as storehouses for plant nutrients while the cations set free are available to plant roots. The capacity of a soil to exchange cations is the best single index of potential soil fertility.

Organic matter in the colloidal state carries both positive and negative charges and is about five times more effective than clay in nutrient exchange. Because soil nitrogen in the nitrate form (NO_3) carries a negative charge, organic matter is the only good storehouse for nitrogen.

The soil pH may influence nutrient absorption and plant growth through the effect of the hydrogen ion and through the indirect influence on nutrient availability. In most soils the latter effect is the most significant.

The term pH expresses the relative concentration of hydrogen and hydroxyl ions in solution. A pH of 7.0 mean the hydrogen and hydroxyl ions are equal and the solution is said to be neutral. A pH below 7.0 means the solution contains more hydrogen ions than hydroxyl ions, and is said to be acid. Similarly, a pH above 7.0 means the solution contains more hydroxyl ions and is alkaline.

The presence of an element in the soil is no guarantee that it is in a soluble form available for absorption. The concentration of hydrogen and associated ions affects soil reaction and the formation of soluble and insoluble compounds. Each nutrient has a pH range of maximum availability simply because within this range it forms a large proportion of soluble compounds. The relationship between soil reaction and nutrient availability for eleven of the essential elements is shown in Figure 4.

Arborists should not neglect the soil when maintaining trees and shrubs. The landscape site often possesses totally different soil conditions, both physically and chemically, from those found in the plant's natural environment. As a result, trees often do not grow vigorously and are more susceptible to insect and disease pests. Because of the importance of soil in root distribution and maintenance of plant health, arborists should have a basic understanding of soil in order to identify and correct and problems that exist.

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CONTRIBUTED ABSTRACT

EFFECT OF DROUGHT AND FREEZING STRESSES ON SUSCEPTIBILITY OF BLUE SPRUCE TO *CYTOSPORA (VALSA)* CANKER[1]

by Donald F. Schoeneweiss[2]

Stems of 5-year-old Colorado blue spruce wound-inoculated with a conidial isolate of *Cytospora (Valsa) kunzei* became predisposed when subjected to controlled drought stress. Typical bark cankers appeared on stems with plant water potentials below −20 bars, while no cankers formed on nonstressed stems or on stems subjected to freezing stress of −20 and −30 °C. Although the pathogen was recovered from wood in both stressed and nonstressed stems, necrotic bark cankers formed only on drought-stressed plants. These results support the hypothesis that drought stress is the controlling factor predisposing spruce to Cytospora canker.

It has been suggested that ascospores serve as inoculum and that conidia are not infective. In this study, cankers did form from conidial infection provided the plants were under significant drought stress for predisposition. Freezing stress had no apparent effect on susceptibility. A selective culture medium was developed (30 g Difco PDA, 0.1 g chloramphenicol, 0.1 g streptomycin sulfate, and 0.3 g ethazol (Truban) in 1 liter H_2O acidified to pH 5.5 with dilute HCl) which should aid in isolating *Cytospora* from spruce stems.

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