

# Weed Control Problems Using Greenwaste

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## Introduction

The Integrated Waste Management Act of 1989 mandated 25% diversion of recyclable materials from landfills by 1995 and 50% reduction by 2000. To meet these stringent requirements, communities all over California have initiated recycling programs for green materials wastes (greenwastes). Curbside collections of greenwaste are brought to central locations, ground (usually with a tub grinder), screened, stockpiled and disbursed as mulch material. The cost and quality of greenwaste mulch materials is variable depending on the sources (feedstocks) and processing performed at the collection site.

Weed control with mulch treatments has been well studied and is a generally accepted practice (see the review by Robinson, 1989). Yet the advent of curbside collected ornamental yard trash is a new concept in California and given the wide range of ornamental plants and weeds that could enter the greenwaste stream; there is doubt about many qualities of such greenwaste products. Horticultural professionals have questions about the allelopathic nature of feedstock components such as eucalyptus wastes, the possibility of feedstock contamination with weed seeds and whether the processing of greenwaste adequately resolves these concerns.

Composting is an effective seed treatment that kills most weed seeds in greenwaste; however, moisture content must be adequate to insure control (Egley, 1990). Dry materials are not easy to compost, but even if temperatures reach 60°C many weeds will survive for up to 7 days. If moisture levels are higher (~20%) most weeds are killed after only 6 hours of exposure to 60°C. Willen and Elmore (1997) found that most weed seeds tested were completely killed after only 3 hours of exposure to the inside of an active compost pile. Thus, provided that a compost pile is kept moist and frequently turned to facilitate mixing, weeds can be controlled preventing contamination of mulch products. Unfortunately, legitimate composting facilities are difficult to start up due to regulatory burdens and cost. Thus “stockpile” operations that simply hold materials until sale, may partially compost their greenwastes but the results are in no way guaranteed. There is also some evidence that freshly chopped organic materials and immature composts which are rich in short-chain organic acids (acetic, propionic, and butyric) are more suppressive to seedling growth than finished compost (Ozores-Hampton, 1998). Thus, although composting may kill weed seed contaminants, it may also reduce the natural ability of fresh organic matter to suppress seedling germination.

Anyone can place whatever green materials they want to in a greenwaste container for curbside pickup. Hand weeding is a common practice in urban, residential landscapes and the waste is often deposited in greenwaste disposal containers. Regardless of the proclivities of

gardeners, there is little documented evidence that weeds are a problem in municipally collected greenwaste. Hartz and Giannini (1998) did find that municipal yardwastes contained one weed seedling per 2L sample and that California burclover (*medicago hispida* Gaertn.) accounted for most of the weeds discovered. We have observed in several trials using municipally ground tree wastes that viable seeds of Palm (*Washingtonia robusta* H. Wendl.) and various species of Eucalyptus can be spread with yardwaste applications. Other fruit producing trees such as loquat (*Eriobotrya* spp.) and avocado (*Persea americana* Mill.) have contaminated yardwastes with viable seed.

This paper highlights preliminary results of several mulching trials conducted in Ventura County over the last several years. Presented here are data regarding composting of eucalyptus and its effect on seedling germination, the effects of mulch thickness on seedling germination and the longevity of mulch treatments in a field plot.

### *Eucalyptus Mulch Studies*

Many horticulturists believe that eucalyptus derived mulch materials are toxic to landscape plants. Because of this perception, we conducted two experiments to determine the effectiveness of eucalyptus mulches as weed seed germination inhibitors. The allelopathic potential of eucalyptus in California landscapes was discussed by Baker (1966) and further demonstrated by del Moral and Muller (1969). Since many of the studies were done on seedlings we wondered if eucalyptus trimmings would be toxic to seedlings under the mulch and if composting would destroy the toxicity. A large study using seven sources of eucalyptus and 100 seeds each of 9 herbaceous annual plants was conducted in nursery propagation flats in randomized complete block design with 5 replications. Flats were seeded with the 900 seeds and covered with composted or fresh eucalyptus mulch or container media (2cm thick). Flats were irrigated from above to wash potential toxins into the media and allowed to grow for 60 days. Plants were harvested sorted, counted and weighed. Fresh eucalyptus mulches retarded germination and growth of most annuals tested; however, composted eucalyptus mulches stimulated growth and yield. *Eucalyptus globulus* Labil. was the least inhibitory species tested and *E. sideroxylon* A. Cunn. ex Wools was most inhibitory to seedling germination (Table 1). While freshly chopped eucalyptus mulch provides some weed control (at 2cm application depth), composted eucalyptus of the same species can increase germination of some herbaceous annuals.

This study was continued in the field with native weed populations. In the field study (also a factorial RCB with 5 replications), 1m plots were covered with various depths of either *E. globulus* or *E. sideroxylon*. All mulches were fresh. Mulch source did not affect germination percentages of emerging weeds (Data not shown). Thickness of mulch controlled the germination percentages. The 7.5cm treatment suppressed 98% of the weeds emerging in unmulched plots (Table 2). This is consistent with observations in other mulching trials in lemons where the threshold for excellent weed control was achieved at 7cm depth (data not shown).

It was our hope to find a species of eucalyptus that would suppress weeds when applied in thin layers. In fact, just the opposite was found to be true. Thin applications of eucalyptus mulches were slightly stimulatory to germination. The mulches acted as a seed cover helping to disperse and hold moisture. Thin mulches should be avoided.

### *Mulch degradation*

Organic materials degrade over time as a consequence of their attack from many microorganisms that use the organic material as a source of carbon and energy. In a mulch study of yardwaste effects in a citrus orchard, we measured mulch depths monthly for several years. There is an initial rapid loss of mulch depth that is likely due to settling of mulch loft. Thickness reductions in the later 2/3 of the year follow a constant and slower rate. On average 75% of applied yardwaste mulches were degraded at the end of the 12 month measurement period. As mulch degrades, weed seeds in underlying soils are exposed to light and are able to germinate. To prevent weed problems in mulched landscapes, re-applications must be made on regular intervals before mulches degrade to layers less than 2cm thickness.

### *Mulch Texture*

Mulch texture is an important quality to consider if weed control is a required from the mulch application. In a study of various mulches on the growth of California sycamore we discovered that a fine textured mulch (biosolids compost) allowed the growth of numerous weeds, while the coarse textured mulches in other plots retarded the growth similar species of weeds (Table 3). Weeds dispersed into biosolids mulched plots grew there because of the fine texture and moisture holding qualities of the biosolids mulch. Coarse textured mulches are advantageous for weed control because they hold small amounts of water and weed seeds will not germinate and grow in them.

## **Conclusions**

Although mulch feedstock and processing (composting) are important factors in the performance of mulches as weed control tools, these factors are not as important as the amount of mulch applied. Coarse, fresh mulch applied at 10-15cm depth will provide adequate weed control in most circumstances. Problems will occur when using un-composted mulch that is heavily contaminated with weed seeds or if mulch texture is fine, creating a favorable seedbed for seeds dispersed onto mulch surfaces by wind. Fresh mulches chopped from fruiting trees should be avoided to minimize tree-weed problems.

**Table 1. Abundance of nine weed species under fresh or composted Eucalyptus mulches**

Mulch Source <sup>1</sup> Age <sup>2</sup>	Germination percentage <sup>3</sup>										
	CF	AL	PT	AM	BW	CP	CG	BG	BYG	misc	TOT
<i>E. globulus</i>											
fresh	52.0	13.2	5.2	9.6	25.4	38.0	31.2	1.8	45.8	13.6	235.8
comp.	75.0	45.0	36.0	46.2	33.6	74.4	50.6	5.2	62.2	12.2	440.4
<i>E. sideroxylon</i>											
fresh	9.6	4.4	1.4	3.6	14.6	18.6	1.6	0.8	1.8	0.2	56.6
comp.	54.6	11.6	7.6	30.0	16.4	57.8	20.8	0.0	33.2	16.0	248
peat	49.2	6.8	7.8	24.8	13.8	39.4	20.8	2.6	35.2	6.0	206
LSD (SXA)	6.1	3.8	3.5	4.5	2.5	6.2	4.4	2.2	5.9	5.2	25.82
Significance <sup>4</sup>											
Source	***	***	***	***	***	*	***	*	***	NS	***
Age	***	***	***	***	***	***	***	**	***	**	***
SXA	***	**	***	***	**	***	***	**	**	NS	***

1. Eucalyptus branches (2-3.5cm diameter) were collected from landscape trees in Ventura CA

2. Branches were shredded with a gasoline powered shredder and composted for 3 months without leaching or used fresh after shredding.

3. One hundred seeds each of the following weeds were planted in a standard nursery propagation flats and mulched 2 cm deep. Numbers are germination percentage means of five replications. CF= Cornflower, Al = Alyssum, PT = Plantago, AM= Amaranth, BW = Bindweed, CP = California Poppy, CG = Smooth crabgrass, BG = Bermudagrass, BY = Barnyardgrass and misc. = various weeds which came up but were not seeded intentionally.

4. Data in table are means for the interactions (SXA), however significance of main effects (Source and Age factors) are also listed. NS, \*, \*\*, \*\*\*, Non-significant or significant at alpha=.05, .01 and .001 respectively.

**Table 2. Effect of mulch thickness on weed densities.**

Thickness	Total	% reduction
0	238.9A	--
0.38	296.4A	--
0.76	270.9A	--
2.0	129.5B	46
7.6	5.6C	98

Thickness is mulch application depth (cm).

Total is the mean number of all weeds found in plots according to mulch thickness (n=10).

% reduction is the percentage of weed control in the plot compared to the untreated plots.

Column means followed by the same letter not significantly different according to Tukey's honestly significant difference test at P<0.05.

**Table 3. Weed densities in mulched and unmulched plots surrounding California sycamore trees.**

Treatment	% coverage <sup>1</sup>
	April
unmulched	67.2a
pine bark	7.6c
biosolids compost	32.9b
composted eucalyptus	8.0c
fresh eucalyptus large chips	10.3c
fresh eucalyptus small chips	9.5c

<sup>1</sup>Percent coverage is a visual estimate of the area of the plot covered by weeds. Means followed by the same letter not significantly different according to ANOVA and Tukey's HSD,  $P=0.01$ .

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