More Addresses from NAGA

Vitality of Trees in Relation to Root Environment

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THERE are six "factors" required for the growth and health of the higher plants: light, heat, air, moisture, soil nutrients and mechanical support. Since soil supplies the tree with five of these, either wholly or in part, we can readily see the importance of root environment in the health of a tree.

We can, within certain limitations, control soil temperatures. By irrigation and drainage we can regulate the moisture supply. In a like manner we may influence aeration of the root area and by the use of fertilizers the needed elements may be supplied. We transplant large trees and in doing this we cut away the roots severely. How can we restore and enlarge this root system rapidly in order to avoid pruning the top too severely? When our trees are suffering from poor soil conditions what fertilizers are usually needed and how may they be applied most efficiently to lawn or to other sod-grown trees?

The presence or absence of air rather definitely limits the downward growth of roots. Aside from the texture or fineness of the soil particles, aeration is quite largely influenced by the moisture supply. We cannot expect to induce deep and vigorous root growth on our common trees in a soil with a high water table or a soil so nearly saturated that but little air movement can take place. Even such shallow rooted and swamp loving trees as larch and black spruce have been known to more than double their growth rate following drainage of their native swamp.

Good drainage is especially essential for transplanted trees where copious and frequent watering is necessary. In fact where the soil drains freely, heavy watering may even assure good aeration. This can be readily understood when we remember that, in entering the soil, water displaces the air present and in draining out draws in a fresh supply of air. In addition, water from a hose or overhead sprinkler is charged with oxygen which is available to the roots.

Cultivation has long been considered a means of introducing air to the soil. Research of recent years indicates quite strongly that stirring of the soil, aside from reducing weed competition for moisture and nutrients, has been over-emphasized. It seems doubtful if surface cultivation would very greatly influence root conditions in the undisturbed soil layers 18 inches or more in depth. Furthermore, when our landscape picture is made on a carpet of green we do not take kindly to having patches of it laid bare in order that our trees may enjoy the benefits of cultivation.

Two white ash trees, August, 1927, being given first of annual fertilizer treatments

Same trees, August, 1930, showing effect of three years of fertilizer applications

Barren soil beneath a tree prepared by power driven earth augers to receive fertilizers and organic material to a depth of 2 feet throughout its entire root-area

During a period of hot summer weather and light rainfall, trees soon exhaust the soil of its available moisture. Here again the deeper rooted trees have an advantage over those which because of their shallowness are denied the moisture of the deeper soil. We should remember, too, that during a prolonged drought such as we had in 1930 the soil moisture is exhausted to a considerable depth and that even normal rainfall during late summer and fall may not restore the normal subsoil water content. For this reason, it may be necessary to water our trees even after our lawns and gardens have recovered from the dry spell.

I had occasion during the past season to examine a number of dying white oak trees on the grounds of The Greenbrier at White Sulphur Springs, W. Va. This was in the heart of the 1930 drought area where for six months during the spring, summer and fall there was not a single rainfall which could be measured in a standard raingage. Rainfall in 1931 up to the first of September had been about normal, and yet the resident engineer assured me that, with the exception of a few inches of surface, the soil to a depth of 12 ft. was almost as dry as dust. This points out once again the value of prolonged irrigation over frequent light applications. Transplanted trees, which draw their moisture from a limited volume of soil, exhaust the supply rapidly and require more frequent but no less thorough watering.

Tree Fertilizing

Of the three elements supplied in complete mixtures, nitrogen is by far the most important in a tree fertilizer. There is much research work yet to be done on shade tree fertilizer problems, but in the light of our present knowledge there is no reason for spending much of our fertilizer dollar for phosphorus or potash.

While nitrogen may be supplied in any one of a number of forms, a mixture of two or three forms should be used. Materials such as sodium nitrate are rapidly available, but leach out so readily under certain soil and moisture conditions that they should not be depended on for the entire supply. On the other hand, straight organic carriers such as bone meal or cottonseed meal are rather slowly available and, even over a period of years, have not proved as efficient on deciduous trees as mixtures of both organic and mineral carriers. Trees make root growth and absorb food materials over a long season of the year and it seems advisable to supply them with a fertilizer containing both immediately and slowly available nitrogen.

Manure or any other organic material, of course, plays much the same role in improving soil conditions for trees as it does for other agricultural or horticultural crops. If manure is used in transplanting or elsewhere, where it may be placed at any considerable depth and where the soil is likely to be quite moist, great care should be taken that it is well rotted and past the period of most rapid decay. For surface mulches or where there is a more direct connection with the atmosphere the shredded manures may be used.

On transplanted trees where rapid root growth is desired, peat moss seems to be especially suitable, perhaps because it combines great water and air holding capacities. This material even when mixed with poor subsoil, under some conditions, induces better and more rapid root growth than when topsoil is used. Peat moss contains but little organic nitrogen and seems to decompose without the formation of harmful gases even when mixed to considerable depths in heavy soils. This, however, may be directly due to its effect on aeration. Where this is done, nitrogen fertilizers should be used from time to time throughout the summer. This is necessary to supply both the tree and the bacteria which decomposes the peat moss and to take care of leaching under the frequent watering necessary for transplanted trees.

The so-called crowbar or perforation system of applying fertilizers to trees has been used for many years. Originally a comparatively small number of holes was made under each tree. In more recent years, we have a newer conception of this method and a higher regard for the place it occupies in our attempt to make shade trees more nearly independent of irregular rainfall and rapidly changing soil temperatures. This is particularly true with the development of power-driven earth augers, with which holes can be made more easily and rapidly than by hand.

By the perforation method it is possible over a period of years to bring about an improvement in the soil around large trees to a considerable depth and with a minimum of disturbance either to the roots or to the lawn.

Food and Air Introduced

Present practice is to form numerous holes from within a safe distance of the trunk throughout the entire spread of the roots. These holes are 10 to 18 ins. deep or even deeper. Chemical fertilizers alone may be used and the holes refilled with the loosened soil. Usually the hole is filled with a mixture of chemical fertilizer and some humus forming material to within a few inches of the top. The hole is then filled to the top with soil to re-establish an immediate growing medium for the grass roots. In either case we have introduced fertilizers at a depth of several inches and at the same time formed a partial air pocket and channel which for some time will offer less resistance to the entrance of air than was the case before the soil was loosened up.

One other point may be made in connection with this method. Soil chemists are fairly well agreed that phosphorus and, to a lesser extent, potash, are fixed in the soil within a short distance of the point where they are applied. If you feel that trees need high phosphorus fertilizers, then it is certainly more advisable to place them deep in the soil where the roots can actually come in contact with the phosphorus than to scatter them over the surface where the phosphorus may never go below the shallowest grass roots.

Extremes of temperature, both winter and summer, can be controlled to a certain extent. Fortunately, a heavy sod is a fairly good protection to the tree roots. Nevertheless, these organs do not possess great resistance to low temperatures and as a result trees do often die of winter injury to the roots. Soil or litter should never be removed from the base of the trunk or large roots just before cold weather. In exposed locations or where winter injury is feared, a mulch of leaves or other material may be used over winter. It should be removed in spring to allow the tissues to regain their resistance by exposure to the air during summer and fall. For trees which as a species have persistently shallow roots, ground cover planting will give the necessary protection. Such covers, made of Vinca minor or Pachysandra terminalis, being evergreen, are less objectionable than ordinary mulches and are quite permanent.

The Greenkeeper's Schedule

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WE ARE deluged with figures indicating the total investment in golf real estate, construction in buildings and layouts, and a little quiet pondering on the relationship of the greenkeeper to all this might well occupy some of his more serious moments. Not with the idea of the glorification of his own importance, but to a fuller realization of his responsibilities and liabilities.

While this office is commonly known as "Greenkeeper" in reality the scope of the work has widened considerably and we find many other duties attached to this position. What we actually find is that in addition to the maintenance of the course, he is "clerk of works," having within his care much of the belongings of the club.

The development in recent years in the golf club organization shows a tendency towards managerial administration. It is not within the purpose of this talk to discuss the pros and cons of this, but I will remark in passing that where the club is run by a general manager, who is responsible to the directorate for all the maintenance, service, and development, the greenkeeper generally becomes the general superintendent in charge of the outside maintenance of buildings, grounds, etc. At times when the administrative offices may be moved to the city or elsewhere, the greenkeeper automatically assumes charge at the club property. At such times, he assumes authority over the physical plant, though not over the service staff where the clubhouse is kept open for winter parties. That, of course, usually comes within the steward's office.

Director and Buyer

The agencies by which the greenkeeper discharges his trust falls into two general classes, labor and materials. In managing the former, he must exercise his best talent as director of operations and in the acquiring of the second, he must possess all the shrewdness and keenness of a first-class purchasing agent. To faithfully combine these is not an easy task, but in these days of keen competition, reduced budgets, etc., the success of the club relies very much upon these shining virtues.

The hiring of labor and its management is the oldest duty in this field of calling, in fact the whole business of greenkeeping in the beginning was a matter of labor supplemented with the simplest of tools.