A BIOASSAY TO INVESTIGATE MOVEMENT OF WOOD PRESERVATIVES FROM POLES INTO SOIL A RESEARCH NOTE

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ABSTRACT

A promising method was found for investigating migration of preservative from preservative-treated poles into surrounding soil. The presence and relative amounts of preservative are indicated by suppression of decay (weight loss) in birch coffee-stirring sticks buried at various distances from the pole.

Keywords: Method, poles, preservative-assessment, soil, decay.

INTRODUCTION

Questions have been raised as to whether enough preservative may move from treated poles into adjacent soil to contribute to the protection of the poles, or to cause soil pollution. This note describes trials of a simple bioassay to help answer these questions. The procedure consists of inserting small sticks of wood into the ground near the poles and using suppressed decay of the sticks to indicate the presence and relative amounts of preservative in the soil.

PROCEDURE

The assay sticks were birch, 0.1 × 0.5 × 14 cm, made for stirring coffee. They were inserted in the soil vertically, with the top end about 5 cm below the ground surface. Also, they were positioned in north, east, south, and west directions from each pole, at 0 distance (touching), 2, and 4 cm, and 15 cm (north only). The period of exposure was from early March to the end of the year.

The poles were Douglas-fir, set in clay soils of western Oregon. Five had been pressure treated with pentachlorophenol (penta) in heavy oil, five with penta in liquified petroleum gas (LPG), and five with ammoniacal copper arsenate (ACA). The penta, LPG, and ACA poles had been treated, respectively, 7 to 12, 16, and 25 years earlier. The ACA poles also had received supplementary, groundline treatment after 13 years with a sodium fluoride and phenolic preparation.

After gentle washing to remove soil, the sticks were measured for decay during the 10 months' exposure by their loss in air-dry weight, at an equilibrium moisture content of about 7%. Because the uppermost wood generally decayed much less than that deeper in the ground, we limited our determinations of weight loss to a segment of the deeper wood. The initial weight of the segment was computed from its proportional length and the initial weight of the entire stick.

RESULTS

Average weight losses of the stick segments for each of the three preservatives and the four directions of stick placement are given in Fig. 1. Sticks farthest from

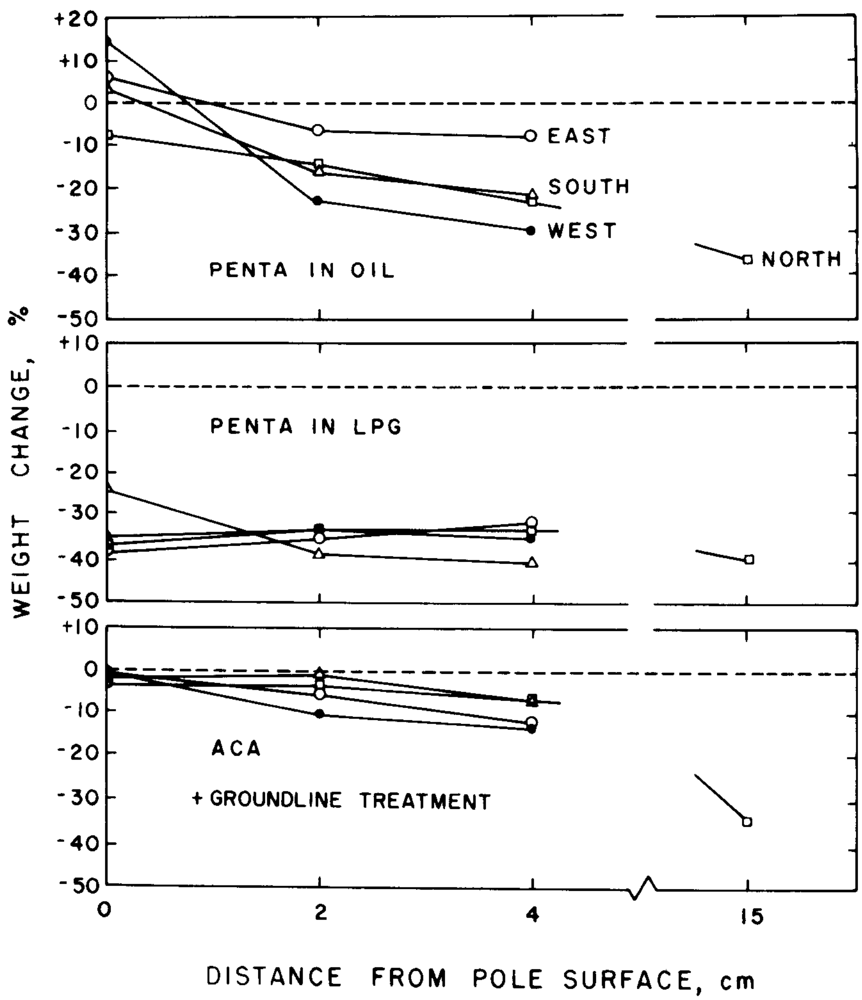

FIG. 1. Weight loss from decay in assay sticks in the soil at various distances and in four directions from preservative-treated utility poles. The 15-cm distance is represented only on the north. Each point represents five poles. Preservatives were penta in heavy petroleum, penta in liquified petroleum gas (LPG), and ammoniacal copper arsenate (ACA) followed later by fluoride and phenolic groundline treatment.

the poles (15 cm) lost 35 to 40% in weight. We concluded that there had been no preservative influence at that distance, nor had differences among the pole sites resulted in significantly different amounts of decay. Accordingly, an average weight loss materially less than 35% (Fig. 1) indicates a decay-retarding amount of preservative in the soil.

The general trend of increasing weight loss (increasing decay) with increasing distance from the penta-in-oil and ACA poles would be expected where a preservative diminishes in amount as it migrates from its source through soil. The gain in weight of sticks touching the penta-in-oil was clearly attributable to absorption of dark oil bleeding from the poles.

The LPG poles lost little or no pentachlorophenol into the soil, as evidenced by the large weight losses for all sticks (25–40%) and growth of a white-rot fungus on the surface of some poles. These poles were either washed with caustic or were steam-cleaned to remove surface penta prior to shipment. Results with the ACA poles probably reflect more the influence of chemicals from the supplementary groundline treatment than of the ACA itself.

The stick bioassay thus appears to be a promising technique for investigating protection afforded by preservative in soil around a pole, or the likelihood of the preservative being a significant soil pollutant. The method is simple and has little disadvantage other than the time required. Burying the sticks deeper should produce representative decay along the entire stick and eliminate the need for calculating weight loss in a segment.

Our data are not extensive enough to warrant general conclusions about movement into and persistence in soil of the preservatives represented in these trials. However, differences in Fig. 1 between curves for the three pole treatments show that the bioassay in this case was sensitive to treatment differences. For comprehensive examination by stick bioassay of movement of a particular preservative into soil, several factors should be considered: depth in the ground, initial retention of the preservative, time since treatment, physical composition of the soil (e.g. proportions of sand, silt, clay, and organic matter), soil pH, drainage, and climate.