

SOILS PROBLEMS IN FOREST NURSERIES AS RELATED TO
HARDWOOD SEEDLING PRODUCTION

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As you will soon realize, I'm not a Soil Scientist, nor a so-called Specialist; therefore, I will discuss the subject as a NURSERYMAN.

Most nurseries have certain problems or difficulties with different types of soils. Some are related to topography, or regional soil characteristics, or different soil texture, and a number of reasons. The original selection of a nursery site can have much bearing on the kind and the number of problems in this connection. Since it is so close to the actual subject, we might briefly mention some of the main points to consider when selecting a nursery site. These include topography, soil fertility, soil texture, under-drainage, etc. A uniform slope or grade will **facilitate** row or furrow irrigation. Determine the source and quantity of available water for irrigation. Test for alkali or salinity. Loam or sandy loam soils are usually preferred, but fairly sandy soils are **still** preferable to heavier soils. Subsoils should be fairly retentive of moisture but not excessively so.

Certain cultural problems can be eliminated by various soil amendments or particular practices. Others are by nature hard to overcome and so you do the best you can to live with them. Some problems are caused by excessive watering. Some because of wrong soil management. We have all experienced trouble from too much water, from one cause or another, in some areas. If this happens while the soil is being worked, you can either leave the effected area until later or you may try to work it anyway the best way you can. I have seen areas worked when the soil was too wet. The soil crusts badly and stays that way until after it has come through a winter freeze and thaw to bring it to its original state of tilth.

Any working of the soil should be carefully timed following irrigation or heavy rains. Plowing or working wet soil is likely to result in cloddy fields. Likewise, plowing when soil is really dry tends to leave the soil lumpy. Every nurseryman knows his fields and soils and how soon he can work them after rains or irrigation. This is very important also in regard to digging or lifting trees. If the ground is too dry, root stripping occurs. To retain a maximum of hair roots on planting stock, soil moisture must be just right at lifting time.

We must know our soils and how best to work them. Quite often there are variations in soil textures within a nursery. Bessey Nursery is 'mown as a sandy soil nursery, with an average of less than 1-1/2 percent of organic content. Our main soil problems are soil blowing between crops, rapid evaporation, and percolation, hard to maintain soil fertility. On the whole this is well suited for conifer production,

but deciduous seedlings require somewhat more fertile and heavier soils.

Other soils problems may be due to chemical composition or the lack of certain elements. It is important that we know what these are, and periodic soil analyses are a must in this respect. Available nutrients such as phosphorus should be determined separately rather than given as a total analysis. A total analysis may show apparent high values in one or both of these properties, and still not have them readily available. Phosphorus, for example, may be tied up in an insoluble state by iron, aluminum, or calcium.

Soil analysis will reveal if alkali is present. Alkalinity of surface soils is sometimes brought on by particular nursery practices such as continued applications of alkaline irrigation water. Alkalis are harmful in several ways. High alkali content of soil causes marked depression or cessation of nitrate and phosphate absorption. They can prevent the absorption of water by the plant roots, resulting in malnutrition and poor balance. Phosphates, even though present in ample quantities, may become unavailable to the plant at a pH of 8.5 and higher. Optimum pH for absorption of phosphates and nitrates being about 6.8. Conifers do best in soils slightly more acid. Applications of sulfur or other acidifying material will lower the pH. Leaching out of salts to below root depth is also recommended but requires good under-drainage.

Russian olive, desert willow, honey locust, and Siberian elm were the most alkali-tolerant of some 20 species commonly used in northern plains shelterbelts.

Analyses have shown that plants remove not less than 10 chemical elements from the soil. They are nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, sodium, iron, chlorine, and silicon. The lack or presence of these and other elements in varying quantities can have great effects on plant growth or resistance to disease. The function of various chemical elements in the growth of plants is subject matter in great detail for many publications and manuals, which for the most part are too technical for me. But, we are told that nitrogen promotes growth of foliage and stem growth, gives leaves a dark green color, and acts as a food reserve. Phosphorus stimulates germination, increases root development, and is vitally necessary in seed production. Potassium aids in formation of carbohydrates, is important in transference of starch from one part of the plant to the other, and increases seed production. Lime, in moderate amounts, increases availability of phosphorus, prevents excess acidity, stimulates growth, improves tilth of fine-textured soils, and has an ameliorating effect on toxic substances in the soil. However, if present in excessive amounts, it may reduce availability of iron and manganese, resulting in chlorosis. An excess of nitrogen causes undesirable succulence and top-heaviness in plants, decreases drought resistance, and increases susceptibility of fungus disease.

So there seems to be an answer to most of our soils problems. We can spot the effect, usually, but to find the cause is another matter. I know I sometimes do a lot of guessing and trying to find the cause. Once you find it, the solution or cure may be quite simple.

Personally, I am much in favor of and strongly recommend taking soil samples and have them analyzed by a competent soil scientist. With the information we have from a thorough soil analysis, and by complying with recommended treatment or amendment, and by intelligent use of irrigation water, and proper soil management, we can prevent or eliminate most of our so-called "soils problems."