tion, 2; rate of dry-weight increase, 8; rate of leaf-area increase, 5; rate of transpirational water loss, 9.

Four derived plant values are considered: (1) Those obtained by averaging the four-week rates of increase in dry weight and in leaf area, (2) the four-week rates of transpirational water loss per unit of total dry weight, (3) the four-week rates of transpirational water loss per unit of leaf area, and (4) the four-week rates of dry weight increase per unit of leaf area. The first of these derived values (which does not differ fundamentally from either of the two values that were averaged) gives what may be called the weight-area index of plant growth. Its maximum is seven times as great as its minimum. The four-week rates of transpirational water loss per unit of total dry weight (water requirement) seem to bear no general relation to the march of the season. The transpiration rates per unit of leaf area (areal coefficient of transpiration), though resembling those of the water requirement in some respects, show an indication of a seasonal march with low midsummer values. The four-week rates of dry weight increase per unit of leaf area (areal coefficient of dry-weight increase) exhibit a general similarity to those of transpiration per unit of leaf area, but show more clearly a seasonal march with high summer and low winter values.

The greenhouse climate during the year of this study, as measured by the plant processes mentioned above, appears to have been most favorable to the general growth of these plants during two separate periods, one in early summer (April 10 to May 22) and one in late summer (July 3 to September 11). The most favorable periods for stem elongation occurred for the two four-week periods ending May 22 and September 25. The period extending from May 22 to July 31 was very favorable for dry-weight production and increase in leaf area. It is also clear that the climatic efficiency for producing growth was lowest during the winter period (about November 20 to about February 26). Even with the usual application of artificial heat, the winter efficiency for plant growth remained very low.

The evaporating power of the air, as measured by the white spherical porous-cup atmometer, showed somewhat higher and more uniform values for the winter than for the summer. The most pronounced seasonal fluctuation was shown by indices of total radiation obtained with the radioatmometer. There is fairly good agreement between these radiation values and those of actual sunshine duration, for corresponding periods. Maximal summer values occurred at approximately the same time for both indices, but the minimum radioatmometric value occurred several weeks earlier than did the minimum duration value. The temperature values (average daily mean and average daily range for each four-week period) showed a rather decided seasonal variation, with high summer values and low winter ones.

The climatic efficiency values within the cheesecloth chamber in the greenhouse appear, in general, to have been lower than those in the unshaded greenhouse, the exceptions being the values for stem height and for leaf area, for periods about June 21. The evaporation and radiation indices for the sheltered series are much lower than those for the exposed series. Very little difference is to be noted between the corresponding temperature values for the cheese-cloth chamber and for the unshaded greenhouse.

While the interpretation of the plant values in terms of those derived from the instruments offers many difficulties, nevertheless the following striking features of this environmental complex that are registered in the records of both plants and instruments, may be mentioned: (1) Fairly good agreement exists between the daily mean temperatures and the transpiration rates, while none of the other plant values shows such agreement with the mean temperatures. (2) The summer values for average daily temperature range and those for transpiration vary in the same direction. (3) Along with high evaporation rates in late summer occur high temperature, radiation and transpiration values, but low values for the rates of increase in dry weight and in leaf area. (4) A rather general agreement is to be observed between the radiation values and the areal coefficients of weight increase and of transpiration, but there is no very marked agreement between the radiation values and those of the water requirement. (5) With the exception of the water requirement of the plants and the evaporating power of the air, the values here studied (both plant and instrumental) exhibit low magnitudes for the winter period.

Where stem elongation is used as a criterion of growth, measurements taken after an exposure period of two weeks appear to be as satisfactory as those taken after a period twice as long. It appears that the climatic conditions effective during the first two weeks of these tests predetermined, in a great measure, the rates of stem elongation for the succeeding two-week period in each case, so that the climatic fluctuations of the second two-week period were practically ineffective to produce differences. These buckwheat plants appear to have been generally much more sensitive to climatic influence during the first two weeks than during the second.

For the rate of stem elongation, and possibly also for that of transpiration, it appears that a period of low values occurs about the summer solstice.

CITRUS ORCHARD HEATING.

The January freeze in southern California gave orchard-heating apparatus a severe test. Commenting upon the results the *Los Angeles Examiner* in a recent issue prints the following:

Fruit Growers' Supply Committee fixes upon standardized device for preventing frost losses.

One hundred per cent citrus crops in California annually through the conquering of frost is the aim of the Fruit Growers' Supply Committee. Factors crystallizing toward that end began to shape themselves at a meeting of the orchard-heating committee in the Consolidated Realty Building yesterday afternoon.

At least two definite points resulted from the discussion. These were (1) that the heating of citrus orchards is not only advisable but essential as a protection against frost; (2) that a standardized heater at a lesser cost than those now on the market is equally as essential.

The Fruit Growers' Supply Committee is described by its officers as the buying organization for the California Fruit Growers' Exchange, through which the products of affiliated growers are sold. The heating committee is a subcommittee of the general board of the parent organization.