Weed control and growth of Douglas fir (*Pseudotsuga menziesii*) are increased with deeper, coarser woodchip mulches.

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Abstract

Properly applied woody mulches are effective soil conditioners and weed suppressors, attributes which enhance the establishment of newly installed trees and shrubs. However, mulch layers that are too thin will stimulate weed growth, and finely textured mulches can inhibit water and gas exchange between the soil and atmosphere. This experiment was conducted to establish a mulch depth and particle size that optimize both weed suppression and plant establishment.

Wood chip mulches from two sources were chipped to two particle sizes (coarse and fine) and applied at three depths (10, 20 and 30 cm) around newly installed Douglas fir (*Pseudotsuga menziesii*). Regardless of source, coarse mulches performed better than fine mulches in both controlling weeds and enhancing plant growth. Increased mulch depth likewise increased weed suppression and plant growth. In none of these treatments were soil parameters including pH and C:N ratio significantly changed from the control, refuting the popular claim that wood chips acidify the soil and create nitrogen imbalances.

- I. Introduction previous research
 - a. Published benefits of woodchip and other mulches
 - i. Moisture retention
 - ii. Improved establishment and growth of new transplants
 - iii. Weed suppression by reducing light intensity at soil surface
 - 1. Germination reduction
 - 2. Photosynthesis reduction
 - b. Mulch particle size
 - i. Particles (7-30 mm) most effective for weed control
 - ii. Smaller particles reduce air and water movement
 - c. Mulch depth

- i. Deeper mulches more effective in weed control
- ii. Possible negative effects of deeper mulches
- d. Sources of wood chips for mulching
 - i. Arborist wood chips
 - 1. Remove from waste stream
 - 2. Locally sourced
 - 3. Source of nutrients, beneficial microbes/insects
 - ii. Recycled wood
 - 1. Clean construction/demolition debris
 - Contains no leaf material, so nutrient value presumably lower

II. Research questions

- a. How does wood chip source affect tree health?
- b. How does wood chip source affect weed control?
- c. How does mulch particle size affect tree health?
- d. How does mulch particle size affect weed control?
- e. How does mulch depth affect tree health?
- f. How does mulch depth affect weed control?

III. Materials and Methods

- a. Location: WSU NWREC, Mt. Vernon, WA.
- b. Field silt loam site
- c. Two trials: 2007-2009 and 2008-2010
- d. Data collected both years for both trials

- e. Variables:
 - Woodchip source (arborist v. recycled [Recovery 1, 1630 East 18th Street, Tacoma, WA 98421])
 - ii. Mulch particle size (fine v. coarse)
 - iii. Mulch depth (0, 10, 20 and 30 mm)
- f. Experimental design:
 - Randomized complete block with a factorial treatment design and 10 replicates
 - ii. 2 m by 2 m plots with one Douglas fir in the center
 - iii. Woodchips separated on an oscillating screen separator to generate fine (≤1.09 cm) and coarse (1.09 to 7.62 cm) particles
 - iv. Soil samples were taken before and during the research trials and analyzed for total nitrogen, total carbon and pH
 - v. Bare-root Douglas fir installed December 2007 and 2008
 - vi. Woodchips were applied after tree installation
 - vii. Annual weed biomass data collected in September of all years by clipping, sorting by species, drying, and weighing
 - viii. Caliper stem width, height, and visual health rating of trees were recorded in September of each year
 - ix. All data analyzed using SAS

IV. Results and Discussion

a. <u>Soil samples</u>: no significant differences in any of the parameters from any treatment or treatment year

- Mulch depth: no noticeable loss of woodchip mulch regardless of mulch type, depth, or particle size
- c. Annual weed species biomass
 - i. 16 weed species (annuals and some perennial seedlings)
 - ii. Increasing mulch depth decreased weed biomass with each additional 10 cm of mulch regardless of woodchip source
 - iii. Biomass of weeds growing in both woodchip particle sizes increased from year 1 to year 2
- d. Douglas fir health and growth
 - i. Tree health ratings were significantly higher under coarse mulch compared to fine mulch regardless of mulch type or year
 - ii. Tree health ratings were higher under coarse mulches than in the control
 - iii. Tree health ratings were the same or lower under fine mulches than in the control
 - iv. Tree caliper size was significantly greater under coarse mulch compared to fine mulch regardless of mulch type or year
 - v. Tree caliper size was significantly greater under coarse mulches than in the control
 - vi. Tree caliper size was the same or greater under fine mulches than in the control
 - vii. Tree height was significantly greater under coarse mulch compared to fine mulch regardless of mulch type or year

- viii. Tree height was significantly greater under coarse mulches than in the control
 - ix. Tree height was the same or greater under fine mulches than in the control

V. Conclusions

- i. Weed suppression increases with increased mulch depth
- ii. Coarse mulches are better than either fine mulches or bare soil for suppressing weeds and enhancing tree establishment
- iii. Fine mulches decrease tree growth and health with increased depth
- iv. Mulches made from recycled wood may not be as beneficial for tree growth and health those made from arborist chips