

1934

APRIL

MASTER OF SCIENCE.

Degree of

In Partial Fulfillment of the Requirements for the

ORVAL G. CALDWELL.

by

of the University of Manitoba.

Submitted to the Committee on Post-graduate Studies

A THESIS

IN THE SOILS OF THE RED RIVER VALLEY.

THE OCCURRENCE AND DEVELOPMENT OF "MAGNETIC SOILS"

ACKNOWLEDGMENTS.

The Writer wishes to express his indebtedness to Professor J. H. Ellis of the Soils Division, Department of Agronomy, University of Manitoba, who suggested the problem, and under whose direction the work was conducted, for his helpful advice in carrying out the laboratory procedure. Thanks are also tendered to Professor Ellis for the use of the soil descriptions and pen sketches of the Red River Valley soils from the Red River Valley Soils Report.

Grateful acknowledgment is also made to Professor L. Shanks, Assistant Professor of Civil Engineering, University of Manitoba, for the results of Dynamometer Studies in the Red River Valley Soils.

TABLE OF CONTENTS.

	Page
1. Statement of the Problem	1
2. Literature Review	1
3. Morphological Description of the Red River Valley Soil Types Studied	6
4. General Description of the Red River Valley Soil Types Studied	12
5. Experimental - Chemical Study of the Red River Valley Soil Types	15
A. Sampling	15
B. Inorganic Carbonate, Organic Matter and Reaction	15
(a). Methods	15
(b). Results and Discussion	16
C. Water Soluble Salts	23
(a). Methods	23
(b). Results and Discussion	24
D. Base Exchange	26
(a). Methods	26
(b). Results and Discussion.	38
6. Experimental - Physical Properties of the Red River Phytomorphic, Alkalinized and Degraded Alkalinized Soils.	63
A. Mechanical Analysis.	64
(a). Methods	64
(b). Results and Discussion.	65

TABLE OF CONTENTS

Page	B. Percolation study	67
	(a) . Methods	67
	(b) . Results and Discussion	67
	C. The Atterberg Constants and Shrinkage Values of Red River Soils	70
	(a) . Methods	70
	(b) . Results and Discussion	73
	D. Sedimentation Study	77
	(a) Review of Literature	77
	(b) . Method	79
	(b) . Results and Discussion	80
	E. Sedimentation Study on the Red River Alkalinized Soil Before and After Drying	91
	(a) . Method	91
	(b) . Results and Discussion	91
	7. Summary of the Data from the Experimental Work	94
	8. Amelioration of the Red River Alkalinized Soil	97
	(a) Review of Literature	97
	(b) . Conclusions	99
	9. General Summary	100
	10. Conclusions	104
	11. Bibliography	105

INDEX OF TABLES.

<u>Number</u>	<u>Title</u>	<u>Page</u>
1.	Hydrogen ion Concentration, and percent of Organic Matter and Inorganic Carbonate in Red River Valley Soils.....	18
2.	Water Soluble Salts in Parts Per Million of Red River Valley Soils.....	20
3.	Red River Phytomorphic Prairie Associate (Sample No. 1). Exchangeable Bases, Hydrogen and Solubility Products, Expressed as Milli-equivalents, extracted by Normal Ammonium Chloride Solution.....	31
4.	Red River Phytomorphic Prairie Associate (Sample No. 1). Exchangeable Bases and Hydrogen as Percent of Total Exchangeable Bases and Hydrogen Extracted.....	31
5.	Red River Phytomorphic Prairie Associate (Sample No. 2). Exchangeable Bases, Hydrogen and Solubility Products, Expressed as Milli-equivalents, extracted by Normal Ammonium Chloride Solution.....	32
6.	Red River Phytomorphic Prairie Associate (Sample No. 2). Exchangeable Bases and Hydrogen as Percent of Total Exchangeable Bases and Hydrogen Extracted.....	32
7.	Red River Alkalinized Phase. Exchangeable Bases, Hydrogen and Solubility Products, Expressed as Milli-equivalents, extracted by Normal Ammonium Chloride Solution.....	33
8.	Red River Alkalinized Phase. Exchangeable Bases and Hydrogen as Percent of Total Exchangeable Bases and Hydrogen Extracted..	33
9.	Red River Degraded Alkalinized Phase. Exchangeable Bases, Hydrogen and Solubility Products, Expressed as Milli-equivalents, extracted by Normal Ammonium Chloride Solution.....	34