

## A Standardized Soil Testing Format

### A Hybrid Model

The need for a standard soil testing protocol is obvious: Albrecht said it best in 1944: "Food is fabricated fertility (1975, p 276). While the contribution of carbon dioxide, oxygen and water makes up 95% of plant weight,

It is soil fertility that constitutes the 5% that is plant ash. It is the handful of dust that makes up the corresponding percentage in the human body. Yet it is the controlling force that determines whether nature in her fabricating activities shall construct merely the woody framework with leaf surfaces catching sunshine with root surfaces absorbing little more than water or whether inside of that woody shell there shall be synthesized the innumerable life-sustaining compounds. (Albrecht, 1975, p 276).

Fertilization affects yield, quality, insect & disease management, and the environment. Can generalizations be made about soils and fertilization which are adaptable to the many climates, crops and soil types existing in the world? Actually generalizations are used frequently in agriculture. Systems of cultural practices (seeding, pruning, irrigating) are taken from one part of the world, adapted and applied in another part. Soil texts are full of charts on pH preferences, micronutrient needs, salinity tolerances and other aspects of different crops. These are based on combinations of theory, practice, and research. These three components are integral parts of any model. Interestingly, the model I propose already exists as a standardized soil testing format , but the interpretation and use of this model has fallen into disuse or was never fully adopted.

Richard Large (1971) reported on the use of Balanced Cation Saturation Ratio theory for soil analysis interpretation of calcium, magnesium, & potassium fertilization, with Sufficient Levels of Available Nutrients used for N, S, P and micronutrients. This provides the best of both theories: balance of major cations for nutrient availability, soil structure, and general plant growth, with research-backed general ranges for macro and micro nutrients. Dr. Large later joined with agronomist Don Ankerman to form A & L Agricultural Laboratories - arguably the largest of its kind in the world, with 10 branches in the United States. Harris Laboratories, a large lab based in Nebraska, uses similar methods.

Cottenie (1980) compiled a soil testing manual for the Food and Agriculture Organization of the United Nations, and proposed using both BCSR and SLAN methods, adapted to local crop conditions. In California, the SLAN method has generally been recommended (Soil and Plant Tissue Testing in California, 1983).

Although attention to ratios and nutrient interactions in sodic soils is often recommended, limestone is recommended for soil pH control only. Researchers and practitioners assume that soil calcium level is adequate for plant growth if the pH is above 6 or the soil has a high pH but is not high in sodium. This is not necessarily true, which results in the belief that most of the agricultural soils in California have "adequate" calcium and do not need limestone or gypsum.

Numerous researchers have stressed the importance of a model for understanding soil fertility and plant growth. Chapman (1965) recognized the value of both soil and tissue analysis to investigate the relation of nutritional status to diseases of plants, In 1992 Rengel (p. 172) called for a "complex, multi nutrient uptake model that will account for complementary-ion effects among major cations." Churchman, Skjemstad and Oades (1993, p. 795), after studying soil permeability and drainage in high sodium and magnesium soils concluded "our knowledge of soil macroscopic behaviour remains largely empirical and still lacks an overall theoretical model." Neither of these studies addressed the BCSR theory, even though the two largest laboratories in the world have used this in their soil reports since the early 1970's.

The combination of BCSR and SLAN as used by the major laboratories, with strict interpretation of calcium needs based on Albrecht's work, makes a practical model which has many benefits and universal adaptation. The generalizations are based on a solid base of research, application, and utility.