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Effects of Certain Light and Soil Characteristics on the Balance of Mineral Nutrients in Triticum.

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In earlier investigations it was observed that foliar chlorosis developed during periods of intense insolation of grain plants grown on humus soils which had been limed to correct acidity. In order to determine the cause of this injury 2 sets of Marquis wheat were grown, one on strongly acid humus soil low in mineral matter and the other on a fertile but acid loam. The acidity of a portion of the soil in each set was corrected by applications of pulverized calcium carbonate. A white muslin screen was installed over one-half of the plants when 6 weeks old, the remainder being left exposed to full illumination.

After symptoms of chlorosis had developed in fully insolated plants, entire tops were cut from several plants in each set at 4-hour intervals, frozen, comminuted and pressed under uniform pressure. The expressed sap was collected and its hydrion concentration measured potentiometrically by means of the calomel half cells and a quinhydrone electrode.

The data indicate that chlorosis was definitely correlated with sap hydrion changes attributable to differences in soil reaction and light intensity. The acidity of sap expressed at 4-hour intervals disclosed a diurnal periodicity in all plants but most pronounced in the plants on limed soil under full insolation. Reversals in the acidity gradient were not conincident with the hour of maximal light intensity, which suggests that the thermal factor in insolation may not be as important as its light effect.

Light intensity and soil alkalinity exercised considerable influence upon the level of acidity attained. Limed cultures in the shaded and unshaded sets maintained a lower degree of acidity and exhibited a greater initial decrease in sap hydrion concentration than the corresponding untreated plants exposed to full light intensity. The pH values of the sap from the limed cultures exposed to strong insolation for several consecutive days show that the period of darkness is too brief for complete acid recovery. Hence acidity falls progressively to lower levels and shows smaller diurnal fluctuations during prolonged periods of strong illumination. Microchemical analyses of leaves show that the diminished acidity of the sap increasingly interferes with iron mobility and finally induces chlorosis such as became apparent in the 8-week-old plants on the limed humus.

The onset of chlorosis in young leaves was delayed and was less severe in plants which were shaded following the use of lime. This fact together with the pH values of these plants, suggests that shading to a considerable extent offsets the iron insufficiency created by lime. The acid recovery of limed plants in shade does not, however, reach the original level of acidity found in the sap of plants grown on the untreated humus. Microchemical inspection of chlorotic plants disclosed an abundance of iron in the roots but little or none in young leaves.

The most vigorous plants grew on the loam soil and the poorest on the fully illuminated, untreated and limed humus. Treated and untreated plants in this soil, though both low in vigor and retarded in development, represent opposite extremes of sap acidity. Seeds in the untreated humus germinated rapidly and the seedlings to all outward appearances grew normally until the fifth week. The rate of stem elongation then diminished and the leaves remained narrow, though increasing in length. During the eighth week the older leaves turned a dull green while their tips became flaccid and turned brown. The leaves then gradually died back toward the stem. The foregoing symptoms differed from those displayed by plants on the same soil after it had been limed. In the latter instance new leaves became noticeably chlorotic during the eighth week, the severity of this condition increasing with age. Reduced size and delay in maturation marked both the limed and untreated plants on the humus soil. The hyperacidity of the plant on untreated humus and the alkalinity of the strongly insolated, limed plants appeared equally injurious to wheat in its formative stages.

During the tenth week, it was found that mature leaves of fully illuminated, chlorotic plants on the limed humus gradually began to lose their turgor and turn brown. Many of the oldest leaves wilted and died. Acidity tests made on these plants during the incipient stages of browning disclosed that the sap hydrion concentration had risen considerably above that found in the 8-week-old plants of the same series. Moisture content had also fallen about 5%. Diurnal acid periodicity could no longer be detected and the hydrion level approximated that of plants growing on the untreated acid humus. This latent increase in the acidity of initially low-acid chlorotic plants is due to the accumulation of acid catabolic products and to the decrease in tissue fluids. The extremes of high and low acidity both eventually result in sap hyperacidity. The untreated loam produced more vigorous plants than the untreated, low-mineral humus though both soils were strongly acid. The higher mineral content of the acid loam may in part account for the better growth of wheat on this soil.

Fluctuations in light intensity and soil acidity produced smaller changes in sap hydrogen concentration of plants grown on the loam soil. Under certain conditions, such as lack of balance among nutrients of mineral insufficiency, it seems that the effect of lime in altering the free acidity of the sap may outweigh its other functions as a nutrient.

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Blood Findings in Albino Rats Suffering From Lack of Vitamin A.

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The literature regarding blood changes in vitamin A deficiency disease deals chiefly with blood counts, platelets and hemoglobin findings. Cramer, Drew and Mottram[1] in a study of blood platelets and corpuscle counts stated that there were no constant differences in the number of white or red corpuscles, although in advanced stages of deficiency there may be a distinct anemia. Koessler, Mauer and Loughlin[2] report that they have produced conditions similar to human pernicious anemia in experimental animals deprived of vitamin A. Hopp[3] studied the occurrence of anemia in rats on deficient diets and concluded that diets deficient in vitamins A and B do not produce anemia in the rat.

Damianovich and collaborators[4] did not observe an anemia in rats suffering from lack of A or B. Falconer[5] reports a slight drop in platelets and a small rise in red and white corpuscles, but con-

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[3] Hopp, W. H., *Johns Hopkins Bull.*, 1922, xxxiii, 163.

[4] Damianovich, H., Bianchi, A., and Savazzini, Lilia A., *Compt. Rend. Soc. de Biol.*, 1923, xxcviii, 377.

[5] Falconer, E. H., and Peachy, G., *Am. J. Physiol.*, 1926, lxxvi, 145.