BOOK REVIEWS

Advances in Agronomy, Vol. 16

This latest volume in the series prepared under the auspices of the American Society of Agronomy contains nine chapters covering both basic and applied phases of research in soil and crop science. The author and chapter coverage are as follows:

D. E. McCloud, R. J. Bula, and R. H. Shaw—Field Plant Physiology.
G. H. Stringfield—Objectives in Crop Improvement.
L. E. Allison—Salinity in Relation to Irrigation.
N. J. Rosenberg—Response of Plants to the Physical Effects of Soil Compaction.

The long time editor of this series, A. G. Norman, and the contributing authors are to be congratulated for this service to their colleagues and their profession.—RCD.

Physiological Basis of Salt Tolerance of Plants

Strogonov’s book combines a review of salt-tolerance literature (359 Russian and 133 non-Russian references) with detailed experimental findings by Strogonov and his colleagues. Most of the experiments reported were done with cotton, but other crops and indicator plants were also studied. Strogonov maintains that salt effects on plants are primarily specific and discounts osmotic effects. This argument is based on observations that the ranking of crops for salt tolerance varies for different parts of the USSR that have different characteristic soil salines. Although the effect of other variables (climate, varieties, and management) is briefly acknowledged, he concludes that, basically, plants respond differently to chloride, sulfate, carbonate, and solonets salinity, as well as to various intergradations, so that single-salt tolerance values for crops have no general applicability.

In most of the experimental work described, soils were salinized to equal percentages of salt on a dry-soil basis using the tabulated salt mixtures representative of chloride, sulfate, or mixed types of salinity. I have found the osmotic pressures of 5 g of these salt mixtures per liter of solution to range from 1.65 atm for the sulfate to 5.06 atm for the chloride. In addition, cation ratios vary widely for the different salt mixtures, but Strogonov attaches importance only to the anion ratios. No measurements of actual salinity of the soil-water are given in any case, and no allowance is made for the probable precipitation of sulfate in the soil as calcium sulfate. It is small wonder, therefore, that the chloride salt treatments, which have osmotic pressures 85%, or more, higher, were generally found to be more “toxic” than the sulfate treatments.

All salinities are expressed as percentages of individual or total salts on a dry-soil basis. The effect of soil texture on moisture content and therefore on the salt concentration in the soil solution is nowhere acknowledged. In fact, Strogonov states that the kind of soil is much more important than the concentration.

In two experiments with nutrient solutions, osmotic concentrations of NaNO₃ and NaCl are given as 1.44 and 0.90% (p. 63) and 2.04 and 1.00% (p. 164), respectively. In the first case, the NaNO₃ actually has a lower osmotic pressure (5.65 vs. 6.4 atm) and in the second a higher osmotic pressure (7.86 vs. 7.13) than the NaCl. The generally high salt concentrations employed injured plants severely, for example, 7+ atm in the preceding example was used on Zea mays, and 0.8% salt on a dry-soil basis was used for most of the cotton experiments. In many instances, it therefore appears that plant necrosis rather than plant physiology was being studied. Quantitative results generally appear questionable, for no measurements and in some cases, have more meaning. For example, the specific effect of chloride salinity in inducing succulence as opposed to the xeromorphic effects of sulfate salinity is well substantiated for grass crops.

The eleven chapters deal with mechanisms of salt action on plants, salinity effects on growth and development, water relations, salt toxicity and plant adaptation, nitrogen metabolism, soil micro-flora, and means for increasing salt tolerance. The toxic effects of salinity, primarily chloride (but see above for lack of comparability of chloride and sulfate treatments), are related to accumulation of pateceine and cadavetine in some species, resulting from altered nitrogen metabolism and decrease in activity of dianine oxidase. Practical means given for increasing salt tolerance of plants include Genkel’s seed-soaking treatment with strong salt solutions, and the use of seed from adapted plants grown in saline areas with the same type of soil salinity as that to which the crop is later to be subjected. Intervarietal hybridization is also advocated, to combine the best of different introgressions even if poorly—on salt spots with the productivity of plants growing well on nonsaline spots. Although this genetic recommendation is supported by data the significance of it cannot be evaluated.

The book contains other assumptions and interpretations that are at variance with those of other workers. Since it precedes their discussion, and this review is necessarily limited to an analysis of the basic assumptions on which the entire treatment rests.

The translation by Professor A. Poljakoff-Mayber and Dr. A. M. Medina is for the most part quite good. Some terms are not properly translated ("nests" and "hollows" for "planting in hills"; "swamp formation" for "waterlogging"; and smaller increases of various plant components are, in several places, referred to as "decreases"), but the meaning, in most instances, is clear from the context or by reference to the data. In several places, the translators have provided useful explanatory notes and have suggested corrections of some apparent errors in the original text. A few errors and inconsistencies remain, including several of the tabular headings which apparently are mislabeled. "Water as percent dry weight of leaves" obviously should be "...as percent fresh weight..." (tables 59 and 67); "per cent of control" should be "per cent of radius" in three subheadings of table 32.

This volume will be of interest to soil and plant specialists whose background in salinity problems is sufficiently developed to permit highly critical reading. The book does provide a very readable summary of Russian work and views. For persons with less experience in salinity research, the text can be misleading.—LEON BERNSTEIN, U.S. Salinity Laboratory, Riverside, Calif.

Fabric and Mineral Analysis of Soils

This fine book is largely concerned with the systematization of visual observations on soil material. It draws heavily and successfully on geological terminology and in so doing bridges between geological and pedological description. Much of the book is devoted to a classification of structure and fabric. This is the part that makes the book unique and tolerable as a section on soil mineral analysis is less successful. It emphasizes genesis rather than description to a fault and has a scholastic flavor.

The mineralogical section begins with an excellent discussion of grain, crystal, and shape. The remainder of the section has several deficiencies. An explanation of modal analysis statistics would have been more useful than the detailed discussion of the narrower subject of grain-count precision. The presentation of the calculation of gains and losses is extremely well done, but the help will wondering if the chances of determining the correct reference composition are usually sufficient to justify such studies. The discussion of mineral stability and weathering gives insufficient attention to aggregates and weathered grains as parent material components. An explanation of the geological description of parent rocks would have been more useful than the discussion of pedological parent rock classification.