dishes was moistened with 0.5 per cent. solutions of thiourea, allyl thiourea, ammonium thiocyanate and potassium thiocyanate. Germination was greatly increased above that obtained from lots of the same seed germinated on filter paper moistened with distilled water. The comparative tests were all made in darkness at 25° C.

On one lot of dormant lettuce seed the 0.5 per cent. solutions of these four compounds gave the following percentages of germination: Thiourea, 94.25 per cent.; allyl thiourea, 83.25 per cent.; ammonium thiocyanate, 69.75 per cent.; and potassium thiocyanate, 36.25 per cent. as compared with 22.75 per cent. for the check lots germinated on filter paper moistened with water. Differences of 5.8 per cent. or greater are significant.

Seeds were treated with 0.1, 0.2, 0.5 and 1.0 per cent. concentrations of each compound. The optimum concentrations for the four most effective compounds were found to be near 0.5 per cent. In each case the highest germination was obtained with the 0.5 per cent. solution.

Other chemicals, including urea, sodium nitrate, ammonium sulfate, potassium ferricyanide, potassium ferrocyanide and calcium sulfate, were also used in the above four concentrations. While some of these in certain concentrations gave some increase in germination over the untreated check, the differences were not statistically significant. None of these approached the effectiveness of the 0.5 per cent. solutions of thiourea, allyl thiourea, ammonium thiocyanate and potassium thiocyanate, and in many cases the chemical definitely retarded germination.

Although thiourea gave the greatest increase in germination, the development of the embryo was abnormal in that the hypocotyl elongated much more rapidly than the radical. In many cases there was little or no radical development. Ammonium thiocyanate and allyl thiourea both resulted in normal embryo development.

That the failure of dormant lettuce seed to germinate is not in all cases due to the same conditions is indicated by the fact that all lots of such seed do not respond to the same treatment. Some lots respond to low temperature, while others do not. Some require exposure to light in addition to low temperature. In some cases a varying temperature is more effective than a constant temperature. Different lots of dormant seed were found to vary greatly in their response to chemical treatments. Thiourea was the only chemical that was effective on all lots of dormant seed tested. Some lots of seed gave no response to various concentrations of allyl thiourea, ammonium thiocyanate and potassium thiocyanate. One lot of seed that gave a check germination of 69 per cent. germinated 97 per cent. when treated with the 0.5 per cent. concentration of thiourea. The other three chemicals failed to give a significant increase in germination above the check at any of the four concentrations.

The most effective concentration of urea (0.2 per cent.) gave only 15 per cent. germination as compared with 94 per cent. for the 0.5 per cent. concentration of thiourea. The most effective concentration of potassium cyanide (0.2 per cent.) gave only 33 per cent. germination, as compared with 50 per cent. germination for the 0.5 per cent. solution of potassium thiocyanate. In these comparisons differences of 14.11 per cent. are significant. In both comparisons the occurrence of the element sulfur in the compound resulted in a marked increase in germination. The increase in germination can not be attributed to sulfur alone, since various concentrations of other sulfur-containing compounds, including ammonium sulfate, sulfuric acid, sulfanilic acid, and calcium sulfate, failed to increase and, in most cases, retarded germination. The point of interest here is the striking difference between thiourea and urea which differ only in the presence of sulfur in thiourea. Thiourea always gave some increase in germination, while urea in every case retarded it.

The writers offer no explanation for the role these chemical compounds may play in stimulating germination in certain lots of lettuce seed that show marked dormancy when germination tests are carried out in darkness at 25° C.

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EXCEPTIONAL TEMPERATURES OF CENTRAL ATLANTIC WATER[1]

CHURCH[2] summarizes the analysis of numerous thermograph records of the surface waters of the western North Atlantic. Used in the analysis were the records obtained by the Biological Board of Canada through the courtesy of the Canadian National Steamships. A recent record, August 28 to August 30, 1937, on a route between Boston and Bermuda indicates exceptional water temperatures of Central Atlantic water north of Bermuda. The instruments were checked at the end of the voyage.

On this route, Central Atlantic water lies south and southeast of the Gulf Stream, and is characterized by the comparative homogeneous nature of the surface temperatures. Minimum temperatures are attained in late winter, and maximum temperatures are reached in late August. According to Church and Iselin,[3] the

[1] Published with the permission of the Biological Board of Canada.

[2] P. E. Church, Assoc. d'Oceanographie physique, Publ. Scien. 4, 1937.

summer maximum of Central Atlantic water is 27° C. or 28° C. north of Bermuda, and the annual range is fully eight degrees.

The water temperature record of the Boston-Bermuda route between August 28 and August 30, 1937, is illustrated in Fig. 1. Imposed upon this is the water

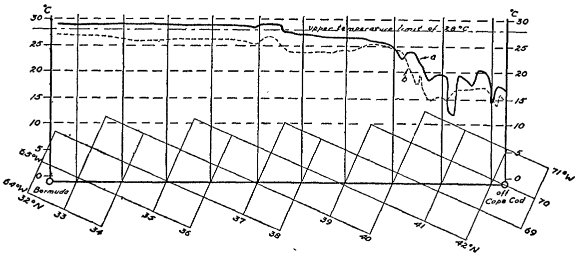

FIG. 1. Distribution of surface water temperature between Boston and Bermuda—(a) August 28 to August 30, 1937, and (b) September 24 to September 26, 1937.

temperature record on the same route between September 24 and September 26, which indicates that the northern edge of the Gulf Stream is in Latitude 40° 10′ N. In August, it is evident that "detached warm masses" extended even north of Latitude 41° 00′ N.

Central Atlantic water, south of Latitude 37° 50′ N., in the latter part of August exhibits surface temperatures which are more than one degree higher than the upper temperature limit of 27° C. or 28° C., set by Church and Iselin. Gulf Stream temperatures (vicinity of Latitude 40° 00′ N.) are at least two degrees lower than the accepted summer maximum of 28° C. or 29° C. Further, in the interval between late August and late September, the surface water temperatures south of Latitude 39° 00′ N. were lowered as much as three degrees, which is more than one third of the total annual temperature range of Central Atlantic water of these latitudes. This large decrease in temperature took place at a time when ocean surface temperatures are, in general, comparatively stationary. It is suggested herein that such a temperature change is, in part, associated with a "pulsation"[4] of the whole North Atlantic eddy. The nature of the suggested "pulsation," of considerable interest to oceanographers on both sides of the Atlantic, awaits elucidation from the five year cooperative program of the Woods Hole Oceanographic Institution and the Bermuda Biological Station.

Our observations have been concerned with a band of water, which, north of Bermuda, is approximately 500 miles in width. In dealing with water temperature departures from the normal, Church points out the possible influence of these in producing weather abnormalities along the eastern seaboard of the North American continent. This band of water is associated with the source area for tropical Atlantic air masses, and in particular with the area of origin of North Atlantic tropical cyclones, which are features of late summer weather of the Atlantic seaboard. The abnormalities of temperature of Central Atlantic water, recorded herein, may therefore prove of interest also to students of marine meteorology.

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[3] C. O'D. Iselin, Papers in Physical Oceanography and Meteorology, 4: 4, 37, 1936.

[4] E. W. MacBride, *Nature*, 139: 3527, 948, 1937.

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