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MINERAL NUTRIENTS IN RELATION TO FLOWER DEVELOPMENT¹

By Professor W. F. LOEHWING

THE STATE UNIVERSITY OF IOWA

For several years, the writer and his associates have investigated the role of mineral nutrients in relation to reproduction and sex expression in higher plants. From these and numerous other investigations, it is evident that the most profound metabolic and structural changes of the plant's entire life originate in the brief period between the origin of floral primordia and full bloom (Loehwing, 1938–39). Hence a detailed study, correlating chemical composition with histological structure in this particular phase of development, appeared to offer exceptional promise of valuable results, not only as to the functions of mineral nutrients in flowering but also as to their specific role in general developmental physiology.

The Cotton Root-rot Tour and Conference of 1940: Dr. Walter N. Ezekiel

Though interest in these investigations has centered primarily in the physiology of flowering, physiological ¹ Address of the retiring president of the American Society of Plant Physiologists, Columbus, Ohio, December 28, 1939.

studies obviously could not be confined to this phase alone. Only a continuous and detailed chronological inventory of the progress of events in root and shoot, from the vegetative, flowering and fruiting phase provides the requisite interpretative data. Because the most significant changes of the flowering phase are highly localized (Borthwick and Parker, 1939) the usual mass analyses of entire tops have to be supplemented with separate, sequential physico-chemical study of all formatively active zones of growth. For interpretative purposes, these data must be expressed in absolute amounts of the individual constituents as well as in the traditional terms of percentage composition. Determination of salts by actual weight is essential because of the fact that the relatively greater rate of carbohydrate and protein accumulation in plants tends to mask the critical changes in actual amounts of mineral matter. A progressively diminish-

method is much to be preferred to recording through skull and scalp by electrodes pasted on the skin. Electrode artifacts, troublesome with this latter type of lead, never appear, localization is precise and the lack of resistance of skull and scalp with the needle, sufficient, in some animals, to make external recording impossible, permits one to record at very low amplification, thus eliminating instability and pick-up artifacts accompanying high amplification. The Victrola needles may be left in situ for a considerable period, a thing not possible with those externally applied to the skin.

The leads may be removed without reanesthetizing the animal by simply extracting each one by a firm jerk with a pair of pliers. This extraction appears to be painless. A drop of collodion placed on the small hole rapidly seals it off.

We have kept animals for several days with the leads in place and could have kept them longer. Some 50 electrode insertions have been made in a dozen animals without complications from infection. trode positions in the cortex could presumably be precisely determined if one wished in the freshly sacrificed animal by passing an electrolytic (D.C.) current through each lead in turn as cathode, thus producing a deposit of iron oxide at the point of contact with the cortex.

HUDSON HOAGLAND

CLARK UNIVERSITY

AN INEXPENSIVE MOUSE CAGE

It is often desirable to keep mice in small groups when they are under observation. This requires a number of small cages, which should be easily cleaned, and, if possible, inexpensive. The following cage is suggested for its simplicity, ease of cleaning and cheapness. The materials used are few and obtainable at any hardware store. They are as follows: coarse wire netting, sometimes called hardware cloth, 8 inches × 22 inches, two tin pie plates, 8½ inches in diameter and about 20 inches of 24-gauge soft wire.

The ends of the hardware cloth are brought together to form a cylinder, $6\frac{1}{2}$ inches in diameter. By overlapping the ends one inch and weaving a length of the soft wire in and out through the meshes of the cloth they can be made secure. This is best accomplished by weaving down one side and up the other of the overlapping ends so that the ends of the wire may be brought together near one point and twisted. The cylinder thus made will fit into the bottom of one of the pie plates. The other plate is now placed over the open end of the cylinder, thereby completing the cage.

As many as six mice may be kept in the cage at one time with no danger of them pushing off the top plate. Rats may also be kept in like manner, but it is suggested that a lead weight be soldered on the plate

which is used for the cover. The plate used for the bottom should be covered with a piece of 25 cm filter paper, which absorbs moisture and assists the sides of the plate in preventing the scattering of food. To clean the cage the paper is removed and fresh put in its place. The mice will tear the paper to some extent, but if they are well fed this is reduced to a minimum.

A drinking fountain may be made by inserting in a small, wide-mouthed bottle a one-hole rubber stopper fitted with a short length of small bore glass tubing. A bit of rust-resisting wire, such as nichrome, should be fastened in the tube to assist in the flow of water when the mouse is drinking. The fountain should be hung inside the cage by means of a wire sling.

Any other dimensions may be substituted for these suggested so that larger or smaller cages may be made. The total cost of the cage described is about twenty cents, and a half dozen can be made in an hour.

E. Wilbur Cook, Jr.

CENTRE COLLEGE

BOOKS RECEIVED

Baitsell, George A., Editor. Science in Progress. Second series. Pp. xii + 317. 129 figures. Yale Univer-\$4.00. sity Press.

Soil Physics. Pp. xi + 370. 70 figures. BAVER, L. D. 4 plates. Wiley. \$4.00. Cambridge Philosophical Society, Proceedings.

36, part 4. Pp. 387 + 512 + vii. Cambridge University Press, London. 10/6.
CISSEL, JAMES H. Stress Analysis and Design of Ele-

mentary Structures. Pp. x + 335. Illustrated. \$4.00.

DLE, LUELLA. The Background for College Teaching. Pp. xxiv+616. 43 figures. Farrar & Rinehart. \$3.50. COLE, LUELLA. EISENHART, LUTHER P. An Introduction to Differential Geometry; With Use of the Tensor Calculus. Pp. x+ 304. 21 figures. Princeton University Press.

FRAENKEL, GOTTFRIED and DONALD L. GUNN. The Orientation of Animals. Pp. vi + 352. 135 figures. \$6.00. ford University Press.

HEWITT, REDGINAL. Bird Malaria. Pp. xvii + 228. figures. 13 plates. Johns Hopkins Press. \$1.10.

Japanese Journal of Astronomy and Geophysics; Trans-Pp. 330 + 51. actions and Abstracts. Illustrated. National Research Council of Japan, Tokyo.

Physical Chemistry of High Polymeric Sys-MARK, H.

tems. Pp. x+345. 99 figures. Interscience Publishers, New York. \$6.50.

MOELWYN-HUGHES, E. A. Physical Chemistry; An Introduction. Pp. viii+660. Illustrated. Cambridge University Press, Macmillan. \$9.50.

PATTERSON, AUSTIN M. and LEONARD T. CAPELL. Ring Index: A List of Ring Systems Used in Organic \$8.00. Chemistry. Pp. 661. Reinhold.

Industrial Banking Companies SAULNIER, RAYMOND J. and Their Credit Practices. Pp. xxi+192. National Bureau of Economic Research, New York.

Science Reports of the Tohoku Imperial University (Mathematics, Physics, Chemistry) First series. Sep-Pp. 163-314. 4 figures. Maruzen. tember, 1940. Tokvo.

Willis, J. C. The Course of Evolution by Differentiation or Divergent Mutation Rather than by Selection. Pp. viii + 207. 10 figures. Cambridge University Press, Macmillan. \$3.00.

Five New Books of Unusual Interest

ENTOMOPHAGOUS INSECTS

By Curtis P. Clausen, United States Department of Agriculture. *McGraw-Hill Publications in the Zoological Sciences*. 669 pages, 6 x 9. \$7.00

In this book an internationally known authority gives a comprehensive account of our present knowledge of the parasitic and predactious representatives of the different orders and families of insects. The book discusses in detail the host preferences, biology, habits, and immature stages of each family.

EMBRYOLOGY OF THE INSECTS AND MYRIAPODS

By Oskar A. Johannsen and Ferdinand H. Butt, Cornell University. McGraw-Hill Publications in the Zoological Sciences. 461 pages, 6 x 9. \$5.00

Here is a book that fills the need for an authoritative text in English dealing exclusively with the developmental history of insects, centipedes, and millepedes, from egg deposition to hatching. Strictly up to date, the book includes such subjects as polyembryony, symbiotic organisms in the egg, and experimental embryology.

SOILS AND SOIL MANAGEMENT

By A. F. Gustafson, Cornell University. McGraw-Hill Publications in the Agricultural Sciences. 415 pages, 6 x 9. \$3.00

The primary purpose of this book is to show the student what to do in order to produce crops economically and at the same time conserve and preserve the soil. Thus, while the book deals briefly with fundamental principles, particular emphasis is placed upon their application in the field.

COMMERCIAL TIMBERS OF THE UNITED STATES

By H. P. Brown, New York State College of Forestry, and A. J. Panshin, Michigan State College. *The American Forestry Series.* 541 pages, 6 x 9. \$5.00

This book represents a complete rewriting and revision of the author's well-known *Identification of the Commercial Timbers of the United States*. The present work, a completely new book, brings under one cover a wealth of information on the anatomy, identification, properties, and uses of the commercial woods of the United States.

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