Managing Calcareous Soils

A calcareous soil is created from parental rock that is primarily calcium carbonate (lime). For this reason, the dominant nutrients or elements in these soils are calcium and carbonate, and the dominance of both of these elements created challenges for the farmer. Calcium (Ca^{2+}) is an important nutrient for crops and is needed in relatively large amounts. However, in a calcareous soil there is so much calcium that the availability of other important nutrients like potassium and magnesium, as well as many trace elements (zinc, copper and manganese), is severely restricted. From a soil testing and fertility perspective, it is practically impossible to determine the soil's cation exchange capacity as well as the ideal ranges for potassium and magnesium. From a practical perspective however, even if the ranges were determinable, it would not be economically viable to increase the potassium and magnesium levels to the point where they would be reasonably balanced with the extremely high calcium level. Furthermore, when these nutrients are added through appropriate organic fertilizers, they are immediately bound in the soil and unavailable to crops. One of the only options for adding nutrients to crops growing in calcareous soils is through foliar feeding, which allows the crops to take up the nutrients directly through their leaves. This can be a challenging method of fertilization for farmers due to the increased cost of foliar fertilizers (nutrients need to be in a chelated form), the need to regularly fertilize, the equipment needed, and the challenges of foliar feeding in a rainy climate.

In addition to the dominance of calcium, there is a large amount of carbonate (CO_3^{2-}) in the soil. Carbonate in the soil reacts chemically with water to increase the soil pH. This can be a helpful process in soils that are acidic and the reason why farmers add lime to acidic soils. However, when carbonate is in such high amounts, the soil pH is increased to a level that causes nutrients that are important to crops to become much less available in the soil. This is particularly true for trace elements (those listed above as well as boron). Again, nutrients are most easily added to crop growing in a calcareous soil not through the soil but through foliar feeding. In addition, a high pH soil reduces the soil's biological diversity, making it more challenging for organisms to decompose, fix nitrogen and carry out the vast array of beneficial activities that they provide soils and crops.