A New Kind

of

DENDROMETER

by

Leif Verner

A New Kind Of Dendrometer

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A new kind of dendrometer, developed at the University of Idaho[2], measures the radial growth made by a tree trunk during periods of one or more days. This instrument has been used successfully in Idaho for the measurement of growth in fruit trees as a guide to scheduling orchard irrigation and in the growth of various forest-tree species. Unlike dial-gauge dendrometers previously available, the lever dendrometer described here provides readings that are not affected by daily trunk shrinkage. The Idaho instrument always shows maximum radius attained by the trunk since the last previous reading.

The accompanying figure shows the new dendrometer in outline as it would appear when mounted vertically on a tree trunk. The essential parts and their functions are as follows:

A is a small, rectangular piece of light-gauge zinc tape fastened to the bark of the tree by means of a waterproof glue. The zinc plate provides a smooth, firm surface against which to place that part of the instrument to be activated by radial growth of the tree trunk.

B is a short bar of stainless steel which, when the instrument is set, rests upon the zinc plate, A.

C is a piece of light-gauge, stainless steel. It operates as a lever, riding on a metal pin, E, which serves as a pivot. Slight tension must be provided on the lever at its point of attachment in order that it will remain fixed, until a reading is taken, in any position to which it has been moved by pressure of the

plate, A, against the bar, B, as a result of radial growth of the trunk. Such tension is applied to the lever by tightening the screws above and below the pivot pin, E.

The lever and pivot are mounted on a metal block, F, which has a hole drilled through it vertically to receive the wood screw, H, to which the block is made fast at any desired point by means of tightening a knurled set screw (not shown in the drawing). The wood screw, H, screwed into the trunk to a depth of about 1½ inches supports the fulcrum for the lever. The wood screw, P, is screwed in to the same depth. The upper part of P has a fine, machine thread. It carries a threaded collar with a flange, K, at its base. The flange is calibrated on its margin in units of 1/5 and 1/25 of its circumference and serves as a dial in measuring growth.

Both the screws, H and P, extend far enough into non-growing, woody tissue so that the screws are not affected by growth in the periphery of the trunk. They serve to anchor the instrument solidly.

M is a short, pointed projection at the end of the lever. At each setting or reading of the dendrometer, M should make contact with the under surface of the dial, K, as this is screwed down. The instant of contact is detected by a slight lateral movement of the lever.

Mounting the dendrometer

On fruit trees, mount the dendrometer vertically between the ground and the lowest limb, with the dial end nearest the ground. Proceed as follows:

1. Select a smooth, nearly flat surface on the bark as the point for measuring the radius. If the cross-sectional outline of the trunk is undulating, select a point where the trunk bulges rather than a depression. Smooth the surface lightly with a knife, removing rough, dead bark without injuring live tissue.

2. With a hand drill and a 3/16 inch bit, drill a hole at right angles with the trunk axis to receive the screw, H, at a point that will place the contact bar, B, over the area selected for measurement. Mount the block, F, and the lever portion of the dendrometer at that point. In turning the screw into the trunk allow 3/8 inch of the screw thread to show above the bark. Adjust the lever to a vertical position with its longer arm downward. Tighten the knurled set screw on the block.

3.   With the 3/16-inch drill bit held at right angles with the trunk axis, drill a second hole with the bit placed so that its upper side is about 1/4 inch from the lower end of the lever. With a special wrench provdided for the purpose (don't use pliers!) insert the screw P, turning it in to the point where 3/8 inch of the screw thread still shows above the bark. Attach the dial to the screw, P.

4.   Fasten the zinc plate, A, so that the contact bar, B, will strike it when the lever is aligned so that its lower end is centered under the edge of the dial, K. Fasten the zinc plate to the bark with a waterproof glue, such as Du Pont Duco cement.

5.   Cover wounds around the screws with an asphalt emulsion tree-wound dressing or with grafting wax to prevent drying and reduce risk of infection.

Setting the dendrometer

1.   Adjust the dial on screw, P, so that the top of the collar above the dial is even with the top of the screw.

2.   By an up-or-down movement of the block on the screw, H, adjust the lever so that the contact bar, B, rests on the plate, A, and the lever point, M, is in contact with the lower surface of the dial, K. Tighten the knurled set screw at that position.

3.   Turn the dial counterclockwise 1 or 2 revolutions. Tap the top of the contact bar, B, with your finger so that it is solidly in contact with the plate, A. Now turn the dial clockwise until it again makes contact with the lever point. This should be detected easily by a slight lateral movement of the end of the lever where it passes under the dial. Tighten the screws above and below the pivot pin just enough to give the lever a moderate resistance to up-and-down movement.

Mounting the shield

An aluminum shield is fastened to the trunk over each dendrometer to guard it against disturbance by birds or animals. If the instruments are to be used where squirrels or other rodents might get under the shields, aluminum end-plates are used to prevent this.

Place the shield over the dendrometer and drive a 1-inch wood screw into the trunk at each of the 2 notches in the flange

on one side of the shield. Squeeze the two edges of the shield together lightly, and drive a screw into the trunk at the notch on the other side. (Allow 1/4 inch space between the bark and the screw heads.) When the pressure exerted on the shield by squeezing is released, the flanges will spring back against the screws, holding the shield in place.

Taking readings

One complete turn of the dial corresponds to a radial movement of 1/200 inch at the point of contact between the plate, A, and the bar, B. The *smallest subdivision* on the dial represents a radial movement of 1/5000 inch. Growth for any 24-hour period may be measured by turning the dial clockwise until it makes contact with the lever point, M, and reading the extent of movement of the dial on its graduated flange. The reading is taken at a point directly over the lever. If more than one day elapses between readings, the instrument accumulates the growth indications for the period covered. That is, with each days growth the lever point, M, is moved farther away from the dial, K, until a reading is taken.

Resetting the dendrometer

The lever dendrometer will record about 1/7 inch of radial growth without resetting. Two resettings should accommodate the growth made in one growing season by vigorous young apple trees. One resetting should be enough for one season's growth of older trees. Resetting is done in the same way as the original setting. It is probably better to reset all instruments at one time rather than individually as they happen to need it.

Number required

Tree trunks vary in the amount of radial growth they make at different points. Consequently, a dendrometer that measures growth at one point only does not give readings that can be relied upon as representing the average for the trunk. This disadvantage in the measurement of trunk radii can be minimized by using a number of trees per treatment and averaging their radial growth. The use of 10 trees per treatment has proved satisfactory in experiments in Idaho.