SOLAR-RADIATION Study Reveals Facts Highly Important to Farmers

The sun is a gaseous body having a diameter of about 865,000 miles, which is more than 100 times the diameter of the earth, and a temperature at its outer radiating surface of about 6,000° on the absolute centigrade scale. It is practically the only source of heat and light for the planets of the solar system, and therefore the source of all forms of life existing thereon.

The exact nature of the energy radiated from the sun is not certainly known. It exhibits the characteristics of wave motion transverse to its line of propagation. The energy radiated by a body as hot as the sun includes a wide range of wave lengths. By passing it through a prism of glass the energy will be arranged in the order of its wave lengths. A visual examination will show the prismatic colors, with violet at one end and red at the other. It is the combination of all these colors that produces white daylight.

By means of a heat-measuring device it will be found that long-wave radiation extends far beyond the red of the visible in what is known as the infra-red spectrum, and that short-wave radiation extends beyond the violet in what is known as the ultra-violet spectrum. Sensitive photographic plates will detect the presence of ultra-violet radiation to much shorter wave lengths than will the most delicate heat-measuring instruments.

Characteristics of Different Parts of the Spectrum

Parts of the spectrum lying between different wave-length limits have each their special rôle. Thus, the so-called visible spectrum, lying between the extremes of the violet and the red, besides supplying us with light is especially potent in promoting plant development, so essential in the maintenance of animal life. The short-wave ultra-violet light is a powerful germicide, and is therefore of great assistance in combating disease. Also, by penetrating the skin to the capillary blood vessels it produces certain changes in the composition of the blood that stimulate physical development. Indeed, it seems to be established that the higher forms of animal life, including domestic animals as well as man himself, do not develop normally when deprived of ultra-violet radiation. Hence the growing popularity of outdoor sun baths, since ultra-violet rays can not pass through ordinary window glass.

The infra-red includes approximately one-half the total energy received from the sun. Its importance will be apparent when the total energy is discussed.

In passing through the earth's atmosphere the solar rays are depleted through absorption by atmospheric gases, principally water vapor, and through scattering by the gas molecules and the solid and liquid particles held in suspension. The loss through scattering is much greater in short-wave than in long-wave radiation. In consequence, with increase in altitude the intensity of ultra-violet radiation increases markedly. Also, skylight, which consists of the scattered light that reaches the surface of the earth, is blue in color. The purer the atmosphere the deeper the blue of the sky.

Daily Totals of Solar Radiation

The total solar radiant energy received on a horizontal surface has been termed "the fundamental basis of the science of meteorology." It is likewise of fundamental importance in climatological studies. The solar energy received diffusely from the sky is an important part of this total. At noon in summer it may be one-fifth of the whole, and the proportional part increases as the sun approaches the horizon.

Instruments have been devised for continuously registering the intensity of this total radiation, but published records are available from only about 21 stations, 7 of which are in the United States.

In Figure 211 abscissas give the time scale in days of the year. The ordinates give the intensity scale, on the left-hand margin in units of energy, on the right-hand margin in units of heat. In the

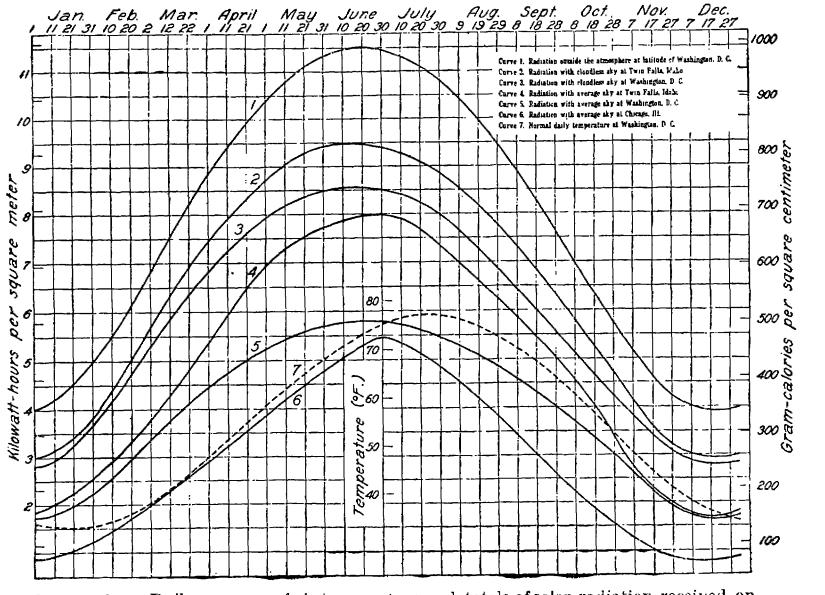

FIGURE 211.—Daily averages of air temperature and totals of solar radiation received on a horizontal surface

center is a temperature scale for curve 7. Curve 1 gives the daily totals of radiation that would be received at the latitude of Washington in the absence of an atmosphere, assuming the solar constant of radiation to be 1.937 gram-calories per minute per square centimeter, or 1.35 kilowatts per square meter. Curves 2 to 6 give measured daily totals of solar radiation received on a horizontal surface; curves 2 and 3 for cloudless sky conditions at Twin Falls, Idaho, latitude 42° 29′ north, altitude 4,250 feet, and Washington, D. C., latitude 38° 56′ north, altitude 414 feet, respectively; curves 4 to 6, for average sky conditions at Twin Falls, Wash., and the university station in Chicago, respectively. The latitude of the last-named station is 41° 47′ north, the altitude 688 feet. Note the increase in daily totals at Twin Falls over the daily totals at lower altitudes. The effect upon vegetation of this increase, which is especially marked in the short-wave radiation, is a subject that is

engaging the attention of plant physiologists. The marked deficiency at Chicago is due principally to the screening effect of city smoke.

On a cloudless day in midsummer at Twin Falls the daily receipt of solar energy per square mile of surface is equal to nearly 33,000,000 horsepower hours, and at Washington to nearly 30,000,000. On an average day in midsummer the daily total at Twin Falls is equal to about 27,500,000 and at Washington to about 20,000,000 horsepower hours.

If all this energy were absorbed by a layer of water 8 centimeters (3.15 inches) thick, and the water retained all the heat it received, the curves of Figure 211 tell us that on a clear day in June at Twin Falls its temperature would be increased about 100° C. (180° F.) and at Washington about 92° C. (166° F.). With average sky conditions the respective water temperature increases would be about 86° C. (155° F.) and 62° C. (113° F.).

What Solar Radiant Energy Does for Us

Solar radiation is the source of the power that keeps the atmosphere in circulation, including the secondary circulation in storms, which latter are sometimes appalling in their violence. It evaporates moisture from land and water surfaces, which is later precipitated in the form of rain or snow. In connection with the atmospheric circulation it controls weather and climate.

Its control of annual temperature changes is shown by a comparison of curves 5 and 7. The relation between the two curves is such that it may be expressed in a mathematical equation. Note that the annual march of temperature lags behind the annual march of radiation in the same way that diurnal temperature changes lag behind radiation changes.

In ages past solar radiation by stimulating plant growth has stored for our present use the supplies of coal and oil we are now spending so lavishly. If in the distant future these supplies become exhausted solar energy, the primary source, will still be unimpaired; and only man's ingenuity is required to make it directly available as power, heat, and light.

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SORGO Known As Atlas Yields Well and Resists Lodging

Atlas is the name recently given to a new and promising variety of sorgo developed in cooperative sorghum-breeding experiments at the Kansas Agricultural Experiment Station. The name Atlas was chosen because of its strong stalks which resist lodging.

Atlas sorgo is a pedigree selection from a cross between Blackhull kafir and Sourless sorgo, made by I. N. Farr, a farmer and sorghum breeder of Stockton, Kans. Mr. Farr sent hybrid heads to the Kansas station. Headrows were grown, and in 1923 the strain recently named Atlas was selected as being the most promising.

Since 1923 this selection has been tested in varietal plots at the Manhattan and Hays stations and on the southeastern Kansas experimental fields. In 1927 and 1928 it was grown in direct comparison with other varieties by a number of Kansas farmers who cooperate with the Kansas station in conducting local varietal tests.