

# TOXIC PLANTING MEDIUMS FOR BAREROOT

by Robert Ludekens - updated 3/13/01

**ORGANIC PRODUCTS HIGH IN TANNIC ACIDS WILL DAMAGE OR KILL SELECTED VARIETIES OF PLANTS AND TREES WHEN USED IN PLANTING BAREROOT, OR WHEN ROOTS ARE CUT.** The tannic acid enters the cut end of the root. It travels up through the plants' xylem with the water and minerals. This is the supply line for water and minerals for all plant life.

The tannic acids do not seem to damage the xylem as much as it does the **phloem or inner bark section of the trees.** The dark (black) acid breaks over into the phloem and burns out plant and tree cells leaving dead areas. Many plant and tree varieties produce adequate sugars to neutralize the acids so damage is limited or seems to be non-existent. Some varieties have very visible damage.

**VISIBLE DAMAGE** A Bartlett Pear with limited tannic acid will show small black triangles in the indented areas under the buds on the tree trunk. It is as if the tannic acid gathered at this location as it moved up the trunk. This area is dead. With more tannic acid, you find black striped areas very parallel with the tree. More acid will bring a blistered look like they have been near a hot fire. High acid brings on lesions in the bark. Most standard pears do not show any damage unless very high acid.

**NOT SO FOR ASIAN AND FLOWERING PEARS.** All Asian and Flowering Pears from calleryana show damage from tannic acids. They are an excellent indicator tree like Bartlett. They show blotches more than stripes as in Bartlett. These blotches are more concentrated a foot to three feet above the ground, but can show up higher on the trunk. State and county inspectors often see the lesions caused by the tannic acid and find only secondary infections like phytophthora cinnamomi. The damage by the tannic acid does not show in any tests, only disease, bacteria, or insects. I believe the finds are secondary problems moving into the dying-decaying plant area.

**I KNOW OF THREE TANNIC ACIDS. ALL ARE FROM WOOD.** The first we are familiar with, which is creosote. This was used for many years to treat utility poles to kill all animal and plant life. Our government got after the utility companies when the creosote was found in the water table. Our second tannic acid is the phenolic acids. I will refer to them most in the review. Today the utility companies are using the phenols to kill animal and plant life on the poles. Please note new poles are more reddish brown than the black of creosote. Would you plant in creosote? Why plant in phenols?

The third tannic acid I will refer to is thujaplicin, found in cedars.

At times these are referred to as volatile acids because they are very inconsistent (give off vapors, gas).

**THERE ARE MANY SOURCES OF PHENOLIC ACIDS** with different percentages of concentrations. My first research in the 1970's was with redwood. The 1980 research was with barks and eucalyptus leaves. All in varying degrees of toxicity. I will review a few others.

## TOXIC ORGANICS

**CEDARS:** (including Cedrus, Chamaecyparis, Thuja) Western Red Cedar - Cedar shavings (Thujaplicata). Cedar has 3 toxic acids: phenol, creosote, thujaplicin. All can damage plants. The most prominent is thujaplicin. Cedar can run 50% of its weight in tannic acids and will kill plants. Most research was done in the 1960's and published by W. B. Bollen with Forestry Science Laboratory, U. S. Forest Service, in Oregon.

**REDWOOD:** (Sequoia sempervirens) Phenol is the main toxic acid. The stump or butt of the tree can test 35% or more of the weight in phenolic acids. The bark is even higher. The top of the tree may only run 10% phenolic acids. Very deadly to many plant and tree varieties if enters the xylem or plant lifeline. Research is available at the University of California Forest Products Laboratories, Richmond, CA.

**BARKS:** Heavy thick barks such as firs and pines are high in phenol. Tests by the University of California, Forest Products Laboratories have found soluble acids up to 35% and total acids up to 50% of the weight of barks. Abstracts go back into the 1930's and a great deal of work was published in the 1960's-70's. Arthur B. Anderson was a leader in the redwood and bark research. Keep in mind pebble barks are slow to decompose and make good ground covers to keep weeds out.

**WALNUT AND PECAN SHELLS/HULLS (HUSKS) & OAK BARK** are very high in tannic acids and very toxic to plants. Keep in mind oak bark was used for years to soak with hides in a process called tanning. Check areas where hulls are spread to dry. Not even a weed grows. They are now used for surfacing farm roads and to sterilize soils. Very deadly.

**EUCALYPTUS LEAVES:** Very little grows under a eucalyptus tree. I always thought it took all the water. Wrong. The leaves are very toxic. They drip phenolic acid. They smother the ground when they fall.

**OTHERS:** There are other toxic organic plant materials. I do not have the research to support them. They are not in use as much as is redwood, barks, cedar. How do you review what is toxic? **Please note most toxic liquids leaving bark, redwood, cedar, and eucalyptus are very dark** - black, reddish purple, very dark brown. The organic product may start as a light color, but will change with water to a very dark color (black).

**GREEN WASTE:** Grasses, green leaves are often very high in minor elements and have high salts from zinc, magnesium, potassium, boron, chlorine, and others. I have seen E.C. tests with over 12.0. I do not know of any plant that will grow in that high of salts. Bareroot prefers 1.0 to 1.5 and not over 2.0. Watch for boron and/or chlorine toxicity, which is common in metropolitan areas.

**SLOW TO DECOMPOSE:** The tannic acids are preservatives to protect from animal and plant life. We use redwood posts because they do not decay. We use cedar for shingles/shakes and pallets. They are slow to decompose. I have a shake roof. It took 16 years before mosses and other plant life could grow on my roof. Now I cannot keep it off.

**BARKS** are used for ground cover because they are slow to disintegrate and limit weeds, etc. The forests have lots of bark, but little wood. I have a ranch in the Sierra Nevada mountains. It has been in the family since 1864. A large sawmill was shut down in 1929. We have a large slash pile. About 1990 I considered using it for a planting mix. All wood was decomposed and gone. The pile was pure bark. About 3 inches under the surface, the bark had not decomposed. The top was exposed to rain, wind, sun for deterioration, but the phenolic acid released above preserved all bark underneath. I took home 3 plastic bags and our salesman were questioned on the age of the bark. All but one guessed 1 or 2 months. One had been to the ranch and knew we had not had a mill for awhile, so he guessed a few years. We were probably looking at 1925 bark or earlier, and it looked as if it was harvested just a few months prior to my bringing it back. The phenol killed all animal and plant life. No weeds.

## COMMENTS ON OTHER PLANTING MEDIUMS

Most of this packet has been on Redwood & Barks, but I will make comments on other mediums.

**Cotton Gin Waste (trash)** - DO NOT USE as a mulch or planting mix. Today most all cotton is defoliated with a herbicide before the cotton is machine picked. There is a carry over of the herbicide in the waste product. Most herbicides are salts. We have seen heavy loss even with old material well decomposed. We have seen bad experiences in trees and roses in cotton bur materials also.

**Mushroom Mixes** - PLEASE DO NOT USE mushroom compost in bareroot mixes. Many losses have occurred from this. We have many testimonials on this, but have not done all the research to tell you why. Most mixes are made with manures and are very high in salts. I believe Soil and Plant Lab can be of help in this area. They have offices in Santa Clara and Santa Ana.

**Fertilizers and Manures** (chicken, rabbit, horse, cow, etc.) PLEASE AVOID USING IN MIX for bareroot. Acids, salts, and chemicals can enter the open cut roots and do damage. Once the roots are callused and forming new feeder roots they can handle proper amounts of fertilizer. Most fertilizer and manures are not used in hard or soft wood cutting beds, so please do not use with bareroot. Damage will vary by variety. Proper amounts of slow release fertilizer such as Osmocote can be put in the canning mix without tree damage. Fertilizers are needed later for proper growth.

**Kelp** - Found to be high in salts - we have only limited information, but do not recommend for bareroot, based on this limited information. We welcome more facts.

**Cedar Shavings** - DO NOT USE as a planting mix. Cedar has three toxic acids (phenol, creosote, thujaplicin). (See warning on toxic planting mediums)

There is some kiln-dried material where the oils are extracted for another product in Texas. My only comments on this product comes from testimony from customers in Dallas, Houston, Austin, and Corpus Christi. They have had losses due to the cedar, where they did not have with other mediums. The Renner Experiment Station - Texas A & M University at Renner, Texas has also run tests on several planting mediums and had a heavy loss with this dried cedar. Other mediums tested, grew well.

**Slow to decompose wood products** can be assumed to have a preservative with a large amount of tannic acid.

**Chlorine** - Chlorinated water deters root development. We saw less tree losses with El Nino rains than in previous years where nurseries watered with chlorinated water. I reviewed research done on a deciduous variety with non chlorinated water vs different amounts of chlorinated water. All had excessive water. No losses in the non chlorinated water even though saturated. Losses went up to 100% in the material with chlorine. This only confirms our recommendation to water in after canning and do not water again until after leafing and limited watering until in heavy leaf. We saw the same results at a wholesaler where one yard is on well water and one on domestic water with chlorine.

The facts in this packet have come from research started in 1970. Redwood surveys were conducted in 1970 and bark surveys, especially in areas of Arizona and all of New Mexico in 1989. Research will be on going.

## **GROWER EXPERIENCES CONFUSE THE FACTS**

A grower can use the same 2/3 redwood or pine bark and 1/3 sand and end up with very different results from year to year. You can have varying results from the same pile.

1. **WHERE DID THE WOOD COME FROM? REDWOOD.** Young dry land plantings have less phenol. Old trees in wet areas are high in phenol. Stump heartwood is very high in phenol, where top growth or cambium layer wood is low. The bark wood is high.

**PINE AND FIR BARK:** The older and thicker the bark, the higher the phenolic acid content. Young Christmas trees are not a problem, because the bark is thin and the storage of acids is very low. How do you know if the redwood is from the top or old stump wood? How do you know if the bark is from young trees or big old trees with thick bark?

2. **HOW MUCH LEACHING OF THE ORGANIC?** If the pile is hot, watch out. Well turned piles in wet climates in well drained areas will be much lower in toxic acids. New redwood, cedar, or thick bark can be very toxic. Rain may leach the top or outside of a pile and concentrate acids in the bottom if poor drainage. Hot water through steam sterilization will remove some tannic acids, if pile is not too thick. Cold water will do the same, with time, and good drainage. The organic needs to be used promptly after leaching. More phenol is released as the organic decomposes and then becomes more available. We use shingletow for a packing material. It is leached with sprinklers for 3 months prior to shipping. All water needs to flow clear before use. All bales are on pallets off the ground. Our shingletow for cold storage must be leached a second year before using.

3. **SELECTING WOOD:** Remember there can be a big difference in a year old pile after a year of rain than a fresh pile. A very significant difference in the top of a well leached pile and the bottom where concentrated.

Today we run into many growers who buy their bark or wood a year in advance and tell us they age it. They say this eliminates losses. In most cases they are exposing it to leaching from rain.

One grower "buys his redwood and spreads it 6" thick on a cement slab and runs sprinklers on it until the dark oils are out." He leaches the phenol out and has good results.

A Dallas area grower "Buys his bark in the spring and uses it the following February. He ages it (He leaches it). He has eliminated most all losses."

There is a redwood product business who puts their product on a hill and runs water on it before drying and bagging. "The bottom of the hill where the black liquid drains is something else." When we did a survey of 956 California nurseries, we found lots of redwood losses from bagged products except for this one product used by many retailers.

A Santa Fe, New Mexico, grower "bought old bark left from a fire at a supply yard. The old bark does much better than the new." Again leached.

A Phoenix grower "runs water on his bark to take out the toxic oils." He leaches the phenol.

We had a San Fernando Nursery who lost only 6 Flowering Peachs. Considering the size of his total order it was very few. I stopped to see the trees assuming the bundle was mishandled. He used Fir to can in except these 6 trees were in Redwood. An employee thought it was a good way to use up a broken bag of redwood mulch, not thinking about the toxicity. It would have worked on non sensitive varieties.

**Fact:** Tannic acids are very soluble for that which is readily available. As the wood product decomposes, more tannic acid will become available for leaching. This is why the product should be used soon after leaching. "Redwood leached of all tannic acids will decompose faster than pine or fir wood." according to Dr. Roy Branson at U.C. Riverside.

**4. CALLUSING ENDS OF ROOTS:** Bareroot trees and plants stored in sand or shavings and not trimmed later will block the entrance of most of the tannic acids. They will also callus in cold storage. You may put a small tree in a large can with no root pruning, or put a large tree into a small container by pruning lots of roots and you now have fresh openings. This can make a difference of a loss or no loss in the same mediums.

**As you can see, there are several factors that affect the amount of loss with the same product. Age, leaching, drainage, location on pile, condition of roots, and as important as anything, the quantity used. 100% bark mix will be more toxic than 25% bark mix and the balance in soil, sand, perlite, etc.**

### **RECOMMENDED CANNING & PLANTING PRODUCTS AND MIXES**

**RICE HULLS:** All L. E. Cooke tests have proven rice hulls to be the best organic material. 1998 I visited nurseries using rice hulls. All had trees far advanced to other nurseries in the same area using pine, fir, peat moss, etc. Better growth, better color, and most important great liveability.

**PINE AND FIR WOOD:** The tannic acid is only 3 - 5% of the weight, and not harmful. This was used for many years until particleboard was developed which took most of the wood. Bark was substituted in the early 1980's. Sawdust is poor because it mats and breaks down fast. Shavings are better, but chunky material is much better. Some people question the use of pine wood because of the turpentine. We see no problems with bareroot. It may be a problem with propagation, although we have no such facts. The switch from wood to barks in California in the early 1980's caused many tree losses.

**PEAT MOSS:** All the UC Soil Mix research was peat moss and sand. It should be a quality grade peat moss low in salts.

**SAND:** DO NOT USE PLASTER SAND. You need a coarse grade of cement sand or coarser. Unfortunately I find all grades of sand being sold for cement sand. Often very fine. A small pea gravel may be used.

**SOIL:** RECOMMEND SANDY LOAM SOILS (AVOID CLAY SOILS). You want a soil that breathes. Adding soils cause a catabolic effect which is the metabolic change or breaking down of complex molecules into simple molecules to transfer nutrients from the air, water and soils to the roots of the plants.

**PERLITE:** Sand and soils are heavy. Replace part of each with coarse perlite to lighten the container.

**VOLCANIC ROCK OR PUMICE:** Often added because it is lighter and coarser than sand and soil. Be sure tested first as some is toxic with copper and boron.

**WASTE MATERIALS:** The future will see more used. Young tree wood, like Christmas trees, is not a problem, but watch out for any that turns black. DO NOT USE "GREEN WASTE".

**BEST CANNING MIX BY VOLUME:** 1/3 non toxic organic, 1/3 sandy loam top soil, 1/3 coarse sand. Because of weight many nurseries have gone to a 1/2 non toxic organic, 1/4 sandy loam top soil, and 1/4 coarse sand. More nurseries are adding perlite or volcanic rock or pumice to lighten the container.

1998 brought the West coast El Nino, and in areas, 60 to 80" of rain. There was very little water sensitive losses if the canning mix was no more than 1/2 organic. The secret was no domestic water with chlorine. There were some losses, later in the year after leafing, caused by chlorinated water because of limited root development due to wet mediums. Keep containers on the dry side until good top growth and good roots. Chlorine inhibits roots.

## VARIETIES MOST SENSITIVE TO TANNIC ACIDS

As found in redwood, cedar wood, thick barks (such as fir, pine, oaks, etc),  
eucalyptus leaves & others slow to decompose

### FRUIT TREES

Apples*	Figs	Pears*
Cherries	Nectarines	Persimmons
Crabapples*	Peaches	Pomegranates

### NUT TREES

Almonds*	Pecans*	Walnuts*
Especially All-in-One		

### DWARF TREES

Genetic Dwarf Peaches and Nectarines  
Semi-Dwarf Peaches, Nectarines, Cherries & Pears on any root  
All varieties of trees on Besseyi or St. Julian root

### FLOWERING TREES

Apricots*	Crabapples*	Peaches inc. weeping
Cherries	Nectarines	Pears*

### SHADE TREES

Berrinda & Bonita Ash	Golden Rain	Smoke Tree
Fan Tex & Raywood Ash	Hackberry	Calif. Native & Yarwood Sycamore*
Birch*	Hawthorn* (especially	Tulip Tree
Box Elder Variegated*	Washington)	Desert Willow
Flamingo*	Redbud	Zelkova Serrata
Chitalpa (Desert Willow a parent)		

### SHRUBS - VINES - VEGETABLES - ETC.

Flg. Almond*	Artichokes	Most Berry Plants
Lilacs	Horseradish	(especially raspberries)
Wisteria	Rhubarb	Grapes

### MISC.

Monterey Pines	Roses (seems to be more sensitive by varieties)*
Bedding Plants	Circus, Tropicana, Thornless Roses, others not researched

\* Special notes on next page

## VARIETY SPECIAL NOTES

The tannic acid usually affects the variety above the bud union, not the rootstock. There are a few exceptions. Most of these varieties prefer acid soils. Again exceptions. Many of the varieties on the water sensitive list are also on the tannic acid list.

**Apples and Crabapples** - The phenol does not usually kill the tree but will damage the inner bark and leave a sick tree. The amount of damage will vary a great deal by variety and amount of phenol. Some varieties will show blistering on the lower trunk. Some will show discoloration of the inner bark. Many varieties do not show signs if affected.

**Pears - BARTLETT & ASIAN** selections are some of the best indicators of phenol acids. It will show in the trunk of the trees as soon as the roots take in any water. Black marks show above the bud union and move up the trunk. These can show under the buds on Bartlett. It looks like blight but starts at the bottom and moves up. Blight starts at the tips and moves down. Pears with phenol seldom leaf out. Many varieties of pears are not affected unless the amount of phenol is high. It looks like all Asian Pears are susceptible for tannic acid damage. Some more than others.

**Flowering Pears** - Especially Aristocrat are very sensitive to the phenol in redwood and barks. Black spots show up first. If lots of phenol, the trunk will have blotches starting at the bud union. If high phenol, the trunk will be solid black moving up from the bud union.

**Almonds, Pecans, Walnuts, Birch, Hawthorn, Flowering Almonds** - will often live in Redwood and Bark if the phenol is low. The loss of a variety comes when the amount of phenol is high. The amount of damage varies with the phenol. Some live but grow poorly because the cambium layer has been damaged.

**Pecans** - Most losses are from root exposure. See special page on pecans.

**Flowering Apricots** - Peggy Clarke is a good indicator of phenol. Low amounts will often kill this one variety. Please note, fruiting apricots are not listed even though they may be on the same root stock.

**Shade trees** - Most Sycamores will grow in redwood or bark mixes if phenol is not too high. California Native (*Platanus racemosa*) and Yarwood (*Platanus x acerifolia*) are exceptions. They will die in such mixes when others live. This also applies to Fan-Tex, Berrinda, Bonita and Raywood Ash. They are sensitive where others are not. The rootstock does not seem to make a difference.

**Variegated & Flamingo Box Elder** - Will not live in a planting mix with tannic acid. The Green Box Elder rootstock will grow in the same mix, and normally sucker when the Variegated Box Elder will die at the bud union.

**Roses** - Very selective by variety: We are just now studying this. Past indications include Circus, Tropicana, Charlotte Armstrong, Thornless selections. There are others to review.

**Varieties where rootstock are damaged** - Birch, Chitalpa, Desert Willow, Golden Rain, Hackberry, Smoke Tree, Native and Yarwood Sycamore, Zelkova, Shrubs, vegetable & berry plants.