EFFECTS OF BLACK PLASTIC AND MULCHES ON GROWTH AND SURVIVAL OF LANDSCAPE PLANTS[1]

by Carl E. Whitcomb

The practice of laying black plastic around trees and/or shrubs in landscape plantings has become widespread. Unfortunately, little research has been done to determine the effectiveness of this practice. It has been observed that feeder roots of some plants can be found in a mat between the plastic and the soil surface. This can make plants more drought susceptible and more poorly anchored in the soil.

Methods: Plots 8 feet wide and 24 feet long were established, each containing one of the following species which previously had been grown for 6 months in 1-gallon containers and selected for uniformity — sawtooth oak (*Quercus acutissima*); Chinese pistache (*Pistacia chinensis*); dwarf burford holly (*Ilex cornuta* 'Burford dwarf'); and pfitzer juniper (*Juniperus chinensis* 'Pfitzeriana'). The treatments were 1) no mulch, 2) bark mulch 2 inches deep, and 3) black plastic plus bark mulch. With each of the three mulch treatments, three fertilizer levels were maintained — 1) no fertilizer applied, 2) a medium level of 1½ pounds N/1000 square feet per month during the growing season, and 3) 3 pounds of N/1000 square feet. Fertilizer applications were made April through August (five applications). The soil was a clay loam of moderate fertility. The study was initiated October 30, 1975 and was terminated in March 1979 and was replicated five times.

During a continued dry period, soil samples were taken on July 14, 1976, 2 inches in diameter and 2½ inches deep from each of the plots in the study.

Results of 1976: The plastic plus bark mulch plots had 6.5% moisture when sampled followed by the bark mulch plots with 4.4%. The least moisture was in those plots not mulched, 1.1%. The moisture level was due primarily to conservation of moisture by the mulch systems. The experimental area was irrigated twice during the summer of 1976 to assure plant survival.

Many weeds were removed by hoeing in the plots without mulch. A few weeds were removed by hand from the bark mulch plots and plastic plus bark mulch plots.

On August 9, 1976, after 10 months all plants were evaluated for growth response. No discernable response to the application of fertilizer was detected where no mulch was present. Where the plastic plus bark mulch or bark mulch was present, a growth increase of 30 and 21%, respectively, was detected due to application of fertilizer on the Chinese pistache.

Pfitzer junipers, generally considered a drought-tolerant plant, increased in size 23% by the presence of either mulch treatment but did not respond to the fertilizer. Even though the plots were irrigated twice during the summer months and one rain occurred, the plants did not take advantage of the additional fertilizer where no mulch was present.

Results of 1977: Tops of some of the Chinese pistache trees died overwinter. When plastic was present beneath the bark mulch, 40% of the trees were killed at the low fertilizer level, 60% were killed at the medium level, and 80% were killed at the high level (Figure 1). Where bark was used alone as a mulch, no injury could be detected on trees at the low and medium fertility levels but 40% of the trees were killed at the high fertility level. No injury could be detected on any tree at any fertility level with no mulch.

The reason for the increased damage when the plastic was present beneath the bark and the fertility level was increased is not well understood. However, root development was restricted by the mulch and plastic due to decreased soil oxygen and perhaps a high percentage of the more shallow root system remained frozen longer dur-

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ing the winter and the top injury was due to desiccation. The mulch may also have kept the soil warmer longer going into the fall and winter and when combined with additional moisture and fertility and shallow root growth, this promoted late fall top growth which was more susceptible to winter injury.

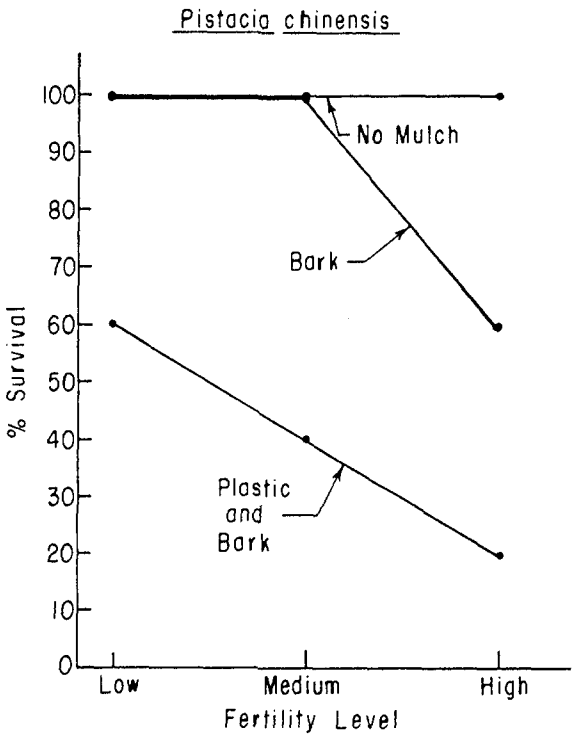

Figure 1. Effects of mulches and fertilizer levels on % survival of Chinese pistache trees.

No injury could be detected in sawtooth oaks from any treatments. The oaks grew similarly whether mulch alone or black plastic plus mulch was used. Both treatments were superior to no mulch. Likewise, both fertilizer levels gave equal response and both were better than with no fertilizer.

Pfitzer junipers were about the same size whether mulched or not mulched. However, both fertilizer levels substantially increased top growth.

Results of 1978: The Chinese pistache trees all resprouted from the root crown, but because of the multiple stems and erratic growth, further evaluation was difficult. Pistache trees were 13% taller and had 15% greater stem caliper when they were *not mulched* as compared to bark mulch alone. Many trees in the unmulched plots were over 10 feet tall with 2-inch or greater caliper. Pistache response to fertilizer was slight with only a 7% growth increase due to the high rate.

Piftzer junipers were 20% larger when *not mulched* as compared to either mulch treatment. Likewise, top growth was 20% greater when the high fertilizer level was used.

Sawtooth oaks were 10% larger when mulch or mulch plus black plastic was used compared to no mulch. High fertilizer response was greatest where mulches were present with a 31% increase in both height and caliper when compared to low fertilizer and no mulch.

Burford holly grew best with high fertility and mulch alone. This combination yielded plants 8% larger than plastic and mulch and 20% larger than no mulch. High fertilizer levels gave an overall plant size 34% greater than low-level fertilizer.

Results of 1979: All plants were dug during March, 1979 and observations on root development were noted. All species had many fine fibrous roots in the interface between the plastic beneath the mulch and the soil surface (Figure 2). A few roots were found growing in the pine bark mulch treatment. Most roots were 5 to 8 cm (2 to 3 inches) below the soil surface in the unmulched plots. Although a distinct difference in the location of fine, fibrous roots was observed, all plants had some larger roots penetrating to a depth of 30 cm (12 inches) or more. These larger roots had few branches, especially with the mulch plus plastic treatment. No difference in root development due to fertilizer levels could be detected.

Summary: All four species benefited from the mulch the first year. Burford holly and sawtooth oak continued to benefit from the mulch through the third growing season. After three growing seasons, the largest Chinese pistache and juniper were in plots where no mulch was present. This emphasizes the need for mulches to assist plant establishment, particularly the first growing season, but also shows that growth is not assisted when mulching treatments are carried on longer for drought-tolerant species. Once the plant is "established" continued coddling, especially on

tough, drought-resistant species, may restrict growth. Black plastic beneath the mulch made little difference in weed problems and provided no additional benefit to the plants compared to mulch alone.

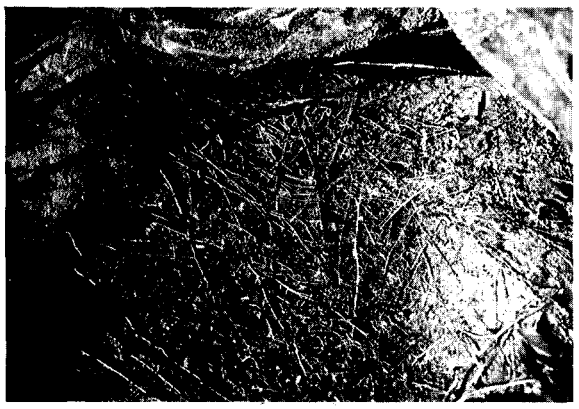

Figure 2. Many fine roots were observed in the interface between plastic and soil on all species.

Species such as Burford holly and sawtooth oak respond to improved moisture conditions but also need adequate oxygen to the root system. In geographic areas of heavy soils, high rainfall, or where irrigation is practiced, the detrimental effect of the plastic would probably be greater due to lower oxygen levels in the soil. The oxygen level in the soil is probably less critical the first season, but as the roots develop a greater deficiency occurs.

Little fertilizer response was detected the first growing season and only a moderate response during the second. However, by the third growing season the plants had developed sufficient root systems so as to be less drought sensitive and better able to absorb and utilize the higher fertilizer levels. This should not be interpreted to mean that newly planted trees or shrubs should not be fertilized, but rather that the visual response to the fertilization at planting may not be seen for several years.

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ABSTRACT

Shank, Bruce. 1978. **Growth of tree fertilization linked to professional methods.** Weeds, Trees & Turf 17(8): 14-16.

The success of lawn care companies suggests that property owners are aware of the increased value of their landscape. The same complete care package could work well for trees. The package could be pruning, fertilization, and repair of winter damage in the spring; insecticide and fungicide treatments in late spring and summer, and mulching, fertilizing, and necessary winter preparation in the fall. The entire program could be one contract at a price per visit. The success of lawn care spray rigs can be attributed to speed of application, rapid and dramatic improvement in the customer's lawn, the outdoor advertising value of the tank truck, professional brochures, and the ability to plan routes accurately and efficiently. These same reasons for success can be utilized in tree care, when a dominant technology is chosen by professionals and recognized by the customer to be professional. The tree care industry needs its sign of professionalism for tree fertilization. The most unique method having the characteristics necessary for customer identification is the soil injection method. If this method could be developed into a route similar to lawn care, there may be great potential.