Plant Establishment with Rainfall Simulators for Erosion Control

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Abstract

Hydroseeding failures on disturbed sites are usually attributable to combinations of improper species selection, seeding at inappropriate times, and/or improper seed mixes, fiber, and tackifier. To investigate these factors, California Polytechnic State University, San Luis Obispo, in conjunction with the California Department of Transportation (Caltrans) and California State University, Sacramento, conducted a study of these factors' affect on vegetation establishment.

The goal was to identify initially fast growing vegetation that demonstrates long-term erosion control effectiveness. Native plant species common to District 5, along the California Central Coast, were used. Treatments were conducted in 0.6 by 2 m by 30 cm soil test boxes set at a 2:1 (H:V) slope. Boxes were filled with a medium sandy loam soil (USDA), typical of District 5 fill slopes, compacted to 90 percent. Erosion control treatments included combinations of imprinted straw and hydroseeding of fiber, fertilizer, and tackifier. All boxes were planted with the same native seed mix that included shrubs, forbs, and grasses. Norton Ladder rainfall simulators were used to simulate natural rainfall patterns found in the area. The rainfall regimes applied were natural precipitation, 53.3 cm (21 in/yr during the study period) and uniform rainfall at the mean annual rate, 56 cm (22 in/yr), half the mean annual rate, 28 cm(11in/yr) and double the mean annual rate, 111 cm (44in/yr). The rainfall simulators mimicked rainfall characteristics for the California coast, such as drop size distribution, terminal velocity and a range of storm intensities. In all, 24 boxes were established and treated under rainfall simulators, eight additional boxes were subjected to natural rainfall, and two more boxes were untreated (bare soil). Percent cover and runoff quality (measured as Suspended Sediment Concentration) were measured for each box.

The boxes treated with straw and fertilizer showed greater percent cover than those treated with tackifier and no fertilizer. The ANOVA results indicated that this effect statistically significant to a high degree ($p=.001$). The effect on runoff was marginally significant ($p=.048$). Runoff volume was greatest on the heavy rainfall treatments. Higher rainfall treatments showed an increase in the quantity of the native plants of yarrow (*Achillea millefolium*), lupine (*Lupinus succulentus*), and California brome (*Bromus carinatus*). Shrubs and deer lotus (*Lotus scoparius*) were the least common species under all rainfall regimes. This project demonstrates using hydroseeding that includes tack and fertilizer is not as effective in establishing native plant cover without the treatment of straw.

Key Words: Native Vegetation, Rainfall Simulators, Hydroseeding, Erosion Control, and Caltrans