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Report on the Meetings
of the Western Section of the
National Soil Survey Committee.
Vancouver, June 20th & 21st, 1957.

In his opening remarks the chairman, Dr. A. Leahey, pointed out that the tentative classification scheme proposed in Nov. 1955 has received considerable study and as a result some changes and modifications, as well as more accurate definitions of some of the classes in Categories IV and V should now be possible. Progress reports on the classification of the Solonetzic soils, Podzolized Gray-Wooded and Brown Wooded soils will be presented and discussed. If time permits some discussion of the Chernozemic soils will also be introduced.

Suggested Names for the Categories in the Classification System

The chairman also pointed out that some attention should be given to nomenclature. He particularly called for the naming of the different categorical units. Following a brief discussion the meeting agreed, subject to the approval of the Eastern Section of the Committee on the following nomenclature:

Cagegory -	VI	V	IV	III	II	I
Name -	Order	Group	Sub-group	Family	Series	Type.

Some members of the committee also felt a dislike for the term "modal" as used in Category IV. Under the present set-up the term "modal" or some other term has to be used when referring to the soils in question in order to avoid confusion with Category V. It was suggested that the terms "Chestnut" & Chernozem" be used for the modal class (1.21 & 1.31) and that similar terms be coined for all the other modal classes in Category IV. This was not acceptable to the meeting. Another suggestion was that the term "earth" be added to the modal class which was also not acceptable. The substitution of "normal" or "ortho" for modal was suggested and discussed but the meeting felt that such substitution would not be an improvement and the question was left unsettled.

Progress Report on the Classification of the Solonetzic Soils of Western Canada, January 1957.

H.C. Moss, Senior Pedologist, Canada Department of Agriculture, Department of Soils, University of Saskatchewan, Saskatoon, Sask.

Introduction

At the Third Conference of the National Soil Survey Committee, the Committee on Soil Classification recommended that a number of sub-committees should be formed to study the soils of Canada. The sub-committees were to deal with the soils of their respective regions, and to attempt to "define more accurately the different soil classes in the three higher categories (of the Canadian Classification) and to review, and re-define where necessary the differentiating criteria."

Following these recommendations Dr. Leahey organized a field trip in Western Canada in June, 1956. Both solonetzic and podzolic soils were studied in a trip extending from Saskatoon, Saskatchewan to Golden, British Columbia. In the present report only the solonetzic soils are discussed.

In addition to Dr. Leahey, the group concerned with the solonetzic soils included Messrs. Bowser, Ehrlich, Farstad, Moss and Odynsky. Following the field trip a report was prepared by H.C. Moss and sent to the group for criticisms and suggestions. The report covered the trip in general and also contained tentative definitions of the solonetzic soils, based upon the field discussions. From the comments received a second report was prepared, and circulated as before. The second report contained revised versions of the tentative definitions. In the present report slight changes have been made in the definitions, in order to take account of recent suggestions received by the editor. It is hoped these definitions will serve as a working basis for determining whether the solonetzic soils are properly defined, and whether the proposed classification is adequate; but it is not suggested that the present report represents a final decision on these soils.

In preparing this progress report, Dr. Leahey suggested that the definitions of Category V of the Canadian soil-classification scheme should be quoted; that the definition of a solonetzic B horizon as given in the current United States Department of Agriculture classification scheme should also be quoted; and finally that explanatory notes, if required, should be included in a separate section.

Definition of Category V

(See page 23 of "Report on the Third Conference of the N.S.S.C").

Each of the seven classes of Category VI are subdivided in Category V into two or more units which are approximately equivalent to the great soil groups in level of abstraction. The criteria used for the sub-divisions in Category V vary from class to class depending on their relevant significance.

The Halomorphic or Solonetzic (class 2) soils are subdivided in Category V on the basis of the degree of development of the A_2 and solonetzic B into: Solonetz, Solodized Solonetz and Solod soils. Sub-divisions of these groups according to zonality are made in Category IV. The placement in Category V of the Solod soil in which the solonetzic B has disintegrated to a point where it no longer interferes with the water regime may be questioned. Eventually it may be desirable to place these soils in Category IV of the Chernozemic or Gray Wooded soils. It is intended that the soils in which the solonetzic or solodic development is very weak will be placed in Category IV of Class 1 or 3. The differentiating criteria of the different sub-units will have to be defined more specifically by the respective sub-committees.

Definition of Solonetzic B Horizon (Note 1)

(See page 4 of "Outline of a Scheme of Soil Classification: 5th Approximation" U.S.D.A. 1956).

"A solonetzic B horizon is a textural B with prismatic or columnar structure, with some part having 15 per cent or more saturation with replaceable sodium or more milli-equivalents of replaceable Na plus Mg than Ca plus H."

Proposed Definitions of Halomorphic (Solonetzic) Soils

(Category V, Classes 2.1, 2.2 and 2.3 of the N.S.S.C. Classification of Canadian soils).

Solonetz - A soil with a dark, sometimes partly grayish A horizon, which is thin in comparison with the B; usually non-acidic in reaction (Note 2). A dark, very hard, columnar or prismatic structured B horizon with organic staining and with alkaline reaction; finer-textured than the A. Saline parent material.

As a guide in checking or preparing descriptions of specific solonetz profiles, the definition may also be presented in tabular form:

A horizon - thin (compared to thickness of B), dark, sometimes partly grayish; usually non-acidic in reaction.

B horizon - dark, finer textured than A, very hard when dry, columnar or prismatic structure with organic staining; alkaline reaction.

C horizon - saline.

Solodized - Solonetz - A soil with leached A horizons, including well developed, light coloured A_2 and with acid to neutral reaction. A very hard, white-capped columnar structured B horizon with organic staining and with acid to alkaline reaction. Saline parent material.

In tabular form the Solodized - Solonetz profile may be described as follows:

A horizon - leached, acid to neutral in reaction, characterized by a well developed, light coloured A_2;

B horizon - very hard, white-capped columnar structure with organic staining on the columns, acid to alkaline reaction - the alkalinity usually occurring in the lower part of the B; finer textured than the A horizon.

C horizon - saline.

<u>Solod</u> - A soil with leached A horizon (including light coloured A_2), very thick in comparison with the B; of faint columnar structure with sharp horizontal cleavage, and acid reaction. A hard, weakly prismatic to weakly columnar macro-structured B horizon (a remnant of the solonetzic B); finer textured than the A, with acid to neutral reaction. Saline parent material.

In tabular form the Solod profile may be described as follows:

A horizon - leached, with light coloured A_2; faint columnar structure with sharp horizontal cleavage; very thick compared with B; acid reaction.

B horizon - hard, weakly prismatic to weakly columnar macro-structure - a remnant of the solonetzic B; finer textured than A horizon; acid to neutral reaction.

C horizon - saline.

<u>Notes to Accompany Definitions</u>

<u>Note 1</u> solonetzic B horizon. This definition as stated, is taken from the current U.S.D.A. classification. It is quoted to serve as a guide in defining solonetzic soils in Canada, but

it has not yet been formally adopted. For Canadian soils it is not considered that the solonetzic B must have 15 per cent or more of replaceable sodium. For example, well developed solodized-solonetz profiles may have 10 per cent or even less of replaceable sodium. The value of 15 per cent is based on the studies of saline and alkali soils as defined by the U.S.D.A. Regional Salinity Laboratory at Riverside, California. It should be noted that these studies are designed to determine values that are significant in plant growth and crop production. Such values may or may not be significant to a scheme of soil classification. In any event we have not yet introduced cation-exchange values into the Canadian classification, although we will have to consider them eventually, particularly in the lower categories. The dominance of exchangeable Na - Mg over exchangeable Ca in solonetzic B horizons has already been noted in Canadian soils.

Note 2 reaction of the A horizon of the Solonetz. From the early discussions and subsequent correspondence, suggestions for describing the reaction ranged through alkaline, alkaline to neutral, non-acidic, and acid. There are soils in western Canada whose morphology resembles that of the Solonetz as defined here, but which are acid in the A and sometimes in the B horizons. In the second report the term "non-acidic" was used to exclude such soils from the definition of the Solonetz. It was considered that "non-acidic" would include neutral reaction as defined in the U.S.D.A. "Soil Survey Manual" (pH 6.6 to pH 7.3), and hence would cover very slightly acid conditions.

Acid soils were excluded from the Solonetz type because so much of the literature of soil science indicates that the Solonetz is associated with a very definite alkaline reaction. It was felt that the inclusion of acid soils with the Solonetz could prove very confusing to workers in other regions. The acid soils with apparent solonetz morphology will have to be defined and named, but for the present it is suggested that they should not be referred to as Solonetz unless some qualifying term is included.

Note 3 general statement: Judging from the number of comments already received it is probable that some members of the N.S.S.C. may feel that the proposed definitions lack sufficient detail. For example, where "thin" is used in describing a particular horizon, some people would prefer to add "not more than so many inches": others would like references to sub-horizons or other features that may occur in a particular profile.

In the present study the aim has been to prepare a definition no longer than that required to identify a particular soil, and to set it apart from other soils. No attempt has been made to write complete descriptions nor to include all features that may occur in some varieties of a given soil. This more detailed information can be compiled, and indeed it will be necessary, when the lower categories of the classification are studied.

The present definitions may be incorrect in part or may be too brief. To determine the adequacy of the definitions the reader should ask himself "Does this definition tell me what are the distinguishing features of the Solonetz (or other soil), and can I separate this type of soil from all others at the Category V level?".

After discussion this report was adopted by the meeting subject to the following changes and additions:

1) The solonetzic B horizon was defined as follows: a textural (Bt) horizon of columnar or prismatic structure, characterized by surface coatings and organic staining, and by a higher content of replaceable sodium plus magnesium than of replaceable calcium.

2) Referring to the 1955 "Outline for the Classification of Canadian Soils" it was agreed that the soils of Category VI-2 should be called "Solonetzic" instead of "Halomorphic" (Note 1).

3) With respect to defining Solonetzic soils at the Sub-Group (Category 4) level, it was suggested that differences in colour and related organic-matter content of the A1 horizons would serve to separate brown, dark brown, and black solonetzic soils. Differences in total thickness or depth of profile might also be a factor.

It was also suggested that the solonetzic types of Chernozemic soils would have to be defined before the full range of solonetzic soil development could be covered in the classification scheme (Note 2).

Finally, it was pointed out that most of the field work which led to the recognition and description of the Solonetzic soils of Western Canada was done before the Munsell colour charts were available. Hence, it may be necessary to check the surface colours of representative zonal soils by our present colour standards before we can suggest colour ranges for the Solonetzic soils at the Sub-Group level.

Note 1.

Since this report was prepared, one of the Western members has raised an objection to the proposal that the term "Solonetzic" be used in place of "Halomorphic". Furthermore, it would appear that several other members have no recollection of the discussion of the above terms. This situation implies that the question of naming the Category VI-2 soils is still to be decided.

It should be pointed out that this matter was included in the report presented at the Vancouver meeting, and that no one spoke in support of the term "Halomorphic". Furthermore, the term "Solonetzic" was used in the title of the Progress Report and no objections were raised after the report was circulated. It may be necessary to decide the issue by taking a vote by correspondence.

Note 2.

A recent field trip by Dr. Leahey and the Saskatchewan group confirmed earlier studies which indicated the presence of a solodic profile in which the solonetzic B has degraded completely. This profile consists essentially of leached A horizons over a B-C or B(ca, sa) horizon. It is obvious that such a profile, lacking a solonetzic B horizon, cannot be placed in the Solonetzic group. On the other hand, the thickness and development of the A_2 horizon are too great to permit its inclusion in the Chernozemic group. (It should be added that this profile appears to have a chernozemic A_1 horizon and that it is our limitation on the degree of development of the A_2 horizon that keeps this soil out of the chernozemic group.)

Have such soils been encountered in other parts of Western Canada? It would seem that if this profile is more than a local type it will be necessary to find a place for it in VI. This would mean changing the present definition of (a) the Chernozemic soils, or (b) that of the Solonetzic soils.

REPORT ON PODZOL-GRAY WOODED INTERGRADES

by W. E. Bowser

In June 1956, Messrs. Leahey, Ehrlich, Moss, Farstad, and Bowser made a brief study of wooded soil types in the Rocky Mountain House area of Alberta and the Golden area of British Columbia. Mr. C.C. Kelley and members of his staff were present in the Golden area. During this study Brown Wooded, Gray Wooded, Podzol Gray Wooded, and Podzol soils were examined, and preliminary descriptions made. These descriptions were subsequently supplemented with more complete descriptions supplied by survey personnel. Brown Wooded and Brown Wooded Gray Wooded intergrades will be discussed in another paper, therefore this will deal only with the Gray Wooded Podzol intergrade.

It should be pointed out that there are in Alberta and British Columbia, large areas where the soil type is an intergrade between Gray Wooded and Podzol. The areas are sufficiently large that there is a strong opinion that an intermediate group should be established for these soils at Category V level. An alternative favored by some is that they be taken care of in two classes in Category IV. In either approach, however, it is necessary that we have a relatively clear conception of a modal or typical Gray Wooded and a modal or typical Podzol.

In the preliminary draft that was circulated, the modals and intergrades were defined in fairly specific terminology. As was stated in that report, this was done to focus attention on the various characterizing factors. Following this an attempt was made to embody these specific data into more general terminology. These descriptions were then presented to the Vancouver Soil Survey Meeting as a basis of discussion. Part of the discussion at this meeting related to the category placement of the intergrades; that is whether the mid-point between Podzol and Gray Wooded be placed in Category V or whether two intergrades between them be taken care of in Category IV.

As a result of the discussion it was decided to attempt to define two intergrades at Category IV level. Following are definitions of these intergrades together with definitions of a Gray Wooded and a Podzol in Category V as they apply to this sequence.

Gray Wooded-Category V:

Gray Wooded soils have developed under a forest vegetation in the cooler portion of the North Temperate Zone. They are characterized by: an O horizon, a distinct Ae horizon of medium to medium-high base saturation and a distinct Bt horizon that is medium to highly base saturated. The C horizon is highly base saturated. In addition the following characteristics are usually applicable: a very thin Ah horizon, a platy Ae horizon, a pronounced AB horizon, an accumulation of fine clay in the Bt horizon, a calcareous C horizon, and an overall grayish to grayish brown color.

Podzol-Category V:-

Podzol soils have developed under forest vegetation in the North Temperate Zone. They are characterized by: an O horizon, a distinct Ae horizon of low base saturation, a distinct Bh ir of low base saturation, and a BC of low to medium base saturation.

The Sub-Group (Category IV) under Gray Wooded might be called Podzol Gray Wooded, (present 3.2.7). The Sub-Group under Podzol might likewise be called Gray Wooded Podzol or Podzol underlain by a clay B (present 3.5.7). This necessitates the drawing of three boundary lines, namely, (1) the division between a modal Gray Wooded and a Podzol Gray Wooded, (2) the division between a Podzol Gray Wooded and a Gray

Wooded Podzol, and (3) the division between a Gray Wooded Podzol and a modal Podzol. The following is suggested for these divisions.

(1) A soil should cease to be called modal Gray Wooded and be called a Podzol Gray Wooded when there is a definite Ao(p) and Bir(p) formed in the Gray Wooded Ae. There should be more than one unit of chroma difference (moist) between the Podzol A and B, or if there is only one unit difference in chroma the base saturation of the podzol A and B should be less than 65%.

(2) A soil should cease to be called a Podzol Gray Wooded and be called a Gray Wooded Podzol when the Bp noticeably begins invading the Btgw, and the base saturation of the Podzol A and B is less than 50%.

(3) A soil should cease to be called a Gray Wooded Podzol and be called a Podzol when the Podzol A and B are dominant, when the Bt is discontinuous and when the base saturation of the A and B horizons are low.

It is realized that the Podzol Gray Wooded will have a Podzol-Gray Brown Podzolic counterpart. The Gray Wooded Podzol and Gray Brown Podzolic Podzol should however, be approaching sameness. It is for this reason that the suggestion was made to call this intergrade Podzol underlain by a clay B.

This is to be considered as a tentative report. It is hoped that the members will, by field observation and analysis, determine whether the above separations are logical or not. In either case, comments and suggestions are requested.

As a result of discussions the meeting agreed to eliminate sub-class 3.28 as suggested in the original classification scheme and to reserve this number tentatively for a Brown (Podzolic)-Gray Wooded intergrade.

Preliminary Report on the Classification of Chernozemic Soils
by H.C. Moss

It was not possible for the Western group to study the classification of the Chernozemic soils prior to the Vancouver meeting, as was done for the Solonetzic soils. However, an introductory report entitled "Notes on Chernozemic Soils" was prepared in June and presented at the Vancouver meeting. Time did not permit a full presentation and discussion of the report, nor was it possible to present a progress report at the final joint meeting of the N.S.S.C. and N.S.F.C.

The report submitted below is, therefore, concerned chiefly with the discussion at the Vancouver meeting, which represents the present stage of our joint study of Chernozemic soils.

1. Starting with the descriptive material under Category VI, it is clear that we must decide at the outset whether we agree with the definition of Chernozemic A_1. This is given in the 5th Approximation of the U.S.D.A. Scheme of Soil Classification, 1956:

A Chernozemic A_1 horizon is a surface horizon with at least 1 percent organic matter, with dominantly flocculated clays producing structure that is not massive and hard or very hard when dry; it has a crushed or rubbed color darker than 3.5 (Munsell notation) when moist and 5.5 when dry, and is at least one Munsell unit lower in value than the C if present; it has a carbon-nitrogen ratio of 13.5 or less, base saturation dominantly with Ca and over 50 percent (by NH4Ac method); it has the following thickness limits: (a) if resting on C or D horizons, more than 4 inches thick, (b) if overlying a B, in a solum of less than 36 inches, the A_1 is more than 1/6 of the solum and (c) if overlying a B in a solum of more than 36 inches, the A_1 is more than 6 inches thick. If only an A_p is present and overlies a B, C or D it is considered a Chernozemic A_1, if it is darker than 3.5 when moist and 5.5 when dry, has a chroma of 3 or less and is at least 1 unit darker than the C, or the D if the C is absent; has base saturation over 50 percent and a C/N ratio of 12 or less; contains at least 1 percent organic matter, and does not become massive and hard on wetting and drying.

The discussion of the U.S.D.A. definition indicated it was suitable for defining Canadian Chernozemic soils, providing the following adjustments are made:

Colour - Some brown Chernozemic soils in Western Canada have Munsell colour values of 6. It was agreed, therefore, that the U.S.D.A. limit of value of 5.5 (dry colour) would not cover all Canadian Chernozemic soils.

The following colour ranges were tentatively adopted to characterize the Chernozemic A_1 horizons of Canada. It will be necessary for all those concerned with Chernozemic soils to check the ranges in the field and to report whether they can be adopted as standards.

Dry Munsell colours of Chernozemic A_1 horizons -

Brown soils	value	5 to 6
Dark Brown soils	"	4.5 to 3.5
Black soils	"	darker than 3.5

<u>Comparative thickness of A_1</u>- It was considered that many Chernozemic soils in Canada would conform to the U.S.D.A. definition whereby the A_1 occupies "more than one-sixth of the solum". However, it was felt that exceptions may occur, as in solonetzic and degraded Chernozemic soils. Hence, for the present time no specific thickness or comparative thickness of the A_1 was adopted. It is assumed that an A_1 horizon must be thick enough to permit and to warrant sampling. Any more specific limitations at this time on the thickness of this horizon would only create difficulties in classifying Canadian soils.

2. The separation of Chernozemic soils in Category V is at first glance a simple matter. We know our major soil zones and the dominant profiles that characterize each zone. We have no trouble in showing visitors the differences between the zones and zonal soils. Yet a preliminary attempt to describe the Brown, Dark Brown and Black soils so as to clearly separate and define them for Category V proved to be far from easy.

First, as already mentioned, many large areas of zonal soils have not been studied since we acquired the Munsell colour chart. Hence, we cannot be certain that we know the dominant colour values for each zone and we may be less sure of the range in colours which occur or which should be permitted.

Second, we need to relate the colour to organic-matter content. This can be done for the regional soils in which progressively darker A_1 horizons and increasing organic matter are associated. However, we cannot say for example that black soils are always higher in organic matter than all dark brown soils. We can only compare similar kinds of profiles, as solonetzic Black with solonetzic Dark Brown. The same holds true for depth of profile or depth to lime carbonate. It is, therefore, doubtful whether we can use specific numerical values for organic matter content and depth of profile for the units of Category V. It should be possible in Category IV.

3. Preliminary Definitions of Chernozemic Soils

(Category V, classes 1.1, 1.2 and 1.3)

Brown - a soil with a brownish Chernozemic A_1 horizon. A prismatic to weak columnar-structured B or (A-B) horizon, usually of stronger chroma than the A. A light coloured B (ca) horizon is usually present. The C horizon is most frequently calcareous and is always neutral to alkaline in reaction. In tabular form the Brown soil may be described as follows:

A horizon - Chernozemic Brown (value 5 to 6)

B or AB horizon - brownish, usually of stronger chroma than the A, and of prismatic to weak columnar structure.

B(ca) horizon - light coloured, moderate to high content of lime carbonate.

C horizon - neutral to alkaline in reaction, and containing lime carbonate.

Dark Brown - a soil with a dark grayish brown or dark brown Chernozemic horizon (values 4.5 to 3.5), higher in organic matter and with greater profile depth than in corresponding Brown soils. B and C horizons essentially similar to above.

Black - a soil with very dark grayish or brownish to black Chernozemic A horizon (values lower than 3.5), higher in organic matter and with greater profile depth than in corresponding Dark Brown soils. B and C horizons essentially similar to above.

Category IV (Sub-Group)

The report prepared for Vancouver contained generalized descriptions of Brown modal or regional, calcareous, solonetzic and solodic profiles, together with notes on saline, meadow and other types. Since these descriptions represent Saskatchewan soils only, and since time did not permit a full discussion of them, they are not included in the present report. It will be necessary to discuss the Chernozemic soils of Category IV by correspondence or further meetings.

Progress Report on the Classification of Brown Wooded Soils

A. Leahey

Foreword: This report is a revision of preliminary report presented at the Vancouver meeting which was accepted only as a basis for discussion.

Introduction

During the past fifteen years pedologists in Western Canada have encountered a number of forested brown soils which did not fit into any of the established groups. These soils have essentially a simple morphology, consisting in the main of a brown mineral layer showing little or no horizon differentiation lying between an Ao or O horizon and the parent material which is generally calcareous. The average thickness of the brown mineral layer or solum is about 15 inches but ranges from about 4 to 30 inches. Base saturation of the solum ranges from moderate to high. These soils occur in dry forested regions in British Columbia[1] and the Yukon where they appear to be the zonal type and under more humid forest sites on relatively young alluvial terraces in Northwestern Canada[2] where they may be considered as intrazonal on account of their age. Field evidence indicates that the Brown Wooded soils are precursors of the Gray Wooded soils.

Prior to 1952 such names as Brown Forest, Western Brown Forest, Brown Podzolic and Regosol had been used to designate the group of soils under consideration but none of these names was generally acceptable. The lack of a prominent A_1 under natural conditions excluded these soils from the Brown Forest group as defined in Canada. Western Brown Forest might have been accepted except for the obvious disadvantages of such a geographical term as "Western" in a group name. Brown Podzolic did not fit as these soils had too high a base status and also lacked the evidence of an orterde B which is characteristic of many Brown Podzolic soils. The fact that in many areas this group of soils appeared to be the zonal type brought opposition

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[1] Soil Survey of Upper Kootenay and Elk River Valleys. Report No. 5 - British Columbia Soil Survey.

[2] Preliminary Soil Survey of Lands Adjacent to Mackenzie Highway in the Northwest Territories, Experimental Farms Service, Mimeographed Report 1953.

to the name of Regosol. Perhaps this past experience with nomenclature led to ready acceptance of the name "Brown Wooded" by the British Columbia and Alberta Soil Surveys when this name was suggested by Leahey in 1952. Later, the name was officially accepted for this group of soils at Category 5 level by the National Soil Survey Committee at its Saskatoon meeting in 1955.

The purpose of this report is to propose for consideration by the National Committee members a definition of the Brown Wooded group (Category 5 level) and definitions for the sub-groups (Category 4 level) which need to be made at the present time. Since there is some controversy regarding horizon designation for the sola of these soils the definitions will avoid the use of horizon nomenclature. Anyway it is difficult to properly apply names designed to label well developed horizons to immature soils such as the Brown Wooded.

A brief discussion on horizon nomenclature for this group of soils will be given after the proposed definitions.

Definitions

Brown Wooded Soil Group

A group of Forested Brown soils with an organic surface layer and a brownish colored mineral layer of moderate to high base saturation without marked eluvial or illuvial horizon development, lying directly on parent material of high base saturation. Thin or very weakly developed A_1 horizons may be present but are usually absent under natural conditions.

or

A group of Forested Brown soils that under a surface organic layer has a brownish colored solum of moderate to high base saturation in which no marked horizon differentiation has occurred. A thin or very weakly developed A_1 horizon may be present but is usually absent under natural conditions.

Definitions for the Sub-Groups

Modal Brown Wooded Sub-Group: Brown Wooded soils which show no or only faint visual evidence of eluviation or illuviation in the solum and in which the upper six inches is free of calcium carbonate. The color of the solum may be fairly uniform throughout or the upper part may have a higher chroma than the lower part.

Regosolic Brown Wooded Sub-Group: Brown Wooded soils with characteristics similar to the modal sub-group except that the depth to calcium carbonate is less than six inches or the solum will be only slightly browner in color than the parent material (dry colors).

Degraded Brown Wooded Sub-Group: Brown Wooded soils which show weak development of eluvial and illuvial horizons in the solum by morphogical, chemical, and physical evidence. A transitional soil between the modal Brown Wooded and a minimal Gray Wooded soil.

Sub-Arctic Brown Wooded Sub-Group: Brown Wooded soils similar to the modal or regosolic sub-group, insofar as development is concerned, but with permafrost in the parent material at sufficiently shallow depth as to impede water movement through the profile. Mottling occurs in the parent material above the permafrost and in the lower part of the solum.

Note 1. Evidence to date indicates that very weak development of what appears to be eluvial and illuvial horizons may be observed visually before they can be detected by chemical analysis. It is suggested that laboratory evidence is necessary before the soil is placed in the degraded sub-group.

Note 2. An imperfectly drained Brown Wooded sub-group may be required but so far I have not seen an imperfectly drained Brown Wooded soil except the Sub-Arctic Brown Wooded.

Horizon Nomenclature: There have been arguments whether the brown mineral solum of the modal Brown Wooded should be labelled as an A or a B horizon. In fact this matter was discussed at considerable length at our meeting in Vancouver without reaching any agreement. I have pointed out previously the inherent difficulty of using A and B horizons properly for immature soils and it might be preferable to use numbers to designate the horizons in this group of soils rather than letters which have definite connotations.

If the committee members believe that the brown mineral solum should be labelled by either A or B, then the arguments appear to be as follows:

For A.

1: It is the uppermost mineral horizon.

2: It is the mineral horizon of maximum weathering.

3: It is the mineral horizon of maximum leaching.

4: It is the mineral horizon with maximum accumulation of organic matter. In fact the upper part may contain more organic matter than the A1 of a Chernozemic Brown.

5: It is the mineral horizon in which an A_2 would form with increasing maturity.

For B.

1: This horizon may be analogous to the colour B horizon as suggested by Smith and the B horizon of Kubiena as used in Europe.

2: The term B has been used for somewhat similar horizons in the Brown Podzolic, Brown Forest and Chernozemic soils in Canada.

My recommendation is that we adopt the letter A to designate the brown solum of the modal Brown Wooded. Adoption of the letter A would necessitate another major profile type O,A,C in the Forested Brown Order and changing the major profile type AC in the Regosolic Order to A_1C. However, I see no objection to such revisions.

It was suggested at the Vancouver meeting that the presence or absence of calcium carbonate might be used as a basis of separating the sub-groups. However, further field examination has convinced me that it is not practical to do so. I think we have only two alternatives here.

(1) Restrict the group to calcareous parent materials.

(2) Use the presence or absence of calcium carbonate as one of the differentiating criteria at Category 3 level.

Actually most of the Brown Wooded soils as classified to date have calcareous parent material. However, there are a few series on non-calcareous parent materials which have been classified as Brown Wooded soils on the basis of their morphology and chemical characteristics. I would recommend against restricting the group to soils with calcareous parent materials.

I would appreciate receiving comments on the matters discussed above in order that a further report on the classification of the Brown Wooded soils may be issued by the spring of 1958.

Report on

Collaborative Work on Cation Exchange Capacity

by H. Atkinson.

Instructions were sent to 13 laboratories. They were to use the 17 reference soil samples.

Two modifications were proposed:

1. Leach NH_4 - saturated soil with NaCl solution and distill leachate.
2. Distill NH_4 - saturated soil direct.

Full or incomplete returns were received from 8 laboratories as follows:

a. 5 labs. gave complete results for 17 soils by both methods
b. 1 lab. " " " 8 " " " "
c. 1 lab. " " " 17 " "leaching method.
d. 1 lab. " " " 17 " " direct Distillation method.

The variation among results was somewhat greater than expected.

However, certain laboratories tended to have either low or high results.

One laboratory (Manitoba) had lowest results on 15 of 17 soils by the leaching method, and on 14 of 17 soils by the direct distillation procedure.

One laboratory (Quebec) had highest results on 10 of 17 soils by leaching and on 14 of 17 soils by direct distillation.

One laboratory (N.B.) reporting on only 8 soils, had 4 highest results by the leaching procedure and 3 by the direct distillation method.

The mean cation exchange capacity value for each soil, by each procedure, was calculated and the range in each case was calculated as percent of the mean.

The range as percent of the mean averaged 30.8 percent by the leaching procedure and 38.3 percent by direct distillation. The leaching method would therefore appear to give less variable results.

One soil had a very low (2-3 me.) exchange capacity and the range as percent of the mean for this soil was very high (up to 100 percent by leaching). When this value was omitted, the average value for range as percent of mean decreased from 30.8 percent to 26.3 percent.

When the exchange capacity values from the laboratory reporting consistently low results were omitted from the calculations, the average value for range as percent of mean was decreased still further from 26.3 percent to 17.0 percent.

The results have been examined by the members of the sub-committee on chemical analysis from eastern Canada. (Incidentally some action should be taken with regard to membership on this committee from Western Canada. When it met in 1955, Prof. J. H. Ellis and the late Dr. John Mitchell were members and no replacements have been named for them. The other member, Dr. J.D. Newton, is out of the country this year.)

It has been suggested that the reason that some laboratories have in general reported high results and some have in general reported low results may be due to an error in the normality factor of the standard solutions used.

One suggestion has been that, in further collaborative work, the standard solutions should be prepared in a central laboratory and distributed to the collaborating laboratories. Another suggestion is that the directions be changed to provide for the absorption of the ammonia in boric acid and titration with standard HCl (instead of absorption in standard H_2SO_4 and titration with standard NaOH), and that each operator forward a sample of his standard acid to a central laboratory for checking.

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BASE EXCHANGE CAPACITIES OF REFERENCE SOIL SAMPLES

(me. per 100 g. a/d soil)

A. -Leached with NaCL, leachate distilled

	N.B.	N.S.	Que.	Ott.	OAC.	Man.	S.C.	Mean	Range as % of mean
1.	12.5	10.1	10.9	10.9	11.1	9.0	13.2	11.1	37.8
2.	32.1	29.4	28.7	29.2	32.2	26.7	32.5	30.1	19.3
3.		11.1	13.2	12.8	12.3	9.7	13.1	12.0	29.2
4.		44.9	47.5	42.8	46.9	39.9	49.7	45.3	21.6
5.	4.5	2.0	4.0	3.6	1.9	1.5	2.7	2.9	103.5
6.		21.2	22.7	20.8	20.6	17.9	20.2	20.6	23.3
7.		41.8	50.2	46.8	46.7	41.9	45.1	45.4	18.5
8.		14.8	16.3	17.1	16.5	15.6	16.9	16.2	14.2
9.		9.1	10.5	9.9	10.0	8.7	9.3	9.6	18.8
10.		8.6	9.9	9.9	9.4	7.4	9.3	9.1	27.5
11.		61.0	61.5	51.3	56.5	44.2	56.3	55.1	31.4
12.	10.1	9.5	11.7	11.1	9.8	9.0	10.1	10.2	26.4
13.	34.6	33.6	33.8	31.1	29.7	28.2	32.3	31.9	20.0
14.		12.9	14.4	14.4	14.8	11.6	13.5	13.6	23.7
15.	16.4	14.6	18.6	15.7	15.0	11.7	16.4	15.5	44.5
16.	9.5	7.8	7.7	8.2	8.4	7.0	7.9	8.1	30.9
17.	11.2	9.8	11.2	10.4	9.9	7.9	9.8	10.0	33.0

B. - Direct distillation

	N.B.	N.S.	Que.	Ott.	Man.	S.C.	UBC.	Mean	Range as % of mean
1.	11.9	10.5	14.6	10.2	7.7	10.6	11.2	11.0	62.7
2.	38.8	31.2	34.6	27.4	26.6	29.3	28.5	30.9	39.5
3.		11.5	13.2	11.9	10.0	11.5	11.0	11.5	27.8
4.		47.8	50.7	42.5	41.1	46.1	44.2	45.4	21.2
5.	2.8	2.1	2.2	2.0	1.4	2.1	1.6	2.0	70.0
6.		20.6	22.9	20.6	16.9	19.7	18.6	19.9	30.2
7.		38.5	52.2	45.9	41.8	36.5	46.6	43.6	36.0
8.		16.5	17.2	16.4	15.1	16.0	14.8	16.0	15.0
9.		8.7	11.5	9.1	8.3	9.0	9.1	9.3	34.4
10.		8.6	10.3	9.2	6.9	8.6	8.0	8.6	39.6
11.		55.7	59.1	50.4	42.6	53.7	52.9	52.4	31.5
12.	11.5	10.5	12.8	10.8	9.6	12.9	10.5	11.2	28.6
13.	40.4	35.7	40.4	36.1	29.3	38.0	34.9	36.4	30.5
14.		14.1	19.0	13.3	11.1	12.6	14.5	14.1	56.0
15.	17.5	15.5	19.8	14.2	11.6	14.9	14.1	15.4	53.2
16.	8.4	8.5	9.8	7.8	6.9	7.3	7.5	8.0	36.2
17.	10.8	9.8	11.0	9.3	7.9	7.4	8.8	9.3	38.8

Discussion

During the discussion it was pointed out that some of the Western laboratories have this work underway and that some additional results should soon become available. Some of the laboratories are using some of the same samples to check their own methods and results. Some discussion also took place on the advisability of collecting a limited number of large samples of soil which would be kept as reference samples and which would be sent to the different laboratories on request for checking purposes. Dr. Leahey pointed out that a limited supply of some of the original samples was still at hand and until they are exhausted there is no need to collect additional samples. He suggested that each laboratory might have some of its own reference samples to check their results from time to time.

Sub-Committee on Physical Analyses

Dr. C.A. Rowles, reporting for the Committee on Physical Analyses, briefly reviewed the 1955 recommendations of the committee and pointed out that the committee had no further recommendations to add at this time. However, he would like to know if the 1955 recommendations had been followed in the different laboratories and, if so, with what success. From the discussions that followed it appeared that no particular study in comparing methods had been undertaken in any of the laboratories outside of Alberta in connection with mechanical analyses. Although the pipette method has been recommended for mechanical analyses a number of laboratories still use the hydrometer method. Some discussion took place on pipette method versus hydrometer method using the pre-treatment recommended for the former. Dr. Alexander pointed out that such a change would save no more than 20% of the time required. He further pointed out that the U.S. Department of Public Roads has re-run 743 samples by the hydrometer method and the results were then compared with those obtained in the soil survey laboratory by the pipette method. The average disagreement varied from 3 to 5% but individual samples differed by as much as 100%. There is apparently no clue for predicting what samples will likely differ in their results.

Apparently very little work has been done during the past years in the Western provinces on the use of other physical tests for the characterization of soils. It was stressed that most institutions have no staff available for this work unless some of the other work which is presently underway is discontinued.

Dr. Hutcheon stressed the great need for more physical studies of our soils and he moved that the Committee in its report make a strong case for the need of physical studies of Canadian soils. This resolution, which was properly seconded, was endorsed by the meeting.

P.C.S.

REPORT ON THE MINERALOGY OF CANADIAN SOILS

by W. A. Ehrlich

From the information received on investigations of soil minerals in Canada it is apparent that the mineralogical data are meagre. To the present time approximately 40 profiles have been analyzed, however in most instances, the examinations were made only on the clay fractions. Information on the sand and silt sized fractions in many of these soil profiles is lacking and very little data are available on materials coarser than two millimeters.

Mineralogical work has been initiated by a number of departments for various reasons. These reasons are: characterization of soil minerals by identification of minerals in sands, silts and clay; degree of mineral weathering in relation to soil formation, and examination of sands and silts for potential nutrient supply. The investigations in soil mineralogy by provinces vary from a few to a moderate number. With the exception of a few departments both equipment and qualified personnel are lacking for this type of research. Presently Science Service at Ottawa is the only department that is adequately supplied with equipment and personnel for complete mineralogical analysis.

The opinions regarding the initial approach to mineralogical work on Canadian soils were varied. For example, one correspondent favoured analysis of a large number of surface samples as well as some profile samples, whereas another correspondent stressed the need for work on parent materials. After due consideration was given to the opinions received on the initial approach to the mineralogical work, the committee felt that the analysis of modal zonal profiles is the most desirable starting point. This analysis would provide information on mineralogical composition and weathering of soils across Canada. Furthermore the information obtained would serve as a guide for future work. Beyond the point of analysis of modal zonal profiles, the committee has reached no agreement. Tentatively it is suggested that some intrazonal and intergrade soils receive attention. The Halomorphic soils consisting of Solonetz, Solodized-Solonetz and Solod in the Brown, Dark Brown and Black soil areas merit attention. It may be desirable to investigate some marine, mountain or some poorly drained soils that are of geographic or agricultural significance. It is not expected however, that mineralogical analysis of the more poorly drained soils will offer much additional information because of their close relationship to the upland members.

For the initial work it is recommended that at least two well-drained (or moderately well-drained) soil profiles widely separated from each other be obtained in: Brown, Black, Gray Wooded, Podzol-Gray Wooded, Gray Brown Podzolic, Brown Podzolic, Podzol, and Concretionary Brown soil groups. Although some mineralogical work by various investigators has been done on a few of the soils mentioned, the work in most instances is incomplete and other profiles should be sampled.

The following virgin soils for the different provinces are suggested:

British Columbia	2 Concretionary Brown; 1 Podzol-Gray Wooded.
Alberta	1 Brown; 1 Black; 1 Podzol-Gray Wooded.
Saskatchewan	1 Brown; 1 Gray Wooded.
Manitoba	1 Black; 1 Gray Wooded.
Ontario	2 Gray Brown Podzolic.
Quebec	2 Brown Podzolic; 1 Podzol (no textural difference between A_2 and B horizons).
New Brunswick	1 Podzol (A_2 finer textured than B).
Nova Scotia	1 Podzol (no textural difference between A_2 and B).
Newfoundland	1 Podzol (A_2 finer textured than B).

It is recommended that the profiles for analysis be boulder till with parent materials containing from 15 to 25 percent clay. The samples should be taken from recognized and described soil types. Only modal profiles at the Category IV level should be sampled. Careful selection of the respective profiles with regard to apparent or original homogeneity of soil materials cannot be over-emphasized. Careful analysis cannot overcome poor sampling. In furtherance to sample sites, it has been indicated that an attempt be made to restrict sampling to reasonably accessible sites which have undisturbed sites of a fairly permanent nature.

When sampling it is suggested that all the important horizons and sub-horizons be obtained. Samples should be about four pounds each and each sample should be obtained from a representative part of the horizon. For example, a thick black "A" horizon should be sampled around the center of the horizon, or a "C" should be sampled at a depth where it is fairly certain that weathering is negligible. If the horizons are thin, as are many "A" and "B" horizons in podzolic soils, it may be necessary to sample most of each respective layer. It is imperative that the samples obtained are representative of the process implied by each respective horizon. Sampling of the transitional portion of each horizon should be avoided where possible. Descriptions of the profiles and other pertinent information, such as nature of parent material, geological age, elevation, slope, drainage (internal, runoff and infiltration), stoniness and vegetation should be obtained at the site of sampling.

Mineralogical analysis is very time consuming and in consequence it is advisable that the number of samples to be analysed should be kept at a minimum. Only the more important horizons, such as the A_2, B_2 and C of the Gray Wooded, A_1, A_2, B_2 and C of the Gray Brown Podzolic, A_2, B and C of the Podzol, etc., need be analysed. It has been indicated in previous mineralogical work that it is unnecessary to analyse all horizons. About 500 grams of each sample should provide sufficient material for mineralogical work. The remainder of the respective soil samples should be kept at the laboratories concerned. It is recommended that five samples, coarse sand (1.0-0.5mm), fine sand (0.25-0.10 mm), medium silt (20-5u), coarse clay (2.0-0.2u) and fine clay (<0.1u) from each horizon be analysed mineralogically at the Science Service Laboratory at Ottawa. It is further recommended that the segregation of the various fractions be made at the Ottawa laboratory since the facilities for clay separations in most laboratories is inadequate.

The laboratories concerned should make provision to retain samples of the respective profiles and are urged to analyse the samples for: SiO_2, Al_2O_3, Fe_2O_3, TiO_2, CaO, MgO, K_2O, MnO, P_2O_5, SO_3, inorganic C, organic C, N, exchange capacity, exchangeable cations, pH, and mechanical analysis. The analyses should be on the complete sample of each horizon rather than on the fractions designated for mineralogical work.

It is felt that additional analyses suggested would provide a very valuable contribution to our knowledge of Canadian soils and it would be a serious mistake if the work at this stage should be restricted to the mineralogical aspect.

This report, which includes the suggestions made during the discussions, was accepted by the meeting. To date (Oct.15), 2 Concretionary Brown, 2 Black, 1 Brown, 1 Gray-Wooded and 1 Podzol-Gray Wooded profiles have been collected.

SOIL HORIZON COMMITTEE
INTERIM REPORT
by W. E. Bowser

The report of the Soil Horizon Committee given at the Saskatoon Meeting November 1955 was accepted for trial. Since it was not possible to circulate the report before the 1956 summer season, it has only been given limited study. The report given at Vancouver was, therefore, of an interim nature.

Since the Saskatoon meeting the U.S.D.A. survey have adopted for trial a symbolic horizon nomenclature. The following subscripts suggested by them found favor with our group and it is recommended that we add them to our subscript list on a trial basis.

(1) O (organic horizon) to be sub-divided into:

d - Raw, relatively undecomposed.

f - fermentation layer.

h - high humus.

(2) The B to be further sub-divided by using subscript:

cr - a color B.

It is recognized that all subscripts used must be clearly and specifically defined. This, it would appear, is the next task of the Horizon Committee and during the coming winter (1957-1958) this will be attempted.

The Saskatoon meeting defined the master horizons A, B, and C in terms of degree of weathering - no other criteria. If this is valid the first problem to be answered is this: Should A and B always be followed by a connotative subscript, or can they stand alone? Put another way, is the subscript only used when there is "pronounced" evidence? For example, would a Chernozemic B be used alone, and B_t used for a Gray Wooded or PlanOsolic B? This question must be answered before the sub-script definitions can be completed and for example, the limits for a clay B, an iron B or a humus B, set.

It is hoped that all members of the soil survey committee will give this some consideration this summer, paying particular attention to horizons that are common to their locale.

Soil Permeability

This subject was discussed by Mr. W.E. Bowser in relation to the rating of soils for irrigation purposes and by Dr. L. T. Alexander who reviewed some of the results on permeability studies obtained in the Washington laboratory.

HYDRAULIC CONDUCTIVITY IN IRRIGATION RATINGS

by W. E. Bowser

If I were to give a term of reference or a reason for this discussion I presume it would be an extract from a letter received by Dr. Leahey and in part relayed to me. The letter read in part "The irrigation engineers are proposing (for Western Canada) to use permeability measurements very extensively in their evaluations and classification - - - and this is of importance to us in the West since the question of the reliability and applicability of physical measurements of permeability is far from settled".

The first irrigation project in Alberta was constructed in 1870 - a small 50-acre project; the first major construction was started in 1903 and encompassed the Magrath-Raymond-Lethbridge-Coledale area. At the present time there is in Alberta close to three quarters of a million acres under irrigation. Up to the present no consideration has been given to providing drainage for any of our projects. As isolated "seepage spots" have developed, local emergency measures have been undertaken; quite often the measure used was to remove the affected area from irrigation, There is however, a general feeling among the irrigationists that drainage will have to be provided; that we cannot go on indefinitely adding water and salt without some removal; provided however, that there is insufficient natural removal.

It is a fact that a large percentage of our presently irrigated land, particularly the portion developed prior to 1939, is on soils that are relatively permeable; in other words on our more desirable land. Development since 1945 has taken us to the fringes and onto land that we suspect is less desirable for irrigation.

The soil series on the major portion of these newer areas is what we term a shallow Chin loam; a soil that has from 12 to 36 inches of relatively permeable wind or water-lain material over a relatively impermeable glacial till; this till being upwards of 50 feet in depth. The major problem that faces those responsible for recommending irrigation development in Alberta might be simply stated as this - Is there sufficient natural drainage through this glacial till to prevent water, and therefore salt, from building up in the root zone, or if there is insufficient natural drainage, can these soils be artificially drained and if so at what cost?

Although this question has been discussed for some time, and I might add, by authorities with opinions almost as divergent as the poles, the problem was brought into sharp focus two years ago on the occasion of an inspection made by one of the United States leading drainage engineers. This authority expressed grave doubts as to the feasibility of irrigating many of our soil areas for any extended period of time. The result of his report was the formation of a land classification committee and a speeding up of our investigations into the drainability of these soil areas.

The United States Bureau of Reclamation have been engaged in irrigation development, on a large scale, for many years. They too, have been working into fringe areas particularly in the northern states. They have assembled a large body of information and they have developed a land classification scheme that they use to determine the irrigability or non-irrigability of the projects investigated. In these investigations drainage receives considerable consideration. Permeability standards have been set and are being used, I believe, with success. Therefore, if we do not feel that they are applicable to our conditions then we have to have some rather convincing arguments. We have I think one reason for questioning the permeability limits that are used by the U.S.B.R. In Alberta we get, on the average, 8 to 10 inches of rain each year. It is salt-free and has a desirable leaching affect. We also get 6 months each year in which the surface is frozen, no water is being added, and natural drainage can take place. The other question we might raise is the fact that the U.S.B.R. system was in general evolved to deal with wind and water-lain materials and not glacial till.

The above is merely some random thoughts related to the problem, now a word on the specific problem itself as it is being approached by our land classification committee. If drainagibility is the crux of the problem then the answer must be obtained in terms of hydraulic conductivity. That can be approached by way of mechanical analyses, non-capillary pore space, density, structure, mineralogy, and by direct hydraulic conductivity measurements, and the last of these can be determined on disturbed samples, on undisturbed cores, and by field permeameters. In this, some assumptions have to be made and it appears to us at the moment, that field permeameter measurements should be the closest to reality, and therefore, the other determination must be related to it. You are quite aware that the field determination is by far the most time consuming, otherwise we would not consider the other determinations whatsoever.

There are in these analyses two problems: One is area variability, and the other is the accuracy or dependability of the measurement itself. Regarding area variability, this is in part tied to a fineness or detail of mapping. In other words, for this purpose do we use a broad series, or an average series, or a phase of series? Again there is a time factor involved. The problem of the soil surveyor is to map to the degree of detail to which the allied sciences have applicable information and yet be able to cover the required acreage. Therefore, how wide a variation in hydraulic conductivity is allowable, and can that range be narrowed by the mapping detail? What is the relationship between site variation and area variation? At the present time, we consider that the lower limit for artificial drainage is around 0.1 - 0.2 inches per hour; for natural drainage, possibly about 0.05 inches per hour (1 inch per day). The upper limit for irrigability is around 2.5 - 3.0 inches per hour. Therefore, the analysis must be able to at least place a sample within three categories. We have done some work on this and to give an example - in one area of 10 acres, surveyed to a phase of series uniformity, 15 holes were dug to a depth of 15 feet and samples were taken for disturbed permeability. Taking the top foot of till (at about 30 inches), the mean hydraulic conductivity was 1.22 inches ± 0.49 with an absolute range of .22 to 2.20. Allowing a 0.5 inch difference, a 95% probability could be obtained with 4 samples. At the 12 to 15 foot depth the mean was 0.06 ± 0.017 with an absolute range of 0.03 to 0.09 allowing a 0.02 deviation from the mean we could get a 95% probability out of 4 samples. These analyses were sufficiently significant to be of value. The next problem would be what relationship is there between these disturbed permeabilities and core analysis and the field permeameter data. Such analyses are being done at the present time. Six duplicate measurements taken last week showed fairly close correlation between core and field - closer than core to disturbed:

Disturbed	Core	Field	
.97	.67	.22 (2"-17"	
.74	.56	.36	
.66	.25	.26	Till
.93	.29	.14	and
.73	.21	.37	contact
.38	.02	.02	till
.22	.06	.08	

You may be interested that other analyses and observations are being made all directed towards drainagibility. For example, salt analyses are being made to depths of 50 feet in an endeavour to see if there is water movement to that depth; field observations are being made using piezometers to measure water table build-up under normal irrigation practice as well as under excess water. Tracer ions are being used to plot movement in the underlying till. These are supplementary and will influence the interpretation of the hydraulic conductivity measurements.

That very briefly is the problem as our committee sees it as far as hydraulic conductivity is concerned; and also an indication of the methods we are using to get something from our data that has reliability.

Dr. L.T. Alexander discussed some of the results of the permeability studies conducted by the Washington laboratory. By the use of Uhland core samples, using 5 replicates of each horizon at each site, it has been possible to tie in variations in permeability to soil groups, soil families and management practices. The probability of accuracy of the permeability rate can be easily calculated. Three different permeability classes can be readily established. As the number of classes increases, the number of sites and samples per sites required increase rapidly. For 7 permeability classes it would require at least 10 sites. Small differences in permeability are much easier to detect on the small end of the scale (low permeability) than on the large end of the scale.

The following permeability classes have been tentatively recommended by the U. S. Soil Survey:

$<$0.2" per hour
0.2 - 0.63" per hour
0.63 - 2.0" " "
2.0 - 6.3" " "
$>$6.3" " "

At the present they propose to give values for certain key sites or soils to the fieldmen and then the fieldmen can use them as guides for their own estimates. The fieldmen can make fairly reliable estimates of permeability, especially if only three classes are used. They can make estimates much easier and perhaps more reliably where variations in soil permeability are great than can be done in the laboratory.

Core samples have given very good correlation with infiltration rates obtained by inserting rings in the field. However, satisfactory core samples can not be obtained on till soils. The soil also must be of the desired moisture content. There is no use in sampling a soil when it is too dry or too wet.

In reply to Dr. Matthews' question regarding what characteristics the surveyor could use in the field, Dr. Alexander thought that many morphological features, i.e. structure, compaction, and clay content, would give an indication of permeability. In Australia they have apparently obtained fairly good correlation between clay + silt content and permeability.

Review of the Classification Scheme Proposed in November 1955.

by P. C. Stobbe

In reviewing briefly the proposed Classification Scheme, Dr. Stobbe stressed that a great deal of work is still required in defining the different classes in Categories V, IV, and III. It is not possible to state exactly what revisions or changes may be required in the Scheme until the different classes have been defined or at least until a serious attempt has been made to define them.

From the experiences during the past year or so, it would seem that the overall scheme has definite merit and probably will be acceptable for the classification of the Canadian soils. However, the need for some specific changes is apparent already.

The Podzol sub-division into ortstein and orterde Podzols in Category V is not workable and these differences will have to be reduced from Category V level to Category IV or III. Some revisions or additions will have to be made in Class 4 on Category V or IV level in order to provide a unit space for brown forested soils that have a prominent A_1 horizon and an acid profile. Some of the regosolic soils, such as dry sands and alluvial soils, probably do not deserve recognition on Category V level and should be moved down to Category IV. In Class 7, under organic soils, no progress has been made to date in establishing the categorical sub-divisions.

These and perhaps other changes will require the committee's attention and they can be brought about more readily if the different sub-committees give the required definitions continued attention.

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