2. BICARBONATE

The Elusive One

Dave West* has aptly termed bicarbonate a "will-o'-the-wisp". The "now you see it, now you don't" nature of bicarbonate makes it difficult to secure a handle on it.

The bicarbonate concentration of the soil solution varies with the moisture content of the soil, the lime, gypsum and calcium con- tent and the phosphorus and iron content. The CO_2 producing capacity of plant roots also influences soil bicarbonate concentration and there are other influencing factors.

Although bicarbonate is routinely run in water analysis, it is not routinely run on the saturation extract of soils - it should be, as the analysis is easy and could provide useful information. Perusal of accumulated bicarbonate analysis data from large numbers of soil samples could provide interesting correlations and aid in diagnosing field problems.

Bicarbonate concentration of plant cell sap is probably a critical factor in bicarbonate related problems, but how do you get a handle on this? Plant analysis for bicarbonate is virtually never done because of the difficulty of correlating results with the actual cell sap concentration. Virtually any type of processing of plant tissue (drying, ashing) will immediately alter the bicarbonate concentration. Perhaps an extract of fresh tissue could provide clues, but this is never done.

Evidence that bicarbonate can be directly toxic to plants was shown in an experiment with radish seedlings by comparing equal concentrations of sodium chloride (NaCl) and sodium bicarbonate ($NaHCO_3$):

RELATIVE ELONGATION OF RADISH RADICLES IN TWO DIFFERENT SOLUTIONS

-Solution concentration in meq/l-

Solution	0	5	10	50	100	200
NaCl	100	94	86	81	75	60
$NaHCO_3$	100	90	78	36	18	2

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Chloride is usually considered the most toxic anion to plants. The preceding data indicate that bicarbonate is more toxic to some species.

Bicarbonate is strongly implicated in iron chlorosis (see chapter on iron). One proposed mechanism for the relationship is that bicarbonate makes phosphorus more available by tying up calcium and thus increasing the solubility of calcium phosphates (remember that a bicarbonate extraction is a standard laboratory method for soil phosphorus analysis). High phosphorus levels in plant tissue are often associated with iron deficiency and can sometimes be used as the sole diagnostic confirmation of an iron deficiency.

Until the day that bicarbonate guidelines for soil and water become better established,

the fieldman should pay close attention to water and soil bicarbonate levels when diagnosing field problems, particularly chlorosis problems.

General References

The May 1960 issue of **Soil Science** (Vol. 89, No. 5) consists of 11 papers on bicarbonate that were presented as a Symposium on Bicarbonates in 1959.