# NEAR SURFACE COMPACTION UNDER GRAZING OF ANNUAL AND PERENNIAL FORAGES*

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## BACKGROUND

Soil compaction was defined by Gupta et al. (1989) as the compression of unsaturated soils, causing an increase in bulk density. Many researchers have reported soil compaction by grazing animals (e.g. Warren et al., 1986; Chanasyk and Naeth, 1996). However, few researchers have examined the influence of grazing intensity on soil bulk density for different forage types under the same soil and climatic regime. Since the objective of most grazing management practices is to maximize livestock production per unit area while maintaining sustained forage resource, using annual forages as supplemental pastures may be an option for some managers. Generally the effect of annual cultivation of these forages on soil bulk density, in conjunction with grazing, is unclear.

The objective of this study was to assess near-surface bulk density under different forages and grazing intensities at a site in central Alberta. It was hypothesized that bulk density would increase as grazing intensity increased. Bulk density was expected to be higher under perennial forages than under annual forages and to increase less under smooth bromegrass than under meadow bromegrass.

## MATERIALS AND METHODS

The study site was at the Agriculture and Agri-Food Canada Lacombe Research Center in the aspen parkland. Annual precipitation averages 447.5 mm. Soils at the study site are Orthic Black Chernozems of a sandy loam texture. Slopes average 1 to 3%.

Heavy, medium and light grazing intensity treatments were implemented on a rotational basis throughout the growing season. Grazing was initiated and ceased at different specific target forage heights for each grazing intensity. Four forage treatments with potentially differing abilities to control erosion and produce litter were used. Smooth bromegrass (*Bromus inermis* L.) and meadow bromegrass (*Bromus riparius* Rehm.) were the perennial treatments; triticale (*X Triticosecale* Whittmack) and a triticale/barley (*Hordeum vulgare* L.) mix were the annual treatments. The twelve resulting treatments were arranged in a randomized complete block design within four parallel blocks across an east-facing 3.8% slope.

In this study, near-surface refers to the top 10 cm of the surface mineral soil horizon. Nuclear gauges were used to measure near-surface bulk density and near-surface volumetric moisture simultaneously. Measurements were made at three locations in the middle of each third of the plots. Measurements were made over two growing seasons: 1994 and 1995, and at three times during each year: after snowmelt but before annual cultivation, immediately after cultivation and again in the fall before freezeup. The total number of cow-days of grazing was used as a measure of the compactive effort imposed on the treatments.

## RESULTS AND DISCUSSION

In both study years, cow-days under heavy grazing were at least twice those under light grazing, except for the triticale/barley treatments. Similarly, cow-days under perennials were approximately twice those under annuals. Surface volumetric moisture content (VMC) was generally not significantly different among forages, except at the

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* Presented at the 21st Annual Meeting, Canadian Land Reclamation Association, Calgary, Alberta, September 18-20, 1996.

beginning of the study. In contrast, VMC was higher in lightly grazed treatments than in the medium or heavily grazed treatments.

Bulk density (Db) was generally not significantly different among forages except at the end of the first growing season. Fewer grazing events throughout the first summer likely kept Db lower under annual forages than perennial forages at all grazing levels.

In all treatments, Db was higher after one season of grazing compared to the beginning of the study. In both springs, with Db averaged over all annual treatments, cultivation only reduced Db 3%. Over the two year study period, Db increased more under perennials than annuals.

Db was significantly different among grazing intensities on all measurement dates after grazing was established, except after cultivation. Generally Db was lower under light and medium grazed than under heavily grazed treatments. The change in Db was most dramatic in the heavily grazed treatments after the first season while the change in Db under both medium and light grazed treatments increased only slightly during this period.

## CONCLUSIONS

Grazing increased Db, especially the heavily grazed treatment. Although Db under annual forages was lower than under perennial forages, Db under annual forages increased faster than under perennial forages. Cultivation lowered Db only slightly. Db was lower under smooth bromegrass than under meadow bromegrass, likely because of the former's rhizomatous rooting habit which helped mitigate Db increase in the zone of greatest compaction.

## REFERENCES

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## ACKNOWLEDGEMENTS

Funding from the Canada Alberta Environmentally Sustainable Agriculture Agreement and the National Sciences and Engineering Research Council is gratefully acknowledged.

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This report may be cited as:

Powter, C.B., M.A. Naeth and D.A. Lloyd (compilers), 1996. Conservation and Reclamation: An Ecosystem Perspective. 21st Annual Meeting, Canadian Land Reclamation Association, Calgary, Alberta. 153 pp.

## ACKNOWLEDGEMENTS

The compilers acknowledge the assistance of Jamie Legarie, Alberta Environmental Protection, Land Reclamation Division in preparing the manuscript. We also thank the authors for providing their papers on short notice.

The compilers edited some of the papers for format and length. We apologize for any errors that may have resulted.

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