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FACTORS AFFECTING THE ESTABLISHMENT OF URBAN TREES[1]

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Abstract: A series of studies has been conducted to determine ways to improve growth of newly planted trees. Incorporating soil amendments at planting time and placing black plastic beneath mulches were found to be detrimental to newly planted trees. Mulches alone were beneficial, particularly when used to maintain a cleared area around newly planted trees and reduce the competitive effects of lawn grasses. Pruning back the tops of newly planted dormant, bareroot, deciduous trees was not beneficial.

Many techniques to aid the establishment of newly planted trees have been proposed. Adding soil amendments to the planting hole, pruning back the top before or immediately following planting and using black plastic beneath mulches to conserve moisture are examples of widely publicized "helpful" planting techniques. Unfortunately, little or no data can be found to support these practices.

Soil amendments, especially peat moss, have been widely promoted as the magic ingredient to mix with backfill soil when planting a new tree or shrub. In recent years, bags of ground pine bark with many "helpful" hints described in detail on the bag filled the retail garden centers. Because of the wide variation in recommended rates, studies were done to determine the optimum amount of soil amendments to add. Soil amendments were peat, vermiculite, sand or ground pine bark at 0, 10, 20, 30, 40 and 50% by volume in the backfill around both bareroot and container grown trees and shrubs. Soil types studied varied from very sandy to a good clay loam to a sterile subsoil clay in a new housing development. Results of five studies showed the optimum amount of soil amendment to add was none (1). Results were very consistent on all soils with all the species used.

Close inspection of the root development showed a proliferation of roots in the amended soil but few roots extended into the surrounding soil (Fig. 1). Ground pine bark was very detrimental to silver maple, *Acer saccharinum,* seedlings. When 40% pine bark was mixed with a clay loam soil, trees were stunted compared to trees where no soil amendment was used (Fig. 2). Subsequent studies showed that additional nitrogen fertilizer could only partly overcome the detrimental effect of the decomposing bark.

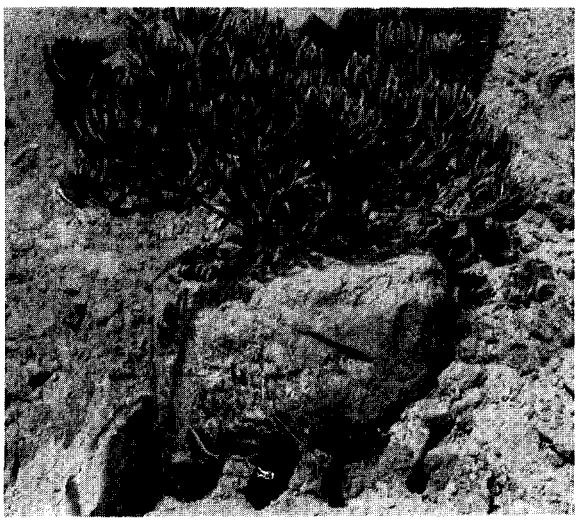

Fig. 1. Root development in planting hole amended with 40% peat. Few roots extended beyond the amended mix and into the surrounding soil.

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Mulching has long been a standard gardening practice. However, the practice of placing black polyethylene beneath the mulch to conserve more moisture and serve as a barrier to weeds should be questioned. A study was designed to determine effects of no mulch, pine bark mulch (2 inches deep) or pine bark mulch with plastic beneath three levels of fertilizer (0, 2 and 4 lbs. N/1000 sq. ft.) with each treatment (4). Sawtooth oak, *Quercus acutissima,* Chinese pistache, *Pistacia chinensis,* Pfitzer juniper, *Juniperus chinensis* 'Pfitzeriana', and Burford holly, *Ilex cornuta* 'Burfordi,' were used as test plants. The first summer was very dry and no irrigating was done. Plants with both mulch treatments increased in growth as fertilizer level increased. By contrast, those plants with no mulch showed no benefit from the fertilizer. The following winter 96% of the *Pistacia chinensis* trees with black plastic beneath the mulch were killed back to the mulch surface, while trees in other treatments were not damaged. Fertilizer level had little effect on winter injury.

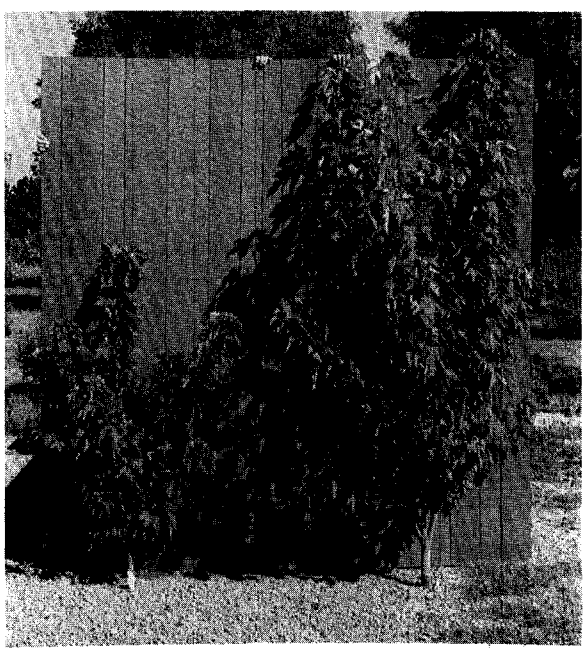

Figure 2. Growth of Silver Maple trees with 20% pine bark in the backfill (left) and with no soil amendment (right).

As the remaining trees and shrubs grew larger, no further direct damage occurred. However, after three growing seasons, plants with mulch alone were largest, followed by mulch plus plastic, while those with no mulch were smallest.

Plastic restricted the root development of all plants and did not provide additional weed control benefits. Roots developed in a thin layer beneath the plastic (Fig. 3).

Figure 3. When black plastic is used beneath a mulch, oxygen level is reduced and roots remain at the soil surface.

Grass competition with newly planted trees can reduce root and top development and in some cases survival. When common Kentucky bluegrass, *Poa pratensis,* was established when either a silver maple or honeylocust, *Gleditsia triacanthos* 'Shademaster,' was planted, root development was restricted as much as 68% when compared to root development where no grass was present (2). Later studies with U-3 bermudagrass and Japanese black pine, *Pinus thunbergi,* showed that a clear area 30 in. × 30 in. around a newly planted tree was sufficient to prevent stunting by the grass for two growing seasons (Fig. 4). Additional fertilizer applied broadcast during the dormant period and the growing season failed to lessen the competitive effect of the grass (3).

The practice of cutting back the tops of newly planted trees is firmly entrenched in the nursery trade. This is probably based on the theory that in most transplanting operations considerable roots are lost and the top should be reduced to com-

pensate for that loss. In the process of conducting numerous weed control studies with field nursery stock, some dormant, bareroot trees were cut back and others were not. It became apparent that at least with some species, pruning of the top at transplant time was not necessary. To study this further an experiment was designed with six species of dormant, bareroot trees, Redbud, *Cercis canadensis,* Bradford pear, *Pyrus calleryana* 'Bradford,' Pin oak, *Quercus palustris,* Hopa crabapple, *Malus spp.,* 'Hopa,' Green ash, *Fraxinus pennsylvanica* and Kwazan cherry *Prunus serrulata* 'Kwazan.' Treatments were 0, 15, 30 or 45% removal of the top immediately following spring planting with fertilizer (4 lbs. N/1000 sq. ft.) or without fertilizer applied at planting time. All trees were six to eight feet tall when the experiment was started. All trees were watered twice following transplanting with no further watering until the soil became very dry in mid-August. Nearly all trees survived and no benefit from pruning back the top following transplanting could be detected. By contrast, trees pruned back 30 or 45% did not have a growth form typical of the species and excessive basal sucker growth occurred on Bradford pear and Hopa crabapple. The high rate of fertilizer applied at planting time was not detrimental even though the soil became very dry (3).

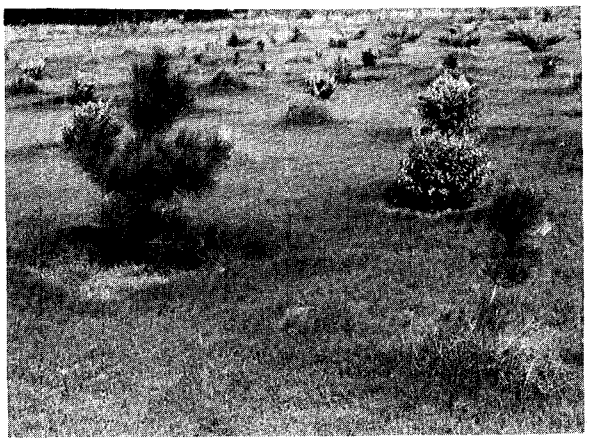

Figure 4. Growth of Japanese Black Pine with additional fertilizer and 60″ clearing (left) and with no additional fertilizer and no clearing (right).

It appears that the intact crown of the tree plays a more beneficial role in carbohydrate production, auxin release and subsequent root regeneration than in transpiring water resulting in moisture stress.

Based on these studies the following practices are recommended: 1) use no soil amendments when planting, 2) use the materials that might have been used as a soil amendment i.e., pine bark, etc. as a mulch instead, 3) do not place plastic beneath the mulch, 4) keep grass away from newly planted trees to reduce competition, 5) do not prune back the top of bareroot or balled in burlap (B&B) trees when transplanting except to remove broken or damaged leaves or correct structural weaknesses and 6) fertilize the tree on the soil surface as soon as planting is complete and mulch is in place. Benefits from the fertilizer will not be noticeable on most species until the second or third growing season but at least nitrogen should be applied to most urban soils.

Literature Cited

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