for grain is not satisfactory. For example, in the drought year of 1914 nearly 1,000,000 acres were cut for hay in New South Wales instead of the normal 150,000 acres.

The distribution of oats differs cansiderably from that of wheat, the chief producing region being found where the temperature is about 5° cooler than in the principal wheat districts and the rainfail 7 inches heavier. Sugar is confined to the well-watered east coast and is derived almost entireiy from cane. The temperature range under which sugar cane is grown is very considerable, varying from 68° to 78° F., but the necessity for a rainfall exceeding 40 inches confines production to the coast section.

The principal stock industry of this country is raising sheep, and here again rainfall is the control. Ninety per cent of the sheep of Australia are found in the southeastern third of the continent, and the number grazed in a region receiving less than 10 inches of rain is insignificant, while there are practically no sheep where the average temperature exceeds 77°. There is a close relation between the distribution of sheep and rainfall. With an annual fall of 8 inches, about 20 can be grazed per square mile; with 20 inches, 180 may be maintained: while with 35 inches, the number has increased to 400 per square mile. With rainfall greater than 35 inches, however, there is a rapid diminution in the number of sheep raised, and where 50 inches or more of rainfall are received no sheep are found. The cattle industry is of not nearly so great importance as that of raising sheep and in many of the cooler regions where sheep are raised cattle also graze, but as a rule the latter are found to thrive in the wetter localities.—*J. B. K.*

WEATHER AND THE YIELD OF TEA.

The influence of temperature, rainfall, and humidity on the yield of tea during 1918, 1919, and 1920 is discussed briefly by C. R. Harler in *Indian Tea Association Science Department Quarterly Journal*, 1921, No. 1, pp. 28–31.

A warm and moist atmosphere is essential for good-sized leaves. An abundant rainfall is necessary, although excessive rainfall causes a water-logged condition of the soil that reduces the leaf yield and weakens the plants.

The normal mean temperature during the hot weather in Assam is about 82.5° F., the normal relative humidity 94 per cent, and the rainfall 16 to 20 inches or more each month. A rise in temperature is usually accompanied by a lowered daytime humidity, which causes a slow development of the leaves. In the latter part of the summer of 1919 there was a considerable increase in temperature, while the relative humidity fell to 75 per cent. A fair amount of rain was received, but "the fall was mostly at night, so that its full effect in raising the humidity was lost." These conditions unfavorably affected the growth of the leaves.—*J. W. S.*

INCREASING LENGTH OF FROST-FREE PERIOD ON WISCONSIN CRANBERRY BOGS BY SANDING.

J. WARREN SMITH, Meteorologist.

While in charge of the Cranberry Experiment Station near Cranmoor, Wis., Mr. O. G. Malde made a very complete and extensive record of temperature on marsh soils. The period of observation was from 1906 to 1916, inclusive. In a recent statement of some of the results of a study of these records, Mr. Malde says:

> Temperature data recently compiled as a summary of 11 seasons of observations at the Cranberry Experiment Station (1906 to 1916, inclusive) show that there is an average of 58 days between the last spring and first fall frost (June 25 to August 22) over unsanded bog, as against 118 days between last spring and first fall frost over sanded bog. This represents a gain of 95 per cent in length of frost-free season on sanded bog over that on unsanded bog. The item of sanding, therefore, greatly reduces frost hazards and conserves the water supply by eliminating the need for the frequent flooding to protect against summer frosts. Sanding also permits and, in fact, requires deeper and better drainage, and is an insurance against fires on a bog in dry times. Sanding, together with thicker setting of plants, reduces labor and expense of weeding, besides insuring earlier cropping on the bog.

These statements are in harmony with the observations made by Prof. H. J. Cox of the Weather Bureau, as published in Bulletin T., U. S. Weather Bureau, "Frost and Temperature Conditions in the Cranberry Marshes of Wisconsin," published in 1910.

THE SEASONAL MARCH OF THE CLIMATIC CONDITIONS OF A GREENHOUSE, AS RELATED TO PLANT GROWTH.[1]

By EARL S. JOHNSTON.

[Author's abstract.[2]]

The study here reported was undertaken to measure and integrate the climatic conditions of a greenhouse by means of various measurements taken from standard plants, as these conditions varied throughout the year, and also to measure and integrate these same environmental conditions in terms of instrumental data, to prepare for an analysis of such an environmental complex and an interpretation of the plant values by means of the instrumental ones.

The general method employed by McLean was followed. Buckwheat plants (approximately alike at the start, when they were small seedlings) were grown for four-week exposure periods during a total time period of 13 months. A new period began every fortnight. The plants were grown in solution culture and the chemical surroundings of the roots were practically the same in all cases. Such culture plants are considered as integrating instruments for measuring the climatic conditions, as these effect plant processes. Measurements of stem height, dry weight, leaf area, and transpiration were made at regular intervals as "readings" of these "instruments." Simultaneous measurements of evaporation, radiation, and temperature were also obtained. These plant and instrumental measurements were made from two series of tests, one conducted under the ordinary conditions of an unshaded greenhouse at Baltimore, the other within a cheesecloth inclosure in the same greenhouse. Most of the measurements were recorded every week and weekly data are presented, but this paper deals mostly with the four-week data, and mainly with the exposed series.

The seasonal march of the four-week plant growth rates may be summarily described as follows: The rates for stem elongation, for dry-weight increase and for leaf-area increase had high summer values and low winter ones. These values increased during the spring and decreased during the autumn. The rates of transpirational water loss varied throughout the year in a similar manner, but they showed low values about the summer solstice. The rates of stem elongation also showed remarkably low values for a period about the time of the summer solstice. The approximate annual ranges (ratios of maximum to minimum) were as follows: Rate of stem elonga-

[1] Botanical contribution from the Johns Hopkins University No. 59. A dissertation submitted to the Board of University Studies of the Johns Hopkins University in conformity with the requirements for the degree of Doctor of Philosophy, June, 1917.
Delay in publication has been brought about by the unsettled conditions existing during and immediately following the war.

[2] Reprinted from *Bulletin No. 245*, Univ. of Md. Agr. Exp. Sta.

Unauthenticated | Downloaded 11/28/21 11:00 AM UTC