RELATION OF COMPACTION AND SOIL PHYSICAL PARAMETERS TO PRODUCTIVITY OF RECLAIMED SOILS

PROJECT GR896381

FINAL REPORT

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ABSTRACT

Compaction by heavy equipment during reclamation of surface-mined lands may affect soil physical parameters as bulk densities increase, porosity and pore sizes decrease. Water infiltration and permeability may decrease and rooting depth may be restricted among other factors affected. The objectives of this research were to determine the effects with time that various topsoil and subsoil tillage treatments (including chiselling, grader ripping and deep ripping) had on physical properties and yields, to determine the effects of prior cropping history on physical properties and small grain yield, and to determine long-term changes in physical properties on reclaimed mineland in North Dakota. Parameters measured included bulk density, soil strength, and yields of various forages and spring wheat. Results indicated that subsoil tillage treatments applied prior to topsoil respreading with scrapers were not effective in reducing bulk densities because the subsoil materials were recompacted during topsoil respreading. Although topsoil tillage treatments had significant effects on bulk density with time at some locations, the effects were not consistent among locations. Subsoil bulk densities and soil strength increased with time due to reconsolidation. Few significant tillage effects on forage or small grain yields were found although part of this was attributed to adverse growing-season weather conditions that prevailed during the time of this experiment. Rooting depths have not, as yet, been affected by the bulk densities and soil strengths measured and showed few significant tillage effects. Long-term locations have also shown some significant increases in bulk density with time. Freeze/thaw cycles have not affected bulk densities within the lower soil profiles because soil water levels are generally low in the fall. Prior cropping effects on small grain yields for the one year of data collected were generally not significant and were greatly

influenced by growing conditions. Overall the data indicated that the applied tillage treatments had few significant effects on bulk densities or soil strengths with time. Weather was the most dominant factor affecting both forage and small grain yields.