

LAND APPLICATION OF BCTMP MILL WASTE RESEARCH IN ALBERTA

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INTRODUCTION

The sludge utilization portion of the Pulp and Paper Research Program at the Alberta Research Council involves three components including the Alberta Newsprint Company/Alberta Research Council joint research venture, landspreading ash and sludge at the operations of Slave Lake Pulp Corporation, and the ARC/ FIDB/ INDUSTRY research program. The research was undertaken to provide industry, government and the public with data that promotes an understanding of the effects of pulp mill waste landspreading and provides a basis for developing operating guidelines and protocols for landspreading (Macyk 1996).

The major activities included a review of the literature; waste stream characterization; greenhouse pot experiments; growth chamber experiments to measure the decomposition rate of sludges; column leaching experiments; and field landspreading trials.

LABORATORY AND GREENHOUSE TRIALS

Characterization work included determination of chemical and physical properties, saturated paste extract properties, DTPA extractable elements and total metals. Some differences were noted in the sludges generated by Alberta Newsprint Company, Millar Western Pulp Ltd and Slave Lake Pulp Corporation.

The greenhouse pot trials used conventional and de-ink sludges applied at the equivalent rates of 0 cm, 2.5 cm, 5 cm, 10 cm, and 20 cm. Fertilizer additions were based on the amount of sludge added and the respective amount of nutrients contained therein to result in equal amounts of nutrient added to all treatments (Macyk 1996). Brome grass, pine, and spruce were the three crops used. Four consecutive grass harvests, each after about a 90-day growth period were completed. The data indicated that the sludge amended treatments had consistently higher yields than the control. The pine and spruce in the sludge amended treatments showed more vigor, greater height growth and root mass than those in the control treatments.

FIELD STUDIES

The field studies involved the establishment of four controlled field experiments (Macyk 1996).

Slave Lake Pulp Corporation Site

A total of 18 individual plots each 6 m x 12 m were established at the mill site in June, 1992 (Macyk and Pojasok 1995). The treatments included control (0 cm) and layers of 1 cm, 3 cm, and 5 cm as well as a 5 cm/yr multiple application, and a combined 5 cm sludge and 0.5 cm wood ash treatment. Each treatment was replicated three times. The plots were tilled and brome grass was seeded.

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Soil samples were collected to a depth of 105 cm prior to sludge application and annually thereafter. Tissue samples were collected at the time of the first harvest in 1992, 1993, and 1994 and the entire plots were harvested to determine yield in 1992 to 1996 inclusive.

Grass yield increases were in proportion to increases in sludge application rate with mean yields as much as five-fold greater than control values for the higher sludge application rates. Yield responses to single sludge application have been evident for the five growing seasons.

Alberta Newsprint Company Sites

In May 1993, an agricultural field plot experiment was established near Mayerthorpe, Alberta with the variables including two sludges (conventional and de-ink), six application rates (0 cm, 1 cm, 3 cm, 5 cm, 10 cm, and a 5 cm/yr multiple application), one crop (brome grass) and three replicates. A total of 45 plots were established. Soil sampling to depths ranging from 105 cm to 3 m was undertaken prior to sludge application and annually thereafter (Macyk and Faught 1996).

Yields on the sludge amended plots were four-to-five fold greater due to the release of nutrients associated with the decomposition of the sludge and the improved moisture holding capacity. In June, 1993 a forest cut-block plot experiment was established south of Fox Creek, Alberta with the variables including the two sludges, four application rates (0 cm, 3 cm, 5 cm, and 10 cm), two crops (lodgepole pine and white spruce), and three replicates. Soil sampling was undertaken as described above.

The pine and spruce grown in the sludge amended treatments had increases in height growth as well as a deeper green color and more overall healthy appearance.

Additional experimental sites were established in disturbed forest locations including a haul road, oil and gas wellsite, and borrow area.

CONCLUSIONS

The land application research to date has provided data regarding the effects of landspreading mechanical mill sludges and a basis for developing guidelines and protocols for operational activities (Macyk 1996). The results indicate that:

1. Conventional and de-ink sludges are beneficial soil amendments.
2. Recommended application rates range from 40 dry t/ha to 80 dry t/ha depending upon characteristics of the sludge to be applied and receiving soil characteristics. Multiple applications should be considered.

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