticulture and Plant Pathology.

[2] E. Mead Wilcox, Nebraska State Hort. Soc. Ann. Rept., pp. 278–285, 1911.

[3] P. W. Zimmerman, Wm. Crocker and A. E. Hitchcock, Contr. from Boyce Thompson Institute, 3: 459–481, 1931.

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