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Soil pH

Though you may not discuss soil chemistry in your social situations, often when I meet someone and respond to their question of what I do, the topic can become soil and plant growth. Of the many characteristics of soil, virtually everyone can relate to the term pH and may have some concept of acidity or alkalinity, but that is usually where it ends. The assumption is that if you know the pH you know the amount of acid in the soil. Or that a pH of 6 is not much different than 7, after all they are only one unit apart. This is further compounded by questioning as to why some plants growh better at different pHs. It is worthwhile sometimes just to look at scientific concepts and consider how to describe these concepts for best understanding.

As far as pH is concerned it would be atypical if you were able to quote your old chemistry text and say "pH is the negative log of the hydronium ion concentration". And even if you could, would you or the person you were talking to know what you were saying? However, I've found that you can relate pH to temperature. That is, that taking the soil pH is like taking the soil's acidity temperature. Of course, knowing the temperature of an object does not tell you how much heat is associated with it. A 200 degree one pound block of compressed paper dropped into a bucket of water would not heat the water significantly compared to putting a one pound lump of copper at 200 degrees into the same bucket. In the same way that the paper block and the copper lump were at the same temperature and have different heating capacities, the different soils that have the same pH may have drastically different total acidity or alkalinity. This then explains why some soils of the same pH may require different amounts of lime or sulfur to adjust their pH.

Without quoting chemistry texts, recall that pH is a log scale, thus a 1 pH difference is really a change of 10 times the acidity and a two pH difference is 10 x 10 or a hundred fold difference. This concept can be related to the logarithmic Richter Earthquake Scale, where a 2 unit change of an earthquake goes from no damage to a total catastrophe, similarly this shows how when soil acidity changes, a small pH change may have large effects on plant growth.

The third common question concerning why some plants grow more effectively at different pH values cannot be answered simply with some an easy comparison. However, remember that acid concentrations effects the way chemical element react and exist in soil and the water in the soil. For example, as the pH decreases the soluble aluminum, potassium, magnesium, and manganese concentration increase and the calcium concentration decreases. If the plant thrives at the lower pH, is it may be because it is less susceptible to Aluminum toxicity or does need high manganese concentration. Also, associated with the plant cells surface are proteins which facilitate transfer of the nutrients into the cell. The ability of these proteins to make this transfer can be affected by the pH of the environment. Thus you have the additional consideration of the effect of pH on the plant cell itself. Specifics of each plant can be and in some cases have been established. However, because of the complexity of this question, the practical solution has been to use the information that has established total yield or growth potential at a specific pH range (see able 1).

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In a similar situation, establishing he optimal pH range for the microbial bio-remediation of organic contaminations does not have the easy practical solution of the established yield of plant crops. Faced with the same problems as the plants, in establishing a optimal growth, the microbial population must also effectively utilize the organic contamination as a carbon

Table 1. Optimal pH for Growth

PLANT TYPE	pH Range
Alfalfa	6.5-7.5
Almonds	6.0-7.0
Beans	6.0-7.5
Camellia	4.5-5.5
Corn	5.5-7.5
Elm	5.0-6.0
Fescue	5.5-6.5
Juniper	5.0-7.5
Pears	6.0-7.5
Pine	5.0-6.5
Red Clover	6.0-7.0
Rice	5.5-6.5
Roses	5.5-7.0
Sugar Beets	5.5-6.5
Tomatoes	6.0-7.0
Wheat	6.0-7.0

source. Seeding microbes that use this carbon source may face the problem that the soil pH is not optimal for the new microbes being seeded.

The pH is a fundamental component effecting the soil conditions and ultimately plant growth or soil micro-organism growth. It should be evaluated and managed for optimal results.