fell to a minimum. The increase in ammonia was accompanied by a decrease in nitrates, which were practically non-existent in the highly heated soils.

The ammonia produced on heating soil has been suggested by Russell as causing the injurious action, although no evidence on this point could be obtained. Pickering suggested that the injurious factor was volatile in nature, on account of its gradual disappearance from the soil, but Russell disagrees on this point. Russell, however, worked with low temperatures, usually not exceeding 100° C., and with volatile antiseptics. Under such treatment, only relatively small amounts of ammonia are produced directly, and seed germination and plant growth are not so strikingly affected as in soils heated to higher temperatures.

The percentage of seed germination has been found to be closely correlated with the amount of ammonia present in the heated soils studied. The amount of ammonia required to injure germination, however, appears to vary with the type of soil when comparisons of different heated soils are made. It appears that the absorptive power of the soil is a very important limiting factor in determining the extent of the injurious action.

The presenec of dihydroxystearic acid as described by Schreiner could not be demonstrated in the most toxic of the heated soils. That the toxic substance is of a volatile nature is evident by the fact that it is readily removed from the soil by aeration. If collected in water upon removal, its toxicity can be readily demonstrated. By collecting in a hydrochloric acid solution the chemical composition of the resultant salt has been shown to be ammonium chloride, containing ammonia in sufficient quantity to account for the toxic action of heated soils.

It is improbable that all the ammonia produced in heated soils exists as free ammonia. Large amounts of carbon dioxide are also produced when soils are heated, which possibly accounts for the increased acidity of heated soils. The evidence at hand points toward the formation and injurious action of ammonium carbonates particularly. These salts being unstable in the soil except when kept in a dry and unaerated condition, accounts for the gradual disappearance of the injurious action of heated soils. It also appears that other compounds of ammonia are formed which are more stable in character.

The beneficial action of heated soils on plant growth, especially of those heated between 150° C., and 250° C., is believed to be due in a large part to the direct assimilation of ammonia or ammonium compounds by the plants after the manner described by various workers. The increased growth follows in practically all cases after a period of injurious action to plant growth, and is no doubt dependent upon the reduction of the toxic substance to a point where it is stimulatory or acts as a plant food. The relative importance of increased plant food production as a result of bacterial activity, and of direct chemical action, in highly heated soils remains to be ascertained.

The writer will be pleased to obtain suggestions or criticisms on the point of view presented in this paper.

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NOTE ON THE INTERFERENCES OF PARALLEL AND CROSSED RAYS

AFTER perfecting the design (Fig. 1) of my last article[1] thus obtaining an apparatus which is free from transmission through glass and in which all the rays are guided by reflection from metal surfaces only, I have secured definite evidence showing that the strands of interference patterns obtained are actually referable to the intersection of two grids, due to the two sodium lines, respectively. One of the grids is retarded in rotational phase with respect to the other. Why in the case of a transmitting grating, the nature of the phenomenon is so effectively concealed, I have not been able to make out; but with mercury light, but one set of striations is obtained, as anticipated.

With this definite understanding of the phenomenon, the resolving power works out as

[1] SCIENCE, February 25, p. 282.

$$d\lambda/\lambda = D\,dh/R\sqrt{D^2-\lambda^2}$$

where D is the grating space, R the path length and dh the displacement of the second grating G', normally to itself, between like rotational phases of the two sodium lines. The second member of the equation is roughly dh/R and if $dh. = .003$ cm. is still guaranteed and $R = 300$ cm. as in my apparatus, the limiting resolving power is $d\lambda/\lambda = 10^{-5}$ or .06 *A. U.* If $d\lambda/\lambda = 10^{-3}$ for the two sodium lines, $dh =$ .3 cm., which is about what I found.

An interesting application of the apparatus (Fig. 1) or the other similar types may be suggested. By half silvering the mirrors and providing a similar set *beyond* them, there should be no difficulty of bringing the interferences due to crossed rays, and to parallel rays, into the field of the telescope, *together*. Strictly homogeneous light (mercury arc) would be needed to obviate the duplications of the sodium arc. In such a case, therefore, the parallel fringes could be used after the manner of a vernier on the crossed fringes. One might think of this with a view to a repetition of the experiment of Michelson and Morley, if this experiment had not been so thoroughly carried out by the original investigators. However, the plan would be to rotate the apparatus, as a whole, so that the two crossed rays would be alternately in and at right angles to the earth's motion, whereas the two parallel rays would preserve the same relation to that motion. Naturally the parallel and crossed paths would in such a case have to be enlarged by multiple reflection. Another favorable feature of the reversed spectrum interferometer is the small displacement, x, of micrometer per fringe. This is $x = \lambda/2(1+\cos\theta)\cos\sigma/2$, θ being the second angle of diffraction, σ the sum of the two. Hence roughly $x = \lambda/4$, or the sensitiveness is about twice that of the customary types of apparatus.

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SOCIETIES AND ACADEMIES

THE BOTANICAL SOCIETY OF WASHINGTON

The 107th regular meeting of the Botanical Society of Washington was held in the Assembly Hall of the Cosmos Club, at 8 P.M., Tuesday, November 2, 1915. Forty-five members and six guests were present. The following papers were presented:

Relation of Catalase and Oxidases to Respiration in Plants (with lantern): Chas. O. Appleman. (To be published in full as bulletin number 191 of the Maryland Agricultural Experiment Station.)

The chemical mechanism of respiration in plants is very complex and imperfectly understood. Enzyme action undoubtedly plays the most important rôle. Among the enzymes which have been assigned various functions in respiration, we find the oxidases and catalase, although their relation to this process is almost entirely hypothetical. Respiration in potato tubers is not only greatly accelerated by various artificial treatments, but is subject to fluctuations under natural conditions, such as greening and sprouting. The rate of respiration also varies in different parts of the same tuber and tubers of different varieties. Since these tubers also contain very active catalase and oxidase, they were chosen as specially favorable material to make a quantitative study of the relation of both catalase and oxidase activity to the intensity of respiration. The data seem to justify the following conclusions:

1. The oxidase content in potato juice gives no indication of the intensity of respiration in the tubers. In other words, there is no correlation between oxidase activity and the rate of respiration in these organs. The author does not disclaim any rôle of the demonstrable oxidases in respiration, but they certainly are not the controlling factor in regulating the rate of respiration in potato tubers.

2. Catalase activity in the potato juice shows a very striking correlation with respiratory activity in the tubers.

Some Philippine Botanical Problems: E. D. Merrill.

To be published in full elsewhere.

Botanical Notes of a Trip to Japan: W. T. Swingle.

To be published in full elsewhere.

The 108th regular meeting of the Botanical Society of Washington was held in the Assembly Hall of the Cosmos Club, at 8 P.M., Tuesday, December 7, 1915. Thirty-two members and three guests were present. Messrs. A. T. Speare, James Johnson, H. R. Rosen and H. C. Rose were elected