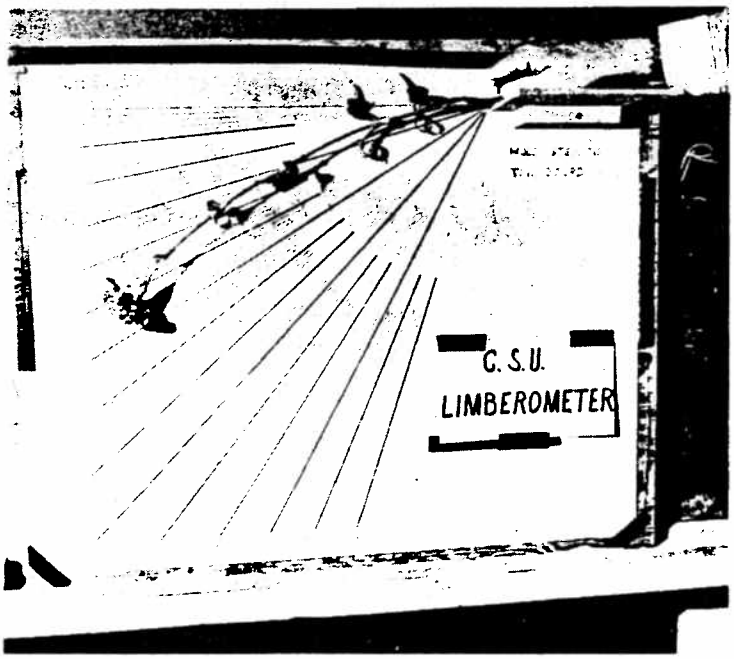
An Objective Measurement of Stem Strength

by Joe J. Hanan

In measuring a plant's response to a specific environment, we are constantly looking for improved methods. Sometimes a useful idea is so simple as to be almost ridiculous. The Limberometer is one of these ideas specifically designed to measure the variation of stem strength in an objective way. While the Limberometer has been in use only four months, it has evoked considerable "comment". Quite likely the device may be applied to measuring stem strength of several cut flowers. This "instrument" is the brainchild of several members of the staff in floriculture at Colorado State University.



The heavy lines on the board in the figure are 5 degrees of arc beginning from the top horizontal line. The lighter lines are 1-degree divisions. In measuring stem strength, the stem is placed parallel with the top line in such a manner that any curvature of the stem will be opposite the direction to which it will bend when the flower head is released. The intersection of the top and vertical lines on the left mark the junction of the stem and calyx. The base of the stem is held firmly on the platform and the flower released. The line on which the calyx and stem junction comes to rest is carried out to the left of the vertical line and a reading obtained in degrees. Eighteen inches has been selected as the distance from the vertical line to the edge of the platform as this is the minimum stem length for standard grade carnations under the C.S.U. grading system.

Table 1. The effect of 4 day temperatures on the stem strength of Red Gayety carnations, with night temperatures in all treatments 52°F. Measurements are in degrees of arc.

Date	Day temperature 60°F	65°F	70°F	75°F
Dec.27,1957	5.7	9.1	13.8	17.5
Jan.6, 1958	10.0	11.5	14.6	22.8
Jan.7, 1958	6.6	10.0	13.2	16.2
Jan.13,1958	8.7	10.6	13.8	17.9

Some typical results obtained with the Limberometer are shown in Table 1. The figures given in the table are averages for several flowers cut from plants grown in 4 different day temperatures on 4 different dates. The differences between treatments are highly significant when analyzed statistically. There is also a lesser significance between measurements on samples cut on different dates.

The specific cause of the difference between dates of cutting is not known at the moment. Since all flowers are allowed to become completely turgid in storage after cutting and prior to measurement, we might assume that differences due to turgor would be cancelled. Also the flowers are cut at the same time each morning. It may be possible that the variation is due to different amounts of solar energy the day preceding cutting.

One might expect that the heavier the flower the more the stem would bend. Environment during the growth of an individual flower and stem regulates this to a large extent. With our present day temperature studies the increase in stem strength at lower day temperatures (65 to 60°F) is more than enough to offset the increase in flower size at these same temperatures. Stems of flowers grown at 60 and 65° are much thicker and more brittle than those grown at 70 and 75°. The stems of flowers grown at 60° are often so strong that their natural curvature would give a negative reading on the Limberometer, however these are arbitrarily assigned the zero degree measurement.

Stem strength also changes with the age of the plant and the stage of the crop. Stems of carnations grown at 60° days and cutting on the first crop are nearly always strong. The stems from the first of a crop are stronger than those from the last of a crop. As the plant continues to age, especially if available light decreases, the stem strength and diameter decreases, although less markedly than those grown at day temperatures of 65° and higher.