



Deep tillage of amendments using specialized equipment in land reclamation
by Matthew Luke Marsh

A thesis submitted in partial fulfillment of the requirements for the degree of Master of Science in Land Rehabilitation

Montana State University

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Abstract:

Many disturbed lands around the world are contaminated with various undesirable elements making the reestablishment of vegetation very difficult or impossible. Most of these sites require some type of amendments to the soil in order to make them more amenable to plant growth. The incorporation of these amendments to a sufficient depth to maximize plant growth is often difficult. The pieces of equipment that can incorporate amendments into the soil profile to a sufficient depth are very limited in number and ability.

This study focuses on two different pieces of specialized equipment utilized for the deep incorporation of amendments. The first is, the Baker Plow. The Baker Plow is a large disc plow used mainly in the South for the deep tillage of soils. The second piece of equipment is the BOMAG MPH-100. It is a large rotary mixer used primarily for the pulverizing of asphalt on highway construction projects.

Several variables were analyzed both qualitatively and quantitatively. Each piece of equipment was evaluated for its ability to work on varying types of soils and terrain, its cost effectiveness, the depth to which it can incorporate amendments, and its ability to uniformly mix amendments into a soil profile.

Both pieces of equipment performed well in the fine textured tailings sites selected for this study. The Baker Plow and the BOMAG MPH-100 were both slowed somewhat at the high rock fragment content sites, but both machines performed adequately. The cost analyses was slightly more favorable for the Baker Plow than the BOMAG MPH-100 due mostly to the purchasing price of the BOMAG and its slower net production. There were not great differences in the depth of amendment incorporation between the two pieces of equipment. The uniformity of amendment incorporation greatly favored the BOMAG MPH-100.

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APPROVAL

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Matthew Luke Marsh

This thesis has been read by each member of the thesis committee and has been found to be satisfactory regarding content, English usage, format, citations, bibliographic style, and consistency, and is ready for submission to the College of Graduate Studies.

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Date 30 Nov 94

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ABSTRACT

Many disturbed lands around the world are contaminated with various undesirable elements making the reestablishment of vegetation very difficult or impossible. Most of these sites require some type of amendments to the soil in order to make them more amenable to plant growth. The incorporation of these amendments to a sufficient depth to maximize plant growth is often difficult. The pieces of equipment that can incorporate amendments into the soil profile to a sufficient depth are very limited in number and ability.

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INTRODUCTION

Land reclamation attempts in the Anaconda, Montana area have taken two basic strategies (Jensen 1993):

- (1) Retrieving suitable soil and using it to cover contaminated soil to a 12-18 inch depth.
- (2) Ameliorating on-site contaminated materials to produce an acceptable growth medium.

The retrieval and use of a suitable coversoil for many areas is a cost prohibitive alternative due to nonavailability and/or length of haul of the coversoil. Therefore, this study focuses on the on-site amelioration of contaminated material. A cost effective and long lasting method of ameliorating contaminated wastes and soils is needed, both to deter pollution and to enhance the appearance of disturbed sites (Smith and Bradshaw 1972).

Soils contaminated with wastes that do not support sufficient vegetation are often amended with neutralizing amendments or organic material. A significant barrier in a large portion of on-site amelioration attempts has been the deep incorporation of amendments into unsuitable soils. Equipment used in most active disturbed land reclamation today will uniformly incorporate amendments to the 12 to 14 inch depth (Dollhopf 1992). Although many of the disturbed lands in this country may have

unsuitable soil profiles that are many feet deep, amending the top 1.75 to 2 feet of these profiles is a reasonable goal for successful plant establishment.

In this study, two unique pieces of equipment were used to incorporate amendments into the soil profile. The first was the Baker Plow for which the manufacturer specifies a working depth of 30 inches (Figure 1). The second



Figure 1. Baker Plow equipped with three discs.

was the BOMAG MPH-100 Rotary Mixer (Figure 2). The manufacturer specifies a maximum working depth of 19 inches for this piece of equipment.

