NICOTINIC ACID AND TOBACCO METABOLISM

RECENT interest attached to nicotinic acid in the vitamin B_2 complex[1, 2] prompts publication of the following observations on the marked effects obtained when nicotinic acid was supplied to green tobacco leaves. Using a specially developed method, tobacco plants were cultured with their cut stems in dilute aqueous solutions of nicotinic acid hydrochloride. Control plants were similarly cultured in tap water. Samples of 45 to 50 leaves were collected from each group for analysis. Preliminary observations showed large and apparently specific influences of nicotinic acid upon the degree and the duration of leaf turgidity, the rates of uptake of solution and of dry weight accumulation, and the postponement of permanent wilting. There was also an effect upon the synthesis of nicotine. One experiment conducted in diffuse light for five days revealed an increase of 190 per cent. in the amount of solution absorbed, a loss of only half as much dry weight, a survival period at least twice as long and an increase in total nicotine content of 31 per cent. compared with the corresponding values for the leaves of those plants cultured in water. Three subsequent experiments conducted for periods of two days each and in full light gave average increases of 52 per cent. in the amount of culture solution absorbed, 700 per cent. in the amount of dry weight gained, at least 100 per cent. in the length of the survival period, and 29 per cent. in the total amount of nicotine formed above the corresponding values for the controls.

These observations were incidental to an investigation of nicotine metabolism in the tobacco plant. A study of the significance of nicotinic acid in the metabolism and water relations of plant tissues is to be undertaken. The author wishes to express his sincere appreciation for the generous counsel and cooperation given by Professor Carl G. Deuber, whose efforts have made this and other studies possible.

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A FUNDAMENTAL PROBLEM CONCERNING THE LORENTZ CORRECTION TO THE THEORY OF REFRACTION

THE relation between the constitution of a conducting medium and its refractive index is a fundamental problem of classical physics to which attention has been devoted for many years but which even now is not completely solved. The question at issue is whether the force per unit charge exerted by an electric field upon an elementary charged particle in the medium should be taken simply as the Maxwellian electric intensity $\mathbf{E}$ (the Sellmeyer theory), or whether there should be added a contribution $(4\pi/3)\mathbf{P}$ (the Lorentz theory), $\mathbf{P}$ being the electric moment per unit volume produced by the electric field in the neighborhood of the charged particle under consideration.

For conduction electrons in metals under the influence of the steady and alternating electric fields ordinarily encountered in electrical engineering the validity of the Sellmeyer theory is universally taken for granted. The Lorentz theory would be inconsistent with Ohm's Law and would in fact render the medium electrically unstable. For the same reasons it may be regarded as beyond question that, for a rarefied gas rendered conducting by ionizing radiation, it is the Sellmeyer theory which must be used at sufficiently small oscillation-frequencies. When the discovery of reflection of radio waves from the ionosphere aroused particular interest in the electrical properties of an ionized medium, it was at first assumed that for such a medium the oscillation-frequency could be raised to the values used in radio communication without affecting the validity of the Sellmeyer theory. This view was challenged in 1929 by Hartree,[1] who expressed the opinion that it is the Lorentz theory which should be used in the ionosphere at radio frequencies. There followed considerable discussion which culminated in 1934 in a theoretical treatment of the subject by Darwin,[2] which seemed to point to the conclusion that the Sellmeyer theory should hold good in the ionosphere at radio frequencies.

An experiment for deciding between the two theories was first indicated by Ratcliffe[3] and subsequently described in detail by Goubau.[4] Goubau shows that, for reflection from the ionosphere of radio waves of frequency less than the gyromagnetic frequency, there is in middle latitudes a clear-cut distinction in the behavior of the extraordinary wave according to the two theories. Over the past year a large number of records showing magneto-ionic splitting of ionospheric echoes at these wave-frequencies have been obtained at the Kensington (Maryland) Experiment Station of this department, using the automatic multifrequency equipment developed here. Details of these observations will be published elsewhere. Comparison with Goubau's theoretical treatment leads us to believe that it is impossible to interpret these observations in terms of the Sellmeyer theory, but that no objection exists to their interpretation in terms of the Lorentz theory. It

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2 *Proc. Roy. Soc.*, A, 146: 17–46, 1934.
3 *Wireless Engineer*, 10: 354–363, 1933.
4 *Hochfrequenz.*, 44: 138–139, 1934.