nutrition at this institution, and since 1925 he has been chemist in the California Agricultural Experiment Station.

Professor Hoagland has contributed numerous scientific papers especially in the fields of mineral nutrition of plants, soil acidity and soil and plant interrelationships. In the field of the mineral nutrition of plants he has done much to elucidate the process of the absorption of salts by the plant and to explain some of the anomalies appearing in this important plant physiological process. In studying the mineral nutrition of plants, it is of course important to control the environment. Professor Hoagland has devised an apparatus by which the conditions of light, temperature, humidity and culture solution may be controlled to such a degree that the growth of plants in duplicate experiments is identical as measured by yield, number of tillers, height of tops and other external features.

In view of the very great services of Professor Hoagland to plant physiology, the committee is very glad to make the first award of the Stephen Hales prize to him. The members of the committee are A. L. Bakke, C. R. Ball and J. B. Overton, *chairman*.

S. V. EATON,
President
H. R. KRAYBILL,
Secretary-treasurer

SCIENTIFIC APPARATUS AND LABORATORY METHODS

THE COLORIMETRIC DETERMINATION OF SOIL REACTION

WHILE electrometric methods are now generally applied in the determination of the reaction of soil suspensions, the different electrodes do not always agree in their indications, and for this and other reasons it may be desired to obtain results by a colorimetric method. In order to observe slight differences in tint of indicators, it is essential that a clear water extract of the soil be obtained. Various means to this end have been employed, such as filtration on conical or Buchner funnel with paper repeatedly extracted until the apparent reaction of pure water is not affected by contact with it, dialysis, centrifuging, etc. Some of these procedures are objectionable on account of the time required, others because it is difficult to protect the extract from contamination. It has been found that clear water extracts can be obtained from many soils without the use of any filter medium other than the soil itself, in a reasonable length of time and without great risk of contamination, by means of very simple apparatus. The method may not succeed with soils which tend to run together and lose their crumb structure when wetted, or with samples that have been ground, but in any case it is easy to determine the possibility of obtaining a clear extract in this way.

A percolating tube is made from a thin Pyrex test-tube, about 17 mm internal diameter, by drawing out the lower end to a cone about 5 cm long and 2 mm wide at the narrowest point. It is cut at this point and the thin tip heated to thicken and contract to about 1 mm inside diameter at the tip. About 25 g of the finely granular air dry or slightly moist soil is charged into this percolator, gently shaken down and about the same amount of water poured on top. With most soils the water will penetrate the soil without much difficulty, and after a few drops have run from the tip, the percolate will be clear. The clear extract is received in the test-tube which is to be used for the color comparison, marked at 10 ml with a wax pencil, and suitably supported. The conical bottom of the percolator fits into the mouth of this test-tube and excludes air. As soon as sufficient extract has been collected, the indicator is added and the color compared with buffer mixtures in similar tubes. As water extracts of most soils are practically unbuffered, it is essential for accuracy to use isohydric indicator solutions and other precautions described by Fawcett and Acree[1] in a recent paper. Several duplicate samples of soil should be percolated at the same time in order to have sufficient extract for the repeated tests which may be necessary to determine the reaction with precision.

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A METHOD FOR DETERMINING HARDINESS IN PLANTS

METHODS of measuring the hardiness of plants by correlation with chemical and physical properties have been the subject of great interest and investigation in the past few years. A new method based upon the degree of exosmosis of electrolytes from tissue after freezing has been worked out in a preliminary way, and determinations of exosmosis have been made at weekly intervals throughout the autumn on alfalfa roots from varieties of known hardiness. The amount of outward diffusion into distilled water is determined by conductivity measurements, which indicate a pro-

[1] Edna H. Fawcett and S. F. Acree, "The Problem of Dilution in Colorimetric H-ion Measurements. 1. Isohydric Indicator Methods for Accurate Determination of pH in Very Dilute Solutions," *Journal of Bacteriology*, vol. 17, no. 3: 163–204.

gressive development of hardiness throughout the autumn period in the hardy varieties, while the tender varieties show no such change. At the end of November, the differences in exosmosis as measured by this method amount to several hundred per cent. between the very tender and the most hardy varieties. Colorimetric tests for chlorides and nitrates in the exudate from the frozen roots correlate very well with the conductivity measurements, and regeneration of growth in the greenhouse indicates that injury by freezing may be closely estimated by this method. The author plans to investigate its application to other plants and to perfect details of technique. The precise experimental method and results will be published soon.

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A SOURCE OF DIASTASE

EXPERIMENTS designed to illustrate digestion are not uncommon in beginning courses in botany, the action of diastase or amylase on starch paste being a common method of procedure. Ptyalin, contained in the saliva, may be successfully employed, but for classes involving large numbers of students this is difficult to obtain in sufficient quantity. Malt diastase may be prepared, if facilities are available, but the extraction must be performed with care, and the yield is small unless large-scale operations are employed. The ordinary commercial preparations, available on the market under various trade names, are unsuited, since they contain starch or sugar or both and thus vitiate the results before the experiments are started. After a considerable canvass of the situation, a source of diastase has been found which meets the requirements of a starch- and sugar-free enzym which is not only entirely suitable for experiments of the nature indicated, but which is useful in a number of physiological and biological procedures as well. Since it seems apparent that teachers generally are unaware of an easily obtainable enzym, this note may not be out of place.

The Digestive Ferments Company manufactures and sells a digestive ferment under the trade name of "Pangestin." The manufacturers claim that it is capable of converting eighty parts of potato starch into water soluble substances in five minutes in accordance with the U. S. P. X Revision test for pancreatin. Pangestin has good solubility, with a small amount of extraneous material not identified. Both the dry enzym and aqueous solution give a negative test for starch. Freshly made aqueous solution and the same after standing fifteen hours give a negative test for glucose. The digestive power has been tried on potato, corn and other starches in 2 per cent. aqueous paste form. Ten minutes at room temperature, and without an activator, give very positive tests for sugar with Fehling's solution. Cornstarch is apparently acted upon more rapidly than potato starch.

Pangestin is not a simple enzym. Not only is it strongly amylolytic, but, because it is of animal origin, it is also proteolytic, as shown by its power to digest completely the white of egg, and lipolytic, as shown by the hydrolysis of oils, such as cottonseed and olive. It is therefore a mixture of enzyms. This does not, however, detract from its usefulness, but rather enhances it. So far as the writer has been able to ascertain, Pangestin is the only trade product made in America conforming to the requirements of a starch- and sugar-free enzym, although several other chemical companies have signified their interest in the production of a purified product. One German product submitted has also been tested out, but has been found unsatisfactory.

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SPECIAL ARTICLES

NITROGEN FIXATION BY BLUE-GREEN ALGAE

NITROGEN fixation, a property common to several species of bacteria and a few fungi, has long been suspected as being a property of algae also. Considerable research by several investigators with green algae (*Chlorophyceae*) has failed to demonstrate that any one of these possesses the ability to use free nitrogen gas. The few claims that have been made to the contrary have been disproved, to the satisfaction of probably all the workers in this field. The writers have recently had occasion to check this point further. Three cultures of green algae, namely, *Chlamydomonas, Chlorella* and *Scenedesmus,* obtained from Cornell University through the courtesy of Dr. F. B. Wann, and a *Pleurococcus,* isolated from a local soil, were repeatedly tested for nitrogen-fixing powers, with negative results.

What are the facts regarding the nitrogen-fixing ability of the other common group of algae, known as the blue-greens (*Cyanophyceae*)? Many articles have appeared during the past forty years in which references are made to the fact that under various