

NOTES ON SOIL pH

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An explanation of the term "pH".—In the past year or two, the Institute has been emphasising the need to pay attention to the pH value of the soil, for various reasons, and superintendents have been showing an increasing interest in this factor. Naturally we have had queries as to the meaning of "pH", but it was usually possible to explain it away as being a means of expressing active acidity. This is perfectly true, but it does not go far enough to answer the direct question which has been put to us—"what is the meaning of the little 'p' and the big 'H'?"

We have been asked to explain this specific point, and since "pH" is a highly technical concept we shall have no hesitation in being technical.

Acidity is due to hydrogen atoms in a certain state of activity, and the greater the concentration of these atoms the higher the acidity. By the nature of things, the concentration of active hydrogen atoms occurring in, say, soil is extremely minute, and if expressed by everyday notation the result would be a cumbersome fraction, and mistakes would arise when referring to soil acidity in everyday matters, such as estate reports.

Scientists, who have no love for inefficient time-wasters, found the conventional methods of expression too clumsy for their purposes, and a mathematical dodge was adopted to simplify discussions on acidity. When this is applied, the results come out as manageable numbers, 4.5, 5.2, and so on. Since hydrogen is referred to scientifically as H, this part of the formula is obvious enough, and as we are now dealing with a juggled version of the true concentration of H it is necessary to have a reminder of the fact—hence the little "p".

We are, in effect, working in a shorthand code whenever we speak of pH values. "p" denotes the code, "H" defines the subject matter, active hydrogen atoms, and the figures attached designate the point on the scale from which we can work out the concentration of these active, acid producing atoms.

In the pursuit of convenience one complication has arisen. The *greater* the acidity the *smaller* the pH number. In practice this is the point to remember, but the foregoing technicalities were needed to show that this seeming anomaly is preferable to more unwieldy straight-forwardness. A further unexpected point is the relation between the pH numbers themselves, and a table will perhaps serve as a summary and a reference:

pH number, or value	Acidity
7.0	Neutral
6.0	Acid
5.0	10 times as acid as pH 6.0
4.0	10 times as acid as pH 5.0 and 100 times as acid as pH 6.0

A difference of 1.0 e.g. 5.1-4.1 or 5.8-4.8 means a difference of ten times in acidity.

A difference of 2.0, e.g. 6.2-4.2 or 5.9-3.9 means a difference of one hundred times in acidity.

In tea growing circles we refer to soils above about pH 6.2 as "alkaline", and although this is not correct the custom need not be abolished as long as we remember that true alkalinity does not start until the pH value is above 7.0. Acidity is expressed by numbers from 7.0 to zero; alkalinity from 7.0 to 14.0.

It is hoped that this very brief note will add to the general knowledge concerning pH numbers, and that we have avoided the usual pitfall in translating technicalities into everyday language, namely of leaving everyone in greater confusion than before.

Soil pH in tea nurseries.—Young tea, whether as seedlings or as vegetatively propagated cuttings, i.e. V.P., is very susceptible to poor growth on a soil which is insufficiently acid. From our experience of some thousands of advisory analyses we can now give a guide to the upper limit of soil pH for nurseries.

For seedlings the pH should be below 6.0.

For V.P. cuttings the pH should be below 5.6.

The difference between seedling and V.P. is interesting; although we can not explain it there is no doubt that V.P. is much more rapidly affected by a too high soil pH than is seedling tea.

Evidence of the adverse effect of too low a soil pH, that is, too great an acidity, is still so scanty that we do not issue any advice on that aspect.

The upper pH limits quoted above refer to well drained soil, and it is well known that even a slight waterlogging in tea nurseries can have the same effect as raising the pH slightly. Thus, if a soil with a pH value a little below the upper limit, say 5.8, for a bed of seedlings, is then waterlogged, the seedlings will probably behave as though the soil pH had been over 6.0. It is, unfortunately, necessary to emphasise that over-watering and poor drainage are in themselves bad for nurseries.

The water which is used on nurseries may itself have a pH of 6.0 to 7.0, but as long as the soil is sufficiently acid and well drained the high pH of the water will not cause damage. If there should be a harder layer at a few inches depth in the beds, or a layer of compost, either of which may hold up large quantities of water, the effect of high pH of the water may be harmful. In any event, such layers will cause trouble on their own account.

Too-high a pH in nursery beds can be corrected very readily *before* they are planted up, but not *after*. Once plants have started to suffer they can only be saved by replanting into more acid soil, which is at best a very costly process. The Tea Research Institute has always offered to test nursery soils for their pH value and the presence of parasitic eelworm species, and perhaps this valuable advisory service has not had the publicity it deserves. Testing a soil before using it in nurseries allows any fault in pH or eelworm to be corrected, and there should really be no reason for a nursery to fail in either of these respects.

Soil samples should be taken from the full depth of the bed, or from the whole bulk of soil which will eventually go into baskets.

There is only one practicable method of lowering the soil pH, and the only advice which the Institute gives is as follows:—

(1) Broadcast sulphur at the recommended rate, see below, and mix it as thoroughly as possible to the full depth of the bed, or throughout the bulk of soil for baskets.

(2) Keep the soil well watered and if necessary well aerated. The reaction is a biological one and the bacteria act more rapidly with a plentiful supply of air and water.

(3) Leave the soil for two months before planting.

If the above instructions have been carried out there should be no danger to plants after this period, and the soil will remain acid indefinitely.

RATE OF APPLICATION.—This is not easy to define rigidly, as different soils will respond in different degree. Also, if the top few inches of soil, only, have a high pH, then less sulphur will be required than if the top foot of soil is too alkaline. Roughly, between 1 and 3 *ounces* per square yard may be taken as the normal application. This is approximately between one third of a *pound* and one *pound* of sulphur per cubic yard of bulked soil.

WARNING.—Sulphur should never be applied to a nursery while there are plants growing.

If a soil with a very high pH, say over 7.0, is met with, the Institute's advice should be sought, as it may not be worth while to try to reduce the pH.