

WEED SURVIVAL IN YARDWASTE MULCH

Oleg Daugovish, Jim Downer and Ben Faber; University of California Cooperative Extension, Ventura County, Ventura, California, 93003, odaugovish@ucdavis.edu

Urban yard waste is being used in considerable quantities in California agriculture as mulch for tree crops (Downer and Faber 1999). When used appropriately, organic mulches can reduce some disease incidence of citrus and avocado, control weeds, reduce water requirements, improve infiltration and soil structure (Faber et al 1996). The availability of large amounts of urban yard waste is a relatively recent phenomenon, since California passed a law in 1989 that mandates waste reduction to landfills. Households practice source separation and in the process, yard waste is kept separate from other household wastes. This material is collected by haulers, taken to a facility where it is cleaned of most contaminants (improperly discarded materials that often get mixed with the yard waste) and ground into 4-8 cm chips. Materials are stockpiled on site and then are delivered to a grower. Growers are spreading various amounts, but a standard practice is to spread 200 t/ha.

In order to keep costs down, these materials are generally not properly composted, although the decomposition process begins as soon as the homeowner collects the plant materials. The waste stream is variable depending on season and point of collection and weed propagules can be introduced into the waste stream with the plant materials such as lawn clippings, leaf litter or vegetable crop biomass.

Little mallow and California burclover are annual weeds that are very difficult to control due to high level of dormancy associated hard seed coats (Porqueddu et al. 1996) that aids their survival during fumigation with chlorpicrin (Haar et al. 2003). Yellow nutsedge and bermudagrass are the worst perennial weeds in irrigated agriculture in California that primarily reproduce by underground nutlets/tubers (nutsedge) or stolones/rhizomes (bermudagrass) (Hembree 1998, Mitich 1989). Survival of these troublesome weeds during mulching and in mulch storage piles can result in grower field contamination during mulch spreading. However, no repeated studies documented weed survival in yardwaste mulch over time. MgGiffen (2003- personal communication) reported 100% mortality of common mallow (*Malva neglecta*) and yellow nutsedge (*Cyperus esculentus*) after 26d burial in compost at 50 and 100 cm depths, while Hartz and Giannini (1998) found viable seed of several weed species during periodic yardwaste compost sampling.

The objective of this study was to evaluate survival of the two common troublesome annual and two perennial weeds in a static yardwaste piles and determine the effects of temperature and exposure time on weed propagule mortality.

Experiments conducted at Oxnard, CA compared survival of seed of little mallow and California burclover, rhizomes of bermudagrass and nutlets of yellow nutsedge in 7.6 m³ static piles of freshly ground mulch and 18 months aged mulch. Heat resistant permeable bags with weed propagules were placed at 0 (surface), 0.15, 0.3 and 1 m depths in the mulch piles and removed at 0.25, 1, 2, 4, 7, 14, 21, 28 and 56 d. The experiment was repeated three times (fall, winter and spring) and the patterns of weed survival in mulch were similar among the seasons (data not shown). All weeds were killed in freshly ground mulch after 2 d at 1 m and after 7 d at 0.3 m, however, germination and viability (for little mallow, due to high dormancy) were variable at 0.15 m and not affected at 0 m. Temperatures greater than 60 C generated at depths greater than 0.3 m in freshly ground mulch were most likely responsible for destruction of weed propagules. Weed germination and viability at all depths and removal times were not affected in aged mulch. Aged mulch, which has previously completed microbiological composting, did not heat up following pile creation (with exception of 1m depth that did heat up to 50 C). Thus, lethal temperatures achieved during fresh mulch composting are essential for weed propagule destruction.

However, the exact temperatures causing complete or partial mortality of studied weeds were not determined, thus, a controlled environment laboratory study was carried out. That lab study examined survival of the propagules of the four weeds at 80, 65, 50, 35 and 20 C in water saturated paper towels after 1, 3, 5 and 7-day exposure. Linear relationships between survival of the studied weeds and time and temperature were determined using SAS (1991) and provided good explanation of variability, except for burclover seed. With exception of burclover burs, no significant effect of time was observed in the studied 1 to 7 day interval and temperature range. The resulting relationships were:

California burclover burs, % germination = 99.5 – 2.27 Time (d) – 1.17 Temperature (°C)

California burclover germination, % = 20.58 – 0.24 Temperature (C); (R²=0.33)

Bermudagrass germination, % = 111.96 – 1.6 Temperature (C); (R²=0.73)

Yellow nutsedge germination, % = 133.42 – 1.9 Temperature (C); (R²=0.75)

Little mallow viability, % = 114.5 – 1.6 Temperature (C); (R²=0.76)

Considering the relative ease with which temperatures can be measured, this equations provide useful estimates of levels of weed survival expected at least 1 day following exposure to the particular temperature (and time, in case of burclover burs). For example, 72 C for at least one day is needed to reduce viability of little mallow to 0%, thus, ensuring that the mulch will be free from little mallow.

The lethal temperatures established in the lab experiment corresponded closely with those recorded in the field study with fresh mulch, however, temperature non-uniformity in constructed piles and, therefore availability of safe sites for weed survival may account for rare occurrence of viable weed propagules at what would be expected lethal temperatures. Most importantly, the studied troublesome weeds are likely to survive on the surface or at depth less than 0.3 m in fresh mulch piles. It is essential, therefore, to mix the mulch and expose the initially surviving weeds to lethal temperatures normally existing at depths greater than 0.3 m. These studies also showed that if re-infested, aged mulch has no mechanisms to suppress weeds and therefore may become a weed carrying substrate.

References

- Downer A. J. and B. Faber. 1999. Weed control problems using greenwaste. Proc. Calif. Weed Sci. Soc. 51:51-55.
- Faber, B.A. A.J. Downer, J. Menge, and H. Ohr. 1996. Proceedings of the World Avocado Congress III, 1995 pp. 412 – 416.
- Haar, M. J., S. A Fennimore, and H. A. Ajwa. 2003. Chloropicrin effect on weed viability. Crop Prot. 22:109-115.
- Hartz, T. K. and C. Giannini. 1998. Duration of composting of yard wastes affects both physical characteristics of compost and plant growth. HortScience 33:1192-1196.
- Hembree, K. 1998. Developing a program for the control of yellow nutsedge. Proc. Calif. Weed Sci. Soc. 50:180-182.
- Mitich L. W. 1989. History and taxonomy of bermudagrass. Proc. Calif. Weed Sci. Soc. 41:181-188.
- Porqueddu, C. A. Loi, and P. S. Cocks. Hardseededness and pattern of hard seed breakdown in Sardinia populations of *Medicago polymorpha* under field conditions. 1996. J. Agric. Sci. 126:161-168.
- SAS Institute Inc. SAS/STAT Users Guide, Version 6, 4th edition, Vol. 2. Cary, NC:SAS Institute Inc.1991.