Soil Survey Investigations Report No. 7

Soil Survey Laboratory Data and Descriptions for Some Soils of...

...MONTANA

SOIL CONSERVATION SERVICE · U.S. DEPARTMENT OF AGRICULTURE
In cooperation with
MONTANA AGRICULTURAL EXPERIMENT STATION

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August 1966

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1. SAMPLE COLLECTION AND PREPARATION
   A. Field sampling
      1. Site selection
      2. Soil sampling
         a. Stony soils
   B. Laboratory preparation
      1. Standard (airdry)
         a. Square-hole 2-mm sieve
         b. Round-hole 2-mm sieve
      2. Field moist
      3. Carbonate-containing material
      4. Carbonate-indurated material
2. CONVENTIONS
   A. Size-fraction base for reporting
      1. <2-mm
      2. <size specified
   B. Data-sheet symbols
      tr: trace, not measurable by quantitative procedure used or less than reportable amount
      tr(s): trace, detectable only by qualitative procedure more sensitive than quantitative procedure used
      ... : analysis run but none detected
      -(s): none detected by sensitive qualitative test
      blank: analysis not run
      nd: analysis not run
      <: less than reported amount or none present
3. PARTICLE-SIZE ANALYSES
   A. <2-mm fraction (pipet method)
      1. Airdry samples
         a. Carbonate and noncarbonate clay
      2. Moist samples
         a. Carbonate and noncarbonate clay
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      2. Volume estimates
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      1. Saran-coated clods
         a. Field state
         b. Airdry
         c. 30-cm absorption
         d. 1/3-bar desorption I
         e. 1/3-bar desorption II
         f. 1/3-bar desorption III
         g. 1/10-bar desorption
         h. Ovendry
      2. Paraffin-coated clods
         a. Ovendry
      3. Cores
         a. Field moist
      4. Nonpolar-liquid-saturated clods
   B. Water retention
      1. Pressure-plate extraction (1/3 or 1/10 bar)
         a. Sieved samples
         b. Soil pieces
         c. Natural clods
         d. Cores
      2. Pressure-membrane extraction (15 bars)
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   C. Water-retention difference
      1. 1/3 bar to 15 bars
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   E. Micromorphology
      1. Thin sections
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   A. Cation-exchange capacity
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         a. Direct distillation
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5A. Cation-exchange capacity (cont.)
      2. NaOAc, pH 8.2
         a. Centrifuge method
      3. Sum of cations
         a. Acidity by $BaCl_2$-TEA, pH 8.2; bases by NH_4OAc, pH 7.0
      4. KOAc, pH 7.0
      5. $BaCl_2$, pH 8.2
         a. Barium by flame photometry
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      1. NH_4OAc extraction
         a. Uncorrected
         b. Corrected (exchangeable)
      2. KCl-TEA extraction, pH 8.2
   C. Base saturation
      1. NH_4OAc, pH 7.0
      2. NaOAc, pH 8.2
      3. Sum of cations
   D. Sodium saturation (exchangeable Na pct.)
      1. NaOAc, pH 8.2
      2. NH_4OAc, pH 7.0
   E. Sodium adsorption ratio
6. CHEMICAL ANALYSES
   A. Organic carbon
      1. Acid-dichromate digestion
         a. $FeSO_4$ titration
         b. CO_2 evolution, gravimetric
      2. Dry combustion
         a. CO_2 evolution I
         b. CO_2 evolution II
      3. Peroxide digestion
         a. Weight loss
   B. Nitrogen
      1. Kjeldahl digestion
         a. Ammonia distillation
      2. Semimicro Kjeldahl
         a. Ammonia distillation
   C. Iron
      1. Dithionite extraction
         a. Dichromate titration
         b. EDTA titration
      2. Dithionite-citrate extraction
         a. Orthophenanthroline colorimetry
      3. Dithionite-citrate-bicarbonate extraction
         a. Potassium-thiocyanate colorimetry
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         b. Manometric
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   F. Gysum
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         a. Precipitation in acetone
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         a. Aluminon I
         b. Aluminon II
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         a. Aluminon III
      4. NaOAc extraction
         a. Aluminon III
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      1. $BaCl_2$-triethanolamine I
         a. Back-titration with HCl
      2. $BaCl_2$-triethanolamine II
         a. Back-titration with HCl
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         a. Gravimetric, $BaSO_4$
   M. Nitrate
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         a. EDTA-alcohol separation
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         c. Oxalate-permanganate II Fe, Al, and Mn removed
         d. Oxalate-cerate
      3. NH_4Cl-EtOH extraction
         a. EDTA titration
      4. KCl-TEA extraction
         a. Oxalate-permanganate
   O. Magnesium
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         a. Flame photometry
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         a. Flame photometry
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         a. Flame photometry
      2. NH_4OAc extraction
         a. Flame photometry
   R. Sulfur
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         a. Methylene blue
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         a. Molybdovanadophosphoric-acid colorimetry
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         c. Iron removal
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      2. X-ray diffraction
      3. Differential thermal analysis
   B. Optical analysis
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   B. Saturated paste, capillary rise
      1. Saturation extract
         a. Conductivity
   C. pH
      1. Soil suspensions
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      2. To noncarbonate clay
      3. Ca to Mg (extractable)

PREFACE

This publication is one in a new U.S. Department of Agriculture series established to preserve and make available technical information resulting from soil survey investigations. These investigations have been going on for about two decades. Data from them have been distributed in unpublished form to those immediately concerned. Some of the data and descriptions have appeared in technical journals, in regional bulletins, in USDA technical bulletins, and in the text of published soil surveys. But most were not available to all who might use them.

We intend to publish in this series all data from the soil survey laboratories that form reasonably complete characterizations of soils. Already-assembled data and descriptions will be published just as rapidly as they can be prepared for printing. Fragmentary data collected as reference points for specific soil surveys will not be included.

While these data were being assembled, there were many changes in laboratory methods. Some were improved and some new ones were devised. Consequently, laboratory data for different soils cannot always be directly compared without allowance for the method.

The method used is indicated by symbol in the column headings of the data table. These symbols are identified in the code sheet on the opposite page. Each method is described in the first number of this series, "Soil Survey Laboratory Methods and Procedures for Collecting Soil Samples," SSIR No. 1.

Ways of describing soils have also changed. Soil descriptions have become explicit on more and more features. The systems for designating horizons and for classifying soils have been changed.

The soil descriptions published here were prepared as working documents to meet a specific need of a soil survey at the time the soil samples were collected. The soil scientists who wrote them had no idea they would be published. Editing has been limited for the most part to that necessary for conformance to the "Soil Survey Manual." Field textural estimates have been retained, even though some are at variance with the laboratory data, because the field estimates themselves are important data.

There were several reasons for sampling these soils. Some were sampled to study soil genesis, some to facilitate classification, and some to obtain data to permit more useful interpretations. Those sampled for genesis or classification studies do not always fit neatly into our present concepts of soil series. Partly because of these studies, our concepts of some soil series have been modified. As a consequence, the soil series name assigned a soil at the time of sampling is not always the name that would be assigned today. Soil series names in this publication follow 1965 series definitions.

Soil Survey
Soil Conservation Service

MONTANA

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Golden Valley	Snowy	S61Mont-19-1	125
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Judith Basin	Alder	S58Mont-23-4	7
	Alder	S58Mont-23-5	9
	Danvers	S58Mont-23-6	27
	Danvers	S58Mont-23-7	29
	Terrad	S58Mont-23-2	141
	Terrad	S58Mont-23-3	143
	Teton	S58Mont-23-1	145
Ravalli	Bass	S55Mont-41-4	17
	Gorus	S55Mont-41-1	49
	Gorus	S55Mont-41-2	51
	Sula	S55Mont-41-3	131
	Sula	S55Mont-41-5	133
	Sula	S55Mont-41-6	135
Roosevelt	Dimmick	S50Mont-43-1	35
	Flynn	S50Mont-43-2	37
	Flynn	S50Mont-43-5	39
	Frazer	S51Mont-43-5	43
	Glendive	S51Mont-43-1	47
	Havre	S51Mont-43-3	53
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	Lohmiller	S50Mont-43-3	89
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	Magnus	S51Mont-43-8	97
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	Straw	S51Mont-43-7	129
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Stillwater	Sweetgrass	S55Mont-48-1	137
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	Nunn	S56Mont-52-8	109
	Nunn	S56Mont-52-9	111
	Nunn	S56Mont-52-10	113
	Promise	S56Mont-52-5	121
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	Arvada	S52Mont-56-26	15
	Bone	S51Mont-56-5	19
	Cherry	S51Mont-56-9	25
	Danvers	S56Mont-56-1	31
	Danvers	S56Mont-56-2	33
	Fort Collins	S51Mont-56-8	41
	Gilt Edge	S53Mont-56-8	45
	Havre	S51Mont-56-10	57
	Hesper	S53Mont-56-1	59
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	Hesper	S53Mont-56-9	63
	Hopley	S51Mont-56-7	65
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	Hopley	S53Mont-56-12	69
	Hysham	S52Mont-56-28	71
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	Keiser	S51Mont-56-2	75
	Keiser	S53Mont-56-2	77
	Keiser	S53Mont-56-5	79
	Keiser	S53Mont-56-10	81
	Keiser	S56Mont-56-4	83
	Keiser	S56Mont-56-5	85
	Laurel	S52Mont-56-24	87
	Lohmiller	S51Mont-56-3	93
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	Nunn	S52Mont-56-21	115
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SOIL SURVEY LABORATORY Lincoln, Nebr. 3/4/58

SOIL TYPE Absarokee silty clay loam **LOCATION** Yellowstone County, Montana

SOIL NOS. S56Mont-56-7-(1-6) **LAB. NOS.** 4758-4763

DEPTH INCHES	HORIZON	1B1a PARTICLE SIZE DISTRIBUTION (in mm.) (per cent) 3A1 VERY COARSE SAND 2-1	COARSE SAND 1.0-0.5	MEDIUM SAND 0.5-0.25	FINE SAND 0.25-0.10	VERY FINE SAND 0.10-0.05	SILT 0.05-0.002	CLAY < 0.002	0.2-0.02	0.02-0.002	2A2 > 2 (<19mm)	TEXTURAL CLASS
0-3	A1	2.2	2.2	1.9	7.7	23.2	39.4	23.4	50.7	17.4	6	l
3-10	B21t	2.6	1.8	1.6	6.0	21.4	36.7	29.9	47.0	15.5	7	cl
10-16	B22t	2.6	1.5	1.3	4.3	17.1	36.9	36.3	41.3	15.9	9	cl
16-19	B23t	1.6	1.6	1.4	4.3	22.1	37.4	31.6	46.1	16.4	7	cl
19-24	C1ca	2.3	2.2	2.0	5.1	17.4	34.9	36.1	36.9	18.9	2	cl
24-35	IIC2ca	4.3	4.2	3.5	11.2	25.0	27.2	24.6	44.3	15.5	-	scl

pH 8C1b SATURATED PASTE	pH 8C1a 1:5	pH 8C1a 1:10	ORGANIC MATTER 6A1a ORGANIC CARBON %	ORGANIC MATTER 6B1a NITROGEN %	C:N	8A2 FST SALT (BUREAU CUP)	ELECTRICAL CONDUCTIVITY EC x 10³ MILLIMHOS PER CM 8A1a	6E1a $CaCO_3$ equivalent %	GYPSUM me./100g. SOIL	MOISTURE TENSIONS 1/10 ATMOS. %	MOISTURE TENSIONS 1/3 ATMOS. %	4B2 15 ATMOS. %
6.5	6.4	6.4	3.91	.343	11.4	<0.20	0.7	-				12.8
6.3	6.4	6.4	1.68	.164	10.2	<0.20	0.6	-				12.3
6.5	6.4	6.5	0.97	.120	8.1	<0.20	0.6	-				14.1
7.0	7.2	7.1	0.97	.114	8.5	<0.20	0.7	-				12.7
7.5	8.2	8.3	1.12	.112	10.0	<0.20	0.6	28				14.9
7.6	8.3	8.4	0.72			<0.20	0.7	24				10.0

5A1a CATION EXCHANGE CAPACITY NH_4Ac	EXTRACTABLE CATIONS 6N2b Ca	6O2b Mg	6H1a H	6P2a Na	5B1a 6Q2a K	5D2 EXCH. Na %	SATURATION EXTRACT SOLUBLE 8A1 6P1a Na	6Q1a K	8A MOISTURE AT SATURATION %
	milliequivalents per 100g. soil →						← milliequivalents per liter →		
21.6	15.8	2.9	4.2	-	2.2	-	0.2	1.6	61.0
22.2	17.3	2.9	3.8	-	1.6	-	0.2	0.7	47.6
27.3	39.4	6.4	3.0	0.1	1.2	-	0.2	0.3	55.9
26.0	24.5	3.2	2.1	-	0.7	-	0.3	0.2	55.2
16.9				0.1	0.4	-	0.3	0.2	55.2
11.6				0.1	0.3	1	0.5	0.2	46.4

Soil type: Absarokee silty clay loam
Soil No.: S56Mont-56-7
Location: Yellowstone County, Montana; 0.25 mile south and 0.25 mile west of northeast corner of Section 2, T4S, R25E.
Vegetation or crop: Native range consisting of bluebunch wheatgrass, Idaho fescue, western wheatgrass, junegrass, sandberg bluegrass and fringed sagewort.
Parent material: Moderately fine textured fine earth, probably partly loess and partly weathered from interbedded sandstone and shale.
Physiography: Residual upland.
Relief: Gently sloping, smooth.
Elevation: About 4000 feet.
Slope: 2 percent.
Aspect: Southeast.
Drainage: Well drained.
Erosion: None or slight.
Permeability: Moderate.
Moisture: Moderately dry to dry.
Climate: Semiarid; rainfall about 16 inches, growing season about 115 days.
Described by: Dave R. Cawlfield, September 26, 1956.

Horizon and Lincoln Lab. Number	
A1 4758	0 to 3 inches. Very dark brown to very dark grayish brown (10YR 2.5/2) loam, grayish brown (10YR 5/2) when dry; moderate fine to coarse platy breaking to moderate fine crumb structure; soft, very friable, slightly sticky and slightly plastic; no effervescense; pH 6.3; abundant roots; clear smooth boundary.
B21t 4759	3 to 10 inches. Dark yellowish brown (10YR 3/4) silty clay loam, dark grayish brown (10YR 4/2) when dry; strong medium prismatic breaking to strong coarse blocky structure; slightly hard, friable, sticky and plastic; no effervescense; pH 6.5; abundant roots; many fine and very fine pores; thin patchy clay skins; diffuse boundary.
B22t 4760	10 to 16 inches. Dark yellowish brown (10YR 3/4) heavy silty clay loam, dark grayish brown (10YR 4/2) when dry; strong medium and fine prismatic breaking to strong medium angular blocky; hard, friable, very sticky and very plastic; no effervescense; pH 6.5; abundant roots; many fine and very fine pores; moderate patchy clay skins; diffuse boundary.
B23t 4761	16 to 19 inches. Dark yellowish brown (10YR 3.5/4 to 10YR 4/4, crushed) silty clay loam, grayish brown (10YR 4.5/2) when dry; moderate fine prismatic breaking to strong medium and fine angular blocky; hard, friable, sticky and plastic; no effervescense; pH 7.0; abundant roots; many fine and very fine pores; moderate patchy clay skins; clear smooth boundary.
C1ca 4762	19 to 24 inches. Dark brown to brown (10YR 4.5/3) clay loam with about 10 percent inclusion of fine sandstone fragments; white (10YR 8/2) when dry; weak fine blocky structure; hard, firm, sticky and plastic; effervesces strongly; pH 8.8; plentiful roots; abrupt smooth boundary.
IIC2ca 4763	24 to 35 inches. Shattered sandstone with interstices filled with fine earth which is pale brown (10YR 6/3) loam, very pale brown (10YR 8/3) when dry; massive; soft, very friable, slightly sticky and slightly plastic; effervesces strongly; pH 8.8; plentiful roots; fine earth makes up about 50 percent of the mass; abrupt smooth boundary.
IIR	35 inches plus. Unweathered hard sandstone (not sampled).

SOIL SURVEY LABORATORY Lincoln, Nebr. 3/4/58

SOIL TYPE. Absarokee silty clay loam **LOCATION** Yellowstone County, Montana

SOIL NOS. S56Mont-56-8-(1-6) **LAB. NOS.** 4764-4769

DEPTH INCHES	HORIZON	1B1a PARTICLE SIZE DISTRIBUTION (in mm.) (per cent) 3A1 VERY COARSE SAND 2-1	COARSE SAND 1-0.5	MEDIUM SAND 0.5-0.25	FINE SAND 0.25-0.10	VERY FINE SAND 0.10-0.05	SILT 0.05-0.002	CLAY < 0.002	0.2-0.02	0.02-0.002	2A2 > 2 (<19mm)	TEXTURAL CLASS
0-3½	A1	1.6	1.9	1.4	5.2	21.2	45.9	22.8	49.0	21.6	4	l
3½-8	AB	2.6	1.9	1.3	3.8	21.1	40.5	28.8	46.7	17.6	5	cl
8-14	B21t	1.2	1.4	1.1	3.0	17.7	38.2	37.4	41.4	16.6	4	cl
14-23	B22t	2.3	1.4	0.8	2.6	17.3	37.7	37.9	40.0	16.9	2	cl
23-26	C1ca	1.4	1.0	0.7	2.3	15.4	38.2	41.0	35.9	19.4	4	c
26-37	IIC2ca	3.6	3.2	2.4	8.8	30.6	26.7	24.7	52.0	11.5	-	scl

	pH		ORGANIC MATTER			8A2	ELECTRICAL CONDUCTIVITY	6E1a		MOISTURE TENSIONS		
8C1b SATURATED PASTE	8C1a 1.5	8C1a 1:10	6A1a ORGANIC CARBON %	6B1a NITROGEN %	C/N	EST% SALT (BUREAU CUP)	EC×10³ MILLIMHOS PER CM 8A1a	$CaCO_3$ equivalent %	GYPSUM meq./100g. SOIL	1/10 ATMOS. %	1/3 ATMOS. %	4B2 15 ATMOS. %
6.5	6.6	6.5	4.83	.433	11.2	<0.20	0.6	-				15.6
6.2	6.4	6.4	1.76	.158	11.1	<0.20	0.6	-				11.2
6.3	6.7	6.5	0.96	.092	10.4	<0.20	0.5	-				14.0
6.4	6.7	6.7	0.78	.074	10.5	<0.20	0.5	-				14.8
7.6	8.3	8.3	1.06	.110	9.6	<0.20	0.8	31				14.1
7.8	8.5	8.5	0.37			<0.20	0.8	12				9.3

5A1a	EXTRACTABLE CATIONS 5B1a					5D2	SATURATION EXTRACT SOLUBLE 8A1					8A
CATION EXCHANGE CAPACITY NH_4Ac	6N2b Ca	6G2b Mg	6H1a H	6P2a Na	6Q2a K	EXCH. Na %	6P1a Na	6Q1a K				MOISTURE AT SATURATION %
← milliequivalents per 100g. soil →							← milliequivalents per liter →					
25.5	20.2	3.5	5.4	-	1.3	-	0.2	0.6				67.6
21.5	16.0	3.0	3.3	0.1	1.1	-	0.3	0.5				47.0
26.2	20.0	4.4	3.4	0.1	0.9	-	0.3	0.2				53.4
29.1	23.6	4.7	6.3	0.1	0.6	-	0.4	0.1				54.9
18.6				0.1	0.3	-	0.6	0.1				60.2
13.8				0.2	0.2	1	0.7	0.1				47.6

Soil type: Absarokee silty clay loam
Soil No.: S56Mont-56-8
Location: Yellowstone County, Montana; 1200 feet east and 800 feet north of southwest corner of Section 28, T3S, R28E.
Vegetation or crop: Native range consisting of Idaho fescue, bluebunch wheatgrass, western wheatgrass, silver sagebrush and some phlox.
Parent material: Moderately fine textured fine earth, probably partly loess and partly weathered from interbedded sandstone and shale.
Physiography: Residual upland.
Relief: Gently sloping, smooth.
Elevation: About 4000 feet.
Slope: 2 percent.
Drainage: Well drained.
Erosion: None or slight.
Permeability: Moderate.
Moisture: Moderately dry on surface, dry below.
Climate: Semiarid; rainfall about 16 inches, growing season about 115 days.
Described by: Dave R. Cawlfield, September 27, 1956.

Horizon and Lincoln Lab. Number	
A1 4764	0 to 3½ inches. Very dark brown (10YR 2/2) loam, dark grayish brown (10YR 3.5/2) when dry; weak medium platy breaking to moderate fine crumb structure; soft, very friable, nonsticky and nonplastic; no effervescense; pH 6.0; abundant roots; clear smooth boundary.
AB 4765	3½ to 8 inches. Very dark brown (10YR 2/2) silty clay loam, to grayish brown (10YR 4.5/2) when dry, to brown (10YR 5/3) when crushed; strong medium prismatic breaking to moderate medium and fine angular blocky structure; slightly hard, friable, sticky and plastic; no effervescense; pH 6.5; abundant roots; moderate fine medium and very fine and few medium pores; clear smooth boundary.
B21t 4766	8 to 14 inches. Dark brown (10YR 3/3 to 3/4 crushed) silty clay, grayish brown (10YR 5/2) when dry; strong medium prismatic breaking to strong fine and very fine angular blocky structure; hard, friable, very sticky and very plastic; no effervescense; pH 6.5; abundant roots; moderate fine and very fine pores; moderate continuous clay skins; diffuse boundary.
B22t 4767	14 to 23 inches. Dark brown (10YR 4/3.5) silty clay, brown (10YR 4.5/3) when dry and crushed; strong medium prismatic breaking to strong fine and very fine angular blocky structure; hard, friable, very sticky and very plastic; no effervescense; pH 7.0; abundant roots; few fine and moderate very fine pores; thick continuous clay skins; clear wavy boundary.
C1ca 4768	23 to 26 inches. Grayish brown to brown (10YR 5/2.5) clay loam, very pale brown (10YR 8/3) dry; moderate medium and fine angular blocky; slightly hard, friable; sticky and plastic; effervesces violently; pH not determined; plentiful roots; many fine and very fine pores; clear wavy boundary.
IIC2ca 4769	26 to 37 inches. Shattered sandstone and shale with interstices filled with fine earth which is brown (10YR 5/3) loam, white (10YR 8/2) when dry; massive; soft, very friable, slightly sticky and slightly plastic; effervesces violently; pH not recorded; plentiful roots with matting of roots along structure planes; gradual boundary.
IIR	Hard sandstone interbedded with soft yellow and brown shale (not sampled).

SOIL SURVEY LABORATORY Lincoln, Nebr. February 1959

SOIL TYPE Alder silty clay loam **LOCATION** Judith Basin County, Montana

SOIL NOS. S58Mont-23-4-(1-5) **LAB NOS.** 8387-8391

DEPTH INCHES	HORIZON	1B1a PARTICLE SIZE DISTRIBUTION (in mm.) (per cent) VERY COARSE SAND 2-1	COARSE SAND 1-0.5	MEDIUM SAND 0.5-0.25	FINE SAND 0.25-0.10	VERY FINE SAND 0.10-0.05	SILT 0.05-0.002	CLAY < 0.002	3A1 0.2-0.02	0.02-0.002	2A2 > 2 (<19mm)	TEXTURAL CLASS
0-4	A1	3.0	1.9	1.0	3.8	8.0	52.8	29.5	33.6	29.7	Tr.	sicl
4-10	B1	2.8	2.1	0.9	3.0	7.6	52.4	31.2	33.7	28.3	Tr.	sicl
10-14	B21	1.2	1.2	0.6	0.9	8.5	54.3	33.3	33.1	29.9	3	sicl
14-21	B22	2.0	1.3	0.5	1.2	6.6	46.2	42.2	24.8	28.6	6	sic
21-27	B3	1.2	1.0	0.4	0.5	4.5	52.3	40.1	19.6	37.3	14	sic

	pH 8C1a		ORGANIC MATTER 6A1a ORGANIC CARBON	6B1a NITROGEN	C/N	Free Iron Fe_2O_3 6C1a	ELECTRICAL CONDUCTIVITY EC×10³ MILLIMHOS PER CM @25°C.	6E1a $CaCO_3$ equivalent	GYPSUM me./100g. SOIL	MOISTURE TENSIONS 1/10 ATMOS.	1/3 ATMOS.	4B2 15 ATMOS.
1:1	1:5	1:10	%	%		%		%		%	%	%
	6.1		6.36	0.476	13.4	0.8						17.3
6.1			3.18	0.256	12.4	0.9						13.9
6.3			1.37	0.126	10.9	0.8						13.3
6.4			0.77	0.084	9	0.8						17.8
6.7			0.49	0.055	9	0.4		<1				18.7

5A1a CATION EXCHANGE CAPACITY NH_4Ac	EXTRACTABLE CATIONS 6N2b Ca	6O2b Mg	6H1a H	6P2a Na	5B1a 6Q2a K	5C1 Base Sat. % NH_4Ac Exch.	5C3 Base Sat. % on Sum Cations	5B1a Sum Ext. Bases	5A3a Sum Ext. Cations	8D3 Ca/Mg
←	milliequivalents per 100g. soil				→			me/100 g		
36.2	23.2	4.3	12.3	<0.1	3.6	86	72	31.1	43.4	5.4
32.5	21.2	4.6	8.8	0.1	2.9	89	76	28.8	37.6	4.6
30.2	19.8	4.5	4.6	0.1	2.5	89	85	26.9	31.5	4.4
47.2	33.1	10.1	1.9	0.3	3.9	100	96	47.4	49.3	3.3
59.6	46.3	13.1	2.9	0.6	5.4	110	96	65.4	68.3	3.5

Soil type: Alder silty clay loam
Soil No.: S58Mont-23-4
Location: Judith Basin County, Montana; 530 feet west of east quarter corner of Section 24, T18N, R8E.
Vegetation: Sandberg bluegrass, prairie junegrass, fringed sagewort, Idaho fescue, broom snakeweed, and annuals.
Elevation: 4750 feet.
Parent material: Thinly stratified shale and cherty sandstone of Colorado formation.
Physiography: Upland.
Relief: Gently rolling.
Slope: 3 percent.
Aspect: North.
Drainage: Good.
Ground water: Deep.
Salt or alkali: None.
Moisture: Moist to 4 inches.
Root distribution: Plentiful through B22.
Erosion: None to slight.
Note: Angular rock fragments are common throughout profile.
Sampled by: James Allen, Dave Cawlfield, Ernest Hogan, and John Parker.
Described by: Dave R. Cawlfield, June 24, 1958.

Horizon and Lincoln Lab. Number	
A1 8387	0 to 4 inches. Dark gray (10YR 4/1 dry, 2/1 moist) heavy loam; moderate fine crumb structure; soft, very friable, sticky and plastic; abundant roots; clear boundary.
B1 8388	4 to 10 inches. Dark gray (10YR 4/1 dry, 2/1 moist) heavy loam; moderate medium prismatic; moderate medium and fine subangular blocky structure; slightly hard, friable, sticky and plastic; abundant roots; gradual bounday.
B21 8389	10 to 14 inches. Dark gray (10YR 4/1 dry, 2/1 moist) clay loam; moderate medium prismatic and moderate medium and coarse subangular blocky structure; slightly hard, friable, sticky and plastic; continuous distinct clay films on vertical faces and patches on horizontal faces; plentiful roots; clear boundary.
B22 8390	14 to 21 inches. Grayish brown (2.5Y 5/2 dry, 3/2 moist) silty clay; strong fine subangular blocky structure; hard, firm, very sticky and very plastic; plentiful roots; continuous distinct clay films on all faces; gradual boundary.
B3 8391	21 to 27 inches. Grayish brown to light brownish gray (2.5Y 5/2 to 6/2 dry, 4/4 to 3/2 moist) clay; moderate medium angular blocky structure; hard, firm, very sticky and very plastic; continuous distinct clay films on vertical faces and patches on horizontal faces; few roots.

SOIL SURVEY LABORATORY Lincoln, Nebr. February 1959

SOIL TYPE Alder loam **LOCATION** Judith Basin County, Montana

SOIL NOS. S58Mont-23-5-(1-5) **LAB. NOS.** 8392-8396

DEPTH INCHES	HORIZON	1B1a PARTICLE SIZE DISTRIBUTION (in mm.) (per cent) 3A1 VERY COARSE SAND 2-1	COARSE SAND 1-0.5	MEDIUM SAND 0.5-0.25	FINE SAND 0.25-0.10	VERY FINE SAND 0.10-0.05	SILT 0.05-0.002	CLAY < 0.002	0.2-0.02	0.02-0.002	2A2 > 2 (<19mm)	TEXTURAL CLASS
0-5	A1	4.9	3.6	2.5	3.0	16.5	44.8	24.7	37.4	24.1	Tr.	l
5-13	B1	4.2	4.1	2.5	3.9	15.6	43.5	26.2	39.1	21.5	Tr.	l
13-17	B21	2.4	3.0	2.0	2.7	18.7	40.6	30.6	41.0	19.0	11	cl
17-22	B22	2.6	2.6	1.4	2.7	25.0	27.6	38.1	40.3	13.1	21	cl
22-27	B3	0.8	0.8	0.6	1.0	11.6	19.7	65.5	20.3	11.2	6	c

	pH 8C1a		ORGANIC MATTER 6A1a	6B1a		Free Iron Fe_2O_3%	ELECTRICAL CONDUCTIVITY EC×10³ MILLIMHOS PER CM @25°C.	$CaCO_3$ equivalent	GYPSUM me./100g. SOIL	MOISTURE TENSIONS 1/10 ATMOS.	1/3 ATMOS.	4B2 15 ATMOS.
1:1	1:5	1:10	ORGANIC CARBON %	NITROGEN %	C/N	6C1a		%		%	%	%
	6.1		6.87	0.496	13.8	1.3						15.8
5.6			3.36	0.246	13.6	1.5						12.2
5.8			1.17	0.102	11.5	1.6						11.9
5.8			0.72	0.066	11	1.9						14.4
5.8			0.67			1.3						25.2

5A1a CATION EXCHANGE CAPACITY NH_4Ac	EXTRACTABLE CATIONS 6N2b Ca	6O2b Mg	6H1a H	6P2a Na	5B1a 6Q2a K	5C1 Base Sat. % NH_4Ac Exch.	5C3 Base Sat. % on Sum Cations	5B1a Sum Ext. Bases	5A3a Sum Ext. Cations	8D3 Ca/Mg
← milliequivalents per 100g. soil →								me/100 g		
31.4	17.7	3.6	16.4	<0.1	2.4	75	59	23.7	40.1	4.9
25.6	14.8	3.6	13.0	<0.1	1.1	76	60	19.5	32.5	4.1
24.3	15.3	5.4	6.5	0.1	0.5	88	77	21.3	27.8	2.8
33.0	22.2	8.4	6.1	0.1	0.4	94	84	31.1	37.2	2.6
65.3	48.7	16.3	6.8	0.4	.0.4	100	91	65.8	72.6	3.0

Soil type: Alder loam
Soil No.: S58Mont-23-5
Location: Judith Basin County, Montana; 1000 feet south and 75 feet west of center of Section 13, T18N, R8E.
Vegetation: Bluebunch wheatgrass, western wheatgrass, Idaho fescue, prairie junegrass, sandberg bluegrass, threadleaf sage, yarrow, and lupine.
Elevation: 4800 feet.
Parent material: Thinly stratified shale and cherty sandstone of Colorado formation.
Physiography: Upland.
Relief: 25 to 50 feet.
Slope: 3 percent.
Aspect: Northeast.
Drainage: Good.
Salt or alkali: None.
Root distribution: Plentiful to 22 inches, few below.
Erosion: None to slight.
Permeability: Moderately slow.
Stoniness: None.
Sampled by: James Allen, Dave Cawlfield, Ernest Hogan, and John Parker.
Described by: Dave R. Cawlfield, June 24, 1958.

Horizon and Lincoln Lab. Number	
A1 8392	0 to 5 inches. Dark gray (10YR 4/1 dry, 2/1 moist) thin charred layer 0.1 to 0.25-inch thick about 1 inch below the surface, loam; moderate fine crumb structure; soft, very friable, slightly sticky and plastic; does not effervesce; abundant roots; clear boundary.
B1 8393	5 to 13 inches. Dark gray (10YR 4/1 dry, 2/1 moist) heavy loam; moderate medium prismatic and weak medium subangular blocky structure; slightly hard, friable, sticky and plastic; patches of clay films on vertical faces; does not effervesce; abundant roots; gradual boundary.
B21 8394	13 to 17 inches. Grayish brown (10YR 5/2 dry, 2/2 moist) light silty clay; weak medium prismatic and moderate fine subangular blocky structure; slightly hard, friable, very sticky and very plastic; continuous distinct clay films on vertical faces and patches on horizontal faces; does not effervesce; plentiful roots; clear boundary.
B22 8395	17 to 22 inches. Grayish brown (10YR 5/2 dry, 3/3 moist) silty clay; moderate medium prismatic and strong fine angular blocky structure; hard, firm, very sticky and very plastic; continuous distinct clay skins on all faces; does not effervesce; plentiful roots; gradual boundary.
B3 8396	22 to 27 inches. Dark grayish brown (10YR 4/2, mottled with 2.5Y 4/2 and 10YR 5/6, dry, 3/3 moist, and f2d 5Y 3/2 and 7.5YR 4/4 mottling) clay; moderate medium angular blocky structure; extremely hard, very firm, very sticky and very plastic; continuous distinct clay films on all faces; does not effervesce; few roots.
IIR	27 to 40 inches. Not sampled.

Notes: Angular rock fragments are common throughout profile; shattered hard fine gravel sandstone thinly bedded with layers of clay shale lie immediately below the B3 horizon; there are some plant roots in the partially weathered shale layers to a depth of about 40 inches; in some places the material between sandstone layers has blocky structure with clay skins on ped faces.

SOIL SURVEY LABORATORY Mandan, N. Dak.

SOIL TYPE Arvada silty clay loam **LOCATION** Yellowstone County, Montana

SOIL NOS. S51Mont-56-4 **LAB. NOS.** 670-675

DEPTH INCHES	HORIZON	1B1a PARTICLE SIZE DISTRIBUTION (in mm.) (per cent) 3A1 VERY COARSE SAND 2-1	COARSE SAND 1-0.5	MEDIUM SAND 0.5-0.25	FINE SAND 0.25-0.10	VERY FINE SAND 0.10-0.05	SILT 0.05-0.002	CLAY < 0.002	0.2-0.02	0.02-0.002	2A2 > 2	TEXTURAL CLASS
0-3	A2	0.2	0.4	0.9	4.1	8.7	49.8	35.9	29.8	31.5	-	sicl
3-9	B21	0.1	0.3	0.9	4.4	11.4	48.7	34.2	34.1	29.3	-	sicl
9-18	B22t	0.1	0.1	0.7	4.5	12.2	38.0	44.4	32.3	21.2	-	c
18-30	B3	-	0.1	1.1	8.3	19.6	41.0	29.9	47.4	19.6	-	cl
30-39	C1ca	-	0.1	1.2	13.4	27.1	35.6	22.6	56.8	16.8	-	l
39-55	C2ca	-	0.1	1.1	6.3	17.5	52.4	22.6	49.1	25.3	-	sil

8C1b SATURATED PASTE	pH 8C1a 1:5	8C1a 1:10	ORGANIC MATTER 6A1a ORGANIC CARBON %	6B1a NITROGEN %	C/N	8A2 EST% SALT (BUREAU CUP)	ELECTRICAL CONDUCTIVITY EC×10³ MILLIMHOS PER CM 8A1a	6K1a $CaCO_3$ equivalent %	6P1a GYPSUM me./100g. SOIL	MOISTURE TENSIONS 1/10 ATMOS. %	1/3 ATMOS. %	4B2 15 ATMOS. %
7.5	8.0	8.4	2.00	0.188	10.6	-	0.8	tr.	-			13.8
7.7	8.4	8.7	0.93	0.105	8.8	0.24	5.0	tr.	-			12.7
8.2	8.6	8.7	0.43	0.056	7.7	1.05	15.0	1	8			17.8
8.5	9.4	9.7	0.20	0.034		0.77	13.0	4	-			12.9
9.3	10.3	10.4	0.16	0.024		-	2.6	10	2			12.2
9.0	10.2	10.3	0.16	0.024		-	2.0	11	-			12.1

5A1a CATION EXCHANGE CAPACITY NH_4OAc	5B1a CATIONS EXTRACTABLE 6N2b Ca	6O2b Mg	EXCHANGEABLE 6P2a Na	6Q2a K	5B1b EXCH. Na %	5D2 SATURATION EXTRACT SOLUBLE 6P1a Na	6Q1a K	6J1a HCO_3	6K1a Cl	6L1a SO_4	8A1 8A MOISTURE AT SATURATION %
← milliequivalents per 100g. soil →						← milliequivalents per liter →					
25.5	18.1	7.6	0.3	2.4	1	2.2	0.9				55.0
22.2	14.4	8.0	3.4	1.7	15	40.6	0.6				52.0
25.4			11.7	1.0	46	170.0	-	5.7	9.9	86.0	79.2
18.2			11.8	0.6	65	156.0	-				69.2
15.3			11.9	0.5	78	27.6	-				75.9
17.8			11.4	0.5	64	20.9	-				69.2

Soil type: Arvada silty clay loam
Soil No.: 51Mont-56-4
Location: Yellowstone County, Montana; SW1/4 NE1/4 Section 29, T3N, R29E.
Vegetation: Dry pasture.
Parent material: Cretaceous alluvium.
Physiographic position: Terrace, level.
Slope: 0.5 percent.
Erosion: Very little.
Drainage: Imperfect.
Moisture: Moist.
Stoniness: None.
Root distribution: Good.
Classification: Solonetz.
Described by: W. C. Bourne, August 8, 1951.

Horizon and Mandan Lab. Number	
A2 670	0 to 3 inches. Dark grayish brown (2.5Y 4/2) moist, silty clay loam; moderate platy structure; soft, friable, sticky and plastic; noncalcareous.
B21 671	3 to 9 inches. Dark grayish brown (10YR 4/2) moist, silty clay; prismatic structure; hard, friable, very sticky and very plastic; noncalcareous.
B22t 672	9 to 18 inches. Brown (10YR 4.5/3) moist, silty clay loam; strong medium blocky structure; very hard, firm, very sticky and very plastic; calcareous.
B3 673	18 to 30 inches. Brown (10YR 5/3) moist, silt loam; weak blocky structure; hard, friable, sticky and plastic; calcareous.
C1ca 674	30 to 39 inches. Light olive brown (2.5Y 5/3) moist, loam; massive structure; soft, friable, slightly sticky and slightly plastic; calcareous with segregated lime.
C2ca 675	39 to 55 inches. Light olive brown (2.5Y 5/3) moist, silt loam; massive structure; soft, friable, slightly sticky and slightly plastic; calcareous with segregated lime.

SOIL SURVEY LABORATORY Mandan, N. Dak.

SOIL TYPE Arvada silt loam **LOCATION** Yellowstone County, Montana

SOIL NOS. S52Mont-56-25 **LAB. NOS.** 1027-1033

DEPTH INCHES	HORIZON	1B1a PARTICLE SIZE DISTRIBUTION (in mm.) (per cent) VERY COARSE SAND 2-1	COARSE SAND 1-0.5	MEDIUM SAND 0.5-0.25	FINE SAND 0.25-0.10	VERY FINE SAND 0.10-0.05	SILT 0.05-0.002	CLAY < 0.002	3A1 0.2-0.02	0.02-0.002	2A2 > 2	TEXTURAL CLASS
0-2	A21	-	0.6	1.3	8.1	26.6	50.9	12.5	64.0	19.2	-	sil
2-4	A22	-	0.2	0.9	7.1	24.3	50.1	17.4	59.8	19.9	-	sil
4-9	B21t	-	0.2	1.0	8.2	20.8	42.1	27.7	50.2	18.8	-	cl
9-14	B22tcs	-	0.2	1.0	10.4	21.5	41.4	25.5	49.2	21.5	-	l
14-27	C1	-	0.2	1.1	15.5	32.2	32.7	18.3	63.1	14.1	-	l
27-33	C2	-	0.1	0.6	8.7	36.1	38.7	15.8	68.7	13.4	-	l
33-54	C3	-	0.2	3.1	29.6	27.9	28.2	11.0	65.6	10.8	-	vfsl

8C1b pH SATURATED PASTE	8C1a pH 1:5	8C1a pH 1:10	6A1a ORGANIC MATTER ORGANIC CARBON %	NITROGEN %	C/N	8A2 EST% SALT (BUREAU CUP)	ELECTRICAL CONDUCTIVITY EC×10³ MILLIMHOS PER CM 8A1a	6E1a $CaCO_3$ equivalent %	6F1a GYPSUM me./100g. SOIL	MOISTURE TENSIONS 1/10 ATMOS. %	1/3 ATMOS. %	4B2 15 ATMOS. %
7.0	7.5	7.7	1.80			-	1.8	tr.	-			7.1
6.9	8.0	8.2	0.96			-	1.0	tr.	-			7.6
6.9	7.4	7.4	0.81			0.37	9.0	tr.	-			11.6
8.1	8.5	8.6	0.64			0.76	15+	2	11			9.0
8.7	9.5	9.6	0.35			0.53	14.0	9	-			8.4
8.8	9.9	10.0	0.29			0.38	8.5	7	-			6.0
8.4	10.0	10.1	0.18			-	4.0	5	-			5.1

5A1a CATION EXCHANGE CAPACITY NH_4OAc	5B1a CATIONS EXTRACTABLE 6N2b Ca	6O2b Mg	H	5B1b EXCHANGEABLE 6P2a Na	6Q2a K	5D2 EXCH. Na %	SATURATION EXTRACT SOLUBLE 8A1 6P1a Na	6Q1a K	8A MOISTURE AT SATURATION %
	milliequivalents per 100g. soil						milliequivalents per liter		
13.9	7.3	5.1		0.3	1.2	2	5.0	1.0	39.8
14.8	8.2	12.6		1.3	1.2	9	7.2	0.5	32.1
22.2				3.6	1.0	16	72.0	0.9	47.8
20.8				5.8	0.7	28	183.0	0.8	52.4
14.0				5.3	0.5	38	159.0	0.8	41.2
14.0				5.8	0.6	41	106.0	0.8	44.9
12.1				4.7	0.5	39	40.2	0.2	38.9

Soil type: Arvada silt loam
Soil No.: S52Mont-56-25
Location: Yellowstone County, Montana; NE1/4 SE1/4 Section 5, T2N, R28E, a few rods from S52Mont-56-24 (Laurel).
Topography: Moderately high; fairly old river terrace; generally well drained however irrigated land just above has been tiled.
Vegetation: Wheatgrass and associated perennials and big sagebrush.
Root distribution: Good.
Described by: W. C. Bourne, July 1952.

Horizon and Mandan Lab. Number	
A21 1027	0 to 2 inches. Light gray (10YR 7/2) silt loam, grayish brown (10YR 5/2) moist; platy structure; soft, friable, nonsticky and nonplastic; noncalcareous.
A22 1028	2 to 4 inches. Grayish brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) moist, inside broken peds; outsides are coated light gray (10YR 7/2) to grayish brown (10YR 5/2) moist; prisms separating to platy structure; soft, friable, nonsticky and nonplastic; noncalcareous.
B21t 1029	4 to 9 inches. Grayish brown (10YR 5/2) clay loam, very dark grayish brown (10YR 3/2) moist; strong medium prismatic structure; hard, friable, sticky and plastic; noncalcareous.
B22tcs 1030	9 to 14 inches. Light yellowish brown (2.5Y 6/3) heavy loam, dark grayish brown (2.5Y 4.5/2) moist; calcareous in lower part with crystals of gypsum.
C1 1031	14 to 27 inches. Light gray (2.5Y 7/2) loam, light olive brown (2.5Y 5/3) moist; slightly hard, friable, nonsticky and nonplastic; calcareous.
C2 1032	27 to 33 inches. Light gray (2.5Y 7/2) loam, grayish brown (2.5Y 5/2) moist; slightly hard, friable, nonsticky and nonplastic; calcareous.
C3 1033	33 to 54 inches. Colors as in horizon above in loamy fine sand and fine sandy loam; soft, very friable, nonsticky and nonplastic; calcareous.
IIC4	54 inches plus. Loose sand and gravel (not sampled).

SOIL SURVEY LABORATORY Mandan, N. Dak.

SOIL TYPE Arvada silty clay loam **LOCATION** Yellowstone County, Montana

SOIL NOS. S52Mont-56-26 **LAB. NOS.** 1034-1038

DEPTH INCHES	HORIZON	1B1a PARTICLE SIZE DISTRIBUTION (in mm.) (per cent) 3A1 VERY COARSE SAND 2-1	COARSE SAND 1-0.5	MEDIUM SAND 0.5-0.25	FINE SAND 0.25-0.10	VERY FINE SAND 0.10-0.05	SILT 0.05-0.002	CLAY < 0.002	0.2-0.02	0.02-0.002	2A2 > 2	TEXTURAL CLASS
0-3	A2	-	0.4	1.0	7.5	26.8	54.8	9.5	66.1	21.1	-	sil
3-9	B2t	-	0.3	0.9	5.3	18.1	43.9	31.5	45.4	20.5	-	cl
9-14	B2sa	-	0.1	0.7	4.7	14.7	40.5	39.3	36.1	22.7	-	cl
14-26	C1cs	-	-	0.2	2.3	12.3	51.1	34.1	33.0	32.4	-	sicl
26-52	C2	-	-	0.1	1.8	23.9	54.1	20.1	57.6	22.0	-	sil

	pH		ORGANIC MATTER			8A2	ELECTRICAL CONDUCTIVITY	6E1a	6F1a	MOISTURE TENSIONS		
8C1b SATURATED PASTE	8C1a 1:5	8C1a 1:10	6A1a ORGANIC CARBON %	NITROGEN %	C/N	EST% SALT (BUREAU CUP)	EC×10³ MILLIMHOS PER CM 8A1a	$CaCO_3$ equivalent %	GYPSUM me./100g. SOIL	1/10 ATMOS. %	1/3 ATMOS. %	4B2 15 ATMOS. %
6.6	7.4	7.5	1.43			-	8.4	tr.	-			14.1
8.4	9.2	9.5	0.70			0.46	10.0	tr.	-			17.4
8.4	8.6	8.8	0.44			1.24	15+	1	4			15.7
8.6	8.7	8.9	0.34			0.86	15+	8	15			10.6
9.0	10.0	10.2	0.24			0.43	7.5	8	-			10.7

5A1a CATION EXCHANGE CAPACITY NH_4OAc	5R1a EXTRACTABLE CATIONS 6N2b Ca	6O2b Mg	H	5R1b EXCHANGEABLE 6P2a Na	6Q2a K	5D2 EXCH. Na %	SATURATION EXTRACT SOLUBLE 6P1a Na	6Q1a K	3A1			8A MOISTURE AT SATURATION %
← milliequivalents per 100g. soil →							← milliequivalents per liter →					
10.2	4.9	2.5		0.5	1.6	5	5.6	1.0				36.3
23.0	6.1	12.1		9.3	1.0	40	117.0	0.5				60.7
26.0		18.7		13.5	0.8	52	248.0	0.8				71.6
22.1		?		12.0	0.6	54	241.0	0.8				59.2
17.2		?		10.5	0.6	61	87.0	0.2				63.6

Soil type: Arvada silty clay loam
Soil No.: S52Mont-56-26
Location: Yellowstone County, Montana; NE1/4 SE1/4 Section 5, T2N, R28E, a few rods from S52Mont-56-25 (Arvada).
Position: Terrace with good drainage.
Parent material: River alluvium.
Vegetation: Wheatgrass and associated perennial grasses, gumweed, sage and greasewood.
Root distribution: Good.
Described by: W. C. Bourne, July 1952.

Horizon and Mandan Lab. Number	
A2 1034	0 to 3 inches. Pale brown (10YR 6/2.5) silt loam, dark grayish brown (10YR 4/2) moist; platy structure; soft, very friable, nonsticky and nonplastic; noncalcareous; abrupt boundary.
B2t 1035	3 to 9 inches. Grayish brown (10YR 5/2) heavy silty clay loam, dark grayish brown (10YR 4/2) moist; strong columns 2 to 6 inches in diameter with the upper 1/2-inch having weak platy structure and coated light gray; hard, firm, sticky and plastic; noncalcareous.
B2sa 1036	9 to 14 inches. Light yellowish brown (2.5Y 6/3) heavy silty clay loam; olive brown (2.5Y 4/3) moist; moderate blocky structure; hard, firm, sticky and plastic; calcareous with abundant salt crystals.
C1cs 1037	14 to 26 inches. Grayish brown (2.5Y 5/2) heavy silty clay loam, very dark grayish brown (2.5Y 3/2) moist; weak blocky structure; hard, friable, sticky and plastic; calcareous with gypsum crystals.
C2 1038	26 to 52 inches. Light brownish gray (2.5Y 6/2) silt loam, dark grayish brown (2.5Y 3.5/2) moist; massive structure; soft, friable, nonsticky and nonplastic.

SOIL SURVEY LABORATORY Lincoln, Nebr. 4/19/57

SOIL TYPE Bass silt loam **LOCATION** Ravalli County, Montana

SOIL NOS. S55Mont-41-4 **LAB. NOS.** 2971-2974

DEPTH INCHES	HORIZON	1B1a PARTICLE SIZE DISTRIBUTION (in mm.) (per cent) 3A1 VERY COARSE SAND 2-1	COARSE SAND 1-0.5	MEDIUM SAND 0.5-0.25	FINE SAND 0.25-0.10	VERY FINE SAND 0.10-0.05	SILT 0.05-0.002	CLAY < 0.002	0.2-0.02	0.02-0.002	2A2 > 2 (<19mm.)	TEXTURAL CLASS
0-7	Ap	10.0	7.3	2.9	4.1	7.7	52.3	15.7	36.3	26.1	7	sil
7-12	B21	11.3	7.4	3.1	4.5	7.6	49.2	16.9	35.4	24.1	11	l
12-22	IIB22	42.7	19.8	5.2	5.6	4.3	12.6	9.8	12.5	7.4	42	cosl
22-36	IIC	28.0	21.6	9.1	11.2	6.7	13.5	9.9	18.1	8.1	53	cosl

	pH 8C1a		ORGANIC MATTER 6A1a	6B1a		EST% SALT (BUREAU CUP)	ELECTRICAL CONDUCTIVITY EC×10³ MILLIMHOS PER CM @25°C.	6E1a		MOISTURE TENSIONS		4B2
1:1	1:5	1:10	ORGANIC CARBON %	NITROGEN %	C/N			$CaCO_3$ equivalent %	GYPSUM me./100g. SOIL	1/10 ATMOS. %	1/3 ATMOS. %	15 ATMOS. %
5.7	6.0	6.6	2.12	.165	12.8							8.7
5.9	6.2	6.0	0.90	.078	11.5							7.9
5.9	6.3	6.3	0.25	.022	11.4							5.2
6.1	6.4	6.5	0.13	.012				1				4.5

5A1a CATION EXCHANGE CAPACITY NH_4Ac	EXTRACTABLE CATIONS 5B1a 6N2b Ca	6O2b Mg	6H1a H	6P2a Na	6Q2a K	BASE SAT. % 5C1	SATURATION EXTRACT SOLUBLE Na	K	MOISTURE AT SATURATION %
←	milliequivalents per 100g. soil →						← milliequivalents per liter →		
15.8	9.6	1.4	7.0	0.2	0.3	73			
13.5	9.1	1.4	4.0	0.2	0.2	81			
8.6	7.2	1.1	2.2	0.1	0.1	99			
9.3			1.4	0.2	0.1				

Soil type: Bass silt loam
Soil No.: S55Mont-41-4
Location: Ravalli County, Montana; SW, NW, NE of Section 2, T2N, R21W.
Vegetation: Run-out meadow.
Parent material: Weathered gneiss outwash with some loess in the top 12 inches.
Physiography: High fan terrace.
Relief: Smooth, convex, 3 percent east-southeast-facing slope.
Drainage: Well drained.
Root distribution: To depth sampled.
Collected by: W. C. Bourne, James Allen, R. A. Campanella, and Dave Gardiner, August 25, 1955.
Described by: W. C. Bourne.

Horizon and Mandan Lab. Number	
Ap 2971	0 to 7 inches. Dark grayish brown (10YR 4/2 dry) to very dark grayish brown (10YR 2.5/2 moist) gritty silt loam; coarse platy to moderate coarse granular; hard when dry, friable when moist; intermixed loess and weathered gneiss.
B21 2972	7 to 12 inches. Brown (10YR 5/3 dry) to dark grayish brown (9YR 4/2 moist) gritty loam; coarse and medium blocky; hard when dry, friable when moist; some mixing of color from above; gray leachings on some of ped surfaces.
IIB22 2973	12 to 22 inches. Dark brown (7.5YR 3/4 moist) gravelly coarse sandy loam; in place the material is weathered gritty clay loam in bands 1 to 3 inches thick around the weathered gneiss boulders and cobbles.
IIC 2974	22 to 36 inches. Weathered cobbles and boulders mostly gneiss with occasional schist and sandstone.

SOIL SURVEY LABORATORY Mandan, N. Dak.

SOIL TYPE *Bone silty clay loam **LOCATION** Yellowstone County, Montana

SOIL NOS. S51Mont-56-5 **LAB. NOS.** 676-682

DEPTH INCHES	HORIZON	PARTICLE SIZE DISTRIBUTION (in mm.) (per cent) 3A1 1B1a VERY COARSE SAND 2-1	COARSE SAND 1-0.5	MEDIUM SAND 0.5-0.25	FINE SAND 0.25-0.10	VERY FINE SAND 0.10-0.05	SILT 0.05-0.002	CLAY < 0.002	0.2-0.02	0.02-0.002	2A2 > 2	TEXTURAL CLASS
0-2	A2	-	-	0.2	0.5	2.4	61.4	35.5	24.7	39.4	-	sicl
2-7	B2tsa	-	-	0.1	0.3	2.1	56.0	41.6	24.6	33.6	-	sic
7-14	B3sa	-	-	0.1	0.5	4.7	56.0	38.7	30.1	31.0	-	sicl
14-28	C1sa	-	-	0.1	1.1	5.4	57.7	35.7	29.8	34.1	-	sicl
28-38	C2sa	-	0.1	0.1	1.2	6.0	50.9	41.7	43.4	14.4	-	sic
38-60	C3	-	-	0.1	0.5	3.2	49.9	46.3	20.8	32.7	-	sic

8C1b SATURATED PASTE	pH 8C1a 1:5	8C1a 1:10	ORGANIC MATTER 6A1a ORGANIC CARBON %	6B1a NITROGEN %	C/N	6A2 EST% SALT (BUREAU CUP)	ELECTRICAL CONDUCTIVITY EC×10³ MILLIMHOS PER CM 6A1a	6K1a $CaCO_3$ equivalent %	6F1a GYPSUM me./100g. SOIL	MOISTURE TENSIONS 1/10 ATMOS. %	1/3 ATMOS. %	4B2 15 ATMOS. %
8.3	9.7	9.9	1.67	0.166	10.1	-	2.5	3	-			16.2
8.5	9.5	9.8	1.01	0.164	6.2	0.69	9.5	3	-			19.1
8.4	8.8	9.0	0.66	0.074	8.9	1.10	15.0	1	7			18.3
8.4	8.8	9.0	0.54	0.062	8.7	1.22	20.0	1	9			16.5
8.4	9.1	9.3	0.37	0.054	6.8	1.46	20.0	4	5			17.5
8.5	9.0	9.2	0.21	0.032	6.6	1.46	18.0	3	7			18.8

5A1a CATION EXCHANGE CAPACITY NH_4OAc	EXCHANGEABLE CATIONS 5B1b Ca	Mg	H	6P2a Na	6Q2a K	5D2 EXCH. Na %	SATURATION EXTRACT SOLUBLE 8A1 6P1a Na	6Q1a K	6J1a HCO_3	6K1a Cl	6L1a SO_4	8A MOISTURE AT SATURATION %
← milliequivalents per 100g. soil →							← milliequivalents per liter →					
24.2				8.5	2.0	35	25.0	0.4				57.7
27.3				19.1	1.2	70	115.0	-				107.2
26.5				19.6	0.9	74	198.0	0.2	8.5	24.7	92.3	87.3
25.0				19.4	0.8	78	265.0	0.2				76.3
23.4				19.2	0.9	82	283.0	0.2	6.0	9.0	122.1	80.0
26.1				20.6	1.0	79	256.0	0.2				101.9

Soil type: *Bone silty clay loam
Soil No.: S51Mont-56-5
Location: Yellowstone County, Montana; SW1/4 NE1/4 Section 28, T3N, R29E.
Vegetation: Greasewood (pasture).
Parent material: Cretaceous alluvium.
Physiographic position: Terrace, level.
Slope: 0.5 percent.
Erosion: None to slight.
Drainage: Imperfect.
Moisture: Moist.
Stoniness: Free.
Root distribution: Good.
Classification: Solonetz.
Described by: W. C. Bourne, August 8, 1951.

Horizon and Mandan Lab. Number	
A2 676	0 to 2 inches. Light brownish gray (2.5Y 6/2) silty clay; olive brown (2.5Y 4/3) moist; vesicular massive in blocks; hard, friable, slightly sticky and slightly plastic; calcareous.
B2tsa 677	2 to 7 inches. Olive brown (2.5Y 4/3) moist, silty clay; columnar structure, separating to angular blocks; very hard, firm, sticky and plastic; calcareous with segregated salt in spots.
B3sa 679	7 to 14 inches. Olive brown (2.5Y 4/3) moist, silty clay loam; weak blocky structure; slightly hard, friable, sticky and plastic; calcareous with segregated salt in spots.
C1sa 680	14 to 28 inches. Olive brown (2.5Y 4/3) moist, silty clay; crumb structure; soft, friable, sticky and plastic; calcareous with segregated salt in many spots.
C2sa 681	28 to 38 inches. Olive brown (2.5Y 4/4) moist, silty clay; crumb structure; soft, friable, sticky and plastic; calcareous with many spots of segregated salt.
C3 682	38 to 60 inches. Olive brown (2.5Y 4/4) moist, silty clay; massive structure; very hard, very firm, very sticky and very plastic; calcareous.

Remarks: Laboratory No. 678 not assigned. Very saline, black crusts in low spot, vegetation sparse, and bare areas.

SOIL SURVEY LABORATORY Lincoln, Nebr. 4/19/57

SOIL TYPE Charlos loam **LOCATION** Carbon County, Montana

SOIL NOS. 855Mont-5-1 **LAB. NOS.** 2992-2997

DEPTH INCHES	HORIZON	1H1a PARTICLE SIZE DISTRIBUTION (in mm.) (per cent) 3A1 VERY COARSE SAND 2-1	COARSE SAND 1-0.5	MEDIUM SAND 0.5-0.25	FINE SAND 0.25-0.10	VERY FINE SAND 0.10-0.05	SILT 0.05-0.002	CLAY < 0.002	0.2-0.02	0.02-0.002	2A2 > 2 (<19mm)	TEXTURAL CLASS
0-7	Ap	9.2	7.7	3.7	8.3	12.5	38.1	20.5	36.9	18.5	7	l
7-11	B1	10.0	7.4	3.3	8.3	13.4	34.4	23.2	36.1	16.6	14	l
11-16	B21	12.1	8.0	4.1	9.8	12.0	27.2	26.8	32.5	12.5	11	scl
16-24	IIB22	34.2	20.1	5.8	8.7	6.5	12.8	11.9	18.2	5.7	29	cosl
24-35	IIC1	38.4	28.4	7.2	8.6	4.4	7.6	5.4	12.4	3.8	29	cos
35-48	IIC2	39.9	28.7	9.5	9.4	3.1	5.1	4.3	9.8	2.3	43	cos

pH 1:1	pH 1:5	8C1a 1:10	ORGANIC MATTER 6A1a ORGANIC CARBON %	6B1a NITROGEN %	C/N	EST% SALT (BUREAU CUP)	ELECTRICAL CONDUCTIVITY EC×10³ MILLIMHOS PER CM @25°C.	6E1a $CaCO_3$ equivalent %	GYPSUM mg./100g. SOIL	MOISTURE TENSIONS 1/10 ATMOS. %	1/3 ATMOS. %	4B2 15 ATMOS. %
5.9	6.1	6.1	2.37	.187	12.7							9.5
5.8	6.0	6.0	0.93	.084	11.1							9.6
5.8	6.0	6.1	0.65	.054	12.0							10.7
5.9	6.1	6.2	0.33	.026	12.7							6.1
6.0	6.1	6.2	0.10									3.5
5.9	6.2	6.2	0.08					-				2.8

5A1a CATION EXCHANGE CAPACITY NH4Ac	EXTRACTABLE CATIONS 6N2b Ca	6O2b Mg	6H1a H	6P2a Na	6Q2a K	BASE SAT. % 5C1	SATURATION EXTRACT SOLUBLE	MOISTURE AT SATURATION %
← milliequivalents per 100g. soil →							← milliequivalents per liter →	
17.8	10.2	2.5	7.0	0.1	0.5	75		
17.9	10.4	3.7	5.2	0.1	0.3	81		
21.7	12.3	5.2	4.5	0.1	0.3	82		
12.2	7.4	3.0	3.2	0.1	0.1	87		
7.4	4.8	1.8	1.6	0.1	0.1	92		
5.0	3.6	1.4		0.1	0.1			

Soil type: Charlos loam
Soil No.: S55Mont-5-1
Location: Carbon County, Montana; SW, NW, NW of Section 15, T7S, R20E.
Vegetation: New seeding of alfalfa.
Parent material: Weathered granitic outwash of probable Pleistocene Age.
Physiography: High fan terrace.
Relief: Smooth, 1 percent north-northeast-facing slope.
Drainage: Well drained.
Root distribution: Good.
Stoniness: Scattered cobbles on surface.
Collected by: W. C. Bourne, James Allen, R. L. Moshier, August 29, 1955.
Described by: W. C. Bourne.

Horizon and Mandan Lab. Number	
Ap 2992	0 to 7 inches. Very dark brown (10YR 2/2 moist) loam; strong medium and coarse granular; friable when moist, slightly sticky and slightly plastic when wet; clear boundary.
B1 2993	7 to 11 inches. Brown with dark brown coatings (9YR 4/3 and 3.5/3 moist) loam; moderate fine and medium subangular blocky; friable when moist, slightly sticky and slightly plastic when wet.
B21 2994	11 to 16 inches. Yellowish brown with brown coatings (9YR 5/4 and 4/3 moist) gritty clay loam; moderate fine and medium subangular blocky; friable when moist, slightly plastic when wet; clear boundary.
IIB22 2995	16 to 24 inches. Strong brown (7.5YR 5/6 with 4/6 coatings moist) heavy gritty clay loam; moderate fine and medium subangular blocky; firm when moist, sticky and plastic when wet; clear boundary.
IIC1 2996	24 to 35 inches. Strong brown (7.5YR 5/6 moist) loamy sand and fine gravel (more than 65 percent of 2-mm.); diffuse boundary.
IIC2 2997	35 to 48 inches. Strong brown (7.5YR 5/6 moist) loamy gravel (80 percent coarser than 2-mm.)

Remarks: Sample was collected in the southeast corner of Klages' experimental plots on the Tom Marriet farm two miles north of Red Lodge. Clay skins on peds of B1, B21, and B22.

SOIL SURVEY LABORATORY Lincoln, Nebr. 4/19/57

SOIL TYPE Charlos loam **LOCATION** Carbon County, Montana

SOIL NOS. S55Mont-5-2 **LAB. NOS.** 2998-3003

DEPTH INCHES	HORIZON	1B1a PARTICLE SIZE DISTRIBUTION (in mm.) (per cent) VERY COARSE SAND 2-1	COARSE SAND 1-0.5	MEDIUM SAND 0.5-0.25	FINE SAND 0.25-0.10	VERY FINE SAND 0.10-0.05	SILT 0.05-0.002	CLAY < 0.002	3A1 0.2-0.02	0.02-0.002	2A2 > 2 <19mm	TEXTURAL CLASS
0-7	Ap	10.8	9.2	3.9	8.0	13.6	37.7	16.8	38.4	17.7	7	l
7-11	B1	10.7	8.5	3.2	7.2	14.2	37.4	18.8	40.0	16.1	10	l
11-15	B21	8.6	6.2	2.5	6.8	15.6	36.3	24.0	40.3	16.0	15	l
15-23	B22	6.4	5.9	3.3	10.1	16.2	31.8	26.3	40.1	14.3	7	l
23-31	IIC1	27.6	27.1	9.7	12.6	6.8	10.3	5.9	18.9	4.5	35	lcos
31-42	IIC2	24.2	44.9	13.8	9.3	2.2	3.6	2.0	7.6	1.8	28	cos

	pH 8C1a		ORGANIC MATTER 6A1a	6B1a		EST% SALT (BUREAU CUP)	ELECTRICAL CONDUCTIVITY EC×10³ MILLIMHOS PER CM @25°C.	6E1a		MOISTURE TENSIONS		4B2
1:1	1:5	1:10	ORGANIC CARBON %	NITROGEN %	C/N			$CaCO_3$ equivalent %	GYPSUM me./100g. SOIL	1/10 ATMOS. %	1/3 ATMOS. %	15 ATMOS. %
5.6	5.9	6.0	1.94	.165	11.8							8.2
5.7	6.1	6.2	0.80	.079	10.1							7.6
5.8	6.2	6.2	0.61	.068	9.0							9.6
5.9	6.3	6.6	0.46	.050	9.2							10.1
6.1	6.3	6.0	0.13									2.9
6.1	6.4	6.1	0.06					1				1.7

5A1a	EXTRACTABLE CATIONS				5B1a	BASE SAT. % 5C1	SATURATION EXTRACT SOLUBLE					
CATION EXCHANGE CAPACITY NH_4Ac	6N2b Ca	6O2b Mg	6H1a H	6P2a Na	6Q2a K							MOISTURE AT SATURATION %
← milliequivalents per 100g. soil →							← milliequivalents per liter →					
15.7	8.8	1.9	7.0	0.2	0.3	71						
13.2	8.2	2.3	4.2	0.1	0.3	82						
17.2	10.6	3.9	4.0	0.2	0.4	88						
19.4	12.0	5.1	3.6	0.2	0.4	91						
5.5	3.5	1.2	0.8	0.1	0.1	87						
2.7		0.6		0.1	0.1							

Soil type: Charlos loam
Soil No.: S55Mont-5-2
Location: Carbon County, Montana; SW, NW, NW of Section 3, T7S R20E.
Vegetation: Timothy meadow.
Parent material: Strongly weathered granitic outwash.
Physiography: High fan terrace presumably of Pleistocene Age.
Relief: Smooth, 1 percent north-northeast-facing slope.
Drainage: Well drained.
Root distribution: Good.
Stoniness: Scattered surface cobbles.
Collected by: W. C. Bourne, J. S. Allen, R. L. Moshier, and A. G. Fielder, August 29, 1955.
Described by: W. C. Bourne.

Horizon and Mandan Lab. Number	
Ap 2998	0 to 7 inches. Dark grayish brown (10YR 4/2 dry) to very dark brown (10YR 2/1.5 moist) loam; strong medium and coarse granular; friable when moist, slightly sticky and slightly plastic when wet; clear boundary.
B1 2999	7 to 11 inches. Brown (10YR 4/3 dry) to dark brown (10YR 2.7/3 moist) heavy loam; moderate medium and fine subangular blocky; friable when moist, slightly sticky and slightly plastic when wet; gradual boundary.
B21 3000	11 to 15 inches. Yellowish brown with brown coatings on the peds (10YR 5/4 and 4/3 moist) clay loam; moderate medium and fine subangular blocky; friable when moist, sticky and plastic when wet; gradual boundary.
B22 3001	15 to 23 inches. Yellowish brown with dark brown coatings on the peds (9YR 5/6 and 4/3 moist) heavy clay loam; moderate medium and fine subangular blocky; firm when moist, sticky and plastic when wet; clear boundary.
IIC1 3002	23 to 31 inches. Dark yellowish brown (10YR 4/4 moist) loamy sand and gravel; the material is 80 percent coarser than 2-mm. with pockets of loam between the cobbles and gravel; clear boundary.
IIC2 3003	31 to 42 inches. Strongly weathered sand and gravel.

OIL SURVEY LABORATORY Mandan, N. Dak.

SOIL TYPE Cherry silty clay **LOCATION** Yellowstone County, Montana

SOIL NOS. 951Mont-56-9 **LAB. NOS.** 701-707

DEPTH INCHES	HORIZON	1B1a PARTICLE SIZE DISTRIBUTION (in mm.) (per cent) 3A1 VERY COARSE SAND 2-1	COARSE SAND 1-0.5	MEDIUM SAND 0.5-0.25	FINE SAND 0.25-0.10	VERY FINE SAND 0.10-0.05	SILT 0.05-0.002	CLAY < 0.002	0.2-0.02	0.02-0.002	2A2 > 2	TEXTURAL CLASS
0-8	Ap	-	0.1	0.3	1.2	2.4	45.7	50.3	15.8	33.2	-	sic
8-19	B2	-	0.1	0.2	0.5	1.7	46.7	50.8	15.0	33.8	-	sic
19-23	C1	-	0.1	0.3	3.6	18.5	47.4	30.1	46.9	21.9	-	cl
23-39	C2	-	-	0.1	0.7	4.3	49.8	45.1	21.1	33.6	-	sic
39-54	C3	-	0.1	0.3	3.3	23.2	44.7	28.4	52.8	18.0	-	cl
54-58	A1b	0.1	0.7	4.9	24.6	22.5	33.8	13.4	58.0	13.7	-	vfsl
58-64	IIB2b	-	0.1	1.0	11.1	22.3	31.2	34.3	51.4	10.6	-	cl

8C1b SATURATED PASTE	pH 8C1a 1:5	8C1a 1:10	ORGANIC MATTER 6A1a ORGANIC CARBON %	6B1a NITROGEN %	C/N	8A2 EST% SALT (BUREAU CUP)	ELECTRICAL CONDUCTIVITY EC×10³ MILLIMHOS PER CM 8A1a	6E1a $CaCO_3$ equivalent %	6F1a GYPSUM me./100g. SOIL	MOISTURE TENSIONS 4B2 1/10 ATMOS. %	1/3 ATMOS. %	15 ATMOS. %
7.7	8.4	8.4	1.18	0.128	9.2	-	0.4	1	-			20.6
7.8	8.6	8.9	0.54	0.070	7.7	-	0.4	2	-			20.0
7.9	8.6	8.7	0.46	0.063	7.3	-	0.5	2	-			18.6
7.8	8.7	9.0	0.26	0.043	6.0	-	0.7	3	-			11.3
7.8	8.8	9.0	0.20	0.035		-	0.5	tr.	-			9.7
7.7	8.1	8.4	0.23	0.034		-	0.6	2	-			5.2
7.8	8.4	8.6	0.38	0.060	6.3	-	0.5	4	-			14.3

5A1a CATION EXCHANGE CAPACITY NH_4OAc	5B1a EXTRACTABLE CATIONS 602b Mg	5B1b EXCHANGEABLE CATIONS 6P2a Na	6Q2a K	5D2 EXCH. Na %	SATURATION EXTRACT SOLUBLE 8A1 6P1a Na	6Q1a K	8A MOISTURE AT SATURATION %
	← milliequivalents per 100g. soil →				← milliequivalents per liter →		
34.1		0.3	1.9	1	1.3	0.4	74.6
33.2		0.5	0.8	2	1.3	-	76.1
31.0		0.5	0.6	2	1.5	-	74.6
22.0		0.3	0.5	1	1.7	-	52.2
20.3	5.2	0.3	0.4	2	1.3	-	50.2
9.8		0.3	0.5	3	2.2	-	28.9
25.3		0.3	0.9	1	1.3	-	62.1

Soil type: Cherry silty clay
Soil No.: S51Mont-56-9
Location: Yellowstone County, Montana; SW1/4 SE1/4 Section 33, T3N, R29E.
Vegetation: Wheat stubble, irrigated.
Parent material: Cretaceous alluvium.
Physiographic position: Terrace (fan).
Slope: 0.5 percent.
Erosion: None to slight.
Drainage: Fair.
Moisture: Wet.
Stoniness: Free.
Root distribution: Good.
Classification: Alluvial soil.
Described by: W. C. Bourne, August 10, 1951.

Horizon and Mandan Lab. Number	
Ap 701	0 to 8 inches. Grayish brown (2.5Y 5/2) silty clay; massive structure; hard, firm, sticky and plastic; noncalcareous.
B2 702	8 to 19 inches. Olive brown (2.5Y 4/4) moist, silty clay; strong angular blocky structure; hard, firm, sticky and plastic; calcareous.
C1 703	19 to 23 inches. Olive brown (2.5Y 4/4) moist, silty clay; angular blocky structure; hard, friable, slightly sticky and slightly plastic; calcareous.
C2 704	23 to 39 inches. Olive brown (2.5Y 4/3) silty clay loam; angular blocky structure; hard, friable, sticky and plastic; strongly calcareous.
C3 705	39 to 54 inches. Olive brown (2.5Y 4/3) silty clay loam made up of layers of silt loam and silty clay loam; massive structure; hard, friable, slightly sticky and slightly plastic; calcareous.
A1b 706	54 to 58 inches. Very dark grayish brown (10YR 3/2) moist, fine sandy loam; massive structure; soft, very friable, nonsticky and nonplastic; calcareous.
IIB2b 707	58 to 64 inches. Brown (10YR 4/3) moist, silty clay loam; strong medium blocky structure; hard, friable, sticky and plastic; calcareous.

Remarks: Drainage obstruction at 58 inches.

SOIL SURVEY LABORATORY Lincoln, Nebr. February, 1959

SOIL TYPE Danvers silty clay loam **LOCATION** Judith Basin County, Montana

SOIL NOS. S58Mont-23-6-(1-7) **LAB. NOS.** 8397-8403

DEPTH INCHES	HORIZON	1B1a PARTICLE SIZE DISTRIBUTION (in mm.) (per cent) 3A1 VERY COARSE SAND 2-1	COARSE SAND 1-0.5	MEDIUM SAND 0.5-0.25	FINE SAND 0.25-0.10	VERY FINE SAND 0.10-0.05	SILT 0.05-0.002	CLAY < 0.002	0.2-0.02	0.02-0.002	2A2 > 2 (<19mm)	TEXTURAL CLASS
0-4	Ap	1.2	2.1	2.8	7.7	11.7	42.6	31.9	37.9	21.0	2	cl
4-8	B2	0.6	1.7	2.8	7.8	8.7	38.6	39.8	32.5	19.4	1	cl
8-12	B3	2.7	2.9	4.6	11.5	9.7	32.5	36.1	30.6	18.1	14	cl
12-19	C1ca	1.6	2.4	3.9	10.9	9.9	32.5	38.8	29.9	19.0	2	cl
19-27	C2ca	0.8	1.6	2.8	8.9	9.8	35.5	40.6	30.2	20.4	15	c
27-31	IIC3	19.6	13.8	9.3	14.1	7.2	17.2	18.8	21.4	9.8	73	cosl
31-45	IIC4	18.0	22.4	19.5	17.4	5.0	10.6	7.1	16.3	6.2	74	lcos

1:1	pH 1:5	8C1a 1:10	ORGANIC MATTER 6A1a ORGANIC CARBON %	6B1a NITROGEN %	C/N	Free Iron Fe_2O_3 6C1a	ELECTRICAL CONDUCTIVITY EC×10³ MILLIMHOS PER CM @25°C.	6E1a $CaCO_3$ equivalent %	GYPSUM me./100g. SOIL	MOISTURE TENSIONS 4B1a 1/10 ATMOS. %	4B1a 1/3 ATMOS. %	4B2 15 ATMOS. %
6.3			1.93	0.171	11.3	1.5						12.2
7.3			1.10	0.132	8.3	1.5		2				15.0
8.0			1.33	0.135	9.8	1.3		18				13.7
8.2			0.94	0.098	10	1.2		24				13.0
8.3			0.53	0.066	8	1.1		26				12.7
8.4			0.30			1.2		29				8.7
8.7			0.07			1.7		24		8.3	7.3	4.2

5A1a CATION EXCHANGE CAPACITY NH_4Ac	EXTRACTABLE CATIONS 6N2b Ca	6O2b Mg	6H1a H	6P2a Na	6Q2a K	5C1 Base Sat. % NH_4Ac Exch.	5C3 Base Sat. % on Sum Cations	5B1a Sum Ext. Bases	5A3a Sum Ext. Cations	8D3 Ca/Mg		
←	milliequivalents per 100g. soil				→			me/100 g				
21.6	15.6	2.8	6.0	<0.1	1.4	92	77	19.8	25.8	5.6		
27.3				<0.1	0.8							
19.0				0.1	0.4							
16.4				0.1	0.3							
16.4				0.1	0.4							
8.5				0.1	0.2							
5.2				0.1	0.1							

Soil type: Danvers silty clay loam
Soil No.: S58Mont-23-6
Location: Judith Basin County, Montana; 900 feet north and 450 feet east of southwest corner of Section 1, T18N, R12E, in summer fallow.
Climate: Semiarid.
Elevation: 3750 feet.
Parent material: Clay loam mantle on gravel-capped land.
Physiography: Smooth high terrace.
Relief: Nearly level.
Slope: 1/2 to 1 percent.
Drainage: Well.
Ground water: Very deep.
Salt or alkali: None.
Moisture: Moist.
Root distribution: Plentiful to 12 inches, few below.
Erosion: Slight.
Permeability: Moderately slow.
Stoniness: Few gravel on surface and through the solum.
Sampled by: James Allen, Dave Cawlfield, Ernest Hogan, and John Parker.
Described by: Dave R. Cawlfield, June 24, 1958.

Horizon and Lincoln Lab. Number	
Ap 8397	0 to 4 inches. Gray (10YR 5/1 dry, 2/2 moist) clay loam; moderate fine granular structure; soft, friable, sticky and plastic; does not effervesce; plentiful roots; abrupt boundary.
B2 8398	4 to 8 inches. Grayish brown (10YR 5/2 dry, 4/2 moist) silty clay; moderate medium prismatic and strong fine blocky structure; hard, friable, very sticky and very plastic; continuous distinct clay skins on all faces; does not effervesce; plentiful roots; clear wavy boundary.
B3 8399	8 to 12 inches. Gray (10YR 5/1 and 6/1 dry, 2.5Y 3/2 moist) silty clay; moderate medium prismatic and moderate fine angular blocky structure; slightly hard, firm, very sticky and very plastic; continuous distinct clay skins on vertical faces and patches on horizontal faces; slight effervescence; plentiful roots; gradual boundary.
C1ca 8400	12 to 19 inches. Light gray (10YR 7/2 dry, 2.5Y 4/2 moist) clay; moderate medium and coarse blocky structure; slightly hard, firm, sticky and plastic; effervesces violently; diffuse boundary.
C2ca 8401	19 to 27 inches. Gray (10YR 6/1 dry, 2.5Y 4/2 moist) clay; moderate medium and coarse blocky structure; slightly hard, friable, sticky and very plastic; effervesces violently; clear wavy boundary.
IIC3 8402	27 to 31 inches. Light gray (10YR 7/2 dry, 2.5Y 5/2 moist) gravelly clay loam; massive structure; slightly hard, friable, slightly sticky and slightly plastic; effervesces violently; clear boundary.
IIC4 8403	31 to 45 inches. Very gravelly clay loam, estimated 1/3 sand, 1/3 fine gravel (2-mm. to 3/4-inch), and 1/3 gravel (3/4-inch to 3 inches); massive structure; loose, effervesces violently.

SOIL SURVEY LABORATORY Lincoln, Nebr. February, 1959

SOIL TYPE Danvers silty clay loam **LOCATION** Judith Basin County, Montana

SOIL NOS. S58Mont-23-7-(1-7) **LAB. NOS.** 8404-8410

DEPTH INCHES	HORIZON	1B1a PARTICLE SIZE DISTRIBUTION (in mm.) (per cent) 3A1 VERY COARSE SAND 2-1	COARSE SAND 1-0.5	MEDIUM SAND 0.5-0.25	FINE SAND 0.25-0.10	VERY FINE SAND 0.10-0.05	SILT 0.05-0.002	CLAY < 0.002	0.2-0.02	0.02-0.002	2A2 > 2 (<19mm)	TEXTURAL CLASS
0-4	Ap	1.0	2.7	3.4	9.1	10.5	40.0	33.3	35.1	20.5	Tr.	cl
4-10	B2	0.9	1.8	3.0	4.3	13.6	38.2	38.2	33.1	19.3	Tr.	cl
10-14	B3	1.8	2.5	4.2	5.1	15.0	32.8	38.6	29.3	18.6	11	cl
14-23	C1ca	1.3a	2.2a	3.3a	4.4a	14.0a	30.5	44.3	26.8	17.9	8	c
23-34	C2	1.0a	1.5a	2.4a	5.7a	12.6a	31.8	45.0	28.1	18.7	8	c
34-39	IIC3	7.3a	4.9a	5.9a	14.6a	14.1a	21.2	32.0	29.3	12.6	60	scl
39-50	IIC4	13.1a	6.8a	8.7a	28.2a	12.6a	12.7	17.9	32.4	6.9	70	sl

	pH 8C1a		ORGANIC MATTER 6A1a	6B1a		Free Iron Fe_2O_3% 6C1a	ELECTRICAL CONDUCTIVITY EC×10³ MILLIMHOS PER CM 25°C.	6E1a		MOISTURE TENSIONS		4B2
	1:5	1:10	ORGANIC CARBON %	NITROGEN %	C/N			$CaCO_3$ equivalent %	GYPSUM me./100g. SOIL	1/10 ATMOS. %	1/3 ATMOS. %	15 ATMOS. %
1:1												
6.4			1.68	0.164	10.2	1.6						12.9
7.2			1.27	0.128	9.9	1.5		<1				14.7
8.1			1.08	0.129	8.4	1.2		19				13.2
8.3			0.72	0.071	10	1.0		27				13.4
8.5			0.24	0.029		0.9		30				13.0
8.7			0.13			1.1		25				10.2
8.7			0.08			1.2		18				6.3

5A1a CATION EXCHANGE CAPACITY NH_4Ac	EXTRACTABLE CATIONS 5B1a 6N2b Ca	6O2b Mg	6H1a H	6P2a Na	6Q2a K	5C1 Base Sat.% NH_4Ac Exch.	5C3 Base Sat.% on Sum Cations	5B1a Sum Ext. Bases	5A3a Sum Ext. Cations	8D3 Ca/Mg		
←	milliequivalents per 100g. soil →							me/100 g				
21.7	16.2	3.5	4.6	<0.1	1.4	97	82	21.1	25.7	4.6		
25.7	25.2	4.4	2.8	<0.1	0.8	118	92	30.4	33.2	5.7		
18.3				<0.1	0.4							
16.6				<0.1	0.4							
15.5				0.1	0.4							
11.7				0.1	0.2							
8.9				0.1	0.2							

a. Common $CaCO_3$ concr.

Soil type: Danvers silty clay loam
Soil No.: S58Mont-23-7
Location: Judith Basin County, Montana; 190 feet south and 125 feet west of northeast corner of Section 1, T18N, R12E.
Vegetation: Summer fallow field.
Elevation: 3750 feet.
Parent material: Clay mantle (old alluvium over stratified gravels, sand and clays).
Physiography: High terrace upland plain.
Relief: Less than 1 percent.
Aspect: None.
Drainage: Good.
Ground water: Deep.
Salt or alkali: None.
Moisture: Moist through C horizon.
Root distribution: Plentiful to 14 inches; few below.
Erosion: Slight.
Permeability: Moderately slow.
Stoniness: Few gravels on surface and through solum; gravels are mixed.
Sampled by: James Allen, Dave Cawlfield, Ernest Hogan, and John Parker.
Described by: Dave R. Cawlfield, June 24, 1958.

Horizon and Lincoln Lab. Number	
Ap 8404	0 to 4 inches. Gray (10YR 5/1 dry, 2/2 moist) heavy silty clay loam; moderate medium granular structure; slightly hard, firm, sticky and plastic; abrupt boundary.
B2 8405	4 to 10 inches. Grayish brown (2.5Y 5/2 dry, 10YR 3/2 moist) silty clay; moderate medium prismatic, strong medium and fine subangular blocky structure; hard, firm, very sticky and very plastic; continuous distinct clay skins on all faces; plentiful roots; clear boundary.
B3 8406	10 to 14 inches. Gray (10YR 5/1 dry, 4/2 moist) silty clay, prominent amount of fine gravel; moderate medium subangular blocky structure; hard, firm, very plastic and very sticky; continuous distinct clay films on vertical faces and patches on horizontal faces; effervesces slightly; plentiful roots; gradual boundary.
C1ca 8407	14 to 23 inches. Gray (10YR 6/1 dry, 5/2 moist) light clay; moderate medium and fine subangular blocky structure; hard, firm, very sticky and very plastic; patches of clay films on vertical faces; effervesces violently; few roots; gradual boundary.
C2 8408	23 to 34 inches. Light gray (5Y 7/2 dry, 5/2 moist) light clay; massive structure; slightly hard, friable, very sticky and plastic; effervesces violently; few roots; clear boundary.
IIC3 8409	34 to 39 inches. Light gray (5Y 7/2 dry, 5/2 moist) gravelly clay loam; massive structure; hard, friable, sticky and plastic; effervesces violently; few roots; clear boundary.
IIC4 8410	39 to 50 inches. Light gray (5Y 7/2 dry, 5/2 moist) very gravelly sand; massive structure; loose, very friable, nonsticky and nonplastic; effervesces violently.

SOIL SURVEY LABORATORY Lincoln, Nebr. 3/3/58

SOIL TYPE Danvers silty clay loam **LOCATION** Yellowstone County, Montana

SOIL NOS. S56Mont-56-1(1-9) **LAB. NOS.** 4712-4720

DEPTH INCHES	HORIZON	1B1a PARTICLE SIZE DISTRIBUTION (in mm.) (per cent) VERY COARSE SAND 2-1	COARSE SAND 1-0.5	MEDIUM SAND 0.5-0.25	FINE SAND 0.25-0.10	VERY FINE SAND 0.10-0.05	SILT 0.05-0.002	CLAY < 0.002	3A1		2A2 > 2 (<19mm)	TEXTURAL CLASS
									0.2-0.02	0.02-0.00[illegible]		
0-5	Ap	1.2	1.5	3.7a	9.7a	14.1a	38.9	30.9	41.8	17.1	5	cl
5-9	B21t	0.8	1.0	3.5a	8.5a	13.7a	31.8	40.7	36.1	14.3	2	c
9-13	B22t	0.9	0.8	3.0a	10.2a	15.0a	30.8	39.3	36.0	15.9	1	cl
13-17	B3	0.7	0.7	3.4a	12.4a	14.8a	30.7	37.3	34.3	18.7	3	cl
17-22	C1ca	0.7b	0.9b	3.9b	14.0b	13.1b	27.0	40.4	30.6	17.7	2	c
22-28	C2	0.9b	1.8b	5.7b	20.4b	18.3b	26.8	26.1	41.2	16.1	3	scl
28-41	C3	0.8b	1.4b	6.0b	20.6b	19.7b	26.5	25.0	42.7	15.5	2	scl
41-48	C4ca	0.8b	1.6b	4.1b	13.1b	19.4b	32.6	28.4	41.6	18.8	6	cl
48-60+	C5	1.1	1.6	6.3a	17.8a	25.4a	31.9	15.9	53.8	14.4	6	vfsl

pH 8C1b SATURATED PASTE	pH 8C1a 1:5	pH 8C1a 1:10	ORGANIC MATTER 6A1a ORGANIC CARBON %	ORGANIC MATTER 6B1a NITROGEN %	ORGANIC MATTER C/N	8A2 EST% SALT (BUREAU CUP)	ELECTRICAL CONDUCTIVITY EC×10³ MILLIMHOS PER CM 8A1a	6E1a $CaCO_3$ equivalent %	GYPSUM req. (tons/100 SOIL	MOISTURE TENSIONS 1/10 ATMOS. %	MOISTURE TENSIONS 1/3 ATMOS. %	4B2 15 ATMOS. %
7.6	7.7	7.9	1.50	.138	10.9	<0.20	0.8	-				13.5
7.3	7.7	7.8	1.13	.104	10.9	<0.20	0.8	-				18.0
7.5	7.8	8.2	1.12	.119	9.4	<0.20	0.7	3				19.2
7.7	8.2	8.4	1.01	.106	9.5	<0.20	0.7	26				15.3
8.0	8.5	8.8	0.57	.065	8.8	<0.20	0.7	38				13.7
8.2	8.9	9.0	0.24	.024		<0.20	0.8	32				12.3
8.6	9.1	9.1	0.16			<0.20	0.9	29				12.7
8.7	9.1	9.3	0.06			<0.20	0.9	33				10.0
8.6	9.1	9.3	0.05			<0.20	1.1	12				8.9

5A1a CATION EXCHANGE CAPACITY NH_4Ac	EXTRACTABLE CATIONS Ca	6O2b Mg	6H1a H	6P2a Na	6Q2a K	5D2 EXCH. Na %	8A1 SATURATION EXTRACT SOLUBLE 6P1a Na	6Q1a K	8A MOISTURE AT SATURATION %
	milliequivalents per 100g. soil						milliequivalents per liter		
26.7		4.0	0.8	0.1	1.1	-	0.3	0.3	54.2
33.4		6.2	0.4	0.1	0.7	-	0.3	0.1	66.3
31.6				0.1	0.6	-	0.3	0.1	71.7
18.2				0.2	0.3	1	0.6	0.1	62.8
11.9				0.5	0.2	3	2.4	-	57.9
11.5				0.8	0.2	5	3.6	-	56.1
11.5				1.3	0.2	9	5.6	0.1	56.7
11.8				1.5	0.2	10	6.1	0.1	48.4
15.0				1.8	0.4	10	7.5	0.1	38.8

a. Few $CaCO_3$ concr.
b. Common $CaCO_3$ concr.

Soil type: Danvers silty clay loam
Soil No.: S56Mont-56-1
Location: Yellowstone County, Montana; 850 feet north and 150 feet west of southeast corner of Section 4, T1N, R29E.
Vegetation or crop: Small grain stubble field.
Parent material: Silty fine earth, probably loess, over gravels.
Physiography: High terrace.
Relief: Smooth convex, 1 percent north slope.
Elevation: Approximately 3,700 feet (about 600 feet above Yellowstone Valley).
Drainage: Well drained.
Erosion: None or slight.
Permeability: Moderate to moderately slow.
Moisture: Moderately dry, moist below 20 inches.
Climate: Cool, semiarid; average annual rainfall about 15 inches, length of growing season 120 days.
Note: Sample from cultivated field. Present Ap includes part of original B2.
Described by: Dave R. Cawlfield, September 24, 1956.

Horizon and Lincoln Lab. Number	
Ap 4712	*0 to 5 inches. Very dark brown (10YR 2.5/2) light silty clay loam, very dark grayish brown (10YR 3.8/2) when dry; weak very fine crumb; soft, very friable, slightly plastic; does not effervesce with HCl; no reliable pH reading; abrupt smooth boundary.*
B21t 4713	5 to 9 inches. Very dark brown (10YR 2.5/2) silty clay, very dark grayish brown (10YR 3.8/2) when dry; strong fine and very fine angular blocky; slightly hard, friable, very sticky; does not effervesce with HCl; no reliable pH reading; plentiful fine roots; moderate number very fine pores; thick continuous clay skins on ped surfaces; clear smooth boundary.
B22t 4714	9 to 13 inches. Very dark grayish brown (10YR 3/2) silty clay, dark grayish brown (10YR 4/2 dry); friable when moist, very sticky and very plastic when wet; no effervescense with HCl; no reliable pH reading; plentiful fine rock; moderate number of very fine pores; continuous clay skins on vertical surfaces and broken clay skins on horizontal surfaces; clear wavy boundary.
B3 4715	13 to 17 inches. Dark grayish brown to grayish brown (10YR 4.5/2) clay loam, light gray (10YR 7/2) when dry; weak medium prismatic breaking to moderate medium and fine angular blocky; slightly hard, friable, sticky and plastic; effervesces weakly with dilute HCl; pH 8.6 with thymol blue indicator; moderate number of fine and very fine pores; patchy clay skin on ped surfaces; clear smooth boundary.
C1ca 4716	17 to 22 inches. Grayish brown (10YR 5/2) heavy clay loam, white (10YR 8/2) when dry; weak thick platy breaking to medium and fine angular blocky; slightly hard, friable, very plastic and sticky; effervesces with dilute HCl; pH 8.6 with thymol blue; moderate number of very fine pores; numerous very fine roots along horizontal surface; clear wavy boundary.
C2 4717	22 to 28 inches. Light brownish gray (10YR 6.5/2) light clay loam, white (10YR 8/2) when dry; massive; very friable when moist, plastic and sticky when wet; effervesces violently; pH 9.0 with thymol blue; plentiful fine roots; few very fine pores; diffuse boundary.
C3 4718	28 to 41 inches. Light brownish gray (10YR 6/2) light clay loam; white (10YR 8/2) when dry; massive; very friable when moist, sticky and plastic when wet; effervesces violently with dilute HCl; pH 9.2 with thymol blue; few roots; few fine pores; diffuse boundary.
C4ca 4719	41 to 48 inches. Grayish brown (10YR 5/2.5) clay loam with many coarse prominent splotches of light gray (10YR 7/2), white (10YR 8/2) when dry; massive; friable when moist, sticky and plastic when wet; effervesces violently with dilute HCl; pH 9.2 with thymol blue; diffuse boundary.
C5 4720	48 to 60 inches plus. Grayish brown (10YR 5/2.5) loam, light gray (10YR 7/2) when dry; massive; friable when moist, slightly plastic and slightly sticky when wet; effervesces weakly with dilute HCl; pH 9.2 with thymol blue.

SOIL SURVEY LABORATORY Lincoln, Nebr. 3/3/58

SOIL TYPE Danvers silty clay loam **LOCATION** Yellowstone County, Montana

SOIL NOS. S56Mont-56-2-(1-8) **LAB. NOS.** 4721-4728

DEPTH INCHES	HORIZON	1B1a PARTICLE SIZE DISTRIBUTION (in mm.) (per cent) VERY COARSE SAND 2-1	COARSE SAND 1-0.5	MEDIUM SAND 0.5-0.25	FINE SAND 0.25-0.10	VERY FINE SAND 0.10-0.05	SILT 0.05-0.002	CLAY < 0.002	0.2-0.02	0.02-0.002	3A1 2A2 > 2 (<19mm)	TEXTURAL CLASS
0-4	Ap	0.4	1.4	3.6	11.8	15.2	42.0	25.6	45.6	19.1	5	l
4-7½	B21t	0.5	1.1	3.3	11.5	14.7	39.7	29.2	43.8	18.0	4	cl
7½-14	B22t	0.5	0.8	2.8a	10.2a	13.8a	32.9	39.0	38.5	15.0	Tr.	cl
14-20	B3	0.2	0.8	3.2a	12.2a	16.2a	29.1	38.3	39.0	14.3	-	cl
20-31	C1ca	0.4	0.8	3.5a	12.2a	15.0a	28.9	39.2	36.1	15.7	Tr.	cl
31-41	C2ca	0.3	0.6	3.4a	14.1a	12.9a	30.3	38.4	34.7	17.4	Tr.	cl
41-54	C3	0.4	1.0	6.3a	25.6a	17.6a	27.5	21.6	47.1	13.7	1	scl
54-60+	C4	0.5	1.2	7.5a	29.1a	19.8a	26.9	15.0	51.1	13.6	2	fsl

pH 8C1b SATURATED PASTE	8C1a 1:5	8C1a 1:10	ORGANIC MATTER 6A1a ORGANIC CARBON %	6B1a NITROGEN %	C/N	8A2 FST% SALT (BUREAU CUP)	ELECTRICAL CONDUCTIVITY EC×10³ MILLIMHOS PER CM 8A1a	6E1a $CaCO_3$ equivalent %	6F1a GYPSUM me. /100g. SOIL	MOISTURE TENSIONS 1/10 ATMOS. %	1/3 ATMOS. %	4B2 15 ATMOS. %
6.6	6.7	6.9	1.26	.117	10.8	<0.20	0.6	-				10.2
6.3	6.4	6.5	1.08	.103	10.5	<0.20	0.6	-				12.2
7.1	7.2	7.4	0.78	.090	8.7	<0.20	0.8	1				17.6
7.7	8.2	8.3	0.82	.085	9.6	<0.20	0.7	21				13.2
8.0	8.5	8.7	0.22	.023		<0.20	0.6	33				13.1
8.4	8.8	8.9	0.14			<0.20	0.8	36				11.4
8.5	9.0	9.2	0.05			<0.20	0.9	16	-			8.8
8.6	9.2	9.2	0.02			<0.20	1.1	10	-			7.2

5A1a CATION EXCHANGE CAPACITY NH_4Ac	EXTRACTABLE CATIONS 6N2b Ca	6O2b Mg	6H1a H	6P2a Na	6Q2a K	5D2 % EXCH. Na %	8A1 SATURATION EXTRACT SOLUBLE 6P1a Na	6Q1a K	8A MOISTURE AT SATURATION %
	milliequivalents per 100g. soil						milliequivalents per liter		
20.4	15.4	3.8	2.9	-	1.1	-	0.2	0.3	41.8
22.2	17.0	4.2	3.8	0.1	0.7	-	0.2	0.2	49.2
32.3	27.6	6.6	2.1	0.1	0.7	-	0.3	0.1	63.4
20.3				0.1	0.3	-	0.4	0.1	56.0
14.0				0.3	0.2	1	1.3	0.1	53.0
11.4				0.5	0.2	4	2.4	0.1	49.4
12.8				0.9	0.3	5	4.1	0.1	37.1
12.7				1.4	0.3	9	6.6	0.1	29.4

a. Few $CaCO_3$ concr.

Soil type: Danvers silty clay loam
Soil No.: S56Mont-56-2
Location: Yellowstone County, Montana; 0.25 mile south and 100 feet east of northwest corner of Section 22, T1N, R29E.
Vegetation or crop: Small grain stubble.
Parent material: Silty fine earth, probably loess, over gravel.
Physiographi: High terrace.
Relief: Smooth convex, 2 percent.
Elevation: Approximately 3,700 feet.
Aspect: South.
Drainage: Well drained.
Erosion: None or slight.
Permeability: Moderate or moderately slow.
Climate: Semiarid; rainfall about 15 inches, length of growing season 120 days.
Note: Sample from cultivated field; present Ap inclues part of original B2.
Described by: Dave R. Cawlfield, September 24, 1956.

Horizon and Lincoln Lab. Number	
Ap 4721	0 to 4 inches. Very dark brown (10YR 2.5/2) silty clay loam, dark grayish brown (10YR 4/2) when dry; weak very fine crumb; soft, very friable, plastic and sticky; no effervescence; abundant roots; abrupt smooth boundary.
B21t 4722	4 to 7½ inches. Very dark brown (10YR 2.5/2) silty clay, dark grayish brown plus (10YR 3.5/2) when dry; strong fine and very fine angular blocky; friable when moist, sticky and plastic when wet; no effervescence; plentiful fine roots; moderate number of fine and medium pores; thick continuous clay skins on all ped surfaces; clear smooth boundary.
B22t 4723	7½ to 14 inches. Very dark grayish brown (10YR 3/2) silty clay, dark brown minus (10YR 4/3) when dry; strong medium prismatic breaking to strong medium and fine angular blocky; friable when moist, sticky and plastic when wet; no effervescence; moderate number of very fine pores; thick continuous clay skins on all ped surfaces; clear wavy boundary.
B3 4724	14 to 20 inches. Grayish brown (10YR 5/2) heavy clay loam, light brownish gray (10YR 6/2) when dry; moderate medium and fine angular blocky; friable when moist, sticky and plastic when wet; effervesces strongly; no reliable pH reading; moderate number of fine and medium pores; clear wavy boundary.
C1ca 4725	20 to 31 inches. Brown (10YR 5/3) clay loam to light gray (10YR 7/2) when dry; many coarse white splotches and streaks, 10YR 8/1 dry; weak medium blocky structure; friable when moist, sticky and plastic when wet; effervesces violently; pH 8.6; moderate number of fine and medium pores; few roots; clear wavy to broken boundary.
C2ca 4726	31 to 41 inches. Pale brown (10YR 6/3) clay loam to light gray (10YR 7/2) when dry with few medium white streaks and splotches; massive; friable when moist, sticky and plastic when wet; effervesces violently; pH 9.0; few fine and many very fine pores; few roots; diffuse boundary.
C3 4727	41 to 54 inches. Dark grayish brown to grayish brown (10YR 4.5/2) loam to light gray (10YR 7/2) when dry; few medium distinct white splotches; massive; very friable when moist, slightly sticky and slightly plastic when wet; effervesces violently; few very fine pores; no roots observed; diffuse boundary.
C4 4728	54 to 60 inches plus. Dark grayish brown to grayish brown (10YR 4.5/2) loam to light gray (10YR 7/2) when dry; few white splotches; massive; few very fine pores.

SOIL SURVEY LABORATORY Mandan, N. Dak.

SOIL TYPE Dimmick clay **LOCATION** Roosevelt County, Montana

SOIL NOS. S50Mont-43-1 **LAB. NOS.** 162-168

DEPTH INCHES	HORIZON	1B1a PARTICLE SIZE DISTRIBUTION (in mm.) (per cent) 3A1 VERY COARSE SAND 2-1	COARSE SAND 1-0.5	MEDIUM SAND 0.5-0.25	FINE SAND 0.25-0.10	VERY FINE SAND 0.10-0.05	SILT 0.05-0.002	CLAY < 0.002	0.2-0.02	0.02-0.002	2A2 > 2	TEXTURAL CLASS
0-2	A11	0.2	0.5	0.3	0.5	0.3	30.6	67.6	2.2	28.9	-	c
2-6	A12	-	0.1	0.1	0.1	0.1	27.4	72.2	0.1	27.5	-	c
6-17	C1	-	0.1	-	0.1	0.1	34.9	64.8	1.2	33.8	-	c
17-31	C2	-	0.1	0.1	-	0.1	28.7	71.0	2.4	26.4	-	c
31-42	C3	-	-	0.1	0.1	0.1	29.9	69.8	-	30.2	-	c
42-54	C4	-	-	0.1	0.1	0.1	31.7	68.0	0.7	31.2	-	c
54-60	C5	-	-	-	0.1	0.1	36.8	63.0	2.7	34.2	-	c

pH 8C1b SATURATED PASTE	8C1a 1:5	8C1a 1:10	ORGANIC MATTER 6A1a ORGANIC CARBON %	6B1a NITROGEN %	C/N	8A2 EST% SALT (BUREAU CUP)	ELECTRICAL CONDUCTIVITY EC×10³ MILLIMHOS PER CM 8A1a	6E1a $CaCO_3$ equivalent %	6F1a GYPSUM me./100g. SOIL	MOISTURE TENSIONS 1/10 ATMOS. %	1/3 ATMOS. %	15 ATMOS. %
6.6	6.5	7.2	9.71	.598	16.2	-	0.6	-	-			
7.2	7.5	8.0	1.28	.133	9.6	-	0.5	-	-			
7.7	8.2	8.6	1.08	.085	12.7	-	0.7	2	-			
7.7	8.2	8.5	0.97	.095	10.2	-	1.0	1	-			
7.8	8.4	8.6	0.67	.062	10.8	-	1.0	2	-			
7.8	8.4	8.6	0.65	.066	9.9	-	1.3	2	-			
7.8	8.4	8.5	0.60	.064	9.4	0.21	2.0	2	-			

5A1a CATION EXCHANGE CAPACITY NH_4OAc	EXCHANGEABLE CATIONS 5B1b Ca	Mg	H	6P2a Na	6Q2a K	5D2 EXCH. Na %	8A1 SATURATION EXTRACT SOLUBLE 6P1a Na	6Q1a K	8A MOISTURE AT SATURATION %
← milliequivalents per 100g. soil →							← milliequivalents per liter →		
50.4				0.6	2.9	1	1.9	2.4	112.1
39.1				0.8	1.9	2	1.8	1.1	100.0
36.5				0.9	1.7	2	2.7	1.2	104.5
39.6				0.9	2.1	2	3.9	1.2	103.6
38.0				1.1	2.6	3	4.0	1.5	110.3
37.4				1.3	1.8	4	4.2	2.8	108.0
38.4				2.0	0.6	5	5.9	4.7	100.0

Soil type: Dimmick clay
Soil No.: S50Mont-43-1
Location: Roosevelt County, Montana; 150 feet east of southwest corner of Section 31, T27N, R46E; on low terrace near Oswego, Montana, under native cover (near mull on surface).
Topography: Missouri River alluvial terrace; slopes under 1 percent.
Drainage: Poorly drained.
Erosion: None.
Parent material: Alluvium from shales and glacial deposits of shales.
Vegetative cover: Ash, willow, wildrose, buckbrush and coarse grasses.
Described by: B. H. Williams, June 5, 1950.

Horizon and Mandan Lab. Number	
A11 162	0 to 2 inches. Dark gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; granular structure; soft, friable, mulch; high in organic matter; noncalcareous; abrupt boundary.
A12 163	2 to 6 inches. Gray (10YR 5/1) clay, very dark gray (N 3/0) upper and 5Y 3/1 lower part, moist; coarse granular structure; hard, friable, sticky and plastic; faintly mottled with light gray and shades of brown; slightly calcareous.
C1 164	6 to 17 inches. Gray (5Y 5/1) clay, olive gray (5Y 4/2) moist; mottled like horizon above; massive structure; hard, firm, sticky and plastic; calcareous.
C2 165	17 to 31 inches. Gray (5Y 6/1) clay, olive gray (5Y 4/2) moist; weak fine blocky structure; hard, firm, sticky and plastic; slightly calcareous; faint mottlings of gray and brown.
C3 166	31 to 42 inches. Gray (5Y 6/1) clay, dark gray (5Y 4/1) moist; otherwise like horizon above.
C4 167	42 to 54 inches. Gray (5Y 6/1) clay, dark gray (5Y 4/1) moist; fine blocky structure; hard, firm, sticky and plastic; calcareous.
C5 168	54 to 60 inches. Color as above; clay; weak medium blocky to massive structure; hard, firm, sticky and plastic; faintly mottled with brown and gray; calcareous.

SOIL SURVEY LABORATORY Mandan, N. Dak.

SOIL TYPE Flynn clay **LOCATION** Roosevelt County, Montana

SOIL NOS. S50Mont-43-2 **LAB. NOS.** 169-172

DEPTH INCHES	HORIZON	1B1a PARTICLE SIZE DISTRIBUTION (in mm.) (per cent) VERY COARSE SAND 2-1	COARSE SAND 1-0.5	MEDIUM SAND 0.5-0.25	FINE SAND 0.25-0.10	VERY FINE SAND 0.10-0.05	SILT 0.05-0.002	CLAY < 0.002	3A1 0.2-0.02	0.02-0.002	2A2 > 2	TEXTURAL CLASS
0-6	A1	0.1	0.1	0.1	0.1	0.1	30.5	69.0	0.9	29.7	-	c
6-20	Cg1	-	-	0.1	0.1	0.1	34.4	65.3	2.0	32.6	-	c
20-36	Cg2	-	-	-	-	0.1	30.5	69.4	0.3	30.2	-	c
36-60	Cg3	-	-	-	-	0.1	32.0	67.9	1.6	30.4	-	c

DEPTH INCHES	pH 8C1b SATURATED PASTE	pH 8C1a 1:5	pH 8C1a 1:10	ORGANIC MATTER 6A1a ORGANIC CARBON %	ORGANIC MATTER 6B1a NITROGEN %	C/N	8A2 EST% SALT (BUREAU CUP)	ELECTRICAL CONDUCTIVITY EC×10³ MILLIMHOS PER CM 8A1a	6E1a $CaCO_3$ equivalent %	6F1a GYPSUM me./100g. SOIL	MOISTURE TENSIONS 1/10 ATMOS. %	MOISTURE TENSIONS 1/3 ATMOS. %	MOISTURE TENSIONS 15 ATMOS. %
0-6	7.0	7.5	7.5	2.35	.201	11.7	-	0.8	-	-			
6-20	7.7	8.3	8.5	0.92	.087	10.6	-	0.9	1	-			
20-36	7.8	8.4	8.7	0.68	.062	11.0	-	0.9	2	-			
36-60	7.8	8.5	8.7	0.62	.052	11.9	-	0.5	2	-			

DEPTH INCHES	5A1a CATION EXCHANGE CAPACITY NH_4OAc	EXCHANGEABLE CATIONS 5B1b Ca	Mg	H	6P2a Na	6Q2a K	5D2 EXCH. Na %	8A1 SATURATION EXTRACT SOLUBLE 6P1a Na	6Q1a K	8A MOISTURE AT SATURATION %
	← milliequivalents per 100g. soil →							← milliequivalents per liter →		
0-6	45.6				0.8	0.9	2	3.2	3.5	110.6
6-20	40.5				0.9	1.0	2	3.1	2.6	102.4
20-36	41.2				1.0	1.6	2	2.2	1.9	98.4
36-60	39.8				0.8	1.8	2	2.6	2.1	106.1

Soil type: *Flynn clay
Soil No.: S50Mont-43-2
Location: Roosevelt County, Montana; Section 31, T27N, R45E; about 1/4 mile from Profile S50Mont-43-1 (Dimmick clay) in lower area near next higher terrace (in hayland).
Topography: Missouri alluvial terrace, slope under 1 percent.
Drainage: Poorly drained.
Erosion: None.
Parent material: Alluvium from shales from glacial and unglaciated areas.
Vegetative cover: Evidently burned-over brushland, now with grass cover; willows near by.
Described by: A. J. Cline, June 5, 1950.

Horizon and Mandan Lab. Number	
A1 169	0 to 6 inches. Gray (5Y 4/1) moist clay with olive (5Y 4/4) moist mottlings; weak coarse granular structure; hard, friable, sticky and plastic; noncalcareous.
Cg1 170	6 to 20 inches. Olive gray (5Y 4/2) moist clay with abundant olive brown (2.5Y 4/4) moist mottlings; weak granular structure; hard, firm, sticky and plastic; calcareous.
Cg2 171	20 to 36 inches. Massive clay with colors as above but with fewer mottlings; consistence and reaction as in horizon above.
Cg3 172	36 to 60 inches. Olive gray (5Y 4/2) moist clay; massive; very hard, firm, sticky and plastic.

SOIL SURVEY LABORATORY Mandan, N. Dak.

SOIL TYPE *Flynn clay **LOCATION** Roosevelt County, Montana

SOIL NOS. S50Mont-43-5 **LAB. NOS.** 188-192

DEPTH INCHES	HORIZON	1B1a PARTICLE SIZE DISTRIBUTION (in mm.) (per cent) 3A1 VERY COARSE SAND 2-1	COARSE SAND 1-0.5	MEDIUM SAND 0.5-0.25	FINE SAND 0.25-0.10	VERY FINE SAND 0.10-0.05	SILT 0.05-0.002	CLAY < 0.002	0.2-0.02	0.02-0.002	2A2 > 2	TEXTURAL CLASS
0-8	A1g	0.2	0.1	-	0.1	0.1	37.7	61.8	5.1	32.8	-	c
8-18	Cg1	-	-	-	0.1	0.3	40.2	59.4	6.4	34.1	-	sic
18-28	Cg2	-	-	0.1	0.2	1.0	41.2	57.5	10.9	31.4	-	sic
28-45	Cg3	-	-	0.1	0.1	0.6	39.8	59.4	8.0	32.5	-	c
45-60	Cg4	-	-	0.1	0.1	0.2	30.3	69.3	3.1	27.5	-	c

8C1b SATURATED PASTE	pH 8C1a 1:5	8C1a 1:10	ORGANIC MATTER 6A1a ORGANIC CARBON %	6H1a NITROGEN %	C/N	8A2 EST% SALT (BUREAU CUP)	ELECTRICAL CONDUCTIVITY EC×10³ MILLIMHOS PER CM 8A1a	6E1a $CaCO_3$ equivalent %	6F1a GYPSUM me./100g. SOIL	MOISTURE TENSIONS 1/10 ATMOS. %	1/3 ATMOS. %	15 ATMOS. %
7.1	7.8	7.9	1.90	.187	10.2	-	0.6	-	-			
7.8	8.7	8.8	0.95	.099	9.6	-	0.7	3	-			
7.9	8.8	8.9	0.77	.077	10.0	-	0.7	2	-			
7.9	8.9	9.1	0.64	.071	9.0	-	0.7	1	-			
7.9	8.7	8.9	0.54	.061	8.9	-	1.4	2	-			

5A1a CATION EXCHANGE CAPACITY NH_4OAc	EXCHANGEABLE CATIONS 5B1b Ca	Mg	H	6P2a Na	6Q2a K	5D2 EXCH. Na %	8A1 SATURATION EXTRACT SOLUBLE 6P1a Na	6Q1a K	8A MOISTURE AT SATURATION %
← milliequivalents per 100g. soil →							← milliequivalents per liter →		
42.9				0.8	1.7	2	4.1	-	85.2
35.7				1.0	1.5	3	3.7	1.2	80.7
35.1				1.8	1.6	5	4.7	1.2	83.5
37.0				2.0	2.4	5	6.7	2.2	85.9
40.7				3.6	1.4	9	10.2	2.4	96.6

Soil type: *Flynn clay
Soil No.: S50Mont-43-5
Location: Roosevelt County, Montana; 600 feet south of northwest corner of Section 33, T27N, R46E, in road right-of-way.
Topography: Missouri River terrace, intermediate level; practically no slope.
Drainage: Very poor.
Erosion: None.
Parent material: Alluvium from shales in glaciated and nonglaciated uplands.
Vegetative cover: Sloughgrasses.
Described by: A. J. Cline, June 6, 1950.

Horizon and Mandan Lab. Number	
Alg 188	0 to 8 inches. Dark gray (5Y 4/1) moist clay with brown (10YR 4/3) moist mottlings; weak coarse granular structure; hard, firm, sticky and plastic.
Cg1 189	8 to 18 inches. Dark grayish brown (2.5Y 4/2) moist clay; weak blocky structure; hard, firm, sticky and plastic; calcareous with a few small lime concretions.
Cg2 190	18 to 28 inches. Gray (5Y 4/1) moist clay; weak blocky structure; hard, firm, sticky and plastic; calcareous.
Cg3 191	28 to 45 inches. Olive brown (2.5Y 4/3) moist clay with dark gray (5Y 4/1) and brown (10YR 4/3) mottlings; massive structure; hard, firm, sticky and plastic; calcareous.
Cg4 192	45 to 60 inches. Olive gray (5Y 4/2.5) moist clay with very dark gray (5Y 3/1) moist mottlings; massive structure; hard, firm, sticky and plastic; calcareous.

SOIL SURVEY LABORATORY Mandan, N. Dak.

SOIL TYPE Fort Collins loam **LOCATION** Yellowstone County, Montana

SOIL NOS. S51Mont-56-8 **LAB. NOS.** 695-700

DEPTH INCHES	HORIZON	1B1a PARTICLE SIZE DISTRIBUTION (in mm.) (per cent) 3A1 VERY COARSE SAND 2-1	COARSE SAND 1-0.5	MEDIUM SAND 0.5-0.25	FINE SAND 0.25-0.10	VERY FINE SAND 0.10-0.05	SILT 0.05-0.002	CLAY < 0.002	0.2-0.02	0.02-0.002	2A2 > 2	TEXTURAL CLASS
0-3	A1	0.2	0.9	4.0	12.6	21.4	46.5	14.4	54.3	21.8	-	1
3-9	B1	0.1	0.8	4.0	12.5	20.4	38.6	23.6	50.3	17.1	-	1
9-19	B2	0.1	0.7	3.8	13.0	20.3	37.0	25.1	50.6	15.4	-	1
19-22	B3	0.2	0.4	2.3	9.4	20.2	43.9	23.6	53.0	17.7	-	1
22-28	C1ca	-	0.3	1.4	6.1	18.7	46.8	26.7	51.1	18.9	-	1
28-40	C2ca	0.7	0.5	2.3	8.8	22.9	47.0	17.8	57.4	18.8	-	1

8C1b pH SATURATED PASTE	8C1a pH 1:5	8C1a pH 1:10	ORGANIC MATTER 6A1a ORGANIC CARBON %	6B1a NITROGEN %	C/N	8A2 EST% SALT (BUREAU CUP)	ELECTRICAL CONDUCTIVITY EC×10³ MILLIMHOS PER CM 8A1a	6E1a $CaCO_3$ equivalent %	6F1a GYPSUM me./100g. SOIL	MOISTURE TENSIONS 1/10 ATMOS. %	1/3 ATMOS. %	4B2 15 ATMOS. %
7.5	8.0	8.0	1.17	0.117	10.0	-	0.5	tr.	-			6.3
7.2	7.7	7.8	0.61	0.074	8.2	-	0.4	tr.	-			8.2
7.8	7.4	7.5	0.49	0.062	7.9	-	0.6	1	-			9.6
8.4	9.0	9.2	0.44	0.056	7.8	-	1.4	7	-			10.4
8.8	9.4	9.6	0.32	0.042	7.6	-	0.7	18	-			10.6
8.7	9.4	9.5	0.17	0.023		-	0.4	15	-			7.4

5A1a CATION EXCHANGE CAPACITY NH_4OAc	5B1a EXTRACTABLE CATIONS 6N2b Ca	6O2b Mg	EXCHAN 6P2a Na	5B1b RABLE 6Q2a K	5D2 EXCH. Na %	SATURATION EXTRACT SOLUBLE 8A1 6P1a Na	6Q1a K	8A MOISTURE AT SATURATION %
← milliequivalents per 100g. soil →						← milliequivalents per liter →		
13.0	9.0	3.7	-	1.2	-	-	0.6	35.4
17.5	8.1	8.3	0.1	0.8	1	0.6	0.2	42.5
19.1	8.1	11.0	0.3	0.6	2	1.5	-	42.2
15.5			0.6	0.3	4	6.5	-	43.6
12.5			0.5	0.3	4	3.9	-	44.2
12.1			0.3	0.2	2	0.9	-	36.6

Soil type: Fort Collins loam
Soil No.: 351Mont-56-8
Location: Yellowstone County, Montana; SE1/4 Section 31, T5N, R34E.
Vegetation: Native grass and sagebrush.
Parent material: Pleistocene--cretaceous outwash.
Physiographic position: High level terrace.
Slope: 1 percent.
Erosion: Some.
Drainage: Good.
Moisture: Dry.
Stoniness: Slight.
Root distribution: Good.
Classification: Brown soil.
Described by: W. C. Bourne, August 9, 1951.

Horizon and Mandan Lab. Number	
A1 695	0 to 3 inches. Pale brown (10YR 6/3) silt loam; dark grayish brown (10YR 4/2) moist; weak platy structure separating into crumb structure; soft, very friable, nonsticky and nonplastic; noncalcareous; clear boundary.
B1 696	3 to 9 inches. Brown (10YR 5/3) silt loam; dark grayish brown (10YR 4/2) moist; blocky structure separating into weak plates; soft, friable, nonsticky and nonplastic; noncalcareous; clear boundary.
B2 697	9 to 19 inches. Brown (10YR 5/3) clay loam or silty clay loam; dark grayish brown (10YR 4/2) moist; weak prisms breaking to crumb structure; slightly hard, friable, slightly sticky and slightly plastic; noncalcareous; gradual boundary.
B3 698	19 to 22 inches. Characteristics as in horizon above but calcareous.
C1ca 699	22 to 28 inches. Light olive brown (2.5Y 5/3) moist, silt loam; weak blocky structure; slightly hard, friable, nonsticky and nonplastic; strongly calcareous.
C2ca 700	28 to 40 inches. Light olive brown (2.5Y 5/3) moist, silt loam; massive structure; slightly hard, friable, nonsticky and nonplastic; strongly calcareous.

SOIL SURVEY LABORATORY Mandan, N. Dak.

SOIL TYPE Frazer silty clay loam **LOCATION** Roosevelt County, Montana

SOIL NOS. S51Mont-43-5 **LAB. NOS.** 823-828

DEPTH INCHES	HORIZON	1B1a PARTICLE SIZE DISTRIBUTION (in mm.) (per cent) VERY COARSE SAND 2-1	COARSE SAND 1-0.5	MEDIUM SAND 0.5-0.25	FINE SAND 0.25-0.10	VERY FINE SAND 0.10-0.05	SILT 0.05-0.002	CLAY < 0.002	3A1 0.2-0.02	0.02-0.002	2A2 > 2	TEXTURAL CLASS
0-6	A1	0.2	0.4	1.1	8.5	8.9	42.8	38.1	25.6	30.8	-	sicl
6-11	C1	0.1	0.3	0.8	21.2	24.9	33.3	19.4	56.2	18.6	-	l
11-16	IIC2	0.1	0.3	1.7	62.0	23.1	1.6	11.2	62.1	6.9	-	lfs
16-25	IIIC3	-	0.2	0.5	2.7	14.4	49.2	33.0	38.9	26.8	-	sicl
25-44	IIIC4	0.1	0.1	0.2	1.2	6.9	58.9	32.6	32.1	34.6	-	sicl
44-60	IVC5	-	0.1	0.4	7.8	46.2	32.1	13.4	76.3	9.3	-	vfsl

	pH		ORGANIC MATTER			8A2	ELECTRICAL CONDUCTIVITY	6E1a	6F1a	MOISTURE TENSIONS		
8C1b SATURATED PASTE	8C1a 1:5	8C1a 1:10	6A1a ORGANIC CARBON %	6B1a NITROGEN %	C/N	EST% SALT (BUREAU CUP)	EC×10³ MILLIMHOS PER CM 6A1a	$CaCO_3$ equiv. %	GYPSUM me./100g. SOIL	1/10 ATMOS. %	1/3 ATMOS. %	4B2 15 ATMOS. %
7.4	8.4	8.6	2.20	0.207	10.6	-	0.7	2	-			16.5
7.8	8.7	9.0	0.88	0.074	11.9	-	0.6	6	-			8.9
8.0	9.4	9.4	0.39	0.029	13.4	-	1.0	5	-			5.6
8.1	9.1	9.4	0.69	0.061	11.3	0.31	9.0	6	-			15.2
8.5	8.8	8.8	0.48	0.050	9.6	0.33	15.0	5	15			15.9
8.4	9.3	9.6	0.27	0.023	11.7	0.28	10.0	6	-			7.6

5A1a	EXCHANGEABLE CATIONS 5B1b					5D2	SATURATION EXTRACT SOLUBLE		8A1			8A
CATION EXCHANGE CAPACITY NH_4OAc	Ca	Mg	H	6P2a Na	6Q2a K	EXCH. Na %	6P1a Na	6Q1a K				MOISTURE AT SATURATION %
← milliequivalents per 100g. soil →							← milliequivalents per liter →					
29.4				0.1	1.2	-	0.9	0.8				65.5
16.1				0.1	0.4	1	1.3	0.2				43.4
8.6				0.8	0.2	9	8.7	0.2				31.4
22.6				6.1	0.5	27	109.0	0.9				70.2
22.5				11.8	0.5	52	178.0	1.0				71.6
10.7				4.1	0.3	38	126.0	0.8				45.6

Soil type: Frazer silty clay loam
Soil No.: S51Mont-43-5
Location: Roosevelt County, Montana; NW1/4 SW1/4 Section 30, T27N, R47E.
Topography: Low terrace; nearly level terrace.
Drainage: Fair.
Parent material: Missouri River Alluvium.
Vegetative cover: Native pasture.

This sample was taken from a soil area occurring on the intermediate levels of the Missouri River Terrace system. These terrace levels have been assigned to age group III by the survey party, i.e., they are of greater age than the lower levels on which alluvial soils occur but are of younger age than the terraces occurring nearest the upland. The sample pit was dug approximately fifty feet from a sharp terrace break and is in an area formed as the natural levee of an abandoned channel of the river. No deposition has occurred in this area since the completion of Fort Peck Dam and occurred infrequently prior to that date. The area sampled shows little or no evidence of accelerated erosion. The water table in this portion of the valley lies at depths of twenty or more feet. The area sampled is used as pasture land and supports a moderately dense cover of blue grama, western wheatgrass, sage and cactus.

Described by: A. J. Cline, September 5, 1951.

Horizon and Mandan Lab. Number	
A1 823	0 to 6 inches. Dark grayish brown (2.5Y 4/2 dry) to very dark grayish brown (2.5Y 3/1.5 moist) calcareous very fine granular silty clay loam; slightly hard when dry and friable when moist.
C1 824	6 to 11 inches. Dark grayish brown (2.5Y 4.5/2 dry) to very dark grayish brown (2.5Y 3/2 moist) calcareous prismatic clay loam; slightly hard when dry and friable when moist.
IIC2 825	11 to 16 inches. Grayish brown (2.5Y 5.5/2 dry) to dark grayish brown (2.5Y 4/2 moist) calcareous weakly prismatic fine sandy loam; soft when dry and very friable when moist.
IIIC3 826	16 to 25 inches. Grayish brown (2.5Y 5/2 dry) to dark grayish brown (2.5Y 4/2 moist) subangular blocky silty clay loam stratified with thin lenses of silty clay; lime accumulation and mycelia and soft nodules of calcium carbonate occur throughout the soil mass; hard when dry and firm when moist.
IIIC4 827	25 to 44 inches. Grayish brown (2.5Y 5.5/2 dry) to dark grayish brown (2.5Y 4/2 moist) calcareous massive to subangular blocky silty clay loam; contains moderate amounts of accumulated calcium carbonate, calcium sulphate, and probably other salts in nodular and myceliated forms; slightly hard when dry and friable when moist.
IVC5 828	44 to 60 inches. Light brownish gray (2.5Y 6/2 dry) to grayish brown (2.5Y 5/2 moist) massive calcareous fine sandy loam; soft when dry and very friable when moist.

SOIL SURVEY LABORATORY Mandan, N. Dak.

SOIL TYPE Gilt Edge silt loam **LOCATION** Yellowstone County, Montana

SOIL NOS. S53Mont-56-8 **LAB. NOS.** 1735-1739

DEPTH INCHES	HORIZON	1B1a PARTICLE SIZE DISTRIBUTION (in mm.) (per cent) VERY COARSE SAND 2-1	COARSE SAND 1-0.5	MEDIUM SAND 0.5-0.25	FINE SAND 0.25-0.10	VERY FINE SAND 0.10-0.05	SILT 0.05-0.002	CLAY < 0.002	3A1 0.2-0.02	0.02-0.002	2A2 > 2 (<19mm)	TEXTURAL CLASS
0-2½	A21	0.6	0.8	1.6	4.2	19.7	52.7	20.4	49.7	25.5	1	sil
2½-6	A22	0.7	0.6	1.2	3.0	17.1	55.0	22.4	46.2	27.9	1	sil
6-14	B2t	0.2	0.3	0.6	1.6	10.0	29.3	58.0	25.9	14.5	-	c
14-24	B3ca	-	0.6	0.5	2.1	15.6	36.1	45.1	34.1	19.1	-	c
24-36	C1ca	1.4	0.9	1.2	3.5	14.4	33.1	45.5	29.1	20.8	1	c

pH 8C1b SATURATED PASTE	pH 8C1a 1:5	pH 8C1a 1:10	ORGANIC MATTER 6A1a ORGANIC CARBON %	ORGANIC MATTER NITROGEN %	ORGANIC MATTER C/N	8A2 EST% SALT (BUREAU CUP)	ELECTRICAL CONDUCTIVITY EC×10³ MILLIMHOS PER CM 8A1a	6E1a $CaCO_3$ equiv. %	6F1a GYPSUM me./100g. SOIL	MOISTURE TENSIONS 1/10 ATMOS. %	MOISTURE TENSIONS 1/3 ATMOS. %	4B2 15 ATMOS. %
6.0	6.3	6.4	1.46			-	0.7	-				8.4
6.3	6.7	6.6	0.82			-	0.5	-				7.1
7.1	7.4	7.5	0.80			-	0.8	1				22.4
7.8	8.8	9.0	0.41			-	3.1	11	-			16.8
7.8	8.2	8.4	0.27			0.27	6.5	7	4			14.2

5A1a CATION EXCHANGE CAPACITY NH_4OAc	5B1a CATIONS EXTRACTABLE 6N2b Ca	6O2b Mg	H	5B1b CATIONS EXCHANGEABLE 6P2a Na	6Q2a K	5D2 EXCH. Na %	SATURATION EXTRACT SOLUBLE 6F1a Na	6Q1a K	6J1a HCO_3	6K1a Cl	6L1a SO_4	8A1 8A MOISTURE AT SATURATION %
←	milliequivalents per 100g. soil →						← milliequivalents per liter →					
15.3	7.2	4.5		0.1	1.1	1	1.2	0.8				39.7
13.0	5.4	5.5		0.1	0.8	1	2.0	0.4				35.3
40.2	12.1	26.1		1.6	1.0	4	5.2	-				81.2
25.6		21.3		1.8	0.5	7	16.7	0.2				62.0
25.1		21.5		1.7	0.4	7	28.3	0.4	1.1	5.0	93.1	61.0

Soil type: Gilt Edge silt loam
Soil No.: S53Mont-56-8
Location: Yellowstone County, Montana; Section 10, T2S, R27E, about 200 feet southeast of northwest corner.
Vegetation: Mostly western wheatgrass and blue grama.
Physiographic position: High smooth bench about 200 feet above Pryor Creek; profile taken in slight sag which has slow or no surface drainage.
Relief: Concave, nearly level.
Slope: 1 percent.
Drainage: Well drained.
Permeability: Slow.
Described by: W. C. Bourne, August 1953.

Horizon and Mandan Lab. Number

A21 1735 — 0 to 2½ inches. Light brownish gray (10YR 6/2 dry) to gray brown (10YR 4.5/2 moist) silt loam; weak thin platy structure breaking to weak very fine crumb structure; soft when dry, friable when moist; noncalcareous; scattered gravel; clear smooth boundary.

A22 1736 — 2½ to 6 inches. Light brownish gray (10YR 5.5/2 dry) to dark gray brown (10YR 4/2 moist) silt loam; moderate thin platy structure breaking to weak fine crumbs; soft when dry, friable when moist; noncalcareous; scattered gravel; abrupt smooth boundary.

B2t 1737 — 6 to 14 inches. Gray brown (10YR 5/2 dry) to dark gray brown (10YR 4/2 moist) silty clay; strong medium and fine prismatic structure becoming coarser at mid horizon (there is a slight twist to the prisms and they have weakly developed caps); very hard when dry, firm when moist; noncalcareous; clear wavy boundary.

B3ca 1738 — 14 to 24 inches. Light brownish gray (2.5Y 6/2 dry) to gray brown (2.5Y 5/2 moist) silty clay; weak prismatic structure breaking to strong medium and fine blocks; very hard when dry, firm when moist; noncalcareous; clear wavy boundary.

C1ca 1739 — 24 to 36 inches. Light gray (2.5Y 7/2 dry) to light brownish gray (2.5Y 5.5/2 moist) light silty clay; weak medium and fine subangular blocky structure; moderately hard when dry, firm when moist; clear irregular boundary.

IIC2 — 36 to 44 inches plus. Light brownish gray (10YR 6/2 dry and moist) calcareous sand, gravel and fine earths (not sampled).

OIL SURVEY LABORATORY Mandan, N. Dak.

SOIL TYPE Glendive loam **LOCATION** Roosevelt County, Montana

SOIL NOS. S51Mont-43-1 **LAB. NOS.** 801-805

DEPTH INCHES	HORIZON	1B1a PARTICLE SIZE DISTRIBUTION (in mm.) (per cent) 3A1 VERY COARSE SAND 2-1	COARSE SAND 1-0.5	MEDIUM SAND 0.5-0.25	FINE SAND 0.25-0.10	VERY FINE SAND 0.10-0.05	SILT 0.05-0.002	CLAY < 0.002	0.2-0.02	0.02-0.002	2A2 > 2	TEXTURAL CLASS
0-5	A1	0.1	0.4	1.3	6.0	13.7	52.1	26.4	47.3	22.7	-	sil
5-10	C1	0.3	0.3	1.1	13.6	27.5	34.5	22.7	56.8	16.4	-	l
10-20	C2	0.1	0.8	3.7	25.0	32.4	20.7	17.3	63.5	10.2	-	vfsl
20-60a	IIC31	-	1.9	29.7	53.0	8.3	3.1	4.0	28.7	1.5	-	fs
20-60b	IIC32	0.1	0.7	6.5	29.4	29.6	21.4	12.3	61.3	9.2	-	vfsl

8C1b SATURATED PASTE	pH 8C1a 1:5	8C1a 1:10	ORGANIC MATTER 6A1a ORGANIC CARBON %	6H1a NITROGEN %	C/N	8A2 EST% SALT (BUREAU CUP)	ELECTRICAL CONDUCTIVITY EC×10³ MILLIMHOS PER CM 8A1a	6E1a $CaCO_3$ equivalent %	6F1a GYPSUM me./100g. SOIL	MOISTURE TENSIONS 1/10 ATMOS. %	1/3 ATMOS. %	4B2 15 ATMOS. %
7.6	8.5	8.8	1.48	0.120	12.3	-	0.6	5	-			11.2
7.6	8.6	9.0	0.72	0.061	11.8	-	0.6	4	-			8.5
7.8	8.7	8.9	0.48	0.038	12.6	-	0.6	5	-			6.9
8.1	9.0	9.1	0.13	0.011		-	0.6	3	-			2.8
7.6	8.6	8.9	0.30	0.024	12.5	-	2.2	5	-			5.4

5A1a CATION EXCHANGE CAPACITY NH_4OAc	EXCHANGEABLE CATIONS 5B1b Ca	Mg	H	6P2a Na	6Q2a K	5D2 EXCH. Na %	SATURATION EXTRACT SOLUBLE 8A1 6P1a Na	6Q1a K	8A MOISTURE AT SATURATION %
←	milliequivalents per 100g. soil →						← milliequivalents per liter →		
21.4				0.3	0.7	1	0.6	0.8	54.9
16.7				0.3	0.4	2	0.6	0.2	45.0
13.1				0.3	0.3	2	1.5	-	39.1
4.6				0.2	0.2	4	2.8	0.2	27.9
10.4				0.3	0.3	3	7.4	0.2	37.7

a. Composed of loamy fine sand.
b. Composed of heavier than loamy fine sand.

Soil type: Glendive loam
Soil No.: S51Mont-43-1
Location: Roosevelt County, Montana; northwest corner of Section 11, T26N, R46E.
Topography: Low terrace; convex slope.
Drainage: Good to excessive.
Parent material: Alluvium.
Vegetative cover: Cottonwood, buckbrush, and grass.

The area in which this sample was taken occurs on the low terrace levels of the Missouri River Valley approximately 1/4-mile from the present river channel. The soil area sampled lies parallel to and just above a low terrace break. The sample pit was dug approximately 50 feet from the upper lip of the break and penetrates the deposits of the natural levee formed during the period that the old channel was active. Little or no deposition has occurred at this location since the completion of Fort Peck Dam, but probably occurred annually prior to that time. The sample site has a convex slope of approximately 3 percent gradient. It is used as pasture land and supports a growth of western wheatgrass, needlegrass, sage, volunteer sweetclover, and scattered cottonwood trees. It does not show evidence of accelerated erosion; it lies approximately 15 to 20 feet above the normal water table.

Described by: A. J. Cline, September 4, 1951.

Horizon and Mandan Lab. Number	
A1 801	0 to 5 inches. Grayish brown (2.5Y 5/2 dry) to very dark grayish brown (2.5Y 3/2 moist) fine granular calcareous loam; soft when dry and very friable when moist; a thin layer of partially decayed grass, leaves, and other organic debris occurs on the surface and the soil mass is thoroughly permeated with grass roots.
C1 802	5 to 10 inches. Light brownish gray (2.5Y 6/2 dry) to dark grayish brown (2.5Y 4/2 moist) fine granular calcareous fine sandy loam; soft when dry and very friable when moist; contains moderate amounts of grass roots.
C2 803	10 to 20 inches. Composite sample of 10 to 16 inches and 16 to 20 inches. 10 to 16 inches. Light gray (2.5Y 7/2 dry) to grayish brown (2.5Y 5/2 moist) single grained loose calcareous loamy fine sand. 16 to 20 inches. Light brownish gray (2.5Y 6/2 dry) to grayish brown (2.5Y 5/2 moist) massive calcareous fine sandy loam; soft when dry and very friable when moist.
IIC31 804	Aggregate of all loamy fine sand layers from 20 to 60 inches.
IIC32 805	Aggregate of all layers of finer texture than loamy fine sand from 20 to 60 inches. 20 to 28 inches. Grayish brown (2.5Y 5.5/2 dry) to dark grayish brown (2.5Y 4/2 moist) calcareous loose single grained loamy fine sand. 28 to 32 inches. Light brownish gray (2.5Y 6/2 dry) to dark grayish brown (2.5Y 4/2 moist) massive calcareous light fine sandy loam. 32 to 40 inches. Light brownish gray (2.5Y 5.5/2 dry) to dark grayish brown (2.5Y 4/2 moist) calcareous loose single grained loamy fine sand. 40 to 44 inches. Light brownish gray (2.5Y 6/2 dry) to grayish brown (2.5Y 5/2 moist) massive calcareous fine sandy loam; soft when dry and very friable when moist. 44 to 60 inches. Light brownish gray (2.5Y 5.5/2 dry) to grayish brown (2.5Y 5/2 moist calcareous loose single grained loamy fine sand.

Remarks: Since only slight textural variation occurs below a depth of 20 inches in this profile and because such variation as does exist is not uniform throughout the soil area, J. R. McHenry did not sample each horizon as described above. He took two samples from the 20-inch to 60-inch portion of the profile; one sample was representative of the aggregate of all the loamy fine sand horizons and the other the aggregate of those horizons heavier-textured than loamy fine sand.

SOIL SURVEY LABORATORY Lincoln, Nebr. 4/19/57

SOIL TYPE Gorus silt loam **LOCATION** Ravalli County, Montana

SOIL NOS. S55Mont-41-1 **LAB. NOS.** 2951-2958

DEPTH INCHES	HORIZON	1B1a PARTICLE SIZE DISTRIBUTION (in mm.) (per cent) 3A1 VERY COARSE SAND 2-1	COARSE SAND 1-0.5	MEDIUM SAND 0.5-0.25	FINE SAND 0.25-0.10	VERY FINE SAND 0.10-0.05	SILT 0.05-0.002	CLAY < 0.002	0.2-0.02	0.02-0.002	2A2 > 2 (<19mm)	TEXTURAL CLASS
0-4	A2	0.7	0.9	0.7	2.9	11.1	69.3	14.4	48.6	33.9	-	sil
4-9	B21	0.9	1.9	1.2	5.3	8.4	63.3	19.0	46.3	28.9	-	sil
9-14	B22	0.7	0.7	0.4	2.0	11.0	65.8	19.4	50.2	28.2	-	sil
14-23	B3	2.5	1.4	0.8	2.8	12.7	63.3	16.5	53.6	24.4	-	sil
23-34	IIB21b	6.5	7.0	4.3	9.1	13.6	39.8	19.7	40.5	18.6	4	l
34-41	IIB22b	3.5	3.9	2.7	7.4	14.5	41.5	26.5	43.2	17.7	2	l
41-52	IIIB3b	18.4	12.7	6.3	9.3	7.7	19.1	26.5	22.4	9.6	10	scl
52-60	IIICcab	22.7	17.6	7.7	10.6	10.2	23.9	7.3	26.1	14.1	18	cosl

pH 8C1a 1:1	1:5	1:10	ORGANIC MATTER 6A1a ORGANIC CARBON %	6B1a NITROGEN %	C/N	EST% SALT (BUREAU CUP)	ELECTRICAL CONDUCTIVITY EC×10³ MILLIMHOS PER CM @25°C.	6E1a $CaCO_3$ equivalent %	GYPSUM me./100g. SOIL	MOISTURE TENSIONS 4B2 1/10 ATMOS. %	1/3 ATMOS. %	15 ATMOS. %
6.3	6.6	6.6	2.96	.177	16.7							9.9
6.4	6.7	6.7	0.70	.052	13.5							8.6
6.5	7.1	6.9	0.55	.036	15.3							8.8
6.7	7.0	7.0	0.52	.027	19.2							7.9
7.1	7.7	7.5	0.28	.024	11.7							8.8
7.5	7.8	7.9	0.27	.024	11.2							11.3
8.4	8.6	8.0	0.11	.015				2				12.1
8.7	9.0	9.2	0.14	.018				12				8.9

5A1a CATION EXCHANGE CAPACITY NH_4Ac	EXTRACTABLE CATIONS 6N2b Ca	6O2b Mg	6H1a H	6P2a Na	6Q2a K	BASE SAT. % 5C1	SATURATION EXTRACT SOLUBLE Na	K	MOISTURE AT SATURATION %
	← milliequivalents per 100g. soil →						← milliequivalents per liter →		
21.7	13.2	3.5	6.8	-	1.1	82			
15.1	9.2	4.0	3.2	0.1	0.3	90			
17.3	10.7	5.3	2.5	0.1	0.3	95			
17.4	10.4	5.8	2.2	0.1	0.2	95			
17.5	9.6	6.4	1.8	0.3	0.2	94			
23.2	13.4	8.9	1.4	0.5	0.2	99			
23.4				0.6	0.3				
14.8				1.0	0.1				

Soil type: Gorus silt loam
Soil No.: S55Mont-41-1
Location: Ravalli County, Montana; SW, NW, SE of Section 12, T2N, R21W.
Parent material: Silty loess 23 inches thick over strongly weathered granitic outwash of probable Pleistocene Age.
Physiography: Somewhat eroded high fan terrace remnant.
Relief: Smooth, 3 percent southeast slope.
Drainage: Well drained.
Root distribution: Plentiful on structure faces to depth sampled.
Collected by: W. C. Bourne, James Allen, R. A. Campanella, and Dave Gardiner, August 24, 1955.
Described by: W. C. Bourne.

Horizon and Mandan Lab. Number	
O1 and O2	1 to 0 inch. Mull; not sampled.
A2 2951	0 to 4 inches. Light gray with some surfaces of grayish brown (10YR 7/2 and 5/2 dry) very dark grayish brown (10YR 3/2 moist) silt loam; strong thin platy; hard when dry, friable when moist; boundary clear.
B21 2952	4 to 9 inches. Brown with thick pale brown coatings on the ped surfaces (10YR 4/3 and 6/3 dry) to dark brown (10YR 4/3 moist) silt loam; moderate medium subangular blocky; hard when dry, friable when moist; boundary gradual.
B22 2953	9 to 14 inches. Yellowish brown, pale brown and dark yellowish brown in bands, streaks and splotches with the lightest color on the ped faces (10YR 5/4, 6/3 and 4/4 dry) to yellowish brown and dark yellowish brown (10YR 5/4 and 4/4 moist) silt loam; moderate medium subangular blocky; hard when dry, friable when moist; boundary gradual.
B3 2954	14 to 23 inches. Yellowish brown (10YR 5/4 dry and moist) silt loam; moderate medium subangular blocky; hard when dry, friable when moist; boundary clear.
IIB21b 2955	23 to 34 inches. Brown (7.5YR 5/4 dry) to dark brown (7.5YR 4/4 moist) silty clay loam; strong medium and coarse subangular blocky; very hard when dry, friable when moist, sticky and plastic when wet; boundary gradual.
IIB22b 2956	34 to 41 inches. Like horizon above except slightly lighter colored; boundary clear.
IIIB23b 2957	41 to 52 inches. Reddish yellow and white (7.5YR 6/6 and 9/2 dry) to strong brown and white (7.5YR 4/6 and 9/2 moist) gritty loam; moderate very coarse blocky; friable when moist, sticky when wet; strong white lime accumulations on structure faces and weakly limy in center of peds; lime horizon of upper soil; boundary abrupt.
IIICcab 2958	52 to 60 inches. Very pale brown (10YR 7/3 dry) to pale brown (10YR 6/3 moist) coarse sandy loam; massive; this is a lime pan, the upper inch of which is hard; the lime is deposited in bands; clear boundary.
IIICb	60 to 72 inches (Not sampled) Pink (7.5YR 7/4 dry) to brown (7.5YR 5/4 moist) loamy coarse sand; massive; very friable when moist; strongly calcareous.

SOIL SURVEY LABORATORY Lincoln, Nebr. 4/19/57

SOIL TYPE Gorus silt loam **LOCATION** Ravalli County, Montana

SOIL NOS. S55Mont-41-2 **LAB. NOS.** 2959-2965

DEPTH INCHES	HORIZON	1B1a PARTICLE SIZE DISTRIBUTION (in mm.) (per cent) VERY COARSE SAND 2-1	COARSE SAND 1-0.5	MEDIUM SAND 0.5-0.25	FINE SAND 0.25-0.10	VERY FINE SAND 0.10-0.05	SILT 0.05-0.002	CLAY < 0.002	0.2-0.02	0.02-0.002	3A1 2A2 > 2 (<19mm)	TEXTURAL CLASS
0-4	A2	1.2	1.6	1.4	7.7	5.7	69.7	12.7	38.3	39.9	1	sil
4-8	A3	1.3	1.9	1.2	3.4	9.8	63.6	18.8	44.0	31.7	-	sil
8-16	B2	1.9	2.0	1.1	3.3	9.6	61.0	21.1	44.5	28.4	2	sil
16-24	B3	2.0	2.7	1.6	4.5	11.6	59.4	18.2	48.6	25.4	2	sil
24-32	IIB21b	8.0	6.8	4.1	9.1	12.6	39.4	20.0	39.3	18.4	13	l
32-41	IIB22b	19.2	10.9	5.4	9.3	9.6	28.8	16.8	28.4	15.6	15	cosl
41-60	IIB3b	13.2	10.7	5.5	10.2	10.6	28.6	21.2	30.1	15.3	14	l

pH 1:1	pH 1:5	8C1a pH 1:10	ORGANIC MATTER 6A1a ORGANIC CARBON %	6B1a NITROGEN %	C/N	EST% SALT (BUREAU CUP)	ELECTRICAL CONDUCTIVITY EC×10³ MILLIMHOS PER CM @25°C.	6E1a $CaCO_3$ equivalent %	GYPSUM me./100g. SOIL	MOISTURE TENSIONS 1/10 ATMOS. %	1/3 ATMOS. %	4B2 15 ATMOS. %
6.6	6.8	6.8	1.61	.086	18.7							9.4
6.2	6.4	6.5	0.66	.044	15.0							10.1
6.2	6.5	6.6	0.45	.033	13.6							10.5
6.4	6.7	6.7	0.29	.022	13.2							8.6
6.6	6.8	6.9	0.17	.018								9.0
6.8	7.1	7.1	0.14	.016								8.3
7.1	7.4	7.3	0.18	.019				1				10.2

5A1a CATION EXCHANGE CAPACITY NH_4Ac	EXTRACTABLE CATIONS 6N2b Ca	6O2b Mg	6H1a H	6P2a Na	5B1a 6Q2a K	BASE SAT. % 5C1	SATURATION EXTRACT SOLUBLE	MOISTURE AT SATURATION %
← milliequivalents per 100g. soil →							← milliequivalents per liter →	
14.4	10.2	1.4	5.2	-	1.0	88		
13.5	9.2	1.9	4.0	-	0.6	87		
15.5	11.2	2.3	3.6	-	0.5	90		
15.2	11.3	2.5	3.0	-	0.3	93		
16.0	12.1	2.5	2.3	0.1	0.2	93		
15.2	11.6	2.5	2.3	0.1	0.2	95		
18.4		3.3		0.1	0.2			

Soil type: Gorus silt loam
Soil No.: S55Mont-41-2
Location: Ravalli County, Montana; NW, SE, NE of Section 11, T2N, R21W.
Vegetation: Dense young ponderosa pine.
Parent material: Silty loess 24 inches thick over strongly weathered granitic outwash presumably of Pleistocene Age.
Physiography: High fan terrace.
Relief: Smooth, 5 percent east-facing slope.
Drainage: Well drained.
Root distribution: To depth sampled.
Collected by: W. C. Bourne, James Allen, R. A. Campanella, and Dave Gardiner, August 24, 1955.
Described by: W. C. Bourne.

Horizon and Mandan Lab. Number	
O	1 to 0 inch. Mull; not sampled.
A2 2959	0 to 4 inches. Very pale brown with thin brown coatings on plates (10YR 7/3 and 5/3 dry) to brown (10YR 5/3 moist) silt loam; strong thin platy; slightly hard when dry, friable when moist; clear boundary.
A3 2960	4 to 8 inches. Coarsely mottled very pale brown and brown (10YR 7/3 and 5/3 dry) to brown and dark brown (10YR 4/3 and 3/3 moist) silt loam; thick platy breaking to weak fine blocky; very hard when dry, friable when moist; clear boundary.
B2 2961	8 to 16 inches. Dark brown with prominent very pale brown leachings on surfaces of peds (10YR 4/3 dry and moist) heavy silt loam; moderate medium and coarse subangular blocky; very hard when dry, friable when moist; gradual boundary.
B3 2962	16 to 24 inches. Light yellowish brown and dark yellowish brown in bands and streaks with very pale brown coatings on the surfaces of the peds (10YR 6/4, 4/4 and 7/3 dry) to yellowish brown and dark yellowish brown (10YR 5/4 and 4/4 moist) heavy silt loam; medium and coarse subangular blocky; very hard when dry, friable when moist; clear boundary.
IIB21b 2963	24 to 32 inches. Brown (7.5YR 5/4 dry) to dark brown (7.5YR 4/4 moist) sandy clay loam; medium and coarse subangular blocky; very hard when dry, friable when moist; gradual boundary.
IIB22b 2964	32 to 41 inches. Light yellowish brown (9YR 6/4 dry) to yellowish brown (9YR 5/4 moist) gritty loam; coarse subangular blocky; very hard when dry, friable when moist; clear boundary.
IIB3b 2965	41 to 60 inches. Very coarse light yellowish brown and very dark grayish brown (10YR 6/4 and 3/2 dry) to yellowish brown and very dark grayish brown (10YR 5/4 and 3/2 moist) gritty loam; massive; hard when dry, friable when moist; may be mixture of krotovinas; clear boundary.
IIIC	60 to 70 inches. (Not sampled) Pink (7.5YR 7/4 dry) to brown (7.5YR 5/4 moist) loamy coarse sand.

SOIL SURVEY LABORATORY Mandan, N. Dak.

SOIL TYPE Havre loam **LOCATION** Roosevelt County, Montana

SOIL NOS. S51Mont-43-3 **LAB. NOS.** 813-817

DEPTH INCHES	HORIZON	1B1a PARTICLE SIZE DISTRIBUTION (in mm.) (per cent) 3A1									2A2	TEXTURAL CLASS
		VERY COARSE SAND 2-1	COARSE SAND 1-0.5	MEDIUM SAND 0.5-0.25	FINE SAND 0.25-0.10	VERY FINE SAND 0.10-0.05	SILT 0.05-0.002	CLAY < 0.002	0.2-0.02	0.02-0.002	> 2	
0-10	A1	0.2	0.3	0.6	1.8	11.9	55.4	29.8	36.7	31.6	-	sicl
10-16	C1	0.2	0.2	0.6	2.6	39.3	38.2	18.9	64.4	15.1	-	l
16-23	C2	0.1	0.2	0.4	1.3	10.5	60.2	27.3	37.2	34.0	-	sicl
23-36	C3	0.2	0.2	0.3	1.7	15.6	49.5	32.5	38.3	28.2	-	sicl
36-60	C4	0.1	0.2	0.4	3.7	30.0	43.8	21.8	59.1	17.9	-	l

	pH		ORGANIC MATTER			8A2	ELECTRICAL CONDUCTIVITY EC×10³ MILLIMHOS PER CM 6A1a	6E1a	6F1a	MOISTURE TENSIONS		4B2
8C1b SATURATED PASTE	8C1a 1:5	8C1a 1:10	6A1a ORGANIC CARBON %	6B1a NITROGEN %	C/N	EST% SALT (BUREAU CUP)		$CaCO_3$ equivalent %	GYPSUM me./100g. SOIL	1/10 ATMOS. %	1/3 ATMOS. %	15 ATMOS. %
7.7	8.7	8.9	1.38	0.112	12.3	-	0.5	5	-			12.6
7.8	8.7	8.9	0.87	0.056	15.5	-	0.5	6	-			9.0
7.8	8.7	9.0	1.08	0.080	13.5	-	2.2	5	-			12.0
7.5	8.2	8.4	0.89	0.070	12.7	0.21	4.5	4	-			13.0
7.6	8.4	8.6	0.54	0.045	12.0	0.30	5.5	5	2			9.4

5A1a	EXCHANGEABLE CATIONS 5B1b					5D2	SATURATION EXTRACT SOLUBLE 6A1					8A
CATION EXCHANGE CAPACITY NH_4OAc	Ca	Mg	H	6P2b Na	6Q2a K	EXCH. Na %	6P1a Na	6Q1a K				MOISTURE AT SATURATION %
← milliequivalents per 100g. soil →							← milliequivalents per liter →					
23.8				0.1	0.7	-	-	0.5				57.4
16.8				0.1	0.4	-	0.2	0.2				48.8
22.0				1.0	0.6	4	9.8	0.8				55.8
23.6				1.6	0.8	7	23.7	1.0				58.3
17.4				2.4	0.4	14	41.5	0.8				49.9

Soil type: Havre loam
Soil No.: S51Mont-43-3
Location: Roosevelt County, Montana; SW1/4 NW1/4 Section 2, T26N, R46E.
Topography: Low terrace; level terrace.
Drainage: Good.
Parent material: Missouri River Alluvium.
Vegetative cover: Western wheatgrass, sage, needlegrass, and some blue grama.

This sample was taken from a soil area lying on the low terrace levels of the present Missouri River Valley (age group I). The sample pit was dug approximately 100 feet from a terrace break and about 1/8-mile from the present river channel. No deposition resulting from river flooding has occurred at this site since the completion of Fort Peck Dam, but probably occurred occasionally prior to that date. The area shows no evidence of accelerated erosion. The sample area is used as pasture land and has never been broken.

Described by: A. J. Cline, September 5, 1951.

Horizon and Mandan Lab. Number	
A1 813	0 to 10 inches. Light brownish gray (2.5Y 6/2) to dark grayish brown (2.5Y 4/2) when moist, calcareous fine granular loam; soft when dry and very friable when moist.
C1 814	10 to 16 inches. Grayish brown (2.5Y 5.5/2 dry) to dark grayish brown (2.5Y 4/2 moist) calcareous massive loam stratified with fine sandy loam; soft when dry and very friable when moist.
C2 815	16 to 23 inches. Grayish brown (2.5Y 5/2 dry) to dark grayish brown (2.5Y 4/2 moist) massive calcareous silty clay loam; slightly hard when dry and friable when moist.
C3 816	Composite sample of 23 to 29 inches and 29 to 36 inches. 23 to 29 inches. Dark grayish brown (2.5Y 4/2 dry) to very dark grayish brown (2.5Y 3/2 moist) massive to platy calcareous silty clay loam stratified with thin lenses of silty clay; slightly hard when dry and friable when moist. 29 to 36 inches. Grayish brown (2.5Y 5.5/2 dry) to 2.5Y 4.5/2 moist, massive calcareous loam; soft when dry and very friable when moist.
C4 817	36 to 60 inches. Light brownish gray (2.5Y 6/2 dry) to dark grayish brown (2.5Y 4/2 moist) massive calcareous fine sandy loam; marbled appearance when viewed on a freshly cut face due to its intense very fine stratification; soft when dry and very friable when moist.

OIL SURVEY LABORATORY Mandan, N. Dak.

SOIL TYPE Havre loam **LOCATION** Roosevelt County, Montana

SOIL NOS. S51Mont-43-6 **LAB. NOS.** 829-834

DEPTH INCHES	HORIZON	1B1a PARTICLE SIZE DISTRIBUTION (in mm.) (per cent) 3A1									2A2	TEXTURAL CLASS
		VERY COARSE SAND 2-1	COARSE SAND 1-0.5	MEDIUM SAND 0.5-0.25	FINE SAND 0.25-0.10	VERY FINE SAND 0.10-0.05	SILT 0.05-0.002	CLAY < 0.002	0.2-0.02	0.02-0.002	> 2	
0-6	A1	0.1	0.2	0.6	22.9	19.2	31.3	25.7	50.2	18.7	-	l
6-11	C1	-	0.1	0.5	24.5	23.4	28.3	23.2	56.4	15.8	-	l
11-16	IIC2	0.1	0.1	0.1	0.8	2.7	49.4	46.8	18.7	34.0	-	sic
16-38	IIIC3	0.1	0.2	0.5	2.3	39.9	40.7	16.3	70.3	12.0	-	l
38-51	IIIC4	0.1	0.2	0.4	1.2	14.5	57.4	26.2	45.8	26.7	-	sil
51-56	IVC5	-	-	-	-	0.6	49.3	50.1	12.5	37.4	-	sic

8C1b SATURATED PASTE	pH 8C1a 1:5	8C1a 1:10	ORGANIC MATTER 6A1a ORGANIC CARBON %	6B1a NITROGEN %	C/N	8A2 EST% SALT (BUREAU CUP)	ELECTRICAL CONDUCTIVITY EC×10³ MILLIMHOS PER CM 8A1a	6E1a $CaCO_3$ equivalent %	6F1a GYPSUM me./100g. SOIL	MOISTURE TENSIONS 1/10 ATMOS. %	1/3 ATMOS. %	4B2 15 ATMOS. %
7.4	8.6	8.5	1.20	0.092	13.0	-	0.7	4	-			11.0
7.5	8.7	8.5	0.60	0.051	11.8	-	0.6	5	-			9.6
7.6	8.8	8.8	0.80	0.072	11.1	-	0.6	4	-			19.4
7.6	8.6	8.7	0.48	0.034	14.1	-	2.0	6	-			7.3
7.6	8.5	8.6	0.59	0.047	12.6	-	3.0	5	-			10.8
7.6	8.3	8.4	0.71	0.062	11.4	0.25	4.5	4	2			21.8

5A1a CATION EXCHANGE CAPACITY NH_4OAc	EXCHANGEABLE CATIONS 5B1b Ca	Mg	H	6P2a Na	6Q2a K	5D2 EXCH. Na %	SATURATION EXTRACT SOLUBLE 6P1a Na	6Q1a K			8A1	8A MOISTURE AT SATURATION %
← milliequivalents per 100g. soil →							← milliequivalents per liter →					
20.4				0.3	1.0	1	0.9	1.0				48.5
18.1				0.4	0.6	2	1.3	0.5				44.8
29.3				0.8	0.9	3	2.2	0.5				65.6
12.9				0.8	0.3	6	9.6	0.5				43.9
18.7				1.8	0.4	10	17.4	0.8				52.1
31.2				3.0	0.6	10	25.2	0.8				87.0

Soil type: Havre loam
Soil No.: S51Mont-43-6
Location: Roosevelt County, Montana; SE1/4 SE1/4 Section 15, T27N, R47E.
Topography: Low terrace, level.
Drainage: Fair
Parent material: Alluvium.
Vegetative cover: Cut-off brush and cottonwood.

This sample was taken from a soil area lying on the low terraces of the present Missouri River Valley and is representative of age level II, i.e., it lies on terraces that are higher than those that are flooded by yearly seasonal overflow, but are of younger age than those whose soils have zonal characteristics. The sample pit was dug approximately 3/4-mile from the present river channel in an area of nearly level to very gently sloping concave relief. The direction of the slope in this area is away from the river and toward the escarpment bordering the next higher terrace level approximately 300 feet back of the location of the sample pit; thus the area sampled does not occur within the marginal drain area of its terrace level but is adjacent thereto. Only slight deposition has occured in this area since the completion of the Fort Peck Dam and this has been the result of local flooding from higher lying terrace levels; prior to the completion of the dam this area was frequently subject to overflow though not necessarily each season. The area sampled shows no evidence of accelerated erosion. The water table in this portion of the terraces rarely exceeds 10 feet. The sample area is used as pasture land and supports a moderately dense cover of cottonwood trees, buckbrush, rose bushes, western wheatgrass, and needlegrass.

Described by: A. J. Cline, September 6, 1951.

Horizon and Mandan Lab. Number	
A1 829	0 to 6 inches. Grayish brown (2.5Y 5/2 dry) to dark grayish brown (2.5Y 4/2 moist) calcareous granular silty clay; soft when dry and very friable when moist.
C1 830	6 to 11 inches. Light brownish gray (2.5Y 6/2 dry) to dark grayish brown (2.5Y 4/2 moist) calcareous weakly granular fine sandy loam; soft when dry and very friable when moist.
IIC2 831	11 to 16 inches. Grayish brown (2.5Y 5/2 dry) to olive (2.5Y 3.5/4 dry) calcareous silty clay stratified with layers of silty clay loam; moderately developed platy or chip-like structure and is slightly hard when dry and friable when moist.
IIIC3 832	Composite of 16 to 20 inches, 20 to 21 inches, and 21 to 38 inches.
	16 to 20 inches. Light gray (2.5Y 7/2 dry) to grayish brown (2.5Y 5/2 moist) massive calcareous loam; soft when dry and very friable when moist; abrupt boundary.
	20 to 21 inches. Grayish brown (2.5Y 5/2 dry) to dark gray (2.5Y 4/1 moist) calcareous clay stratified with very thin lenses of loam; pronounced platy or chip-like structure; slightly hard when dry and friable when moist.
	21 to 38 inches. Light brownish gray (2.5Y 6/2 dry) to grayish brown (2.5Y 5/2 moist) massive calcareous fine sandy loam; a fresh cut shows intense very fine stratification but the individual strata are too thin to determine their individual texture; soft when dry and very friable when moist.
IIIC4 833	38 to 51 inches. Light brownish gray (2.5Y 6/2 dry) to dark grayish brown (2.5Y 4/2 moist) massive calcareous intensely stratified loam; soft when dry and very friable when moist; abrupt boundary.
IVC5 834	51 to 56 inches. Grayish brown (2.5Y 5/2 dry) to very dark grayish brown (2.5Y 3/2 moist) calcareous clay; very pronounced angular blocky structure and is intensely mottled with large to medium distinct strong brown (7.5YR 5/6 dry) mottles and stains; extremely hard when dry and very firm when moist; abrupt boundary.
IVC6	56 to 60 inches. Light gray (2.5Y 7/2 dry) to dark grayish brown (2.5Y 4/2 moist) massive calcareous intensely stratified light clay loam; texture of individual strata cannot be determined because they are too thin to sample; soft when dry and very friable when moist. (Not sampled.)

SOIL SURVEY LABORATORY Mandan, N. Dak.

SOIL TYPE Havre silt loam **LOCATION** Yellowstone County, Montana

SOIL NOS. S51Mont-56-10 **LAB. NOS.** 708-713

DEPTH INCHES	HORIZON	1B1a PARTICLE SIZE DISTRIBUTION (in mm.) (per cent 8A1) VERY COARSE SAND 2-1	COARSE SAND 1-0.5	MEDIUM SAND 0.5-0.25	FINE SAND 0.25-0.10	VERY FINE SAND 0.10-0.05	SILT 0.05-0.002	CLAY < 0.002	0.2-0.02	0.02-0.002	2A2 > 2	TEXTURAL CLASS
0-8	Ap	-	0.3	1.1	8.1	24.3	48.5	17.7	60.2	18.7	-	1
8-17	C1	-	0.2	1.2	10.0	34.4	42.0	12.2	70.3	13.8	-	1
17-23	C2	-	0.1	0.6	5.0	24.7	52.8	16.8	59.8	21.6	-	sil
23-26	A1b	0.1	0.1	0.2	2.7	11.4	61.1	24.4	38.1	36.8	-	sil
26-39	C1b	-	0.1	0.3	2.4	16.5	62.2	18.5	53.0	27.6	-	sil
39-53	C2b	-	0.2	1.2	13.8	27.3	42.8	14.7	62.1	18.6	-	1

8C1b SATURATED PASTE	pH 8C1a 1:5	8C1a 1:10	ORGANIC MATTER 6A1a ORGANIC CARBON %	6R1a NITROGEN %	C/N	8A2 EST% SALT (BUREAU CUP)	ELECTRICAL CONDUCTIVITY EC×10³ MILLIMHOS PER CM 8A1a	6E1a $CaCO_3$ equivalent %	6F1a GYPSUM me./100g. SOIL	MOISTURE TENSIONS 1/10 ATMOS. %	1/3 ATMOS. %	4B2 15 ATMOS. %
7.8	8.7	8.8	1.12	0.122	9.2	-	1.0	5	-			9.1
8.0	8.8	9.0	0.39	0.048	8.1	-	0.6	4	-			5.8
8.0	8.8	9.0	0.53	0.061	8.7	-	0.6	2	-			8.3
7.9	8.6	9.0	0.78	0.083	9.4	-	1.0	4	-			12.1
7.9	8.6	9.0	0.57	0.064	8.9	-	1.4	4	-			9.1
8.0	8.8	9.0	0.50	0.049	10.2	-	1.2	2	-			7.9

5A1a CATION EXCHANGE CAPACITY NH_4OAc	EXCHANGEABLE CATIONS 5B1b		6P2a Na	6Q2a K	5D2 EXCH. Na %	SATURATION EXTRACT SOLUBLE 8A1 6P1a Na	6Q1a K	8A MOISTURE AT SATURATION %
← milliequivalents per 100g. soil →						← milliequivalents per liter →		
16.1			0.3	1.6	2	2.6	1.3	44.3
12.7			0.2	0.7	2	1.5	0.4	38.7
16.1			0.5	0.4	3	3.3	-	43.6
22.8			1.2	0.5	5	4.8	-	52.1
18.5			0.8	0.4	4	5.4	-	49.6
18.1			1.2	0.3	7	5.2	-	43.0

Soil type: Havre silt loam
Soil No.: S51Mont-56-10
Location: Yellowstone County, Montana; NW1/4 SE1/4 Section 27, T3N, R28E.
Vegetation: Sugar beets, irrigated.
Parent material: Alluvium.
Physiographic position: Low terrace.
Slope: 1 percent.
Erosion: None to slight.
Drainage: Imperfect.
Moisture: Wet.
Stoniness: None.
Root distribution: Good.
Classification: Alluvial soil.
Described by: W. C. Bourne, August 10, 1951.

Horizon and Mandan Lab. Number	
Ap 708	0 to 8 inches. Dark grayish brown (10YR 4/2) moist, silt loam; weak medium granular structure; soft, friable, nonsticky and nonplastic; calcareous.
C1 709	8 to 17 inches. Dark grayish brown (2.5Y 4/2) moist, very fine sandy loam; massive structure; soft, very friable, nonsticky and nonplastic; calcareous.
C2 710	17 to 23 inches. Dark grayish brown (2.5Y 4/2) moist, silt loam; massive structure; soft, very friable, nonsticky and nonplastic; calcareous.
A1b 711	23 to 26 inches. Very dark gray (10YR 3/1) moist, silt loam; weak platy structure; soft, very friable, nonsticky and nonplastic; calcareous; wavy boundary.
C1b 712	26 to 39 inches. Dark grayish brown (10YR 4/2) moist, silt loam, made up of thinly stratified dark-colored very fine sandy loam and lighter-colored silt loam; massive structure; soft, very friable, nonsticky and nonplastic; calcareous.
C2b 713	39 to 53 inches. Dark grayish brown (2.5Y 4/2) moist, fine sandy loam; massive structure; soft, very friable, nonsticky and nonplastic; calcareous.

Remarks: Entire profile above field capacity.

SOIL SURVEY LABORATORY Mandan, N. Dak.

SOIL TYPE *Hesper silty clay loam **LOCATION** Yellowstone County, Montana

SOIL NOS. S53Mont-56-1 **LAB. NOS.** 1688-1695

DEPTH INCHES	HORIZON	1B1a PARTICLE SIZE DISTRIBUTION (in mm.) (per cent) VERY COARSE SAND 2-1	COARSE SAND 1-0.5	MEDIUM SAND 0.5-0.25	FINE SAND 0.25-0.10	VERY FINE SAND 0.10-0.05	SILT 0.05-0.002	CLAY < 0.002	3A1 0.2-0.02	0.02-0.002	2A2 > 2 (<19mm)	TEXTURAL CLASS
0-2	A11	0.7	1.4	2.8	13.6	26.8	41.4	13.3	61.0	16.2	1	l
2-4½	B21t	0.4	0.7	1.4	8.8	16.9	32.0	39.8	41.5	13.4	-	cl
4½-12	B22t	-	0.4	0.9	6.5	18.0	36.4	37.8	43.8	15.3	-	cl
12-15	B31	-	0.4	0.8	6.7	22.7	44.2	25.2	55.4	17.5	-	l
15-22	B32	-	0.2	0.7	7.2	26.6	42.2	23.1	57.9	16.3	-	l
22-28	C1ca	0.2	0.2	1.0	11.7	34.4	31.8	20.7	63.6	11.5	-	l
28-37	C2ca	-	0.1	0.8	12.7	39.0	29.2	18.2	68.3	9.9	-	vfsl
37-45	C3	0.2	0.3	1.5	16.1	38.7	26.7	16.5	67.8	9.8	tr.	vfsl

pH 8C1b SATURATED PASTE	8C1a 1:5	8C1a 1:10	ORGANIC MATTER 6A1a ORGANIC CARBON %	NITROGEN %	C/N	8A2 EST% SALT (BUREAU CUP)	ELECTRICAL CONDUCTIVITY EC×10³ MILLIMHOS PER CM 8A1a	6E1a $CaCO_3$ equivalent %	6F1a GYPSUM me./100g. SOIL	MOISTURE TENSIONS 1/10 ATMOS. %	1/3 ATMOS. %	4B2 15 ATMOS. %
5.8	6.0	6.3	1.39			-	0.7	1				6.4
6.5	6.7	6.8	0.81			-	0.6	1				14.7
6.8	7.1	7.3	0.66			-	0.5	1				16.0
7.7	8.5	8.6	0.49			-	0.8	1	-			11.2
8.2	9.0	9.1	0.30			-	1.6	7	-			9.7
8.4	9.1	9.3	0.21			-	3.9	9	-			7.8
8.3	9.1	9.3	0.14			-	4.9	7	-			7.0
8.2	9.0	9.2	0.12			0.24	6.5	6	-			6.5

5A1a CATION EXCHANGE CAPACITY NH_4OAc	5B1a CATIONS EXTRACTABLE 6N2b Ca	6O2b Mg	H	5B1b EXCHANGEABLE 6P2a Na	6Q2a K	5D2 EXCH. Na %	SATURATION EXTRACT SOLUBLE 6P1a Na	6Q1a K	6J1a HCO_3	6K1a Cl	8A1 6L1a SO_4	8A MOISTURE AT SATURATION %
←	milliequivalents per 100g. soil →						← milliequivalents per liter →					
12.0	5.5			0.1	1.2	1	0.9	0.6				35.2
29.2	12.9			0.4	1.7	1	0.9	0.2				47.9
29.6	12.2	15.0		0.5	1.0	2	2.0	-				53.8
20.7	19.7	13.2		0.9	0.5	4	4.6	-				44.9
15.4				1.2	0.3	8	11.2	0.4				41.9
12.3				1.6	0.3	13	26.1	0.4				37.1
11.6				1.9	0.3	16	38.2	0.4	1.6	15.5	34.4	38.1
11.5				1.4	0.3	12	58.0	0.6	2.2	21.2	62.1	36.0

Soil type: *Hesper silty clay loam
Soil No.: S53Mont-56-1
Location: Yellowstone County, Montana; 300 feet south-southwest of E1/4 Section 6, T1N, R28E.
Vegetation: Western wheatgrass with needlegrass and cheatgrass brome; some of the area is in dense sage.
Parent material: Silty fine earths, probably loess, over gravel.
Physiographic position: High terrace, probably 100 to 150 feet above Yellowstone River.
Relief: Very slightly irregular, nearly level.
Slope: 1 to 2 percent.
Drainage: Well drained.
Depth to lime (range): 12 to 20 inches.
Described by: W. C. Bourne, August 1953.

Horizon and
Mandan
Lab. Number

A11
1688 — 0 to 2 inches. Mulch; gray brown (10YR 5/2 dry) to very dark grayish brown (10YR 3/2 moist) very fine sandy loam; weak thin platy structure breaking to weak very fine crumb structure; soft when dry, friable when moist; abrupt smooth boundary; noncalcareous.

B21t
1689 — 2 to 4½ inches. Dark gray brown (10YR 4/2 dry) to very dark gray brown (10YR 3/2 moist) silty clay loam; weak coarse blocky structure breaking to coarse medium and fine crumb; soft when dry, friable when moist; clear smooth boundary; noncalcareous.

B22t
1690 — 4½ to 12 inches. Dark gray brown (10YR 4/2 dry) to very dark gray brown (10YR 3/2 moist) heavy silty clay loam; strong medium and coarse prismatic structure breaking to strong medium and fine blocks; hard when dry, friable when moist; clear smooth boundary.

B31
1691 — 12 to 15 inches. Brown (10YR 5/3 dry) to dark gray brown (10YR 4/2 moist) silty clay loam; weak prismatic structure breaking to strong subangular blocks; hard when dry, friable to firm when moist; clear wavy boundary; noncalcareous.

B32
1692 — 15 to 22 inches. Light brownish gray (10YR 6/2 dry) to gray brown (2.5Y 5/2 moist) heavy silt loam; weak coarse subangular blocky structure; slightly hard when dry, friable when moist; calcareous; some whitish spots on fresh surface; gradual irregular boundary.

C1ca
1693 — 22 to 28 inches. Light brownish gray (10YR 6/2 dry) to light olive brown (2.5Y 5/3 moist) light clay loam; massive breaking to clods; soft when dry, friable when moist; gradual irregular boundary; very calcareous with white specks.

C2ca
1694 — 28 to 37 inches. Light brownish gray (10YR 6/2 dry) to light olive brown (2.5Y 5/3 moist) silt loam; massive; soft when dry, friable when moist; gradual irregular boundary; very calcareous with white specks.

C3
1695 — 37 to 45 inches. Light brownish gray (10YR 6/2 dry) to light olive brown (2.5Y 5/3 moist) very fine sandy loam; massive; soft when dry, friable when moist; very calcareous with white specks; has scattered pebbles; horizon is underlain by a slightly reddish buried surface soil which was not sampled; gradual wavy boundary.

Remarks: Profile on slope toward slight swale at head of drain; soil in the slight swale position is darker in B horizon, and has weaker A2. Numerous gopher mounds have gravel; field in which sample was taken could have been broken and early abandoned.

SOIL SURVEY LABORATORY Mandan, N. Dak.

SOIL TYPE *Hesper silty clay loam **LOCATION** Yellowstone County, Montana

SOIL NOS. S53Mont-56-7 **LAB. NOS.** 1728-1734

DEPTH INCHES	HORIZON	1B1a PARTICLE SIZE DISTRIBUTION (in mm.) (per cent) 3A1 VERY COARSE SAND 2-1	COARSE SAND 1-0.5	MEDIUM SAND 0.5-0.25	FINE SAND 0.25-0.10	VERY FINE SAND 0.10-0.05	SILT 0.05-0.002	CLAY < 0.002	0.2-0.02	0.02-0.002	2A2 > 2 <19mm	TEXTURAL CLASS
0-2	A11	1.8	2.6	2.6	5.8	27.0	45.3	14.9	60.1	15.7	2	l
2-5	B1	2.0	2.0	1.8	4.1	21.2	45.2	23.7	47.6	21.3	3	l
5-8	B21t	0.6	0.8	0.9	2.0	16.3	39.5	39.9	41.6	15.4	tr.	cl
8-11	B22t	0.3	0.4	0.4	1.0	11.6	42.0	44.3	36.9	17.3	-	sic
11-20	B23t	0.4	0.2	0.2	1.1	16.8	50.1	31.2	47.6	20.1	-	sicl
20-28	B3ca	2.2	0.8	0.4	1.6	20.6	41.6	32.8	46.5	16.9	2	cl
28-40	C1ca	0.6	0.5	0.4	1.5	16.8	43.4	36.8	43.2	18.1	tr.	cl

SATURATED PASTE 8C1b	pH 1:5 8C1a	pH 1:10 8C1a	ORGANIC MATTER ORGANIC CARBON % 6A1a	NITROGEN %	C/N	8A2 EST% SALT (BUREAU CUP)	ELECTRICAL CONDUCTIVITY EC×10³ MILLIMHOS PER CM 8A1a	6F1a $CaCO_3$ equivalent %	6F1a GYPSUM me./100g. SOIL	MOISTURE TENSIONS 1/10 ATMOS. %	1/3 ATMOS. %	4B2 15 ATMOS. %
6.2	6.6	6.6	1.63			-	0.4	-				7.9
6.4	6.6	6.6	0.98			-	0.5	-				9.3
6.4	6.7	6.6	0.91			-	0.4	-				16.1
6.7	7.0	6.9	0.68			-	0.4	-	-			18.1
7.7	8.5	8.8	0.52			-	0.7	1	-			13.0
8.2	9.2	9.3	0.26			-	1.2	11	-			11.7
8.2	9.0	9.1	0.14			-	3.3	13	-			12.9

5A1a CATION EXCHANGE CAPACITY NH_4OAc	5B1a EXTRACTABLE CATIONS 6N2b Ca	6O2b Mg	H	5B1b EXCHANGEABLE 6P2a Na	6Q2a K	5D2 EXCH. Na %	SATURATION EXTRACT SOLUBLE 6P1a Na	6Q1a K	8A1	8A MOISTURE AT SATURATION %
	milliequivalents per 100g. soil						milliequivalents per liter			
13.9	7.4	4.4		0.1	1.1	1	0.9	0.6		44.0
17.7	8.6	6.6		0.1	1.0	-	1.2	0.4		39.7
29.7	13.4	12.0		0.1	1.4	-	1.2	0.2		51.8
33.0	15.3	15.5		0.3	1.3	1	1.5	0.2		59.8
24.4	19.9	14.2		0.7	0.5	3	3.8	0.2		52.1
20.2				1.6	0.3	8	9.1	0.2		48.8
20.9				2.5	0.4	12	24.0	0.2		55.6

Soil type: *Hesper silty clay loam
Soil No.: S53Mont-56-7
Location: Yellowstone County, Montana; NE1/4 Section 14, T4S, R26E.
Classification: Medial Chestnut.
Vegetation: Mixed tall and short grasses.
Parent material: Silty mantle, at least in part loess.
Physiographic position: High Tertiary age bench.
Relief: Gently sloping.
Slope: 3 to 4 percent.
Drainage: Good.
Moisture: Dry.
Stoniness: None.
Ground water: Very deep.
Salt or alkali: None.
Root distribution: Good.
Erosion: None.
Permeability: Moderate.
Described by: W. C. Bourne, August 1953.

Horizon and Mandan Lab. Number	
A11 1728	0 to 2 inches. Light brownish gray (10YR 6/2 dry) to dark gray brown (10YR 4/2 moist) silt loam; weak thin platy structure breaking to weak very fine crumb; soft when dry, friable when moist.
B1 1729	2 to 5 inches. Pale brown (10YR 6/3 dry) to dark gray brown (10YR 4/2 moist) light silty clay loam; moderate medium prismatic structure breaking to coarse platy and very fine granules; soft when dry, friable when moist.
B21t 1730	5 to 8 inches. Brown (10YR 5/3 dry) to dark brown (10YR 3/3 moist) heavy silty clay loam; weak medium prismatic structure breaking to fine and very fine blocky; soft when dry, friable when moist.
B22t 1731	8 to 11 inches. Brown to dark brown (10YR 4/3 dry) to dark brown (10YR 3/3 moist) silty clay; strong medium prismatic structure breaking to medium and fine blocky; hard when dry, friable to firm when moist.
B23t 1732	11 to 20 inches. Pale brown (10YR 6/3 dry) to dark gray brown (10YR 4/2 moist) heavy silty clay loam; moderate medium and fine prismatic structure breaking to fine blocky; hard when dry, friable when moist.
B3ca 1733	20 to 28 inches. Light brownish gray (2.5Y 6/2 dry) to gray brown (2.5Y 5/2 moist) silty clay loam; moderate to weak medium to fine subangular blocky structure; hard when dry, friable when moist; highly calcareous.
C1ca 1734	28 to 40 inches. Pale brown (10YR 6/2.5 dry) to brown (10YR 5/2.5 moist) silty clay loam; massive to weak very coarse prismatic or blocky; moderately hard when dry, friable when moist; highly calcareous.
C2	40 to 48 inches. Light yellowish brown (10YR 6/4 dry) to brown (10YR 5/3 moist) silty clay loam; massive; soft when dry, friable when moist; calcareous; (not sampled).

SOIL SURVEY LABORATORY Mandan, N. Dak.

SOIL TYPE *Hesper silty clay loam **LOCATION** Yellowstone County, Montana

SOIL NOS. S53Mont-56-9 **LAB. NOS.** 1740-1745

DEPTH INCHES	HORIZON	1B1a PARTICLE SIZE DISTRIBUTION (in mm.) (per cent) VERY COARSE SAND 2-1	COARSE SAND 1-0.5	MEDIUM SAND 0.5-0.25	FINE SAND 0.25-0.10	VERY FINE SAND 0.10-0.05	SILT 0.05-0.002	CLAY < 0.002	3A1 0.2-0.02	0.02-0.002	2A2 > 2 (<19mm)	TEXTURAL CLASS
0-2	A1	1.0	0.9	1.2	6.8	29.0	44.2	16.9	59.6	18.2	1	l
2-5	B21t	0.6	0.4	0.6	3.8	18.8	40.7	35.1	44.5	17.8	1	cl
5-11	B22t	-	0.2	0.2	1.6	14.3	36.9	46.8	36.4	16.0	-	c
11-16	B23t	0.2	0.2	0.2	2.6	24.1	40.4	32.3	50.4	16.1	-	cl
16-20	B3	0.6	0.3	0.3	2.8	29.0	38.7	28.3	54.3	15.7	1	cl
20-38	Cca	0.5	0.4	1.0	7.8	32.9	27.5	29.9	52.0	14.5	tr.	cl

DEPTH INCHES	8C1b pH SATURATED PASTE	8C1a pH 1:5	8C1a pH 1:10	ORGANIC MATTER 6A1a ORGANIC CARBON %	NITROGEN %	C/N	8A2 EST% SALT (BUREAU CUP)	ELECTRICAL CONDUCTIVITY EC×10³ MILLIMHOS PER CM 8A1a	6E1a $CaCO_3$ equivalent %	6F1a GYPSUM me./100g. SOIL	MOISTURE TENSIONS 1/10 ATMOS. %	1/3 ATMOS. %	4B2 15 ATMOS. %
0-2	7.0	7.2	7.2	1.48			-	0.6	-				7.9
2-5	6.7	6.9	7.0	1.06			-	0.4	-				12.6
5-11	6.7	6.6	7.1	0.80			-	0.4	-				18.9
11-16	7.4	8.1	8.1	0.61			-	0.6	-	-			12.9
16-20	7.8	8.6	8.8	0.44			-	0.7	7	-			10.2
20-38	8.0	8.9	9.1	0.30			-	0.8	8	-			9.9

DEPTH INCHES	5A1a CATION EXCHANGE CAPACITY NH_4OAc	5B1a CATIONS EXTRACTABLE 6N2b Ca	6O2b Mg	H	5B1b EXCHANGEABLE 6P2a Na	6Q2a K	5D2 EXCH. Na %	SATURATION EXTRACT SOLUBLE 8A1 6P1a Na	6Q1a K	8A MOISTURE AT SATURATION %
	← milliequivalents per 100g. soil →							← milliequivalents per liter →		
0-2	14.8	9.9	3.8		0.1	0.9	1	1.2	0.4	44.1
2-5	24.8	12.8	9.4		0.1	1.2	-	0.9	0.2	47.9
5-11	33.5	16.5	15.7		-	1.3	-	1.2	0.2	63.1
11-16	25.4	14.8	13.4		-	0.7	-	1.2	0.2	51.8
16-20	19.1		11.6		0.1	0.5	-	1.7	0.2	46.0
20-38	17.9		15.9		0.5	0.4	3	4.6	0.2	44.1

Soil type: *Hesper silty clay loam
Soil No.: S53Mont-56-9
Location: Yellowstone County, Montana; northwest part of SE1/4 of NW1/4 Section 33, T2N, R29E (just east of road).
Classification: Medial Brown.
Vegetation: Sagebrush, wheatgrass and grama.
Parent material: Loess--old alluvium of fan origin.
Physiographic position: Eroded high terrace sloping north.
Relief: Gently sloping.
Drainage: Well drained.
Slope: 2 to 4 percent.
Described by: W. C. Bourne, August 1953.

Horizon and Mandan Lab. Number	
A1 1740	0 to 2 inches. Light brownish gray (10YR 6/2 dry) to dark gray brown (10YR 4/2 moist) silt loam; very weak very thin platy structure breaking to weak very fine crumb; soft when dry, friable when moist; clear smooth boundary; noncalcareous.
B21t 1741	2 to 5 inches. Gray brown (10YR 5/2 dry) to very dark gray brown (10YR 3/2 moist) light silty clay loam; weak thin platy structure breaking to strong fine crumb; slightly hard when dry, firm when moist; abrupt smooth boundary; noncalcareous.
B22t 1742	5 to 11 inches. Brown (10YR 4/2.5 dry) to dark brown (10YR 3/3 moist) light silty clay; strong medium and coarse prismatic structure; hard when dry, friable to firm when moist; gradual smooth boundary; noncalcareous.
B23t 1743	11 to 16 inches. Dark gray brown (10YR 4/2 dry) to very dark gray brown (10YR 3/2 moist) silty clay loam; strong medium and fine prismatic structure breaking to strong fine blocky; hard when dry, friable to firm when moist; gradual wavy boundary; noncalcareous.
B3 1744	16 to 20 inches. Light olive brown (2.5Y 5/3 dry) to olive brown (2.5Y 4/3 moist) silty clay loam; moderate medium and fine subangular blocky structure; hard when dry, firm when moist; gradual wavy boundary; calcareous.
Cca 1745	20 to 38 inches. Pale olive (5Y 6/3 dry) to olive gray (5Y 4/2 moist) clay loam with many white lime spots; massive or weak very coarse subangular blocky structure; hard when dry, friable when moist; very calcareous; contains fine roots; underlaid by gravelly fine earths.

SOIL SURVEY LABORATORY Mandan, N. Dak.

SOIL TYPE Hopley loam **LOCATION** Yellowstone County, Montana

SOIL NOS. 851Mont-56-7 **LAB. NOS.** 689-694

DEPTH INCHES	HORIZON	1B1a PARTICLE SIZE DISTRIBUTION (in mm.) (per cent) 3A1								2A2	TEXTURAL CLASS
		VERY COARSE SAND 2-1	COARSE SAND 1-0.5	MEDIUM SAND 0.5-0.25	FINE SAND 0.25-0.10	VERY FINE SAND 0.10-0.05	SILT 0.05-0.002	CLAY < 0.002	0.2-0.02	0.02-0.002	> 2	
0-7	Ap	0.6	1.8	9.9	24.9	12.8	27.8	22.2	39.5	14.3	-	scl
7-13	B2	0.2	1.4	11.0	33.1	15.4	17.4	21.5	42.8	8.1	-	scl
13-21	B3	0.7	1.3	10.2	32.1	14.3	18.8	22.6	40.4	10.5	-	scl
21-29	IIC1ca	0.1	0.7	4.9	14.5	6.0	28.1	45.7	22.0	20.0	-	c
29-42	IIC2ca	0.1	0.8	5.0	17.1	19.7	29.2	28.1	45.6	14.0	-	cl
42-50	IIIC3	-	0.9	21.1	60.3	8.5	6.6	2.6	35.3	2.4	-	fsl

pH			ORGANIC MATTER			8A2	ELECTRICAL CONDUCTIVITY	6E1a	6F1a	MOISTURE TENSIONS		4B2
8C1b SATURATED PASTE	8C1a 1:5	8C1a 1:10	6A1a ORGANIC CARBON %	6B1a NITROGEN %	C/N	EST% SALT (BUREAU CUP)	EC×10³ MILLIMHOS PER CM 8A1a.	$CaCO_3$ equivalent %	GYPSUM me./100g. SOIL	1/10 ATMOS. %	1/3 ATMOS. %	15 ATMOS. %
7.0	7.6	7.8	1.44	0.138	10.4	-	0.5	tr.	-			9.7
7.3	7.8	7.9	0.50	0.064	7.8	-	0.5	tr.	-			9.7
7.9	8.8	8.9	0.48	0.044	10.9	-	0.4	2	-			9.0
8.2	9.0	8.9	0.33	0.049	6.7	-	0.6	18	-			15.8
8.3	9.2	9.3	0.12	0.018		-	0.7	17	-			8.6
8.3	9.3	9.3	0.02	0.002		-	1.2	3	-			2.0

5A1a CATION EXCHANGE CAPACITY NH_4OAc	5B1a EXTRACTABLE CATIONS 6N2b Ca	6O2b Mg	5B1b EXCHANGEABLE 6P2a Na	6Q2a K	5D2 EXCH. Na %	SATURATION EXTRACT SOLUBLE 8A1 6P1a Na	6Q1a K	8A MOISTURE AT SATURATION %
← milliequivalents per 100g. soil →						← milliequivalents per liter →		
18.5	12.2	4.8	0.2	1.1	1	1.3	0.2	39.8
18.3	11.7	6.3	0.2	0.6	1	1.3	-	39.3
18.2			0.3	0.3	2	0.9	-	39.0
23.0			0.5	0.5	2	2.2	-	60.1
13.3			0.4	0.3	3	2.2	-	37.0
5.0			0.2	0.1	4	5.2	-	29.6

Soil type: Hopley loam
Soil No.: S51Mont-56-7
Location: Yellowstone County, Montana; NW1/4 SW1/4 Section 2, T2N, R29E.
Vegetation: Irrigated alfalfa.
Parent material: Cretaceous alluvium and Pleistocene gravel.
Physiographic position: Level high terrace.
Slope: 1 percent.
Erosion: Slight.
Drainage: Good surface.
Moisture: Moist.
Stoniness: Slight.
Root distribution: Good.
Classification: Mature Brown soil.
Described by: W. C. Bourne, August 9, 1951.

Horizon and Mandan Lab. Number	
Ap 689	0 to 7 inches. Very dark grayish brown (10YR 3/2) moist, loam; fine crumb structure; slightly hard, friable, nonsticky and nonplastic; noncalcareous.
B2 690	7 to 13 inches. Brown (10YR 4/3) moist sandy clay loam; strong medium prismatic structure; hard, friable, nonsticky and nonplastic; noncalcareous.
B3 691	13 to 21 inches. Olive brown (2.5Y 4/4) moist, clay loam; strong medium blocky structure; hard, friable, nonsticky and nonplastic; weakly calcareous with a few crystals of gypsum.
IIC1ca 692	21 to 29 inches. Olive brown (2.5Y 4/4) moist, silty clay loam; moderate blocky structure; very hard, firm, sticky and plastic; calcareous with spots and streaks of segregated lime.
IIIC2ca 693	29 to 42 inches. Olive brown (2.5Y 4/3) moist, silty clay loam; massive structure; hard, friable, slightly sticky and slightly plastic; strongly calcareous with segregated lime in white streaks.
IVC3 694	42 to 50 inches. Olive gray (5Y 4/2) moist, fine sand; massive; soft, very friable, nonsticky and nonplastic; calcareous.

Remarks: Apparently restricted underdrainage — sands saturated but alfalfa suffers.

SOIL SURVEY LABORATORY Mandan, N. Dak.

SOIL TYPE Hopley loam **LOCATION** Yellowstone County, Montana

SOIL NOS. S53Mont-56-3 **LAB. NOS.** 1704-1710

DEPTH INCHES	HORIZON	1B1a PARTICLE SIZE DISTRIBUTION (in mm.) (per cent) VERY COARSE SAND 2-1	COARSE SAND 1-0.5	MEDIUM SAND 0.5-0.25	FINE SAND 0.25-0.10	VERY FINE SAND 0.10-0.05	SILT 0.05-0.002	CLAY < 0.002	3A1 0.2-0.02	0.02-0.002	2A2 > 2 (<19mm)	TEXTURAL CLASS
0-2	A1	1.2	1.7	3.0	21.6	33.3	23.5	15.7	63.0	9.0	-	vfsl
2-4	A3	0.7	-	3.1	21.5	34.1	21.6	19.0	63.5	7.8	-	vfsl
4-6½	B2	0.6	0.8	2.1	19.7	32.4	21.9	22.5	60.0	8.7	-	scl
6½-10	B3ca	0.3	0.8	1.6	18.3	35.2	21.6	22.2	60.8	10.1	-	scl
10-22	C1ca	0.4	0.6	1.5	18.1	36.1	24.5	18.8	53.5	10.9	-	vfsl
22-31	C2ca	-	0.4	1.0	13.2	38.4	28.2	18.8	66.3	10.7	-	vfsl
31-42	C3	-	0.2	0.7	12.0	41.7	27.3	18.1	68.1	10.7	-	vfsl

pH 8C1b SATURATED PASTE	pH 8C1a 1:5	pH 8C1a 1:10	ORGANIC MATTER 6A1a ORGANIC CARBON %	NITROGEN %	C/N	8A2 EST% SALT (BUREAU CUP)	ELECTRICAL CONDUCTIVITY EC×10³ MILLIMHOS PER CM 5A1a	6E1a $CaCO_3$ equivalent %	6F1a GYPSUM me./100g. SOIL	MOISTURE TENSIONS 1/10 ATMOS. %	1/3 ATMOS. %	4B2 15 ATMOS. %
6.8	6.8	6.8	1.66			-	0.6	-				8.3
7.7	8.0	8.0	1.06			-	0.7	1				8.2
7.8	8.3	8.4	0.94			-	0.6	5				9.0
7.9	8.4	8.6	0.63			-	0.6	11	-			8.7
7.9	8.5	8.7	0.42			-	0.6	1	-			7.2
8.1	8.6	8.7	0.29			-	0.7	7	-			6.8
8.2	8.7	8.9	0.20			-	0.7	8	-			6.4

5A1a CATION EXCHANGE CAPACITY NH_4OAc	5B1a EXTRACTABLE CATIONS 6N2b Ca	6O2b Mg	H	5B1b EXCHANGEABLE 6P2a Na	6Q2a K	5D2 EXCH. Na %	SATURATION EXTRACT SOLUBLE 6P1a Na	6Q1a K	8A1			8A MOISTURE AT SATURATION %
← milliequivalents per 100g. soil →							← milliequivalents per liter →					
16.4	11.9	4.1		0.1	1.0	1	0.3	0.4				42.3
16.5		4.3		0.1	0.9	1	0.3	0.4				39.2
16.4		4.4		0.2	0.8	1	0.6	0.4				42.4
13.3		4.3		0.2	0.5	2	0.6	0.4				40.2
12.5		6.4		0.2	0.5	2	0.6	0.4				37.1
12.2				0.2	0.3	2	0.9	0.4				37.6
12.2				0.3	0.2	2	1.7	0.2				38.2

Soil type: Hopley loam
Soil No.: S53Mont-56-3
Location: Yellowstone County, Montana; SE1/4 NW1/4 Section 8, T1N, R28E, on rounded ridge southeast of small Kettle hole.
Vegetation: Sagebrush and mid and short grasses.
Physiographic position: Rounded nose on dissected high fan or footslopes; part of high terrace system.
Drainage: Well drained.
Described by: W. C. Bourne, August 1953

Horizon and Mandan Lab. Number	
A1 1704	0 to 2 inches. Grayish brown (10YR 5/2 dry) to very dark grayish brown (10YR 3/2 moist) silt loam; moderate thin platy breaking to weak very fine crumb structure; soft when dry, friable when moist; noncalcareous; clear smooth boundary.
A3 1705	2 to 4 inches. Brown (10YR 5/3 dry) to very dark grayish brown (10YR 3/2 moist) silt loam; weak thin platy breaking to very fine crumb structure; soft when dry, friable when moist; noncalcareous; clear wavy boundary.
B2 1706	4 to 6½ inches. Dark gray brown (10YR 4/2 dry) to very dark gray brown (10YR 3/2 moist) heavy silt loam; moderate coarse blocky structure; soft when dry, friable when moist; weakly calcareous; clear wavy boundary.
B3ca 1707	6½ to 10 inches. Pale brown (10YR 6/3 dry) to dark gray brown (10YR 4/2 moist) heavy silt loam; weak medium subangular blocky structure; soft when dry, friable when moist; very calcareous; gradual irregular boundary.
C1ca 1708	10 to 22 inches. Light brownish gray (2.5Y 6/2 dry) with numerous white spots to light olive brown (2.5Y 5/3 moist) silt loam; massive; very calcareous; diffuse wavy boundary.
C2ca 1709	22 to 31 inches. Light brownish gray (2.5Y 6/2 dry) with numerous white spots to light olive brown (2.5Y 5/3 moist) silt loam; massive; soft when dry, friable when moist; very calcareous with white spots; gradual wavy boundary.
C3 1710	31 to 42 inches. Gray brown (2.5Y 5/2 dry) to dark gray brown (2.5Y 4/2 moist) loam high in very fine sand; massive; soft when dry, friable when moist; calcareous.

SOIL SURVEY LABORATORY Mandan, N. Dak.

SOIL TYPE Hopley loam **LOCATION** Yellowstone County, Montana

SOIL NOS. S53Mont-56-12 **LAB. NOS.** 1758-1764

DEPTH INCHES	HORIZON	1B1a PARTICLE SIZE DISTRIBUTION (in mm.) (per cent) VERY COARSE SAND 2-1	COARSE SAND 1-0.5	MEDIUM SAND 0.5-0.25	FINE SAND 0.25-0.10	VERY FINE SAND 0.10-0.05	SILT 0.05-0.002	CLAY < 0.002	3A1 0.2-0.02	0.02-0.002	2A2 > 2 (<19mm)	TEXTURAL CLASS
0-2	A11	1.1	9.0	12.8	15.8	12.2	35.7	13.4	41.1	14.6	1	l
2-6	A12	1.7	10.3	13.3	15.3	11.6	32.2	15.6	37.2	14.2	1	l
6-12	B21	4.2	10.0	13.0	16.1	11.5	28.6	16.6	35.8	12.4	5	fsl
12-21	B22	2.6	10.3	13.5	16.8	10.8	26.6	19.4	34.4	11.4	3	fsl
21-26	B3	2.3	10.2	13.1	16.7	10.6	25.8	21.3	32.4	12.3	3	scl
26-34	C1ca	2.4	8.3	11.5	18.4	13.3	27.2	18.9	35.4	14.8	4	fsl
34-42	C2	2.2	13.0	20.2	26.2	12.0	17.3	9.1	34.1	8.0	2	sl

SATURATED PASTE 8C1b	pH 1:5 8C1a	pH 1:10 8C1a	ORGANIC MATTER ORGANIC CARBON % 6A1a	NITROGEN %	C/N	8A2 EST% SALT (BUREAU CUP)	ELECTRICAL CONDUCTIVITY EC×10³ MILLIMHOS PER CM 8A1a	6E1a $CaCO_3$ equivalent %	6F1a GYPSUM me./100g. SOIL	MOISTURE TENSIONS 1/10 ATMOS. %	1/3 ATMOS. %	4B2 15 ATMOS. %
6.5	6.9	7.0	2.13			-	0.6	-				9.5
6.8	6.9	6.9	1.16			-	0.4	-				8.2
7.1	7.0	7.0	0.72			-	0.4	-				7.9
7.2	7.4	7.1	0.49			-	0.6	-	-			8.8
7.5	8.1	8.3	0.42			-	0.7	6	-			10.2
7.7	8.4	8.6	0.30			-	0.7	19	-			9.3
7.9	8.6	8.6	0.17			-	0.7	9	-			5.7

5A1a CATION EXCHANGE CAPACITY NH_4OAc	5B1a EXTRACTABLE CATIONS 6N2b Ca	6O2b Mg	H	5B1b EXCHANGEABLE CATIONS 6P2a Na	6Q2a K	5D2 EXCH. Na %	SATURATION EXTRACT SOLUBLE 8A1 6P1a Na	6Q1a K	8A MOISTURE AT SATURATION %
← milliequivalents per 100g. soil →							← milliequivalents per liter →		
16.0	11.2	2.1		0.4	1.3	2	0.3	0.8	45.4
15.6	12.2	1.9		0.4	1.1	2	0.3	0.6	39.3
16.1	13.2	2.0		0.4	1.0	2	0.3	0.4	38.9
18.6	15.5	2.4		0.4	1.0	2	0.6	0.4	33.9
17.5	39.5	3.0		0.4	1.0	2	0.6	0.4	34.6
13.8	39.9	3.3		0.4	0.9	3	0.6	0.4	33.1
10.0	34.8	3.0		0.4	0.8	4	0.9	0.4	26.8

Soil type: Hopley loam
Soil No.: S53Mont-56-12
Location: Yellowstone County, Montana; SW1/4 SW1/4 Section 20, T1N, R29E; about 350 feet west and 75 feet north of southeast corner.
Vegetation: Short and mid grasses.
Parent material: Old alluvium and loess mixed by animals.
Physiographic position: High bench; approximately 3900 feet elevation.
Relief: Nearly level.
Slope: 1 percent.
Drainage: Well drained.
Note: Entire area is filled with krotovinas though the openings are not evident on the surface.
Described by: W. C. Bourne, August 1953.

Horizon and Mandan Lab. Number	
A11 1758	0 to 2 inches. Gray brown (10YR 5/2 dry) to very dark gray brown (10YR 2.5/2 moist) loam; very weak thin platy structure breaking to moderately fine and very fine crumb; soft when dry, friable when moist; clear smooth boundary; noncalcareous.
A12 1759	2 to 6 inches. Dark gray brown (10YR 4.5/2 dry) to very dark brown (10YR 2/2 moist) loam; moderate very coarse blocky structure breaking to moderate fine and very fine crumb; soft when dry, friable when moist; clear smooth boundary.
B21 1760	6 to 12 inches. Gray brown (10YR 5/2 dry) to very dark gray brown (10YR 3/2 moist) loam; moderate medium and coarse prismatic structure breaking to moderate fine crumb; slightly hard when dry, friable when moist; clear smooth boundary.
B22 1761	12 to 21 inches. Light brownish gray (10YR 6/2 dry) to dark gray brown (10YR 4/2 moist) heavy loam; moderate medium and coarse prismatic to moderate fine crumb; slightly hard when dry, friable when moist; clear wavy boundary.
B3 1762	21 to 26 inches. Light brownish gray (10YR 6/2 dry) to dark gray brown (10YR 4.5/2 moist) heavy loam; moderate medium and coarse blocky; slightly hard when dry; friable when moist; clear wavy boundary; calcareous.
C1ca 1763	26 to 34 inches. White (10YR 9/2 dry) to light gray (10YR 7/2 moist) silt loam; massive; soft when dry, friable when moist; gradual wavy boundary; very calcareous.
C2 1764	34 to 42 inches. White (10YR 8/2 dry) to light gray (10YR 7/2 moist) loamy fine sand; loose when dry; calcareous.

SOIL SURVEY LABORATORY Mandan, N. Dak.

SOIL TYPE Rysham silty clay loam **LOCATION** Yellowstone County, Montana

SOIL NOS. S52Mont-56-28 **LAB. NOS.** 1044-1048

DEPTH INCHES	HORIZON	1B1a PARTICLE SIZE DISTRIBUTION (in mm.) (per cent) 3A1 VERY COARSE SAND 2-1	COARSE SAND 1-0.5	MEDIUM SAND 0.5-0.25	FINE SAND 0.25-0.10	VERY FINE SAND 0.10-0.05	SILT 0.05-0.002	CLAY < 0.002	0.2-0.02	0.02-0.002	2A2 > 2	TEXTURAL CLASS
0-7	Ap	0.2	0.3	0.8	3.8	17.2	47.3	30.4	46.9	20.5	-	cl
7-18	C1sa	0.1	0.1	0.3	2.1	12.9	47.9	36.6	39.1	23.4	-	sicl
18-37	C2gcs	-	-	0.2	1.3	9.1	54.2	35.2	32.7	31.7	-	sicl
37-52	C3g	-	-	0.1	0.6	6.1	58.3	34.9	28.0	36.9	-	sicl
52-60	C4g	0.2	0.2	0.3	1.9	13.2	56.0	28.2	40.3	30.5	-	sicl

8C1b SATURATED PASTE	pH 8C1a 1:5	8C1a 1:10	ORGANIC MATTER 6A1a ORGANIC CARBON %	NITROGEN %	C/N	8A2 EST% SALT (BUREAU CUP)	ELECTRICAL CONDUCTIVITY EC×10³ MILLIMHOS PER CM 8A1a	6E1a $CaCO_3$ equivalent %	6F1a GYPSUM me./100g. SOIL	MOISTURE TENSIONS 1/10 ATMOS. %	1/3 ATMOS. %	4B2 15 ATMOS. %
8.4	9.4	9.7	0.49			0.54	13.0	5	-			12.7
8.5	9.5	9.8	0.18			0.59	10.0	6	-			15.2
8.0	8.8	9.4	0.13			0.46	8.1	9	5			15.1
8.1	9.4	9.7	0.13			0.24	4.2	12	-			15.4
8.5	9.8	10.0	0.12			-	2.2	9	-			15.6

5A1a CATION EXCHANGE CAPACITY NH_4OAc	EXCHANGEABLE CATIONS 5B1b Ca	Mg	H	6P2a Na	6Q2a K	5D2 EXCH. Na %	8A1 SATURATION EXTRACT SOLUBLE 6P1a Na	6Q1a K	8A MOISTURE AT SATURATION %
← milliequivalents per 100g. soil →							← milliequivalents per liter →		
17.4				11.4	0.9	66	159.0	0.2	57.7
20.6				14.0	0.6	68	133.0	-	91.6
21.5				7.7	0.5	36	96.0	0.2	72.2
22.6				7.7	0.4	34	42.8	-	74.0
20.9				11.1	0.5	53	22.4	-	76.2

Soil type: Hysham silty clay loam
Soil No.: S52Mont-56-28
Location: Yellowstone County, Montana; NE1/4 NW1/4 Section 17, T2N, R28E (Photo 9G-124); Anton Pfiffer farm.
Position: Swale on terrace and slope wash level.
Drainage: Imperfectly drained.
Vegetation: Crop--very poor barley and saltwort,
Note: Field has been leveled.
Described by: W. C. Bourne, July 1952.

Horizon and Mandan Lab. Number	
Ap 1044	0 to 7 inches. Dark grayish brown (10YR 4.5/2.5) moist, silty clay loam; weak blocky structure beneath a vesicular crust; calcareous.
C1sa 1045	7 to 18 inches. Pale brown (10YR 6/3) silty clay loam, grayish brown (10YR 5/2) moist; slightly hard, friable, sticky and plastic; calcareous with scattered crystals of salt and gypsum.
C2gcs 1046	18 to 37 inches. Pale brown (10YR 6/3) silty clay loam, brown (10YR 5/3) moist; slightly hard, friable, sticky and plastic; gray and brown mottles in the moist soil; calcareous with gypsum crystals.
C3g 1047	37 to 52 inches. Light brownish gray (10YR 6/2) loam or clay loam, grayish brown (10YR 5/2) moist; massive structure; slightly hard, friable, sticky and plastic; common faint mottlings of dark yellowish brown and gray in moist soil; calcareous.
C4g 1048	52 to 60 inches. Light brownish gray (10YR 6/2) silty clay loam with thin lenses of fine sandy loam, grayish brown (10YR 5/2) moist; massive structure; hard, friable, sticky and very plastic; many distinct dark yellowish brown and gray mottles in the moist soil; calcareous.

SOIL SURVEY LABORATORY Mandan, N. Dak.

SOIL TYPE Hysham clay loam **LOCATION** Yellowstone County, Montana

SOIL NOS. S53Mont-56-6 **LAB. NOS.** 1722-1727

DEPTH INCHES	HORIZON	1B1a PARTICLE SIZE DISTRIBUTION (in mm.) (per cent) 3A1 VERY COARSE SAND 2-1	COARSE SAND 1-0.5	MEDIUM SAND 0.5-0.25	FINE SAND 0.25-0.10	VERY FINE SAND 0.10-0.05	SILT 0.05-0.002	CLAY < 0.002	0.2-0.02	0.02-0.002	2A2 > 2 (<19mm)	TEXTURAL CLASS
0-7	Ap	0.1	0.3	0.6	10.8	21.6	38.0	28.6	49.9	18.4	-	cl
7-13	C1	0.1	0.3	0.6	12.9	24.1	36.2	25.8	55.3	15.8	-	l
13-22	A1b	-	0.2	0.9	15.3	22.9	36.8	23.9	53.1	19.2	-	l
22-32	C1b	-	0.4	1.7	28.2	32.9	22.2	14.6	67.8	10.5	-	vfsl
32-38	C2b	-	0.1	0.4	11.6	22.7	36.0	29.2	56.7	12.0	-	cl
38-62	C3b	-	0.3	1.2	17.5	19.6	38.3	23.1	50.4	20.8	-	l

8C1b SATURATED PASTE	pH 8C1a 1:5	8C1a 1:10	ORGANIC MATTER 6A1a ORGANIC CARBON %	NITROGEN %	C/N	8A2 EST% SALT (BUREAU CUP)	ELECTRICAL CONDUCTIVITY EC×10³ MILLIMHOS PER CM 8A1a	6E1a $CaCO_3$ equivalent %	6F1a GYPSUM me./100g. SOIL	MOISTURE TENSIONS 1/10 ATMOS. %	1/3 ATMOS. %	4B2 15 ATMOS. %
8.0	8.2	8.3	0.74			0.30	11.5	2	9			10.9
8.3	8.4	8.5	0.58			0.46	15+	2	7			10.5
8.3	8.5	8.5	0.54			0.46	15+	2	16			11.1
8.5	8.7	8.7	0.22			0.48	15+	3	8			6.5
8.0	8.4	8.5	0.28			0.39	10.0	7	4			8.6
7.7	8.6	8.7	0.25			0.22	7.5	6	-			8.9

5A1a CATION EXCHANGE CAPACITY NH_4OAc	5B1a CATIONS EXTRACTABLE Ca	6O2b Mg	H	5B1b EXCHANGEABLE 6P2a Na	6Q2a K	5D2 EXCH. Na %	SATURATION EXTRACT SOLUBLE 8A1 6P1a Na	6Q1a K	6J1a HCO_3	6K1a Cl	6L1a SO_4	8A MOISTURE AT SATURATION %
	milliequivalents per 100g. soil						milliequivalents per liter					
15.8				2.7	1.3	17	120.0	1.8	2.2	3.5	166.2	50.6
14.6				4.7	0.9	32	194.0	1.4	2.7	4.0	212.5	47.2
16.0				5.6	0.8	35	266.0	1.2	1.1	7.8	237.0	40.9
8.3				1.9	0.3	23	200.0	0.8	2.2	9.5	256.8	35.2
10.9				1.4	0.3	13	105.0	0.8	0.5	3.0	158.3	42.5
12.2		10.6		1.4	0.4	11	67.0	0.6	-	1.5	104.4	38.6

Soil type: Hysham clay loam
Soil No.: S53Mont-56-6
Location: Yellowstone County, Montana; about 300 feet south of northeast corner and 30 feet into field of Section 13, T2S, R26E.
Vegetation: Dense fireweed; has not produced crop in at least three years.
Physiographic position: Low terrace.
Relief: Nearly level.
Slope: 1 percent.
Drainage: Imperfectly drained; altered by irrigation.
Described by: W. C. Bourne, August 1953.

Horizon and Mandan Lab. Number	
Ap 1722	0 to 7 inches. Dark gray brown (10YR 4/2 moist) silt loam with stratified loams; salt and gypsum streaks are evident, also common faint organic mottlings; calcareous; abrupt smooth boundary.
C1 1723	7 to 13 inches. Gray brown (10YR 5/2 moist) stratified fine sandy loams to clay loams with gypsum and salt streaks; calcareous; clear smooth boundary.
A1b 1724	13 to 22 inches. Very dark gray (10YR 3/1 moist) grading to dark gray (10YR 4/1 moist) silt loam with salt (gypsum) spots; calcareous; gradual wavy boundary.
C1b 1725	22 to 32 inches. Light olive brown (2.5Y 5/3 moist) stratified fine sandy loam with common medium and coarse distinct gray and brown mottlings; massive; friable when moist; calcareous; gradual irregular boundary.
C2b 1726	32 to 38 inches. Gray brown (2.5Y 5/2 moist) stratified silt loam with common medium and coarse distinct mottles, mostly gray; friable when moist; gradual irregular boundary.
C3b 1727	38 to 62 inches. Gray brown (2.5Y 5/3 moist) stratified loam, silt loam, and silty clay loam with few coarse distinct gray mottlings; friable when moist; calcareous; abrupt boundary.
IIC4b	62 inches plus. Compact silty clay (not sampled).

SOIL SURVEY LABORATORY Mandan, N. Dak.

SOIL TYPE *Keiser silty clay loam **LOCATION** Yellowstone County, Montana

SOIL NOS. S51Mont-56-2 **LAB. NOS.** 660-663

DEPTH INCHES	HORIZON	1B1a PARTICLE SIZE DISTRIBUTION (in mm.) (per cent) 3A1 VERY COARSE SAND 2-1	COARSE SAND 1-0.5	MEDIUM SAND 0.5-0.25	FINE SAND 0.25-0.10	VERY FINE SAND 0.10-0.05	SILT 0.05-0.002	CLAY < 0.002	0.2-0.02	0.02-0.002	2A2 > 2	TEXTURAL CLASS
0-10	Ap	0.1	0.3	1.7	8.5	19.1	40.3	30.0	45.2	19.9	-	cl
10-16	B2	-	0.2	1.9	10.8	22.1	37.8	27.2	48.8	18.7	-	cl
16-30	C1ca	-	0.2	1.2	8.9	17.1	42.7	29.9	41.1	25.2	-	cl
30-48	C2ca	-	0.1	0.4	15.0	34.2	34.9	15.4	68.1	14.1	-	l

8C1b SATURATED PASTE	pH 8C1a 1:5	8C1a 1:10	ORGANIC MATTER 6A1a ORGANIC CARBON %	6B1a NITROGEN %	C/N	8A2 EST% SALT (BUREAU CUP)	ELECTRICAL CONDUCTIVITY EC×10³ MILLIMHOS PER CM 8A1a	6E1a $CaCO_3$ equivalent %	6F1a GYPSUM me./100g. SOIL	MOISTURE TENSIONS 1/10 ATMOS. %	1/3 ATMOS. %	4B2 15 ATMOS. %
7.4	8.0	8.2	0.88	0.101	8.7	-	1.0	tr	-			12.0
7.8	8.8	9.0	0.41	0.062	6.6	-	0.7	1	-			11.1
8.0	8.6	8.7	0.35	0.047	7.4	-	0.7	8	-			12.4
8.2	9.1	9.4	0.19	0.025		-	0.7	8	-			6.8

5A1a CATION EXCHANGE CAPACITY NH_4OAc	5B1a CATIONS EXTRACTABLE 6N2b Ca	6O2b Mg	5B1b EXCHANGEABLE 6P2a Na	6Q2a K	5D2 EXCH. Na %	SATURATION EXTRACT SOLUBLE 8A1 6P1a Na	6Q1a K	8A MOISTURE AT SATURATION %
	← milliequivalents per 100g. soil →					← milliequivalents per liter →		
21.7	14.6	7.5	0.3	1.2	1	1.5	0.2	49.2
20.5			0.3	0.5	2	1.3	-	46.1
19.8			0.3	0.5	2	1.3	-	47.7
13.4			0.4	0.2	3	0.9	-	44.1

Soil type: *Keiser silty clay loam
Soil No.: 51Mont-56-2
Location: Yellowstone County, Montana; SW1/4 SW1/4 Section 25, T3N, R28E.
Vegetation: Fallow, irrigated.
Parent material: Cretaceous alluvium.
Physiographic position: Terrace.
Topography: Level.
Slope: 0.5 percent.
Erosion: None to slight.
Drainage: Slow.
Moisture: High.
Stoniness: None.
Root distribution: Good.
Classification: Maximal Brown soil.
Described by: W. C. Bourne, August 7, 1951.

Horizon and Mandan Lab. Number	
Ap 660	0 to 10 inches. Brown (10YR 5/3) clay loam, dark grayish brown (10YR 4/2) moist; weak granular structure; slightly hard, friable, slightly sticky and slightly plastic; noncalcareous.
B2 661	10 to 16 inches. Dark grayish brown (2.5Y 4/2) moist silty clay loam; moderate medium prismatic structure; slightly hard, friable, slightly sticky and slightly plastic; noncalcareous.
C1ca 662	16 to 30 inches. Light olive brown (2.5Y 5/3) moist silty clay loam; weak blocky structure; slightly hard, friable, slightly sticky and slightly plastic; calcareous.
C2ca 663	30 to 48 inches. Dark grayish brown (2.5Y 4/2) moist very fine sandy loam; massive structure; soft, friable, nonsticky and nonplastic; calcareous; water saturated below 36 inches.

Remarks: Water table in sands standing at 40 inches.

SOIL SURVEY LABORATORY Mandan, N. Dak.

OIL TYPE *Keiser silty clay loam **LOCATION** Yellowstone County, Montana

SOIL NOS. S53Mont-56-2 **LAB. NOS.** 1696-1703

DEPTH INCHES	HORIZON	1B1a PARTICLE SIZE DISTRIBUTION (in mm.) (per cent) 3A1 VERY COARSE SAND 2-1	COARSE SAND 1-0.5	MEDIUM SAND 0.5-0.25	FINE SAND 0.25-0.10	VERY FINE SAND 0.10-0.05	SILT 0.05-0.002	CLAY < 0.002	0.2-0.02	0.02-0.002	2A2 > 2 <19mm	TEXTURAL CLASS
0-1½	A1	0.6	0.6	1.3	12.8	32.9	36.2	15.6	64.1	14.5	tr.	l
1½-3	B1	0.4	0.3	0.9	9.0	25.8	31.9	31.7	51.2	13.2	-	cl
3-9	B2t	0.2	0.1	0.3	5.8	25.8	30.0	37.8	48.5	12.1	-	cl
9-12	B3	-	0.2	0.3	7.8	33.6	31.6	26.5	59.2	12.5	-	l
12-19	C1ca	-	0.1	0.5	10.0	36.2	28.2	25.0	61.3	11.3	-	l
19-25	C2ca	-	0.2	0.5	12.0	39.1	27.0	21.2	66.0	10.2	-	scl
25-37	C3	-	0.2	1.1	17.4	41.8	21.3	18.2	68.9	8.4	-	vfsl
37-50+	C4	-	0.2	0.8	16.4	41.5	24.0	17.1	70.0	8.7	-	vfsl

8C1b SATURATED PASTE	pH 8C1a 1:5	8C1a 1:10	ORGANIC MATTER 6A1a ORGANIC CARBON %	NITROGEN %	C/N	8A2 EST% SALT (BUREAU CUP)	ELECTRICAL CONDUCTIVITY EC×10³ MILLIMHOS PER CM 8A1a	6F1a $CaCO_3$ equivalent %	6F1a GYPSUM me./100g. SOIL	MOISTURE TENSIONS 1/10 ATMOS. %	1/3 ATMOS. %	4B2 15 ATMOS. %
6.1	6.3	6.4	1.44			-	0.5	-				7.3
6.6	6.7	6.7	1.09			-	0.6	-				11.9
7.3	8.2	8.2	0.81			-	0.6	1				15.4
7.9	8.4	8.5	0.56			-	0.5	10	-			10.4
8.0	8.6	8.8	0.39			-	0.6	12	-			9.0
8.3	8.8	8.9	0.22			-	0.6	10	-			7.4
8.4	9.1	9.1	0.15			-	0.8	7	-			6.3
8.5	9.1	9.2	0.14			-	1.0	4	-			6.2

5A1a CATION EXCHANGE CAPACITY NH_4OAc	5B1a CATIONS EXTRACTABLE 6N2b Ca	6O2b Mg	H	5B1b EXCHANGEABLE 6P2a Na	6Q2a K	5I2 EXCH. Na %	SATURATION EXTRACT SOLUBLE 8A1 6P1a Na	6Q1a K	MOISTURE AT SATURATION %
←	milliequivalents per 100g. soil →						← milliequivalents per liter →		
13.4	6.8	3.6		0.1	0.9	1	0.9	0.4	37.5
23.4	13.0	7.9		0.1	1.4	-	-	0.2	45.0
30.3	22.8	11.5		0.2	0.8	1	-	0.2	57.2
17.4		6.9		0.2	0.3	1	0.3	0.2	43.2
13.7		9.7		0.1	0.2	1	1.5	-	40.4
12.2				0.4	0.2	3	1.5	-	36.2
11.5				0.5	0.2	4	3.5	-	35.8
11.6				1.0	0.2	9	6.7	-	36.4

Soil type: *Keiser silty clay loam
Soil No.: S53Mont-56-2
Location: Yellowstone County, Montana; NW1/4 SE1/4 Section 8, T1N, R28E; about 250 feet east of west line and 75 feet north of bench edge.
Vegetation: Dense sagebrush, wheatgrass, needlegrass, and niggerwool.
Parent material: Weakly stratified alluvial and aeolian fine earths from cretaceous sandstones and shales.
Physiographic position: Smooth remnant of dissected fan (footslope) below gravel-capped sandstone escarpment.
Relief: Gently sloping.
Slope: 3 percent.
Drainage: Well drained.
Depth to lime (range): 8 to 14 inches.
Described by: W. C. Bourne, August 1953

Horizon and Mandan Lab. Number	
A1 1696	0 to 1½ inches. Pale brown (10YR 6/3 dry) to dark gray brown (10YR 4/2 moist) silt loam; weak thin platy structure breaking to weak fine crumb; friable when moist, crumbs are firm; clear smooth boundary; non-calcareous.
B1 1697	1½ to 3 inches. Dark brown (10YR 4/3 dry) to very dark gray brown (10YR 3/2 moist) silty clay loam; moderate thin platy, developed from prismatic, breaking to strong fine and medium granular; upper surface of plates are pale brown (10YR 6/3 dry), upper plates are this color throughout; soft when dry, friable when moist; abrupt smooth boundary.
B2t 1698	3 to 9 inches. Dark brown (10YR 4/3 dry, 3/3 moist) light silty clay; strong medium prismatic structure breaking strong medium and fine blocky; hard when dry, firm when moist; clear wavy boundary; noncalcareous.
B3 1699	9 to 12 inches. Pale brown (10YR 6/3 dry) to gray brown (10YR 5/2.5 moist) light silty clay loam; moderate medium blocky; slightly hard when dry, friable when moist; clear wavy boundary; calcareous.
C1ca 1700	12 to 19 inches. Light brownish gray (10YR 6.5/2 dry) to gray brown (2.5Y 4.5/2 moist) fine silt loam; weak coarse subangular blocky structure; slightly hard when dry, friable when moist; diffuse irregular boundary; very calcareous; strongly spotted with white.
C2ca 1701	19 to 25 inches. Light brownish gray (2.5Y 6.5/2 dry) to gray brown (2.5Y 4.5/2 moist) coarse silt loam; massive; soft when dry, friable when moist; diffuse irregular boundary; very calcareous with white specks.
C3 1702	25 to 37 inches. Light brownish gray (2.5Y 6.5/2 dry) to gray brown (2.5Y 4.5/2 moist) loam, slightly heavier than horizon below; massive; soft when dry, friable when moist; diffuse irregular boundary; very calcareous.
C4 1703	37 to 50 inches plus. Light brownish gray (2.5Y 6.5/2 dry) to gray brown (2.5Y 4.5/2 moist) loam, high in very fine sand; massive; soft when dry, friable when moist; diffuse irregular boundary; calcareous.

SOIL SURVEY LABORATORY Mandan, N. Dak.

SOIL TYPE *Keiser silt loam **LOCATION** Yellowstone County, Montana

SOIL NOS. S53Mont-56-5 **LAB. NOS.** 1716-1721

DEPTH INCHES	HORIZON	1B1a PARTICLE SIZE DISTRIBUTION (in mm.) (per cent) 3A1 VERY COARSE SAND 2-1	COARSE SAND 1-0.5	MEDIUM SAND 0.5-0.25	FINE SAND 0.25-0.10	VERY FINE SAND 0.10-0.05	SILT 0.05-0.002	CLAY < 0.002	0.2-0.02	0.02-0.002	2A2 > 2 <19mm	TEXTURAL CLASS
0-1	A1	4.2	2.4	1.9	16.0	26.3	34.4	14.8	60.4	12.3	5	l
1-3½	B21t	2.1	1.7	1.4	13.6	22.0	33.6	25.6	53.3	12.6	2	l
3½-6	B22t	0.6	0.7	0.8	9.3	18.3	36.1	34.2	44.5	17.1	-	cl
6-16	C1ca	-	0.4	0.6	6.6	19.0	40.6	32.8	43.6	21.2	-	cl
16-29	C2	-	0.2	0.5	7.3	19.9	40.1	32.0	44.8	21.3	-	cl
29-41	C3cs	0.2	0.4	1.0	9.3	21.1	40.3	27.7	47.3	21.4	-	cl

8C1b SATURATED PASTE	pH 8C1a 1:5	8C1a 1:10	ORGANIC MATTER 6A1a ORGANIC CARBON %	NITROGEN %	C/N	8A2 EST% SALT (BUREAU CUP)	ELECTRICAL CONDUCTIVITY EC×10³ MILLIMHOS PER CM 8A1a	6E1a $CaCO_3$ equivalent %	6F1a GYPSUM me./100g. SOIL	MOISTURE TENSIONS 1/10 ATMOS. %	1/3 ATMOS. %	4B2 15 ATMOS. %
6.8	7.1	7.1	1.00			-	0.6	-				6.3
7.0	7.2	7.0	0.82			-	0.6	-				9.5
7.9	8.5	8.6	0.91			-	0.6	7				12.0
8.3	9.0	9.1	0.45			-	0.8	13	-			10.1
8.2	9.1	9.3	0.29			-	4.5	10	-			10.6
8.1	8.1	8.2	0.21			0.21	10.0	6	23			10.1

5A1a CATION EXCHANGE CAPACITY NH_4OAc	5H1a EXTRACTABLE CATIONS 6N2b Ca	6O2b Mg	H	5B1b EXCHANGEABLE 6P2a Na	6Q2a K	5D2 EXCH. Na %	SATURATION EXTRACT SOLUBLE 6P1a Na	6Q1a K	6J1a HCO_3	6K1a Cl	8A1 6L1a SO_4	8A MOISTURE AT SATURATION %
←	milliequivalents per 100g. soil →						← milliequivalents per liter →					
12.5	7.8	3.9		0.1	0.8	1	0.9	0.4				36.5
18.8	12.0	6.0		0.1	0.8	-	1.2	0.2				40.8
22.1		8.4		0.1	0.6	-	1.5	0.2				53.3
16.7				0.7	0.1	4	5.5	-				49.0
16.2				2.0	0.3	12	31.6	0.2	0.5	4.8	39.6	53.4
15.2				1.7	0.3	11	81.0	0.4	0.5	7.5	144.7	52.2

Soil type: *Keiser silt loam
Soil No.: S53Mont-56-5
Location: Yellowstone County, Montana; 400 feet north-northwest of center of Section 33, T1S, R24E.
Vegetation: Mid and short grasses and sagebrush.
Parent material: Old local alluvial fan material.
Physiographic position: Long fan slope which has been dissected enough to be sloping toward local drains; most ridges are gravel-capped.
Relief: Irregular; sloping.
Slope: 6 percent.
Drainage: Well drained.
Described by: W. C. Bourne, August 1953.

Horizon and Mandan Lab. Number	
A1 1716	0 to 1 inch. Brown (10YR 5/3 dry) to dark gray brown (10YR 4/2 moist) loam; weak thin platy structure breaking to moderate fine and very fine granules; abrupt smooth boundary; noncalcareous.
B21t 1717	1 to 3½ inches. Brown (10YR 5/3 dry) to very dark gray brown (10YR 3/2 moist) heavy loam or silt loam; strong thin platy structure breaking to fine granules; soft when dry, friable when moist; clear smooth boundary; noncalcareous.
B22t 1718	3½ to 6 inches. Dark brown (10YR 4/3 dry) to dark gray brown (10YR 4/2 moist) silty clay loam; moderately strong medium and coarse blocky, beginning of prismatic; slightly hard when dry, friable when moist; clear wavy boundary; weakly calcareous.
C1ca 1719	6 to 16 inches. Brown (10YR 5/2.5 dry) to dark gray brown (10YR 4/2 moist) silty clay loam; weak medium subangular blocky; hard when dry, firm when moist; gradual wavy boundary; calcareous with whitish spots.
C2 1720	16 to 29 inches. Light brownish gray (2.5Y 6/2 dry) to dark gray brown (2.5Y 4/2 moist) silty clay loam; weak very coarse prismatic and blocky, weak paleosol; slightly hard when dry, firm when moist; clear wavy boundary; calcareous.
C3cs 1721	29 to 41 inches. Light brownish gray (2.5Y 6/2 dry) with numerous white gypsum spots, to gray brown (2.5Y 5/2 moist) light clay loam; massive; soft when dry, friable when moist; clear wavy boundary; calcareous; high in gypsum.

OIL URVEY LABORATORY Mandan, N. Dak.

OIL TYPE *Keiser silty clay loam **LOCATION** Yellowstone County, Montana

SOIL NOS. S53Mont-56-10 **LAB. NOS.** 1746-1751

DEPTH INCHES	HORIZON	1R1a PARTICLE SIZE DISTRIBUTION (in mm.) (per cent) 3A1 VERY COARSE SAND 2-1	COARSE SAND 1-0.5	MEDIUM SAND 0.5-0.25	FINE SAND 0.25-0.10	VERY FINE SAND 0.10-0.05	SILT 0.05-0.002	CLAY < 0.002	0.2-0.02	0.02-0.002	2A2 > 2 (<19mm)	TEXTURAL CLASS
0-2½	A1	1.0	1.4	3.1	14.9	28.1	32.6	18.9	57.3	13.3	2	l
2½-5	B21t	0.4	0.5	1.1	6.6	21.4	26.8	43.2	41.1	11.8	tr.	c
5-9	B22t	0.2	0.2	0.6	5.7	28.1	29.5	35.7	50.0	11.9	-	cl
9-16	B3	0.1	0.2	0.5	6.3	33.8	28.1	31.0	54.1	12.7	-	cl
16-27	C1ca	0.2	0.3	0.8	9.1	33.9	30.5	25.2	58.0	13.2	tr.	l
27-40	C2	0.7	0.8	3.5	18.6	21.2	27.5	27.7	47.7	13.2	2	cl

pH 8C1b SATURATED PASTE	pH 8C1a 1:5	pH 8C1a 1:10	ORGANIC MATTER 6A1a ORGANIC CARBON %	ORGANIC MATTER NITROGEN %	ORGANIC MATTER C/N	8A2 EST% SALT (BUREAU CUP)	ELECTRICAL CONDUCTIVITY EC×10³ MILLIMHOS PER CM 8A1a	6E1a $CaCO_3$ equivalent %	6F1a GYPSUM me./100g. SOIL	MOISTURE TENSIONS 1/10 ATMOS. %	MOISTURE TENSIONS 1/3 ATMOS. %	4B2 15 ATMOS. %
6.8	6.9	7.1	1.60			-	0.6	-				8.8
6.7	6.9	6.9	0.96			-	0.4	-				16.1
7.4	8.2	8.4	0.80			-	0.6	1				14.8
7.8	8.5	8.5	0.52			-	0.6	10	-			9.3
8.0	8.7	8.9	0.35			-	0.5	10	-			8.7
8.3	9.1	9.3	0.18			-	0.9	8	-			9.0

5A1a CATION EXCHANGE CAPACITY NH_4OAc	5B1a EXTRACTABLE CATIONS 6N2b Ca	6O2b Mg	H	5B1b EXCHANGEABLE 6P2a Na	6Q2a K	5D2 EXCH. Na %	SATURATION EXTRACT SOLUBLE 6P1a Na	6Q1a K	8A1			8A MOISTURE AT SATURATION %
←	milliequivalents per 100g. soil →						← milliequivalents per liter →					
16.9	11.3	4.0		-	1.2	-	0.9	0.6				39.7
32.0	20.0	9.6		-	1.5	-	0.9	0.4				54.1
28.1		9.4		0.1	0.7	-	0.6	0.2				56.5
16.5		6.9		0.1	0.3	1	0.6	0.2				43.6
15.3		10.8		0.5	0.2	3	0.9	0.2				41.6
15.8				1.2	0.4	8	6.1	0.2				42.0

Soil type: *Keiser silty clay loam
Soil No.: S53Mont-56-10
Location: Yellowstone County, Montana; SW1/4 of NE1/4 Section 29, T2N, R29E; 50 feet east of road and 300 feet south of curve; south of short coulee.
Vegetation: Western and slender wheatgrass, needlegrass, sagebrush, and blue grama.
Parent material: Old alluvium.
Physiographic position: Eroded bench; approximately 3,400 feet elevation.
Relief: Convex; gently sloping.
Slope: 2 to 4 percent.
Drainage: Well drained.
Permeability: Moderately permeable.
Described by: W. C. Bourne, August 1953.

Horizon and Mandan Lab. Number	
A1 1746	0 to 2½ inches. Gray brown (10YR 5/2 dry) to dark gray brown (10YR 4/2 moist) silt loam; weak thin platy structure breaking to weak very fine crumb; soft when dry, friable when moist; clear smooth boundary; noncalcareous.
B21t 1747	2½ to 5 inches. Dark gray brown (10YR 4/2 dry) to very dark gray brown (10YR 3/2 moist) light silty clay loam; weak thin platy structure breaking to strong fine crumb; soft when dry, friable when moist; abrupt smooth boundary; noncalcareous.
B22t 1748	5 to 9 inches. Brown (10YR 5/3 dry) to dark brown (10YR 3/3 moist) heavy silty clay loam; strong medium and fine prismatic structure breaking to strong fine and very fine blocky; hard when dry, friable when moist; clear wavy boundary; noncalcareous.
B3 1749	9 to 16 inches. Light brownish gray (2.5Y 6/2 dry) to gray brown (2.5Y 4.5/2 moist) clay loam; moderate medium and coarse blocky structure; moderately hard when dry, friable when moist; gradual wavy boundary; calcareous with white spots.
C1ca 1750	16 to 27 inches. Light gray (5Y 7/2 dry) to gray brown (2.5Y 5/2 moist) clay loam; weak very coarse prismatic structure; moderately hard when dry, friable when moist; gradual wavy boundary; calcareous with white flecks and spots.
C2 1751	27 to 40 inches. Light olive gray (5Y 6/2 dry) to olive gray (5Y 4/2 moist) clay loam with white lime splotches; massive; soft when dry, friable when moist; moderately calcareous.

SOIL SURVEY LABORATORY. Lincoln, Nebr. 3/4/58

SOIL TYPE. *Keiser silty clay loam LOCATION. Yellowstone County, Montana

SOIL NOS. S56Mont-56-4-(1-6) LAB. NOS. 4736-4741

DEPTH INCHES	HORIZON	1B1a PARTICLE SIZE DISTRIBUTION (in mm.) (per cent) VERY COARSE SAND 2-1	COARSE SAND 1-0.5	MEDIUM SAND 0.5-0.25	FINE SAND 0.25-0.10	VERY FINE SAND 0.10-0.05	SILT 0.05-0.002	CLAY < 0.002	3A1 0.2-0.02	0.02-0.002	2A2 > 2 (<19mm)	TEXTURAL CLASS
0-9	Ap	0.1	0.2	0.6	11.4	18.0	40.3	29.4	43.9	23.6	-	cl
9-14	B2ca	-	-	0.2	6.1	16.6	49.5	27.6	41.4	29.9	-	cl
14-22	C1ca	-	-	0.1	4.5	25.2	46.4	23.8	53.4	22.2	-	l
22-35	C2	-	-	0.1	0.8	6.3	63.6	29.2	28.0	42.6	-	sicl
35-50	C3	-	-	-	0.8	1.6	52.2	45.4	8.3	46.2	-	sic
50-54+	C4	-	-	0.2	20.0	33.6	29.6	16.6	66.8	15.0	-	vfsl

DEPTH INCHES	pH 8C1b SATURATED PASTE	pH 8C1a 1:5	pH 8C1a 1:10	ORGANIC MATTER 6A1a ORGANIC CARBON %	ORGANIC MATTER 6B1a NITROGEN %	C/N	8A2 EST% SALT (BUREAU CUP)	ELECTRICAL CONDUCTIVITY EC x10³ MILLIMHOS PER CM 8A1a	6E1a $CaCO_3$ equivalent %	GYPSUM m.e./100g. SOIL	MOISTURE TENSIONS 1/10 ATMOS. %	MOISTURE TENSIONS 1/3 ATMOS. %	4B2 15 ATMOS. %
0-9	7.6	7.9	8.3	0.97	.109	8.9	<0.20	1.1	2				11.4
9-14	7.8	8.3	8.5	0.53	.072	7.4	<0.20	0.9	11				10.5
14-22	8.0	8.5	8.7	0.33	.044	7.5	<0.20	0.9	11				9.1
22-35	8.0	8.4	8.7	0.34	.043	7.9	<0.20	0.8	10				11.1
35-50	8.0	8.4	8.6	0.30			<0.20	0.7	5				16.1
54+	8.0	8.6	8.8	0.16			<0.20	0.8	6				6.7

DEPTH INCHES	5A1a CATION EXCHANGE CAPACITY NH_4Ac	EXTRACTABLE CATIONS 5B1a Ca	Mg	H	6P2a Na	6Q2a K	5D2 EXCH. Na %	SATURATION EXTRACT SOLUBLE 8A1 6P1a Na	6Q1a K	MOISTURE AT SATURATION %
	milliequivalents per 100g. soil							milliequivalents per liter		
0-9	17.4				0.3	0.8	1	1.7	0.3	51.0
9-14	12.5				0.2	0.4	2	1.0	0.2	47.4
14-22	10.6				0.2	0.3	2	1.2	0.2	42.4
22-35	13.8				0.3	0.4	2	1.1	0.2	52.9
35-50	20.2				0.2	0.8	1	0.9	0.2	64.1
50-54+	8.8				0.2	0.4	2	1.2	0.3	35.3

Soil type: *Keiser silty clay loam
Soil No.: S56Mont-56-4
Location: Yellowstone County, Montana; 150 feet east and 100 feet north of west quarter corner Section 16, T1S, R25E.
Vegetation or land use: Clean tilled bean field.
Parent material: Alluvium.
Physiography: Intermediate terrace; 200 to 300 feet above Yellowstone Valley bottom land.
Relief: Nearly level, smooth.
Elevation: About 3,200 feet.
Slope: Less than 1 percent.
Drainage: Moderately well drained, water table at 54 inches.
Erosion: None or slight.
Permeability: Moderately slow to slow.
Moisture: Moist to 14 inches, wet below.
Climate: Semiarid; rainfall about 14 inches, growing season 135 days (irrigated).
Note: Sample from cultivated field; part of original B is incorporated in Ap.
Described by: Dave R. Cawlfield, September 25, 1956.

Horizon and Lincoln Lab. Number	
Ap 4736	0 to 9 inches. Very dark grayish brown to dark grayish brown (2.5Y 3.5/2) silty clay loam, grayish brown (2.5Y 5/2) when dry; weak very coarse blocky breaking to weak very fine crumb structure; slightly hard when dry, friable when moist; effervesces weakly; pH 8.2; abundant roots; abrupt smooth boundary.
B2ca 4737	9 to 14 inches. Olive brown (2.5Y 4/3) silty clay loam, light gray (2.5Y 6.5/2) when dry; moderate fine and very fine angular blocky; friable when moist, plastic and sticky when wet; effervesces strongly; plentiful fine roots; many fine and few medium and coarse pores; thin patchy clay skins; diffuse boundary.
C1ca 4738	14 to 22 inches. Olive brown (2.5Y 4/3) silty clay loam, light gray (2.5Y 7/2) when dry; weak fine and very fine angular blocky structure; firable when moist, plastic and sticky when wet; effervesces strongly; pH 8.6; plentiful fine roots; mamy fine and few medium and coarse pores; diffuse boundary.
C2 4739	22 to 35 inches. Olive brown (2.5Y 4/3) silty clay loam with coarse prominent white lime splotches; light brownish gray (2.5Y 6/2) when dry; weak medium and fine angular blocky; friable when moist; plastic and sticky when wet; effervesces weakly; pH 8.8; plentiful fine roots; diffuse boundary.
C3 4740	35 to 50 inches. Dark grayish brown to grayish brown (2.5Y 4.5/2) silty clay loam with few faint gray and brown mottles; light brownish gray (2.5Y 6/2) when dry; effervesces weakly; pH 8.8; weak medium and fine blocky; friable when moist, sticky and plastic when wet; few roots; clear smooth boundary.
C4 4741	50 to 54 inches plus. Dark grayish brown to grayish brown (2.5Y 4.5/2) loam, light brownish gray (2.5Y 6/2) when dry; massive; slightly sticky and slightly plastic when wet; effervesces weakly; pH 8.5

SOIL SURVEY LABORATORY Lincoln, Nebr. 3/4/58

SOIL TYPE *Keiser loam **LOCATION** Yellowstone County, Montana

SOIL NOS. S56Mont-56-5-(1-7) **LAB. NOS.** 4742-4748

DEPTH INCHES	HORIZON	1B1a PARTICLE SIZE DISTRIBUTION (in mm.) (per cent) 3A1 VERY COARSE SAND 2-1	COARSE SAND 1-0.5	MEDIUM SAND 0.5-0.25	FINE SAND 0.25-0.10	VERY FINE SAND 0.10-0.05	SILT 0.05-0.002	CLAY < 0.002	0.2-0.02	0.02-0.002	2A2 > 2 (<19mm)	TEXTURAL CLASS
0-11	Ap	0.3	0.5	1.4	20.2	22.3	34.5	20.8	57.5	14.5	Tr.	l
11-17	B2ca	-	-	0.4	4.6	16.4	60.5	18.1	60.0	20.4	-	sil
17-23	B3ca	0.4	0.5	0.9a	6.7a	8.1a	43.2	c40.2	24.6	31.4	-	sic
23-29	C1ca	2.1b	1.1b	2.4b	15.2b	16.9b	30.9	31.4	41.5	16.5	Tr.	cl
29-39	C2	0.3	0.9	2.5a	16.9a	18.9a	31.1	29.4	44.3	16.9	-	cl
39-53	C3	0.5	1.4	3.0a	21.5a	20.4a	27.2	26.0	46.8	15.3	-	scl
53-60	C4	0.2	1.4	4.2a	25.5a	17.1a	25.3	26.3	42.0	16.7	-	scl

pH 8C1b SATURATED PASTE	pH 8C1a 1:5	pH 8C1a 1:10	ORGANIC MATTER 6A1a ORGANIC CARBON %	ORGANIC MATTER 6B1a NITROGEN %	ORGANIC MATTER C/N	8A2 EST% SALT (BOREAU CUP)	ELECTRICAL CONDUCTIVITY EC×10³ MILLIMHOS PER CM 8A1a	6E1a $CaCO_3$ equivalent %	GYPSUM mo./100g SOIL	MOISTURE TENSIONS 1/10 ATMOS. %	MOISTURE TENSIONS 1/3 ATMOS. %	4B2 15 ATMOS. %
7.6	8.1	8.3	1.00	.116	8.6	<0.20	1.5	3				8.3
7.7	8.2	8.4	0.55	.060	9.2	<0.20	1.2	10				7.2
7.8	8.3	8.5	0.41	.049	8.4	<0.20	1.0	11c				12.3
8.0	8.4	8.6	0.23	.032		<0.20	1.0	10				11.7
8.2	8.8	8.8	0.23			<0.20	0.9	11				10.0
8.3	8.9	9.0	0.20			<0.20	0.9	8				9.0
8.2	8.6	8.9	0.25			<0.20	0.9	2				8.9

5A1a CATION EXCHANGE CAPACITY NH_4Ac	EXTRACTABLE CATIONS 5B1a Ca	Mg	H	6P2a Na	6Q2a K	5D2 EXCH. Na %	SATURATION EXTRACT SOLUBLE 8A1 6P1a Na	6Q1a K				8A MOISTURE AT SATURATION %
	← milliequivalents per 100g. soil →						← milliequivalents per liter →					
13.2				0.4	1.0	2	3.9	0.7				41.3
10.4				0.2	0.3	1	2.4	0.2				42.6
17.5c				0.2	0.5	-	1.5	0.2				56.9
16.4				0.3	0.6	1	1.6	0.1				47.6
12.8				0.3	0.3	2	1.8	0.1				45.6
12.0				0.2	0.3	1	1.6	0.2				45.4
12.5				0.2	0.4	2	1.4	0.2				43.2

a. Few $CaCO_3$ concr.
b. Many $CaCO_3$ concr.
c. The clay percentage may be high. The 15-bar water retention for 4744 is similar to 4745; yet there is 10 percentage units difference in clay. A possible but unlikely explanation is that 4744 contains appreciably more carbonate clay than 4745.

Soil type: *Keiser loam
Soil No.: S56Mont-56-5
Location: Yellowstone County, Montana; 300 feet south and 185 feet west of northeast corner of Section 21, T1S, R25E.
Vegetation or crop: Clean tilled bean field.
Parent material: Alluvium.
Physiography: Intermediate terrace; 200 to 300 feet above Yellowstone Valley bottom land.
Relief: Smooth, nearly level.
Elevation: About 3,200 feet.
Slope: About 1 percent.
Aspect: Flat.
Drainage: Well drained.
Erosion: None or slight.
Permeability: Moderately slow to moderate.
Moisture: Moist throughout.
Climate: Semiarid; rainfall about 14 inches, growing season 135 days (irrigated).
Described by: Dave R. Cawlfield, September 26, 1956.

Horizon and Lincoln Lab. Number	
Ap 4742	0 to 11 inches. Dark grayish brown (2.5Y 3.8/2) silty clay loam; grayish brown (2.5Y 5/2) when dry; weak coarse blocky to moderate very fine crumb structure; hard, friable, sticky and plastic; effervesces weakly; pH 8.2; abundant roots; moderate number of coarse pores; patchy clay skins on remnants of blocky structure from former B2; abrupt smooth boundary.
B2ca 4743	11 to 17 inches. Dark grayish brown (2.5Y 4/2) silty clay loam, light brownish gray (2.5Y 5.5/2) when dry; moderate medium and fine angular blocky structure; effervesces strongly; pH 8.4; plentiful fine roots; slightly hard, friable, sticky and plastic; many medium to fine and few coarse pores; thin patchy clay skins; clear irregular boundary.
B3ca 4744	17 to 23 inches. Dark grayish brown (2.5Y 4/2) silty clay to light brownish gray (2.5Y 5.5/2) when dry; many coarse prominent white splotches (2.5Y 8/2 dry) moderate medium and fine angular blocky structure; hard, friable, sticky and plastic; effervesces strongly to violently in white splotches; pH 8.2; plentiful roots; many fine and very fine and few coarse pores; thin and very patchy clay skins; diffuse boundary.
C1ca 4745	23 to 29 inches. Dark grayish brown (2.5Y 4/2) silty clay loam, light brownish gray (2.5Y 5.5/2) when dry; many coarse prominent white splotches (2.5Y 8/2 dry); weak coarse and medium angular blocky; friable when moist, sticky and plastic when wet; effervesces violently; pH 8.3; few roots; few very fine pores; clear smooth boundary.
C2 4746	Olive brown (2.5Y 4/3) clay loam, light brownish gray (2.5Y 6/2 dry), with few moderate distinct white splotches (2.5Y 8/2 dry); weak or very weak medium angular blocky structure; firm when moist, sticky and plastic when wet; effervesces violently; pH 8.6; few roots; few coarse fine and very fine pores; diffuse boundary.
C3 4747	39 to 53 inches. Dark grayish brown (2.5Y 4/2) clay loam, light brownish gray (2.5Y 6/2) when dry; massive; firm when moist, sticky and plastic when wet; effervesces strongly; pH 8.3; few roots; few fine and very fine and very few coarse pores; clear irregular boundary.
C4 4748	53 to 60 inches. Dark grayish brown (2.5Y 4/2) light clay loam, light brownish gray (2.5Y 6/2) when dry; massive; firm when moist, sticky and plastic when wet; effervesces strongly; pH 8.4; few fine and very fine pores.

SOIL SURVEY LABORATORY Mandan, North Dakota

SOIL TYPE Laurel silty clay loam **LOCATION** Yellowstone County, Montana

SOIL NOS. S52Mont-56-24 **LAB. NOS.** 1020-1026

DEPTH INCHES	HORIZON	1B1a PARTICLE SIZE DISTRIBUTION (in mm.) (per cent) 3A1 VERY COARSE SAND 2-1	COARSE SAND 1-0.5	MEDIUM SAND 0.5-0.25	FINE SAND 0.25-0.10	VERY FINE SAND 0.10-0.05	SILT 0.05-0.002	CLAY < 0.002	0.2-0.02	0.02-0.002	2A2 > 2	TEXTURAL CLASS
0-2	A	-	0.5	0.8	3.2	12.3	66.1	17.1	47.7	32.8	-	sil
2-8	B2	-	0.3	0.6	1.6	8.8	58.7	30.0	37.6	30.9	-	sicl
8-14	B3	-	0.1	0.3	1.4	9.6	60.4	28.2	43.2	27.8	-	sicl
14-21	A1b	-	0.3	0.8	1.7	4.4	56.6	36.2	23.7	38.4	-	sicl
21-30	C1b	-	0.1	0.4	2.0	4.6	59.3	33.6	23.1	42.4	-	sicl
30-41	C2b	-	0.7	2.1	3.4	18.6	55.1	20.1	50.6	25.2	-	sil
41-51	IIC3b	-	0.2	12.0	51.1	31.5	2.3	2.0	8.7	1.4	-	s

	pH		ORGANIC MATTER			8A2	ELECTRICAL	6E1a	6F1a	MOISTURE TENSIONS		4B2
8C1b SATURATED PASTE	8C1a 1:5	8C1a 1:10	6A1a ORGANIC CARBON %	NITROGEN %	C/N	EST% SALT (BUREAU CUP)	CONDUCTIVITY EC×10³ MILLIMHOS PER CM 8A1a	$CaCO_3$ equivalent %	GYPSUM me./100g. SOIL	1/10 ATMOS. %	1/3 ATMOS. %	15 ATMOS. %
7.6	8.8	9.2	3.80			-	5.0	2	-			12.4
8.5	9.7	10.0	1.23			0.45	10.0	5	2			16.3
8.7	9.7	9.9	0.54			0.83	15+	6	-			13.9
8.5	9.1	9.4	0.90			1.20	15+	2	-			18.3
8.9	9.8	10.0	0.59			1.05	15+	5	-			17.9
9.0	9.9	10.2	0.35			0.69	13.0	4	-			12.4
8.9	9.8	9.7	0.08			-	4.5	tr.	-			2.1

5A1a	5B1a EXTRACTABLE CATIONS			5B1b EXCHANGEABLE CATIONS		5D2	SATURATION EXTRACT SOLUBLE 8A1				8A
CATION EXCHANGE CAPACITY NH_4OAc	6D2b Ca	6D2b Mg	H	6P2a Na	6Q2a K	EXCH. Na %	6P1a Na	6Q1a K			MOISTURE AT SATURATION %
← milliequivalents per 100g. soil →							← milliequivalents per liter →				
20.0				4.0	2.9	20	56.0	2.8			59.4
20.7				10.5	2.5	51	126.0	1.5			59.2
18.8				8.2	1.2	44	350.0	1.3			64.0
35.3				24.0	1.2	68	261.0	1.0			71.2
29.0				22.0	0.9	76	233.0	0.5			88.4
20.6				17.5	0.5	85	174.0	0.2			68.7
5.8		4.4		3.0	0.1	52	52.0	-			32.8

Soil type: Laurel silty clay loam
Soil No.: S52Mont-56-24
Location: Yellowstone County, Montana; NE1/4 SE1/4 Section 5, T2N, R28E.
Topography: Low terrace cut through river alluvium; irregular surface.
Drainage: Imperfectly drained.
Vegetation: Virgin field of saltgrass, greasewood, gumweed and foxtail barley.
Described by: W. C. Bourne, July 1952.

Horizon and Mandan Lab. Number	
A 1020	0 to 2 inches. Light gray (10YR 6/1) silt loam, light brownish gray (2.5Y 6/2) moist; platy crushing to very fine crumb structure; soft, friable, slightly sticky and slightly plastic; calcareous.
B2 1021	2 to 8 inches. Dark grayish brown (2.5Y 4/2) moist, silty clay loam; weak blocky structure; hard, friable, sticky and plastic; calcareous.
B3 1022	8 to 14 inches. Dark grayish brown (2.5Y 4/2) moist, heavy silt loam; weak blocky structure; slightly hard, friable, slightly sticky and slightly plastic; calcareous with spots of segregated salt.
A1b 1023	14 to 21 inches. Very dark gray (10YR 3/1) moist, heavy silt loam; streaks and seams of abundant segregated salt; calcareous.
C1b 1024	21 to 30 inches. Dark grayish brown (2.5Y 4/2) and very dark gray (10YR 3/1) moist, stratified silty clay loam and silt loam; very calcareous.
C2b 1025	30 to 41 inches. Dark grayish brown (2.5Y 4/2) moist, stratified silt loam, loam and very fine sandy loam; massive structure; soft, friable, nonsticky and nonplastic; calcareous.
IIC3b 1026	41 to 51 inches. Light gray (10YR 6/1) loamy sand to sand, dark gray (10YR 4/1) moist; single grain structure; loose; noncalcareous.

SOIL SURVEY LABORATORY Mandan, N. Dak.

SOIL TYPE Lohmiller silty clay **LOCATION** Roosevelt County, Montana

SOIL NOS. S50Mont-43-3 **LAB. NOS.** 173-179

DEPTH INCHES	HORIZON	1B1a PARTICLE SIZE DISTRIBUTION (in mm.) (per cent) VERY COARSE SAND 2-1	COARSE SAND 1-0.5	MEDIUM SAND 0.5-0.25	FINE SAND 0.25-0.10	VERY FINE SAND 0.10-0.05	SILT 0.05-0.002	CLAY < 0.002	3A1 0.2-0.02	0.02-0.002	2A2 > 2	TEXTURAL CLASS
0-2½	A11	0.6	0.2	0.2	0.6	2.4	52.2	43.8	13.8	41.3	-	sic
2½-6	A12	0.2	0.1	0.1	0.3	1.2	45.4	52.7	8.6	38.1	-	sic
6-7	C1	0.1	0.1	0.2	1.2	13.4	54.4	30.6	37.0	31.8	-	sicl
7-18	C2	0.1	0.1	0.1	0.2	0.5	41.0	58.0	5.1	36.6	-	sic
18-42	C3	0.1	0.1	0.2	0.7	7.6	70.0	21.3	46.5	31.6	-	sil
42-51	C4	-	0.1	0.1	0.1	0.2	53.5	46.0	8.9	44.9	-	sic
51-60	C5	-	0.1	0.1	0.4	3.8	70.2	25.4	38.9	35.4	-	sil

	pH		ORGANIC MATTER			8A2	ELECTRICAL CONDUCTIVITY	6E1a	6F1a	MOISTURE TENSIONS		
8C1b SATURATED PASTE	8C1a 1:5	8C1a 1:10	6A1a ORGANIC CARBON %	6B1a NITROGEN %	C/N	EST% SALT (BUREAU CUP)	EC×10³ MILLIMHOS PER CM 8A1a	$CaCO_3$ equivalent %	GYPSUM me./100g. SOIL	1/10 ATMOS. %	1/3 ATMOS. %	15 ATMOS. %
7.6	8.2	8.5	2.66	.242	11.0	-	0.5	2	-			
7.6	8.6	8.8	1.80	.173	10.4	-	0.5	2	-			
7.9	8.7	8.9	0.93	.101	9.2	-	0.6	5	-			
7.8	8.6	8.8	1.40	.141	9.9	-	0.6	3	-			
8.0	8.8	9.0	0.60	.058	10.3	-	0.9	7	-			
7.8	8.1	8.3	0.78	.076	10.3	0.29	3.8	4	5			
7.9	8.6	8.7	0.63	.058	10.9	0.21	4.0	6	-			

5A1a	EXCHANGEABLE CATIONS 5B1b					5D2	8A1 SATURATION EXTRACT SOLUBLE					8A
CATION EXCHANGE CAPACITY NH_4OAc	Ca	Mg	H	6P2a Na	6Q2a K	EXCH. Na %	6P1a Na	6Q1a K				MOISTURE AT SATURATION %
← milliequivalents per 100g. soil →							← milliequivalents per liter →					
33.7				1.3	1.6	4	1.5	2.3				72.8
35.2				1.1	1.8	3	3.1	1.2				67.2
21.8				0.4	1.2	2	1.6	-				49.4
36.2				0.4	1.3	1	1.2	-				73.7
16.9				0.9	0.9	5	4.4	1.2				49.9
30.8				1.9	1.3	6	1.8	3.7				73.0
20.4				1.5	1.7	7	25.2	3.4				55.5

Soil type: Lohmiller silty clay
Soil No.: S50Mont-43-3
Location: Roosevelt County, Montana; 300 feet north and 100 feet east of southwest corner of Section 32, T37N, R46E.
Topography: Missouri alluvial terrace, slope under 1 percent.
Drainage: Imperfect.
Erosion: Slight.
Parent material: Missouri River alluvium from shales and shaly glacial deposits.
Vegetative cover: Needlegrass (Stipa) cover; had been broken once years ago.
Described by: A. J. Cline, June 5, 1950.

Horizon and Mandan Lab. Number	
A11 173	0 to 2½ inches. Light brownish gray (2.5Y 6/2) clay, dark grayish brown (2.5Y 4/2) moist; weak coarse granular structure; hard, friable, sticky and plastic.
A12 174	2½ to 6 inches. Very dark grayish brown (2.5Y 3/2) moist clay; weak coarse granular structure; hard, friable, sticky and plastic; abrupt boundary.
C1 175	6 to 7 inches. Olive brown (2.5Y 4/3) moist silty clay loam; massive structure; hard, friable, slightly sticky and slightly plastic; calcareous; abrupt boundary.
C2 176	7 to 18 inches. Very dark grayish brown (2.5Y 3/2) moist clay; massive structure; hard, friable, sticky and plastic; calcareous; abrupt boundary.
C3 177	18 to 42 inches. Olive brown (2.5Y 4/3) moist loam and very fine sandy loam stratified; massive structure; slightly hard, very friable, slightly sticky and nonplastic; calcareous; abrupt boundary.
C4 178	42 to 51 inches. Olive brown (2.5Y 4/3) moist clay loam; massive structure; hard, friable, sticky and plastic; calcareous; abrupt boundary.
C5 179	51 to 60 inches. Olive brown (2.5Y 4/3) moist loam to very fine sandy loam; massive structure; slightly hard, very friable, slightly sticky and nonplastic; calcareous.

SOIL SURVEY LABORATORY Mandan, N. Dak.

SOIL TYPE Lohmiller silty clay loam **LOCATION** Roosevelt County, Montana

SOIL NOS. S51Mont-43-2 **LAB. NOS.** 806-812

DEPTH INCHES	HORIZON	1B1a PARTICLE SIZE DISTRIBUTION (in mm.) (per cent) 3A1 VERY COARSE SAND 2-1	COARSE SAND 1-0.5	MEDIUM SAND 0.5-0.25	FINE SAND 0.25-0.10	VERY FINE SAND 0.10-0.05	SILT 0.05-0.002	CLAY < 0.002	0.2-0.02	0.02-0.002	2A2 > 2	TEXTURAL CLASS
0-10	A11	0.1	0.3	0.5	1.2	7.3	54.9	35.7	27.0	35.8	-	sicl
10-16	A12	0.1	0.2	0.3	0.9	7.2	48.8	42.5	21.4	35.2	-	sic
16-21	C1	0.1	0.2	0.2	1.1	4.3	55.6	38.5	23.7	37.0	-	sicl
21-27	C2	-	0.2	0.5	6.5	37.2	37.6	18.0	64.9	15.9	-	l
27-36	C3	-	0.1	0.1	0.1	0.2	45.8	53.7	6.4	39.7	-	sic
36-60a	C41	-	-	-	-	0.5	43.4	56.1	7.2	36.7	-	sic
36-60b	C42	0.1	0.3	0.6	2.2	4.8	59.4	32.8	32.1	32.8	-	sicl

	pH		ORGANIC MATTER			8A2	ELECTRICAL CONDUCTIVITY	6E1a	6F1a	MOISTURE TENSIONS		4B2
8C1b SATURATED PASTE	8C1a 1:5	8C1a 1:10	6A1a ORGANIC CARBON %	6B1a NITROGEN %	C/N	EST% SALT (BUREAU CUP)	EC×10³ MILLIMHOS PER CM 8A1a	$CaCO_3$ equivalent %	GYPSUM mm./100g. SOIL	1/10 ATMOS. %	1/3 ATMOS. %	15 ATMOS. %
7.6	8.7	9.0	1.56	0.142	11.0	-	0.7	4	-			13.2
7.6	8.6	8.9	1.21	0.114	10.6	-	1.8	4	-			14.5
7.6	8.6	8.8	0.96	0.089	10.8	-	2.3	6	-			14.0
7.8	9.1	9.3	0.61	0.049	12.4	-	1.1	7	-			7.7
7.8	9.3	9.4	1.01	0.094	10.7	-	1.3	4	-			19.1
7.7	8.9	9.3	0.91	0.066	13.8	0.22	3.8	4	-			19.5
7.9	8.6	8.9	0.64	0.056	11.4	0.37	9.5	7	5			14.2

5A1a	EXCHANGEABLE CATIONS			5B1b	5I2	SATURATION EXTRACT SOLUBLE 8A1					8A
CATION EXCHANGE CAPACITY NH_4OAc	Ca	Mg	H	6P2a Na	6Q2a K	EXCH. Na %	6P1a Na	6Q1a K				MOISTURE AT SATURATION %
← milliequivalents per 100g. soil →							← milliequivalents per liter →					
25.5				0.2	0.9	1	1.7	0.5				55.1
27.0				0.8	0.9	3	6.5	0.9				62.0
25.0				0.7	0.9	3	7.2	0.8				60.9
14.4				0.4	0.5	3	7.0	0.5				104.2
32.8				2.7	1.2	8	9.6	0.2				75.3
32.9				4.9	1.0	15	30.9	0.8				86.5
22.9				4.0	0.5	17	96.0	0.9				68.2

a. Aggregate of heavy horizons.
b. Aggregate of light-textured horizons.

Soil type: Lohmiller silty clay loam
Soil No.: S51Mont-43-2
Location: Roosevelt County, Montana; NW1/4 NW1/4 of Section 2, T26N, R46E.
Topography: Terrace; level.
Drainage: Moderate.
Parent material: Missouri River alluvium.
Vegetative cover: Native grass and shrubs (pastured).

This sample was taken from a soil area lying on the intermediate terrace levels of the present Missouri River Valley. These terraces belong to the group of terrace levels arbitrarily designated by the survey party as age group III, i.e., they are of older age than those levels upon which the Alluvial soils occur (age groups I and II) and not as old as those levels lying adjacent to the upland (age group IV). The sample pit was dug approximately 1/8-mile from the edge of the nearest terrace break in an area of convex slope of about 1 percent gradient. Very little deposition occurred in this area as a result of annual river overflow even prior to the completion of Fort Peck Dam. The site shows little or no evidence of accelerated erosion and supports a natural vegetation in which western wheatgrass, sage, blue grama, and cactus are dominant; presently used as pasture land.

Described by: A. J. Cline, September 5, 1951.

Horizon and Mandan Lab. Number	
A11 806	0 to 10 inches. Light brownish gray (2.5Y 6/2 dry) to dark grayish brown (2.5Y 4/2 moist) fine granular calcareous silty clay loam; soft when dry and very friable when moist.
A12 807	10 to 16 inches. Dark grayish brown (2.5Y 4.5/2 dry) to very dark grayish brown (2.5Y 3/2 moist) calcareous silty clay stratified with thin lenses of silty clay loam; moderately well developed medium prismatic structure; slightly hard when dry and friable to firm when moist.
C1 808	16 to 21 inches. Light brownish gray (2.5Y 6/2 dry) to dark grayish brown (2.5Y 4/2 moist) asymmetrically blocky silty clay loam stratified with thin lenses of silty clay; poorly developed horizon of lime accumulation and some nodules and mycelia of lime occur throughout its mass; slightly hard when dry and friable when moist.
C2 809	21 to 27 inches. Light gray (2.5Y 7/2 dry) to grayish brown (2.5Y 4.5/2 moist) massive calcareous loam. Contains a few soft nodules and mycelia of calcium carbonate and possibly other salts; soft when dry and very friable when moist.
C3 810	27 to 36 inches. Dark grayish brown (2.5Y 4/2 dry) to very dark grayish brown (2.5Y 3/2 moist) calcareous silty clay; few small indistinct brown (10YR 5/3 dry) mottles; medium granular to moderately well developed chip-like platy structure. This horizon breaks down to relatively hard and stable aggregates 5 to 6-mm. in size that are plate-like in form but whose edges are beveled so that the aggregate often assumes the general appearance of a sunflower seed; these chip-like aggregates are loosely arranged within the horizon with their longest axis generally nearly horizontal; however, it is not uncommon to find some sections of the profile in which the aggregates lie at oblique, and on occasion nearly vertical, angles; the faces of the individual aggregates have a colloidal sheen.
C41 811	Aggregate of fine textured horizons from 36 to 60 inches.
C42 812	Aggregate of coarser textured horizons from 36 to 60 inches. 36 to 42 inches. Olive gray (5Y 4/2 dry) to very dark grayish brown (2.5Y 3/2 moist) calcareous silty clay stratified with light brownish gray (2.5Y 6/2 dry) silt clay loam; the horizon has a well developed chip-like platy structure and is slightly hard when dry and friable when moist. 42 to 46 inches. Light brownish gray (2.5Y 6/2 dry) to dark grayish brown (2.5Y 4/2 moist) calcareous stratified silty clay loam and silty clay; massive to poorly developed platy structure and contains a few nodules of calcium carbonate and possibly other salts; slightly hard when dry and friable when moist. 46 to 50 inches. Grayish brown (2.5Y 5/2 dry) to dark grayish brown (2.5Y 4/2 moist) massive calcareous silty clay; contains moderate amounts of calcium carbonate and probably other salts; slightly hard when dry and friable when moist. 50 to 60 inches. Light brownish gray (2.5Y 6/2 dry) to grayish brown (2.5Y 4.5/2 moist) massive calcareous silty clay loam; very hard when dry and firm when moist; contains moderate amounts of salt.

Remarks: J. R. McHenry did not sample all the textural variations found below 36 inches; his sample depths are as follows: 1 to 10 inches, 10 to 16 inches, 16 to 21 inches, 21 to 27 inches, 27 to 36 inches, 36 to 60 inches aggregate of heavy horizons, and 36 to 60 inches aggregate of light textured horizons.

SOIL SURVEY LABORATORY Mandan, N. Dak.

SOIL TYPE Lohmiller silty clay, saline and alkali subsoil **LOCATION** Yellowstone County, Montana

SOIL NOS. S51Mont-56-3 **LAB. NOS.** 664-669

DEPTH INCHES	HORIZON	1B1a PARTICLE SIZE DISTRIBUTION (in mm.) (per cent) 3A1 VERY COARSE SAND 2-1	COARSE SAND 1-0.5	MEDIUM SAND 0.5-0.25	FINE SAND 0.25-0.10	VERY FINE SAND 0.10-0.05	SILT 0.05-0.002	CLAY < 0.002	0.2-0.02	0.02-0.002	2A2 > 2	TEXTURAL CLASS
0-8	Ap	0.1	0.2	0.4	1.6	3.9	45.2	48.6	18.1	32.0	-	sic
8-14	C1	-	0.2	1.8	7.1	9.4	42.9	38.6	32.3	24.2	-	sicl
14-23	C2	-	0.7	3.1	10.6	19.4	36.4	29.8	42.7	20.1	-	cl
23-41	C3	-	1.3	6.0	21.1	21.6	26.3	23.7	48.7	12.5	-	scl
41-48	C4cs	-	0.1	0.3	3.3	11.7	47.0	37.6	34.9	26.4	-	sicl
48-60	A1b	-	0.1	0.2	2.1	6.7	42.9	48.0	24.6	26.6	-	sic

8C1b SATURATED PASTE	pH 8C1a 1:5	8C1a 1:10	ORGANIC MATTER 6A1a ORGANIC CARBON %	6B1a NITROGEN %	C/N	8A2 EST% SALT (BUREAU CUP)	ELECTRICAL CONDUCTIVITY EC×10³ MILLIMHOS PER CM 8A1a	6E1a $CaCO_3$ equivalent %	6F1a GYPSUM me./100g. SOIL	MOISTURE TENSIONS 1/10 ATMOS. %	1/3 ATMOS. %	4B2 15 ATMOS. %
7.8	8.2	8.8	0.82	0.099	8.3	-	0.6	2	-			17.8
7.8	8.5	8.9	0.51	0.073	7.0	-	1.2	3	-			13.9
7.8	8.5	8.9	0.35	0.052	6.7	0.31	5.4	4	-			10.5
8.1	8.8	9.0	0.26	0.041	6.3	0.52	12.0	2	3			9.0
7.9	8.3	8.4	0.67	0.078	8.6	0.60	10.0	tr.	18			15.7
7.9	8.3	8.4	0.60	0.073	8.2	0.69	9.0	tr.	10			18.0

5A1a CATION EXCHANGE CAPACITY NH_4OAc	5B1a EXTRACTABLE CATIONS 6O2b Mg	5B1b EXCHANGEABLE CATIONS 6P2a Na	6Q2a K	5D2 EXCH. Na %	SATURATION EXTRACT SOLUBLE 6P1a Na	6Q1a K	6J1a HCO_3	6K1a Cl	6L1a SO_4	8A1 MOISTURE AT SATURATION %
	milliequivalents per 100g. soil				milliequivalents per liter					
30.6		0.1	1.6	0	-	0.2				68.7
25.0		0.4	0.5	2	2.8	-				61.0
19.8		2.0	0.4	10	30.9	-				52.3
16.0		4.4	0.4	28	113.0	0.4	3.5	11.8	32.8	46.4
25.6	18.2	5.6	0.7	22	98.0	0.2				65.8
29.8	20.6	5.7	0.7	19	80.0	0.2	4.7	12.0	49.9	78.6

Soil type: Lohmiller silty clay, saline and alkali subsoil
Soil No.: S51Mont-56-3
Location: Yellowstone County, Montana; SE1/4 Section 11, T2N, R28E.
Vegetation: Fallow, dryland.
Parent material: Alluvial-colluvial fan.
Physiographic position: Terrace fan.
Slope: 2 percent.
Erosion: None to slight.
Drainage: Good.
Moisture: Moist.
Stoniness: Free.
Root distribution: Good.
Classification: Alluvial.
Described by: W. C. Bourne, August 7, 1951.

Horizon and Mandan Lab. Number	
Ap 664	0 to 8 inches. Pale olive (5Y 6/3) silty clay, olive brown (2.5Y 4/3) moist; weak fine granular structure; slightly hard, friable, sticky and plastic; calcareous.
C1 665	8 to 14 inches. Olive brown (2.5Y 4/3) moist, silty clay; weak blocky structure; friable, slightly sticky and slightly plastic; calcareous.
C2 666	14 to 23 inches. Olive brown (2.5Y 4/3) moist, clay loam; weak blocky structure; friable, slightly sticky and slightly plastic; calcareous.
C3 667	23 to 41 inches. Olive brown (2.5Y 4/4) moist, sandy loam or clay loam; massive structure; friable, slightly sticky and slightly plastic; calcareous.
C4cs 668	41 to 48 inches. Dark grayish brown (2.5Y 4/2) moist, silty clay loam; massive structure; friable, slightly sticky and slightly plastic; calcareous with gypsum crystals.
A1b 669	48 to 60 inches. Very dark gray (10YR 3/1) moist, clay; massive structure; firm, sticky and plastic; calcareous with segregated lime and crystals of gypsum.

SOIL SURVEY LABORATORY Mandan, N. Dak.

SOIL TYPE Lohmiller silty clay **LOCATION** Yellowstone County, Montana

SOIL NOS. S52Mont-56-27 **LAB. NOS.** 1039-1043

DEPTH INCHES	HORIZON	1B1a PARTICLE SIZE DISTRIBUTION (in mm.) (per cent) 3A1 VERY COARSE SAND 2-1	COARSE SAND 1-0.5	MEDIUM SAND 0.5-0.25	FINE SAND 0.25-0.10	VERY FINE SAND 0.10-0.05	SILT 0.05-0.002	CLAY < 0.002	0.2-0.02	0.02-0.002	2A2 > 2	TEXTURAL CLASS
0-8	Ap	0.2	0.3	0.9	7.2	9.2	37.2	45.0	28.1	23.4	-	c
8-14	C1	0.1	-	0.1	0.8	3.2	55.5	40.3	26.0	33.3	-	sic
14-27	C2	0.1	0.4	1.4	9.7	24.0	39.6	24.8	54.8	15.8	-	l
27-37	C3	-	-	-	0.3	5.6	57.0	37.1	30.0	32.9	-	sicl
37-50	C4	-	-	0.1	1.0	13.2	50.1	35.6	38.2	25.9	-	sicl

	pH		ORGANIC MATTER			8A2	ELECTRICAL CONDUCTIVITY	6E1a	6F1a	MOISTURE TENSIONS		
8C1b SATURATED PASTE	8C1a 1:5	8C1a 1:10	6A1a ORGANIC CARBON %	NITROGEN %	C/N	EST% SALT (BUREAU CUP)	EC×10³ MILLIMHOS PER CM 6A1a	$CaCO_3$ equivalent %	GYPSUM me./100g. SOIL	1/10 ATMOS. %	1/3 ATMOS. %	4B2 15 ATMOS. %
7.6	8.2	8.8	0.99			-	0.8	1	-			17.9
7.7	8.5	8.8	0.62			-	1.1	5	-			16.1
7.7	8.7	8.7	0.33			-	0.9	4	-			10.0
7.8	8.4	9.0	0.51			-	0.7	3	-			15.3
7.8	8.8	9.1	0.55			-	0.8	4	-			14.6

5A1a	EXCHANGEABLE CATIONS 5B1b					5D2	8A1 SATURATION EXTRACT SOLUBLE					8A
CATION EXCHANGE CAPACITY NH_4OAc	Ca	Mg	H	6F2a Na	6Q2a K	EXCH. Na %	6P1a Na	6Q1a K				MOISTURE AT SATURATION %
← milliequivalents per 100g. soil →							← milliequivalents per liter →					
28.8				0.7	2.0	2	3.5	0.8				62.2
27.9				0.4	0.6	1	3.7	-				61.3
19.8				0.5	0.3	2	3.0	-				44.3
27.3				1.0	0.4	4	4.1	-				56.2
25.7				1.3	0.4	5	5.6	-				53.4

Soil type: Lohmiller silty clay
Soil No.: S52Mont-56-27
Location: Yellowstone County, Montana; Huntley Experiment Station, Field L, across roadway from water level plots on edge of stubble; about 60 feet north of southeast corner of water level block.
Topography: Lower part of convex fan.
Drainage: Good; water table artificially at 3 to 5 feet.
Parent material: Slope wash from cretaceous shales and sandstones.
Note: Good productive soil; nonsaline.
Described by: W. C. Bourne, July 1952.

Horizon and Mandan Lab. Number	
Ap 1039	0 to 8 inches. Dark grayish brown (2.5Y 4.5/2.5) moist, silty clay; massive structure; extremely hard, firm, sticky and plastic; calcareous.
C1 1040	8 to 14 inches. Grayish brown (2.5Y 5/2) heavy silty clay loam, dark grayish brown (2.5Y 4/2) moist; weak coarse blocky structure breaking to weak medium and fine granules; hard, friable, slightly sticky and slightly plastic; calcareous.
C2 1041	14 to 27 inches. Light olive brown (2.5Y 5/3) stratified silt loam and fine sandy loam with a few 1/2-inch thick layers of sand; olive brown (2.5Y 4/3) moist; massive structure; friable, nonsticky and nonplastic.
C3 1042	27 to 37 inches. Light olive brown (2.5Y 5/3) silty clay loam, olive brown (2.5Y 4/3) moist; thin laminations; slightly hard, friable, slightly sticky and slightly plastic; calcareous.
C4 1043	37 to 50 inches. Pale olive (5Y 6/4) light clay loam, olive (5Y 4/2.5) moist; massive structure; calcareous.

SOIL SURVEY LABORATORY Mandan, N. Dak.

SOIL TYPE Magnus silty clay **LOCATION** Roosevelt County, Montana

SOIL NOS. S51Mont-43-8 **LAB. NOS.** 843-849

DEPTH INCHES	HORIZON	1B1a PARTICLE SIZE DISTRIBUTION (in mm.) (per cent) 3A1 VERY COARSE SAND 2-1	COARSE SAND 1-0.5	MEDIUM SAND 0.5-0.25	FINE SAND 0.25-0.10	VERY FINE SAND 0.10-0.05	SILT 0.05-0.002	CLAY < 0.002	0.2-0.02	0.02-0.002	2A2 > 2	TEXTURAL CLASS
0-10	A11	0.1	0.2	0.2	0.8	2.9	54.6	41.2	16.1	42.0	-	sic
10-19	?	-	0.1	0.2	1.1	4.5	47.4	46.7	17.3	35.4	-	sic
19-29	?	-	0.1	0.2	0.5	4.1	47.3	47.8	17.6	34.1	-	sic
29-35	C1	-	0.2	0.4	1.3	13.9	54.1	30.1	43.5	25.1	-	sicl
35-45	C2	0.1	0.2	0.3	3.9	24.4	40.4	30.7	46.9	21.4	-	cl
45-55	C3	-	-	0.1	0.6	4.3	50.3	44.7	16.3	38.8	-	sic
55-63	C4	-	-	-	0.1	1.7	39.8	58.4	7.8	33.8	-	c

8C1b SATURATED PASTE	pH 8C1a 1:5	8C1a 1:10	ORGANIC MATTER 6A1a ORGANIC CARBON %	6B1a NITROGEN %	C/N	8A2 EST% SALT (BUREAU CUP)	ELECTRICAL CONDUCTIVITY EC×10³ MILLIMHOS PER CM 8A1a	6E1a $CaCO_3$ equivalent %	6F1a GYPSUM me./100g. SOIL	MOISTURE TENSIONS 1/10 ATMOS. %	1/3 ATMOS. %	4B2 15 ATMOS. %
7.8	8.3	8.7	1.52	0.154	9.9	-	0.7	4	-			17.8
7.9	8.9	9.2	1.06	0.121	8.8	-	1.1	4	-			17.8
8.0	9.1	9.4	0.86	0.098	8.8	-	1.8	5	-			18.0
7.9	8.8	9.2	0.65	0.068	9.6	0.22	4.8	7	-			12.1
7.9	8.8	9.4	0.50	0.049	10.2	0.37	8.6	5	1			11.3
8.1	8.8	9.3	0.47	0.055	8.5	0.60	9.8	4	-			18.2
8.0	8.3	8.5	0.45	0.047	9.6	0.86	10.1	4	15			22.0

5A1a CATION EXCHANGE CAPACITY NH_4OAc	EXCHANGEABLE CATIONS 5B1b Ca	Mg	H	6P2a Na	6Q2a K	5D2 EXCH. Na %	SATURATION EXTRACT SOLUBLE 8A1 6P1a Na	6Q1a K	8A MOISTURE AT SATURATION %
	← milliequivalents per 100g. soil →						← milliequivalents per liter →		
28.6				0.5	1.1	2	2.6	0.5	66.0
30.1				2.3	0.6	8	8.7	0.2	68.1
29.5				3.7	0.4	12	15.4	0.2	69.9
21.5				3.5	0.4	16	37.0	0.5	59.4
20.3				4.5	0.4	22	78.0	0.2	56.7
27.4				7.0	0.4	26	98.0	0.8	87.4
33.3				9.8	0.6	29	106.0	0.8	99.8

Soil type: Magnus silty clay
Soil No.: 851Mont-43-8
Location: Roosevelt County, Montana; NE1/4 NE1/4 Section 13, T27N, R47E.
Topography: Terrace; level terrace.
Drainage: Fair.
Parent material: Missouri River Alluvium.
Vegetative cover: Native pasture.

The area from which this sample was taken lies on the intermediate terrace levels of the present Missouri River Terrace system and is representative of age group III as tentatively classified by the field party, i.e., it is of older age than levels I and II on which the alluvial soils are developing but is of younger age than the terraces that lie adjacent to the upland slopes. The sample pit was dug in a nearly level area approximately 1 mile from the present river channel. Deposition from flood waters has occurred in this area only rarely, even prior to the completion of Fort Peck Dam and then chiefly from local flooding from the higher lying terraces or upland slopes. The area shows little or no evidence of accelerated erosion and the water table in this portion of the valley is about 25 feet. The area sampled is used as pasture land and supports a fair native cover of western wheatgrass, sage, cactus, and some blue grama.

Described by: A. J. Cline, September 6, 1951.

Horizon and Mandan Lab. Number	
A11 843	0 to 10 inches. Grayish brown (2.5Y 5/2 dry) to very dark grayish brown (2.5Y 2.5/2 moist) fine granular calcareous silty clay; slightly hard when dry and friable when moist.
? 844	10 to 19 inches. Dark grayish brown (2.5Y 4.5/2 dry) to very dark grayish brown (2.5Y 2.5/2 moist) calcareous silty clay; well developed medium prismatic structure; hard when dry and firm when moist.
? 845	19 to 29 inches. Grayish brown (2.5Y 5/2 dry) to very dark grayish brown (2.5Y 3/2 moist) calcareous subangular blocky silty clay; hard when dry and firm when moist.
C1 846	29 to 35 inches. Light brownish gray (2.5Y 6/2 dry) to dark grayish brown (2.5Y 4/2 moist) subangular blocky silty clay loam stratified with silty clay; contains moderate amounts of accumulated calcium carbonate in soft nodular and myceliated forms; slightly hard when dry and friable when moist.
C2 847	35 to 45 inches. Light brownish gray (2.5Y 6/2 dry) to dark grayish brown (2.5Y 4/2 moist) massive calcareous stratified silty clay, silty clay loam, and loam; contains slight accumulations of calcium carbonate, calcium sulphate and probably other salts in myceliated and nodular forms; slightly hard when dry and friable when moist.
C3 848	45 to 55 inches. Grayish brown (2.5Y 5/2 dry) to dark grayish brown (2.5Y 4/2 moist) calcareous subangular blocky silty clay; hard when dry and firm when moist.
C4 849	55 to 63 inches. Grayish brown (2.5Y 5/2 dry) to dark grayish brown (2.5Y 4/2 moist) calcareous massive silty clay or clay; contains moderate amounts of accumulated salts, chiefly carbonates; hard when dry and firm when moist.

SOIL SURVEY LABORATORY Mandan, N. Dak.

SOIL TYPE Marias silty clay, saline and alkali **LOCATION** Roosevelt County, Montana

SOIL NOS. S50Mont-43-7 **LAB. NOS.** 201-206

DEPTH INCHES	HORIZON	1B1a PARTICLE SIZE DISTRIBUTION (in mm.) (per cent) 3A1 VERY COARSE SAND 2-1	COARSE SAND 1-0.5	MEDIUM SAND 0.5-0.25	FINE SAND 0.25-0.10	VERY FINE SAND 0.10-0.05	SILT 0.05-0.002	CLAY < 0.002	0.2-0.02	0.02-0.002	2A2 > 2	TEXTURAL CLASS
0-6	A1	0.2	0.1	0.1	0.2	0.1	56.7	42.6	10.0	46.8	-	sic
6-14	B2	0.1	0.1	0.1	0.1	0.1	50.1	49.4	7.3	43.0	-	sic
14-27	B2sa	-	0.1	-	-	-	43.5	56.4	2.9	40.6	-	sic
27-44	C1sa	0.1	-	-	0.1	0.7	43.7	55.4	4.7	39.8	-	sic
44-50	C2cs	-	-	-	0.1	1.8	55.7	42.4	16.3	41.1	-	sic
50-60	C3gcs	-	-	-	-	0.1	37.8	62.1	3.3	34.6	-	c

8C1b SATURATED PASTE	pH 8C1a 1:5	8C1a 1:10	ORGANIC MATTER 6A1a ORGANIC CARBON %	6R1a NITROGEN %	C/N	8A2 EST% SALT (BUREAU CUP)	ELECTRICAL CONDUCTIVITY EC×10³ MILLIMHOS PER CM 8A1a	6E1a $CaCO_3$ equivalent %	6F1a GYPSUM me./100g. SOIL	MOISTURE TENSIONS 1/10 ATMOS. %	1/3 ATMOS. %	15 ATMOS. %
7.6	8.5	8.6	1.91	.185	10.3	-	0.4	2	-			
7.8	9.0	9.0	1.54	.160	9.6	-	0.7	3	-			
8.0	9.2	9.3	1.17	.117	10.0	-	2.0	4	-			
7.9	8.5	8.7	0.89	.088	10.1	0.59	7.5	4	2			
8.1	8.7	8.7	0.70	.072	9.7	0.70	9.5	4	8			
8.0	8.5	8.5	0.73	.071	10.3	0.79	9.5	3	10			

5A1a CATION EXCHANGE CAPACITY NH_4OAc	EXCHANGEABLE CATIONS 5R1b Ca	Mg	H	6P2a Na	6Q2a K	5I2 EXCH. Na %	8A1 SATURATION EXTRACT SOLUBLE 6P1a Na	6Q1a K	8A MOISTURE AT SATURATION %
←	milliequivalents per 100g. soil →						← milliequivalents per liter →		
30.9				0.4	0.7	1	1.0	-	61.5
32.0				1.5	1.0	5	3.8	0.8	62.5
33.5				6.2	1.9	19	31.4	3.3	72.4
33.7				10.4	1.5	31	77.5	5.7	84.5
27.0				12.7	2.2	47	90.3	5.2	68.7
35.1				8.2	2.4	23	125.8	4.8	95.7

Soil type: Marias silty clay, saline and alkali
Soil No.: S50Mont-43-7
Location: Roosevelt County, Montana; 150 feet southwest of northeast corner of Section 35, T27N, R46E.
Topography: Terrace; slope under one percent.
Drainage: Moderately good.
Erosion: Some wind.
Parent material: Shaly alluviums of higher Missouri River terraces.
Vegetative cover: Western wheatgrass (Agropyron smithii) and sage--used as pasture.
Described by: A. J. Cline, June 6, 1950.

Horizon and Mandan Lab. Number	
A1 201	0 to 6 inches. Grayish brown (2.5Y 5/2) silty clay, dark grayish brown (2.5Y 4/2) moist; blocky structure; hard, friable, sticky and plastic; calcareous.
B2 202	6 to 14 inches. Dark grayish brown (2.5Y 4/2) moist clay; moderate blocky structure; hard, firm, sticky and plastic; calcareous.
B2sa 203	14 to 27 inches. Very dark grayish brown (2.5Y 3/2) silty clay; strong blocky structure; hard, firm, sticky and plastic; calcareous with many streaks of salt crystals.
C1sa 204	27 to 44 inches. Very dark gray (2.5Y 3/1) moist clay; weak blocky and platy structure; hard, friable, sticky and plastic; calcareous with salt crystals visible.
C2cs 205	44 to 50 inches. Grayish brown (2.5Y 5/2) moist clay and silt loam stratified, mottled with light olive brown (2.5Y 5/4) moist; massive structure; hard, friable, sticky and plastic; calcareous with plentiful gypsum crystals.
C3gcs 206	50 to 60 inches. Light olive brown (2.5Y 5/4) moist clay with many mottles of dark gray (5Y 4/1) moist; massive structure; very hard, firm, sticky and plastic; calcareous with abundant gypsum crystals.

SOIL SURVEY LABORATORY Mandan, N. Dak.

OIL TYPE Marias silty clay variant **LOCATION** Yellowstone County, Montana

SOIL NOS. S51Mont-56-1 **LAB. NOS.** 655-659

DEPTH INCHES	HORIZON	1B1a PARTICLE SIZE DISTRIBUTION (in mm.) (per cent) 3A1 VERY COARSE SAND 2-1	COARSE SAND 1-0.5	MEDIUM SAND 0.5-0.25	FINE SAND 0.25-0.10	VERY FINE SAND 0.10-0.05	SILT 0.05-0.002	CLAY < 0.002	0.2-0.02	0.02-0.002	2A2 > 2	TEXTURAL CLASS
0-8	Ap	-	0.2	0.6	2.1	6.3	45.5	45.3	24.5	28.6	-	sic
8-14	B2	0.2	0.1	0.6	2.2	5.7	42.8	48.4	21.0	29.1	-	sic
14-27	B3	-	0.1	0.4	1.8	4.5	37.9	55.3	16.4	27.2	-	c
27-42	C1ca	-	0.1	0.5	2.0	6.1	38.8	52.5	21.6	24.8	-	c
42-54	IIC2	0.1	0.3	1.5	5.9	18.9	43.3	30.0	47.4	19.0	-	cl

8C1b SATURATED PASTE	pH 8C1a 1:5	8C1a 1:10	ORGANIC MATTER 6A1a ORGANIC CARBON %	6B1a NITROGEN %	C/N	8A2 EST% SALT (BUREAU CUP)	ELECTRICAL CONDUCTIVITY EC×10³ MILLIMHOS PER CM 8A1a	6E1a $CaCO_3$ equivalent %	6F1a GYPSUM me./100g. SOIL	MOISTURE TENSIONS 1/10 ATMOS. %	1/3 ATMOS. %	4B2 15 ATMOS. %
7.4	7.8	8.1	1.08	0.115	9.4	-	0.4	tr.	-			20.7
7.5	8.2	8.5	0.50	0.066	7.6	-	0.4	tr.	-			17.6
7.7	8.2	8.8	0.34	0.044	7.7	-	0.4	1	-			19.3
7.6	8.3	8.2	0.18	0.035		-	2.2	2	2			18.7
7.7	8.4	8.6	0.07	0.023		-	2.2	5	2			11.4

5A1a CATION EXCHANGE CAPACITY NH_4OAc	5B1a CATIONS EXTRACTABLE 6N2b Ca	6O2b Mg	5B1b EXCHANGEABLE 6P2a Na	6Q2a K	5D2 EXCH. Na %	SATURATION EXTRACT SOLUBLE 8A1 6F1a Na	6Q1a K	8A MOISTURE AT SATURATION %
← milliequivalents per 100g. soil →						← milliequivalents per liter →		
27.6	18.4	9.3	0.5	1.6	2	1.3	-	60.9
28.2	19.2	9.6	0.5	1.0	2	0.9	-	66.8
31.5		9.5	0.8	0.9	2	0.9	-	75.2
29.2			0.7	1.0	2	2.6	-	74.7
17.5			0.4	0.8	2	2.2		50.9

Soil type: Marias silty clay variant
Soil No.: 51Mont-56-1
Location: Yellowstone County, Montana; SE1/4 NW1/4 Section 1, T2N, R28E.
Vegetation: Redclover, irrigated.
Parent material: Alluvium (local fan).
Physiographic position: Terrace.
Slope: 1 percent.
Erosion: None to slight.
Drainage: Surface good.
Moisture: Good.
Stoniness: Free.
Root distribution: No restriction.
Classification: Minimal Brown soil.
Described by: W. C. Bourne, August 7, 1951.

Horizon and Mandan Lab. Number	
Ap 655	0 to 8 inches. Grayish brown (2.5Y 5/2) silty clay, dark grayish brown (2.5Y 4/2) moist; massive structure; hard, firm, sticky and plastic; weakly calcareous.
B2 656	8 to 14 inches. Grayish brown (2.5Y 5/2) silty clay, dark grayish brown (2.5Y 4/2) moist; moderate blocky structure; hard, friable, sticky and plastic; calcareous with soft segregated lime.
B3 657	14 to 27 inches. Olive brown (2.5Y 4.5/3) moist clay; moderate blocky structure; hard, firm, sticky and plastic; calcareous with soft segregated lime and a few crystals of gypsum.
C1ca 658	27 to 42 inches. Light olive brown (2.5Y 5/4) moist clay; weak blocky structure; hard, firm, sticky and plastic; calcareous with segregated lime.
IIC2 659	42 to 54 inches. Olive brown (2.5Y 3/4) moist silt loam and silty clay loam stratified; slightly hard, friable, slightly sticky and slightly plastic; calcareous.

SOIL SURVEY LABORATORY Lincoln, Nebr. 3/4/58

SOIL TYPE McRae loam **LOCATION** Yellowstone County, Montana

SOIL NOS. S56Mont-56-3-(1-7) **LAB. NOS.** 4729-4735

DEPTH INCHES	HORIZON	1B1a PARTICLE SIZE DISTRIBUTION (in mm.) (per cent) 3A1 VERY COARSE SAND 2-1	COARSE SAND 1-0.5	MEDIUM SAND 0.5-0.25	FINE SAND 0.25-0.10	VERY FINE SAND 0.10-0.05	SILT 0.05-0.002	CLAY < 0.002	0.2-0.02	0.02-0.002	2A2 > 2 (<19mm)	TEXTURAL CLASS
0-9	Ap	0.1	0.4	2.1	30.2	28.6	22.4	16.2	63.9	9.5	-	fsl
9-14	B2t	-	0.2	1.6	23.2	24.8	27.8	22.4	56.6	12.9	-	scl
14-23	C1ca	-	0.2	2.2	30.1	33.8	20.0	13.7	68.2	7.8	-	vfsl
23-32	C2	-	0.2	2.9	34.9	33.5	17.5	11.0	69.6	6.4	-	fsl
32-36	C3ca	-	0.4	2.5a	21.8a	24.9a	34.9	15.5	62.2	12.0	-	l
36-56	C4	0.1	0.4	4.5a	44.6a	28.2a	13.7	8.5	66.4	5.3	-	fsl
56-60	C5	-	0.2	2.0a	24.1a	26.1a	33.3	14.3	62.2	14.3	-	vfsl

8C1b SATURATED PASTE	pH 8C1a 1:5	8C1a 1:10	ORGANIC MATTER 6A1a ORGANIC CARBON %	6B1a NITROGEN %	C/N	8A2 EST% SALT (SUREAU CUP)	ELECTRICAL CONDUCTIVITY EC x 10³ MILLIMHOS PER CM 8A1a	6E1a $CaCO_3$ equivalent %	6F1a GYPSUM me./100g. SOIL	MOISTURE TENSIONS 1/10 ATMOS. %	1/3 ATMOS. %	4B2 15 ATMOS. %
7.6	8.0	8.1	0.99	.101	9.8	<0.20	0.9	1				7.1
7.7	8.1	8.4	0.72	.100	7.2	<0.20	0.9	4				8.8
7.9	8.4	8.5	0.38	.044	8.6	<0.20	0.7	5				5.3
8.0	8.4	8.7	0.26	.037	7.0	<0.20	0.7	6				4.3
7.9	8.5	8.6	0.30			<0.20	0.7	5				6.0
8.1	8.5	8.7	0.11			<0.20	0.7	4	-			3.6
8.0	8.5	8.6	0.10			<0.20	0.7	4	-			5.6

5A1a CATION EXCHANGE CAPACITY NH_4Ac	EXTRACTABLE CATIONS 5B1a Ca	6O2b Mg	6H1a H	6P2a Na	6Q2a K	5D2 EXCH. Na %	SATURATION EXTRACT SOLUBLE 8A1 6P1a Na	6Q1a K			8A MOISTURE AT SATURATION %
	milliequivalents per 100g. soil						milliequivalents per liter				
12.3		3.0	0.4	0.1	0.8	1	0.8	0.6			36.2
12.9				0.2	0.5	2	1.1	0.3			42.6
7.2				0.1	0.2	1	1.2	0.2			36.5
6.2				0.1	0.2	2	1.3	0.2			35.3
8.3				0.2	0.2	1	1.7	0.2			38.1
5.2				0.2	0.2	2	2.0	0.2			32.5
8.4				0.4	0.2	4	2.7	0.2			33.6

a. Few $CaCO_3$ concr.

Soil type: McRae loam
Soil No.: S56Mont-56-3
Location: Yellowstone County, Montana; 1,200 feet west and 400 feet south of east quarter Section 3, T1S, R25E.
Vegetation or crop: Small grain stubble.
Parent material: Alluvium. Relief: Smooth 1 percent slope.
Physiography: Intermediate fan terrace related to Yellowstone River.
Elevation: About 3,150 feet.
Slope: 1 percent.
Aspect: Southeast.
Drainage: Well drained.
Erosion: None or slight.
Permeability: Moderate to moderately rapid.
Moisture: Moderately dry to 9 inches, moist to 56 inches, wet below.
Climate: Semiarid; rainfall about 14 inches, growing season 135 days (irrigated).
Note: Sample from cultivated field; part of original B2 incorporated in Ap.
Described by: Dave R. Cawlfield, September 25, 1956.

Horizon and Lincoln Lab. Number	
Ap 4729	0 to 9 inches. Very dark grayish brown to dark grayish brown (10YR 3.5/2) loam, grayish brown (10YR 4.5/2) when dry; very weak coarse blocky breaking to moderate medium crumb structure; hard, friable, plastic and sticky; weak effervescense in spots; pH 7.8; abundant roots; few coarse pores; some worm casts; abrupt smooth boundary.
B2t 4730	9 to 14 inches. Dark grayish brown (2.5Y 4/2) clay loam, grayish brown (2.5Y 5/2) when dry; weak coarse prismatic breaking to medium and coarse angular blocky; hard, friable, sticky and plastic; weak effervescense in spots; pH 8.4; plentiful roots; few coarse pores, chiefly wormholes; thin patchy clay skins on vertical ped surfaces; clear irregular boundary.
C1ca 4731	14 to 23 inches. Dark grayish brown to grayish brown (2.5Y 4.5/2) loam, light brownish gray (2.5Y 6/2) when dry; very weak coarse prismatic breaking to weak medium and coarse angular blocky structure; slightly hard, friable, plastic and sticky; weak effervescense in spots; pH 8.4; plentiful roots; few coarse worm and root holes; gradual wavy boundary.
C2 4732	23 to 32 inches. Light olive brown (2.5Y 5/3) fine sandy loam, light brownish gray (2.5Y 6/2) when dry; massive; soft, very friable, nonplastic and nonsticky; strong effervescense; plentiful roots; few coarse fine and very fine pores; clear irregular boundary.
C3ca 4733	32 to 36 inches. Dark grayish brown to grayish brown (2.5Y 4.5/2) clay loam, light gray (2.5Y 7/2) when dry; massive; slightly hard, friable, sticky and plastic; plentiful roots; few fine and very fine pores; clear broken boundary.
C4 4734	36 to 56 inches. Dark grayish brown to grayish brown (2.5Y 4.5/2) sandy loam, light brownish gray (2.5Y 6/2) when dry; massive; soft, very friable, nonplastic and nonsticky; plentiful roots; few wormholes and worm casts; clear smooth boundary.
C5 4735	56 to 60 inches plus. Dark grayish-brown to grayish brown (2.5Y 4.5/2 heavy loam, light brownish gray (2.5Y 6/2) when dry; massive; friable, moist; sticky and plastic, wet; few roots; few coarse and many fine and very fine pores; few white streaks of salt.

SOIL SURVEY LABORATORY Lincoln, Nebr. 3/4/58

SOIL TYPE McRae loam **LOCATION** Yellowstone County, Montana

SOIL NOS. S56Mont-56-6-(1-9) **LAB. NOS.** 4749-4757

DEPTH INCHES	HORIZON	1B1a PARTICLE SIZE DISTRIBUTION (in mm.) (per cent) 3A1 VERY COARSE SAND 2-1	COARSE SAND 1-0.5	MEDIUM SAND 0.5-0.25	FINE SAND 0.25-0.10	VERY FINE SAND 0.10-0.05	SILT 0.05-0.002	CLAY < 0.002	0.2-0.02	0.02-0.002	2A2 > 2 <2mm	TEXTURAL CLASS
0-10	Ap	0.2	0.4	1.8	27.5	30.3	21.9	17.9	63.9	9.0	-	vfsl
10-13	B2	-	0.2	1.5	18.7	30.5	29.1	20.0	62.0	11.7	-	l
13-16	B3	-	0.1	0.9	17.6	35.4	28.6	17.4	66.4	11.6	-	vfsl
16-25	C1ca	-	0.1	1.4	18.7	35.2	29.2	15.4	67.0	11.5	-	vfsl
25-33	C2	-	0.1	1.7	32.5	32.4	21.7	11.6	71.2	8.4	-	fsl
33-38	C3	0.2	1.0	3.8	36.6	28.5	19.9	10.0	66.8	7.9	-	fsl
38-44	C4	-	0.2	1.8	24.8	31.6	28.3	13.3	68.2	11.0	-	vfsl
44-49	C5	-	0.1	1.2	32.8	32.0	22.3	11.6	71.1	9.3	-	fsl
49-60	C6	-	-	0.7	18.6	33.6	32.9	14.2	70.2	11.8	-	vfsl

8C1b SATURATED PASTE	pH 8C1a 1:5	8C1a 1:10	ORGANIC MATTER 6A1a ORGANIC CARBON %	6B1a NITROGEN %	C/N	8A2 EST% SALT (BUREAU CUP)	ELECTRICAL CONDUCTIVITY EC x10³ MILLIMHOS PER CM 8A1a	6E1a $CaCO_3$ equivalent %	GYPSUM me./100g. SOIL	MOISTURE TENSIONS 1/10 ATMOS. %	1/3 ATMOS. %	4B2 15 ATMOS. %
7.7	8.1	8.2	1.01	.100	10.1	<0.20	1.1	1				7.6
7.8	8.3	8.5	0.56	.074	7.6	<0.20	1.0	10				8.2
7.8	8.3	8.6	0.48	.059	8.1	<0.20	0.9	10				7.1
8.0	8.4	8.6	0.37	.042	8.8	<0.20	0.9	10				5.9
8.0	8.5	8.7	0.21			<0.20	0.8	10				4.2
8.0	8.6	8.8	0.13			<0.20	0.8	8				3.8
8.1	8.6	8.7	0.16			<0.20	0.8	9				5.0
8.1	8.7	8.7	0.13			<0.20	0.8	7				4.4
8.1	8.5	8.8	0.13			<0.20	0.8	10				5.2

5A1a CATION EXCHANGE CAPACITY NH_4Ac	EXTRACTABLE CATIONS 5B1a Ca	6O2b Mg	6H1a H	6P2a Na	6Q2a K	5D2 EXCH. Na %	SATURATION EXTRACT SOLUBLE 8A1 6P1a Na	6Q1a K	8A MOISTURE AT SATURATION %
	milliequivalents per 100g. soil →						← milliequivalents per liter →		
12.1		4.0	0.4	0.2	1.2	1	1.8	1.2	37.9
9.3				0.2	0.3	1	1.7	0.3	39.9
8.1				0.2	0.2	1	1.7	0.2	37.0
7.4				0.2	0.2	3	1.6	0.2	36.5
5.9				0.1	0.2	2	1.5	0.2	34.6
5.1				0.1	0.2	2	1.6	0.2	34.0
7.0				0.2	0.2	3	1.7	0.2	34.9
6.0				0.1	0.2	2	1.8	0.2	33.0
7.3				0.2	0.3	3	1.7	0.3	36.0

Soil type: McRae loam
Soil No.: S56Mont-56-6
Location: Yellowstone County, Montana; 1370 feet west and 400 feet south of northeast corner of Section 24, T2S, R23E.
Vegetation or crop: Small grain stubble.
Parent material: Alluvium.
Physiography: Intermediate fan terrace related to Yellowstone River.
Relief: Smooth, nearly level.
Elevation: About 3200 feet.
Slope: 1 percent.
Drainage: Well drained.
Erosion: None or slight.
Permeability: Moderate to moderately rapid.
Moisture: Moist to 48 inches, wet below.
Climate: Semiarid; rainfall about 14 inches, growing season 135 days (irrigated).
Described by: Dave R. Cawlfield, September 26, 1956.

Horizon and Lincoln Lab. Number	
Ap 4749	0 to 10 inches. Dark grayish brown (2.5Y 4/2) loam, grayish brown (2.5Y 5/2) when dry; weak medium to coarse angular blocky structure; hard, friable, sticky and plastic; effervesces weakly; pH 8.2; moderate number of coarse and few fine and very fine pores; abrupt smooth boundary.
B2 4750	10 to 13 inches. Dark grayish brown (2.5Y 4/2) heavy loam, grayish brown (2.5Y 5/2) when dry; weak coarse platy to weak medium angular blocky structure; friable, moist; sticky and plastic, wet; effervesces strongly, pH 8.4; plentiful roots; many medium to coarse pores; thin patchy clay skins; clear smooth boundary.
B3 4751	13 to 16 inches. Dark grayish brown to grayish brown (2.5Y 4.5/2) light loam, light brownish gray (2.5Y 6/2) when dry; weak coarse prismatic breaking to very weak coarse blocky structure; very friable when moist, slightly sticky and slightly plastic when wet; effervesces strongly; pH 8.4; plentiful roots; many fine and very fine and a few medium to coarse pores; clear wavy boundary.
C1ca 4752	16 to 25 inches. Dark grayish brown (2.5Y 4/2) heavy fine sandy loam to light brownish gray (2.5Y 5.5/2) when dry; weak coarse prismatic structure; very friable when moist, slightly plastic and nonsticky when wet; effervesces violently; pH 8.6; plentiful roots; few fine medium and coarse pores; diffuse boundary.
C2 4753	25 to 33 inches. Grayish brown to dark grayish brown (2.5Y 4.5/2) fine sandy loam to light brownish gray (2.5Y 5.5/2) when dry; massive; very friable when moist, nonsticky and nonplastic when wet; effervesces weakly; pH 8.6; plentiful roots; moderate number of fine and very fine pores; diffuse boundary.
C3 4754	33 to 38 inches. Olive brown (2.5Y 4/3) loamy fine sand to light brownish gray (2.5Y 5.5/2) when dry; massive; soft, friable, nonsticky and nonplastic; effervesces weakly; pH 8.4; plentiful roots; clear wavy boundary.
C4 4755	38 to 44 inches. Olive brown (2.5Y 4/3) loam, light brownish gray to light yellowish brown (2.5Y 6/3) when dry; massive; friable when moist; slightly sticky and slightly plastic when wet; effervesces weakly; pH 8.4; few roots; few fine and very fine pores; diffuse boundary.
C5 4756	44 to 49 inches. Olive brown (2.5Y 4/3) fine sandy loam to light brownish gray (2.5Y 5.5/2) when dry; massive; very friable when moist; nonsticky and nonplastic when wet; effervesces weakly; pH 8.4; few roots; few fine and very fine pores.
C6 4757	49 to 60 inches. Olive brown (2.tY 4/3) loam, light brwonish gray (2.5Y 6/2) when dry; massive; slightly plastic and slightly sticky when wet; few roots; few fine and very fine pores.

SOIL SURVEY LABORATORY Lincoln, Nebr. 3/5/58

SOIL TYPE Nunn silty clay loam **LOCATION** Treasure County, Montana

SOIL NOS. S56Mont-52-7-(1-8) **LAB. NOS.** 4811-4818

DEPTH INCHES	HORIZON	1B1a PARTICLE SIZE DISTRIBUTION (in mm.) (per cent) 3A1 VERY COARSE SAND 2-1	COARSE SAND 1-0.5	MEDIUM SAND 0.5-0.25	FINE SAND 0.25-0.10	VERY FINE SAND 0.10-0.05	SILT 0.05-0.002	CLAY < 0.002	0.2-0.02	0.02-0.002	2A2 > 2 (<19mm)	TEXTURAL CLASS
0-5	Ap1	0.1	0.2	0.9	11.9	16.2	44.5	26.2	46.2	22.8	-	l
5-9	Ap2	0.1	0.3	0.7	10.1	14.3	45.9	28.6	41.7	26.1	-	cl
9-17	B2	-	0.1	0.2	9.5	15.9	43.9	30.4	40.0	27.9	-	cl
17-23	B3cal	-	0.1	0.1	7.5	13.7	49.0	29.6	36.2	33.1	-	cl
23-34	C1ca	-	-	0.1	0.8	2.7	61.2	35.2	16.2	48.3	-	sicl
34-45	C2	-	-	-	0.5	2.0	46.9	50.6	8.4	40.9	-	sic
45-50	C3	-	-	-	1.5	7.7	57.6	33.2	29.4	37.2	-	sicl
50-62+	C4	-	-	0.2	7.9	23.6	50.7	17.6	61.2	20.0	-	sil

8C1b SATURATED PASTE	pH 8C1a 1:5	8C1a 1:10	ORGANIC MATTER 6A1a ORGANIC CARBON %	6B1a NITROGEN %	C/N	8A2 EST% SALT (BUREAU CUP)	ELECTRICAL CONDUCTIVITY EC×10³ MILLIMHOS PER CM (8A1a)	6E1a $CaCO_3$ equivalent %	GYPSUM me./100g. SOIL	MOISTURE TENSIONS 1/10 ATMOS. %	1/3 ATMOS. %	4B2 15 ATMOS. %
7.6	8.0	8.2	1.02	.103	10.1	<0.20	0.9	1				10.6
7.7	8.1	8.3	0.97	.100	9.7	<0.20	0.8	4				10.9
7.9	8.4	8.6	0.61	.067	9.1	<0.20	0.8	11				11.0
8.1	8.7	8.9	0.43	.045	9.6	<0.20	0.8	12				10.5
8.3	8.9	8.9	0.40	.040	10.0	<0.20	0.8	13				12.6
8.4	9.0	9.0	0.34			<0.20	1.0	8				16.2
8.3	9.1	9.0	0.38			<0.20	1.1	9				12.0
8.2	9.1	9.1	0.26			<0.20	1.2	11				6.6

5A1a CATION EXCHANGE CAPACITY NH_4Ac	EXTRACTABLE CATIONS 5B1a Ca	6G2b Mg	6H1a H	6P2a Na	6Q2a K	5D2 EXCH. Na %	SATURATION EXTRACT SOLUBLE 6A1 6P1a Na	6Q1a K			8A MOISTURE AT SATURATION %
← milliequivalents per 100g. soil →							← milliequivalents per liter →				
17.5		7.0	-	0.4	1.0	2	2.8	0.4			45.8
18.0				0.4	0.8	2	2.6	0.4			46.0
15.7				0.4	0.4	2	2.1	0.2			54.3
14.9				0.4	0.4	2	2.4	0.2			50.9
17.3				0.5	0.4	2	2.4	0.1			57.9
24.2				1.6	0.5	5	5.3	0.1			72.1
18.8				1.7	0.4	7	7.6	0.1			55.9
11.4				1.3	0.2	9	8.1	0.1			36.8

Soil type: Nunn silty clay loam
Soil No.: S56Mont-52-7
Location: Treasure County, Montana; 0.15 mile east of north quarter corner of Section 20, T6N, R36E.
Vegetation or crop: Volunteer small grain in cultivated field.
Parent material: Alluvium of local origin.
Physiography: Broad fan terrace at mouth of Boxelder Creek.
Relief: Smooth.
Elevation: About 2600 feet.
Slope: 1 percent.
Aspect: Northwest.
Drainage: Well drained.
Erosion: Slight.
Permeability: Moderately slow.
Moisture: Moist.
Climate: Semiarid; rainfall about 11 inches, growing season about 135 days (irrigated).
Described by: R. L. Moshier, October 1, 1956.

Horizon and Lincoln Lab. Number	
Ap1 4811	0 to 5 inches. Dark grayish brown (1Y 4/2) silty clay loam, grayish brown (1Y 5/2) when dry; weak fine to medium granular structure; hard, friable, sticky and plastic; effervesces weakly; pH 8.0 with thymol blue; plentiful roots; abrupt boundary.
Ap2 4812	5 to 9 inches. Very dark grayish brown (1Y 3/2) heavy silty clay loam, grayish brown to light olive brown (1Y 5/3) when dry; cloddy; friable when moist, sticky and plastic when wet; effervesces; pH 8.2 with thymol blue; plentiful roots; moderate continuous clay skins in lower part; abrupt wavy boundary.
B2 4813	9 to 17 inches. Dark grayish brown to olive brown (2.5Y 4/3) heavy silty clay loam, olive gray to pale olive (5Y 5.5/3) when dry; moderate medium prismatic breaking to moderate coarse blocky structure; friable when moist, sticky and plastic when wet; effervesces strongly; pH 8.6 with thymol blue; plentiful roots; many fine and very fine pores; moderate patchy clay skins on vertical ped surfaces; clear smooth boundary.
B3ca1 4814	17 to 23 inches. Olive (4Y 4.5/3) silty clay loam, pale olive (5Y 5.5/3) when dry; weak medium prismatic structure; friable when moist, sticky and plastic when wet; effervesces violently; pH 8.8 with thymol blue; plentiful roots; many very fine pores; thin patchy clay skins; gradual boundary.
C1ca 4815	23 to 34 inches. Olive (5Y 4/3) light silty clay, pale olive (5Y 6.5/3) when dry; very weak coarse prismatic breaking to very weak coarse blocky structure; friable when moist, sticky and plastic when wet; effervesces violently; pH 8.8 with thymol blue; plentiful roots; many fine pores; gradual boundary.
C2 4816	34 to 45 inches. Olive (5Y 5/3) silty clay loam, pale olive (5Y 6/3) when dry; massive; friable when moist, sticky and very plastic when wet; effervesces; pH 8.8 with thymol blue; plentiful roots; few very fine pores; gradual boundary.
C3 4817	45 to 50 inches. Olive (5Y 5/3) silty clay loam, pale olive (5Y 6/3) when dry; massive; friable when moist, sticky and plastic when wet; effervesces; pH 8.8 with thymol blue; plentiful roots; abrupt smooth boundary.
C4 4818	50 to 62 inches plus. Olive (5Y 5/3) stratified loam and fine sandy loam, pale olive (5Y 6/3) when dry; massive; very friable when moist, nonsticky and nonplastic when wet; few roots.

SOIL SURVEY LABORATORY Lincoln, Nebr. 3/5/58

SOIL TYPE Munn silt loam **LOCATION** Treasure County, Montana

SOIL NOS. S56Mont-52-8-(1-8) **LAB. NOS.** 4819-4826

DEPTH INCHES	HORIZON	1B1a PARTICLE SIZE DISTRIBUTION (in mm.) (per cent) VERY COARSE SAND 2-1	COARSE SAND 1-0.5	MEDIUM SAND 0.5-0.25	FINE SAND 0.25-0.10	VERY FINE SAND 0.10-0.05	SILT 0.05-0.002	CLAY < 0.002	3A1 0.2-0.02	0.02-0.002	2A2 > 2 (<19mm)	TEXTURAL CLASS
0-4	Ap1	-	0.2	0.8	12.1	19.1	42.9	24.9	49.8	21.5	-	l
4-10	Ap2	0.1	0.2	0.8	14.2	23.9	39.8	21.0	59.1	15.7	-	l
10-18	B31	-	0.1	0.1	2.3	9.2	59.0	29.3	34.2	36.0	-	sicl
18-28	B32ca	-	0.1	0.3	3.3	8.7	53.8	33.8	29.6	35.4	-	sicl
28-36	B33ca	-	0.1	0.3	3.9	3.8	46.1	45.8	15.1	37.7	-	sic
36-42	C1	-	-	0.1	2.2	6.8	58.3	32.6	31.1	35.8	-	sicl
42-50	C2	-	-	0.2	6.2	18.8	54.4	20.4	52.2	26.3	-	sil
50-62	C3	-	0.3	1.7	18.3	30.5	31.5	17.7	61.9	13.5	-	l

pH 8C1b SATURATED PASTE	pH 8C1a 1:5	pH 8C1a 1:10	ORGANIC MATTER 6A1a ORGANIC CARBON %	ORGANIC MATTER 6B1a NITROGEN %	C/N	8A2 EST% SALT (BUREAU CUP)	ELECTRICAL CONDUCTIVITY EC·10³ MILLIMHOS PER CM 8A1a	6E1a $CaCO_3$ equivalent %	GYPSUM me./100g. SOIL	MOISTURE TENSIONS 1/10 ATMOS. %	MOISTURE TENSIONS 1/3 ATMOS. %	4B2 15 ATMOS. %
7.7	8.2	8.3	1.07	.107	10.0	<0.20	1.0	2				10.3
7.7	8.1	8.3	0.85	.085	10.0	<0.20	0.8	2				8.5
7.8	8.4	8.6	0.85	.081	10.5	<0.20	0.9	13				11.3
7.9	8.7	8.8	0.58	.059	9.8	<0.20	0.9	13				12.0
8.1	8.7	8.8	0.43			<0.20	0.9	10				15.6
8.2	8.8	8.9	0.33			<0.20	0.9	10				11.8
8.2	8.8	8.9	0.24			<0.20	1.0	10				7.8
8.0	8.7	8.9	0.59			<0.20	1.0	8				6.9

5A1a CATION EXCHANGE CAPACITY NH_4Ac	EXTRACTABLE CATIONS Ca	6O2b Mg	6H1a H	6P2a Na	5B1a 6Q2a K	5D2 EXCH. Na %	SATURATION EXTRACT SOLUBLE 8A1 6P1a Na	6Q1a K	8A MOISTURE AT SATURATION %
	milliequivalents per 100g. soil						milliequivalents per liter		
17.2		5.9	-	0.4	1.0	2	2.6	0.6	46.5
15.0		4.6	-	0.4	0.7	2	3.0	0.4	40.1
16.2				0.4	0.4	2	2.8	0.2	52.1
16.7				0.5	0.4	2	2.6	0.1	53.5
21.6				0.6	0.5	2	2.6	0.1	62.4
17.4				0.4	0.4	2	2.7	0.2	52.9
12.8				0.4	0.3	2	2.6	0.2	42.5
13.1				0.3	0.3	2	2.4	0.2	39.5

Soil type: Munn silt loam
Soil No.: 856Montana-52-8
Location: Treasure County, Montana; 600 feet west and 50 feet south of north quarter corner of Section 21, T6N, R36E.
Vegetation or crop: Volunteer small grain in cultivated field.
Parent material: Alluvium of local origin.
Physiography: Broad fan terrace at mouth of Boxelder Creek.
Relief: Smooth.
Elevation: About 2600 feet.
Slope: 1 percent.
Aspect: North.
Drainage: Well drained.
Erosion: Slight.
Permeability: Moderate.
Moisture: Moist.
Climate: Semiarid; rainfall about 11 inches, growing season about 135 days (irrigated).
Described by: R. L. Moshier, October 1, 1956.

Horizon and Lincoln Lab. Number	
Ap1 4819	0 to 4 inches. Dark grayish brown (1Y 4/2) silt loam, grayish brown (1Y 5/2) when dry; cloddy; friable when moist, slightly sticky and slightly plastic when wet; effervesces weakly; pH 8.4 with thymol blue; abundant roots; abrupt smooth boundary.
Ap2 4820	4 to 10 inches. Dark grayish brown (1Y 3.5/2) light silty clay loam, grayish brown (1Y 5/2) when dry; cloddy; friable when moist, slightly sticky and slightly plastic when wet; effervesces; pH 8.4 with thymol blue; abundant roots; abrupt smooth boundary.
B31 4821	10 to 18 inches. Olive (5Y 4/3) crushed, light silty clay loam, light olive gray (5Y 6/2) when dry; weak medium prismatic structure; friable when moist, slightly sticky and slightly plastic when wet; effervesces strongly; pH 8.8 with thymol blue; plentiful roots; few fine medium and very fine pores; moderate patchy clay skins; abrupt smooth boundary.
B32ca 4822	18 to 28 inches. Olive (5Y 4/3) light silty clay loam, light olive gray (5Y 6/2) when dry, with scattered white lime splotches; weak coarse prismatic structure; friable when moist, sticky and plastic when wet; effervesces violently; pH 8.7 with thymol blue; plentiful roots; thin patchy clay skins; gradual smooth boundary.
B33ca 4823	28 to 36 inches. Olive (5Y 4/3) silty clay loam, light olive gray (5Y 6/2) when dry; weak coarse prismatic structure; friable when moist, sticky and plastic when wet; effervesces violently; pH 8.6 with thymol blue; many very fine pores; occasional thin clay skin; gradual smooth boundary.
C1 4824	36 to 42 inches. Olive (5Y 4.5/3) heavy silt loam, pale olive (5Y 6.5/3) when dry; massive; very friable when moist, sticky and plastic when wet; effervesces strongly; pH 8.6 with thymol blue; few roots; moderate number of very fine pores; clear smooth boundary.
C2 4825	42 to 50 inches. Olive (5Y 4.5/3) heavy silty loam, pale olive (5Y 6.5/3) when dry; massive; very friable when moist, slightly sticky and slightly plastic when wet; effervesces strongly; pH 8.7 with thymol blue; few very fine pores; clear smooth boundary.
C3 4826	50 to 62 inches. Olive (5Y 4.5/3) stratified fine sandy loam, pale olive (5Y 6/3) when dry; very friable when moist, nonsticky and nonplastic when wet; effervesces; pH 8.7 with thymol blue.

SOIL SURVEY LABORATORY Lincoln, Nebr. 3/5/58

SOIL TYPE Munn silt loam **LOCATION** Treasure County, Montana

SOIL NOS. S56Mont-52-9-(1-8) **LAB. NOS.** 4827-4834

DEPTH INCHES	HORIZON	1B1a PARTICLE SIZE DISTRIBUTION (in mm.) (per cent) VERY COARSE SAND 2-1	COARSE SAND 1-0.5	MEDIUM SAND 0.5-0.25	FINE SAND 0.25-0.10	VERY FINE SAND 0.10-0.05	SILT 0.05-0.002	CLAY < 0.002	3A1 0.2-0.02	0.02-0.002	2A2 > 2 <19mm	TEXTURAL CLASS
0-4	Ap1	0.3	0.4	0.7	8.8	17.7	47.2	24.9	47.7	23.9	-	l
4-9	Ap2	0.4	0.5	0.6	8.3	17.6	47.4	25.2	50.1	21.3	-	l
9-11½	B2	0.1	0.3	0.6	9.2	18.9	47.4	23.5	50.6	22.7	-	l
11½-21	B31ca	-	0.1	0.3	7.0	23.8	36.0	32.8	55.5	10.1	-	cl
21-34	B32ca	-	0.1	0.1	0.5	1.9	50.1	47.3	10.4	42.0	-	sic
34-45	C	-	-	-	0.2	0.7	49.9	49.2	7.8	43.0	-	sic
45-59	C2	0.1	0.1	0.1	2.1	3.2	50.3	44.1	27.7	27.2	-	sic
59-67	C3	-	0.1	0.8	29.4	20.0	26.3	23.4	52.0	17.3	-	l

pH 8C1b SATURATED PASTE	pH 8C1a 1:5	pH 8C1a 1:10	ORGANIC MATTER 6A1a ORGANIC CARBON %	ORGANIC MATTER 6B1a NITROGEN %	C/N	8A2 EST% SALT (BUREAU CUP)	ELECTRICAL CONDUCTIVITY EC×10³ MILLIMHOS PER CM 8A1a	6E1a $CaCO_3$ equivalent %	GYPSUM me./100g. SOIL	MOISTURE TENSIONS 1/10 ATMOS. %	1/3 ATMOS. %	4B2 15 ATMOS. %
7.6	8.3	8.4	1.48	.130	11.4	<0.20	1.0	2				10.2
7.7	8.2	8.4	1.48	.137	10.8	<0.20	1.0	2				10.3
7.8	8.5	8.5	0.91	.091	10.0	<0.20	0.9	3				10.9
8.0	8.6	8.7	0.64	.062	10.3	<0.20	0.9	7				8.6
8.3	8.8	8.9	0.58	.060	9.7	<0.20	0.9	10				14.8
8.4	9.0	9.2	0.47			<0.20	1.1	8				15.7
8.1	8.8	9.1	0.47			<0.20	1.1	6				16.0
8.0	8.9	9.2	0.35			<0.20	1.2	5				8.8

5A1a CATION EXCHANGE CAPACITY NH_4Ac	EXTRACTABLE CATIONS 5B1a Ca	6O2b Mg	6H1a H	6P2a Na	6Q2a K	5D2 EXCH. Na %	SATURATION EXTRACT SOLUBLE 8A1 6P1a Na	6Q1a K	8A MOISTURE AT SATURATION %
	milliequivalents per 100g. soil →						← milliequivalents per liter →		
18.2		5.8	-	0.3	1.2	1	2.1	0.8	46.6
18.6		6.0	-	0.4	1.2	2	2.7	0.7	48.2
15.5				0.4	0.8	2	2.6	0.4	44.4
13.2				0.3	0.3	2	2.6	0.2	43.5
21.5				0.9	0.5	3	3.8	0.1	64.9
24.2				2.0	0.5	6	7.3	0.1	67.6
22.3				2.4	0.5	8	8.2	0.1	58.9
13.5				1.4	0.4	8	8.5	0.2	38.5

Soil type: Nunn silt loam
Soil No.: S56Mont-52-9
Location: Treasure County, Montana; 200 feet west and 40 feet south of the north quarter corner of Section 16, T6N, R36E.
Vegetation or crop: Irrigated small grain stubble.
Parent material: Alluvium of local origin.
Physiography: Broad fan terrace at mouth of Boxelder Creek.
Relief: Smooth.
Elevation: About 2600 feet.
Slope: 1 percent.
Aspect: North.
Drainage: Well drained.
Erosion: Slight.
Permeability: Moderate.
Moisture: Dry.
Climate: Semiarid; rainfall about 11 inches; growing season about 135 days.
Described by: R. L. Moshier, October 1, 1956.

Horizon and Lincoln Lab. Number	
Ap1 4827	0 to 4 inches. Dark grayish brown (10YR 3.5/2) silt loam, grayish brown (1Y 5/2) when dry; clods breaking to weak fine and medium crumb structure; hard, friable, slightly sticky and slightly plastic; pH 7.8 with thymol blue; abundant roots; abrupt smooth boundary.
Ap2 4828	4 to 9 inches. Dark grayish brown (2.5Y 4/2) light silty clay loam, grayish brown (2.5Y 5/2) when moist; cloddy with an occasional thin clay skin on surface; very hard, friable, slightly sticky and plastic; effervesces weakly; pH 7.8 with thymol blue; abundant roots; abrupt smooth boundary.
B2 4829	9 to 11½ inches. Dark grayish brown (2.5Y 4.5/2) light silty clay loam, grayish brown (2.5Y 5.5/2) when moist; compound moderate medium prismatic and moderate medium blocky structure with continuous moderate clay skins on all ped faces; hard, friable, sticky and plastic; effervesces strongly; pH 8.4 with thymol blue; abundant roots; abrupt smooth boundary.
B31ca 4830	11½ to 21 inches. Olive brown (2.5Y 4.5/3) silt loam, light olive brown (2.5Y 5.5/3) when dry; compound weak medium prismatic and weak medium and coarse blocky structure with thin patchy clay skins and 10YR 3/2 moist organic stains on vertical faces; hard, friable, sticky and slightly plastic; effervesces very strongly; few soft lime nodules; pH 8.6 with thymol blue; plentiful roots; few fine and many very fine pores; clear smooth boundary.
B32ca 4831	21 to 34 inches. Olive (5Y 4.5/3) light silty clay loam, pale olive (5Y 6/3) when dry; weak coarse prismatic structure with patchy thin clay skins; very hard, friable, sticky and plastic; effervesces very strongly; streaks and nodules of lime; pH 8.6 with thymol blue; plentiful roots; few fine and many very fine pores; gradual wavy boundary.
C 4832	34 to 45 inches. Olive (5Y 4.5/3) light silty clay loam, pale olive (5Y 5.5/3) when dry; massive; hard, friable, sticky and plastic; effervesces strongly; pH 8.3 with thymol blue; few roots; many very fine pores; diffuse smooth boundary.
C2 4833	45 to 59 inches. Olive (5Y 4.5/3) light silty clay loam, pale olive (5Y 6/3) when dry; massive; hard, friable, sticky and plastic; effervesces strongly; pH 8.6 with thymol blue; few very fine pores; abrupt smooth boundary.
C3 4834	59 to 67 inches. Olive (5Y 5/3.5) loam and fine and very fine sandy loam stratified, pale olive (5Y 6/3.5) when dry; massive; soft, very friable, nonsticky and nonplastic; effervesces strongly; pH 8.4 with thymol blue.

SOIL SURVEY LABORATORY Lincoln, Nebr. 3/5/58

SOIL TYPE Nunn silty clay loam **LOCATION** Treasure County, Montana

SOIL NOS. S56Mont-52-10-(1-8) **LAB. NOS.** 4835-4842

DEPTH INCHES	HORIZON	1B1a PARTICLE SIZE DISTRIBUTION (in mm.) (per cent) VERY COARSE SAND 2-1	COARSE SAND 1-0.5	MEDIUM SAND 0.5-0.25	FINE SAND 0.25-0.10	VERY FINE SAND 0.10-0.05	SILT 0.05-0.002	CLAY < 0.002	3A1 0.2-0.02	0.02-0.002	2A2 > 2 (<19mm)	TEXTURAL CLASS
0-3	Ap1	0.1	0.1	0.2	3.6	11.1	48.0	36.9	35.0	26.9	-	sicl
3-6½	Ap2	-	0.1	0.1	3.0	10.5	47.3	39.0	32.1	28.1	-	sicl
6½-11	B2	0.1	0.1	0.1	1.0	3.3	53.2	42.2	16.0	41.3	-	sic
11-17½	B31	-	0.1	0.2	4.3	12.0	53.9	29.5	35.4	34.1	-	sicl
17½-24	B32ca	-	-	0.1	1.2	4.7	55.1	38.9	18.1	42.7	-	sicl
24-30	B33ca	-	0.1	0.1	2.6	10.8	52.9	33.5	29.1	36.9	-	sicl
30-45	C1	-	0.1	0.2	1.8	5.6	56.8	35.5	24.5	39.3	-	sicl
45-64	C2	-	0.1	0.6	11.2	13.8	48.0	26.3	41.5	28.7	-	l

	pH		ORGANIC MATTER			8A2	ELECTRICAL CONDUCTIVITY	6E1a	6F1a	MOISTURE TENSIONS		
8C1b SATURATED PASTE	8C1a 1:5	8C1a 1:10	6A1a ORGANIC CARBON %	6B1a NITROGEN %	C/N	EST% SALT (BUREAU CUP)	EC×10³ MILLIMHOS PER CM 8A1a	$CaCO_3$ equivalent %	GYPSUM me./100g. SOIL	1/10 ATMOS. %	1/3 ATMOS. %	4B2 15 ATMOS. %
7.3	7.7	7.8	1.75	.174	10.0	<0.20	0.9	-				13.7
7.2	7.6	7.7	1.19	.094	12.6	<0.20	0.7	-				14.4
7.7	8.0	8.5	0.89	.123	7.2	<0.20	0.8	7				14.5
7.9	8.6	8.7	0.58	.063	9.2	<0.20	0.8	9				13.4
8.1	8.8	8.9	0.58	.058	10.0	<0.20	0.9	10				10.0
8.4	9.2	9.3	0.46			<0.20	1.0	10				12.0
8.3	9.3	9.4	0.42			<0.20	1.4	8	-			12.4
7.9	8.6	8.8	0.34			0.34	6.5	8	-			8.6

5A1a	EXTRACTABLE CATIONS					5D2	SATURATION EXTRACT SOLUBLE		8A1		8A
CATION EXCHANGE CAPACITY NH_4Ac	6N2b Ca	6O2b Mg	6H1a H	6P2a Na	6Q2a K	EXCH. Na %	6P1a Na	6Q1a K			MOISTURE AT SATURATION %
← milliequivalents per 100g. soil →							← milliequivalents per liter →				
24.7	14.0	9.4	0.4	0.4	2.3	1	2.2	1.0			59.9
26.4	16.7	9.5	1.3	0.4	1.4	1	2.0	0.4			54.5
24.7				0.5	0.5	1	2.4	0.1			66.9
17.4				0.4	0.3	2	2.5	0.1			50.6
19.7				0.6	0.4	2	3.2	0.1			58.8
17.1				1.5	0.3	6	6.8	0.1			54.8
19.5				3.1	0.4	12	11.2	0.1			63.3
15.1				2.8	0.3	7	34.0	0.2			49.6

Soil type: Nunn silty clay
Soil No.: 356Mont-52-10
Location: Treasure County, Montana; 400 feet south and 100 feet west of the southeast corner of Section 9, T6N, R36E.
Vegetation or crop: Irrigated alfalfa.
Parent material: Alluvium of local origin.
Physiography: Broad fan terrace at mouth of Boxelder Creek.
Relief: Smooth.
Elevation: About 2600 feet.
Slope: 1 percent.
Aspect: North.
Drainage: Well drained.
Erosion: Slight.
Permeability: Moderately slow.
Moisture: Moist.
Climate: Semiarid; rainfall about 11 inches, growing season about 135 days.
Described by: R. L. Moshier, October 2, 1956.

Horizon and Lincoln Lab. Number	
Ap1 4835	0 to 3 inches. Dark grayish brown (2.5Y 4/2) silty clay loam, grayish brown (2.5Y 5/2) when dry; strong fine and medium platy structure; very hard, friable, sticky and plastic, effervesces very weakly; pH 7.5 with thymol blue; abundant roots; abrupt smooth boundary.
Ap2 4836	3 to 6½ inches. Dark grayish brown (2.5Y 2.5/2) heavy silty clay loam, grayish brown (2.5Y 5/3) when dry; cloddy structure with occasional thin clay skins; very hard, friable, sticky and plastic; effervesces very weakly; pH 7.6 with thymol blue; abundant roots; abrupt smooth boundary.
B2 4837	6½ to 11 inches. Olive (5Y 4/3) heavy silty clay loam, olive (5Y 4.5/3) crushed, olive (5Y 5.5/3) when dry; compound moderate medium prismatic and moderate medium and coarse blocky structure with moderate continuous clay skins on all ped faces; very hard, friable, sticky and plastic; effervesces strongly; pH 7.9 with thymol blue; abundant roots; many fine and very fine pores; clear wavy boundary.
B31 4838	11 to 17½ inches. Olive (5Y 5/3) silty clay loam, pale olive (5Y 6.5/3) when dry; compound weak coarse blocky structure with moderate patchy clay skins on vertical faces; very hard, friable, sticky and plastic; effervesces very strongly; pH 8.6 with thymol blue; plentiful roots; many very fine pores; gradual wavy boundary.
B32ca 4839	17½ to 24 inches. Olive gray (5Y 4.5/2.5) heavy silty clay loam, light olive gray (5Y 6/2) when dry; weak coarse prismatic structure with thin patchy clay skins on vertical faces; very hard, friable, very sticky and plastic; effervesces very strongly with scattered seams and nodules of lime; pH 8.5 with thymol blue; plentiful roots; many very fine and few fine pores; gradual wavy boundary.
B33ca 4840	24 to 30 inches. Olive (5Y 5/2.5) heavy silty clay loam, pale olive (5Y 6.5/3) when dry; weak coarse prismatic structure with an occasional thin clay skin; hard, friable, sticky and plastic; effervesces strongly; few soft nodules and seams of lime; pH 8.8 with thymol blue; few roots; few fine and many very fine pores; diffuse wavy boundary.
C1 4841	30 to 45 inches. Olive (5Y 5/3) silty clay loam, light olive gray (5Y 6/2) when dry; massive; hard, friable, sticky and plastic; effervesces strongly; pH 8.7 with thymol blue; few roots; many very fine pores; abrupt smooth boundary.
C2 4842	45 to 64 inches. Olive (5Y 5/3) stratified loam and fine and very fine sandy loam, light olive gray (5Y 6/2) when dry; massive; slightly hard, very friable, nonsticky and nonplastic; effervesces strongly; pH 8.4 with thymol blue; few streaks of gypsum.

SOIL SURVEY LABORATORY Mandan, N. Dak.

SOIL TYPE Nunn clay loam **LOCATION** Yellowstone County, Montana

SOIL NOS. S52Mont-56-21 **LAB. NOS.** 1000-1005

DEPTH INCHES	HORIZON	1B1a PARTICLE SIZE DISTRIBUTION (in mm.) (per cent) 3A1 VERY COARSE SAND 2-1	COARSE SAND 1-0.5	MEDIUM SAND 0.5-0.25	FINE SAND 0.25-0.10	VERY FINE SAND 0.10-0.05	SILT 0.05-0.002	CLAY < 0.002	0.2-0.02	0.02-0.002	2A2 > 2	TEXTURAL CLASS
0-3	A1	0.3	1.3	3.4	21.3	18.2	30.0	25.5	48.8	14.2	tr.	l
3-13	B2t	0.2	1.0	2.7	16.0	12.0	32.3	35.8	38.9	16.6	-	cl
13-21	B3ca	-	0.4	1.4	12.0	5.3	49.9	31.0	44.6	19.5	-	cl
21-29	C1	-	1.3	5.6	29.2	14.8	25.5	23.6	46.6	12.8		scl
29-41	C2	0.4	0.7	3.6	29.2	18.9	24.7	22.5	51.6	12.2	tr.	scl
41-57	C3ca	-	0.3	1.2	7.7	8.2	46.4	36.2	32.0	28.0	-	sicl

DEPTH INCHES	pH 8C1b SATURATED PASTE	pH 8C1a 1:5	pH 8C1a 1:10	ORGANIC MATTER 6A1a ORGANIC CARBON %	ORGANIC MATTER NITROGEN %	ORGANIC MATTER C/N	8A2 EST% SALT (BUREAU CUP)	ELECTRICAL CONDUCTIVITY EC x10³ MILLIMHOS PER CM 6A1a	6K1a $CaCO_3$ equivalent %	6F1a GYPSUM me./100g. SOIL	MOISTURE TENSIONS 1/10 ATMOS. %	MOISTURE TENSIONS 1/3 ATMOS. %	4B2 15 ATMOS. %
0-3	7.2	7.8	8.0	1.57			-	0.6	tr.	-			10.3
3-13	7.5	8.2	8.6	0.65			-	0.5	2	-			13.8
13-21	8.0	8.9	9.3	0.46			-	0.6	7	-			12.0
21-29	8.4	9.6	9.6	0.24			-	0.8	6	-			9.6
29-41	8.5	9.8	10.0	0.20			-	0.9	4	-			9.2
41-57	8.1	8.9	9.4	0.32			0.43	7.5	4	-			15.0

DEPTH INCHES	5A1a CATION EXCHANGE CAPACITY NH_4OAc	5B1a EXTRACTABLE CATIONS 6N2b Ca	6O2b Mg	H	5B1b EXCHANGEABLE 6P2a Na	6Q2a K	5D2 EXCH. Na %	SATURATION EXTRACT SOLUBLE 8A1 6P1a Na	6Q1a K	6I1a CO_3	6J1a HCO_3	8A MOISTURE AT SATURATION %
	← milliequivalents per 100g. soil →							← milliequivalents per liter →				
0-3	20.2	15.1	5.1		0.3	1.3	1	-	0.8			43.4
3-13	24.1				0.4	0.8	2	0.9	-			53.0
13-21	20.7				1.2	0.3	6	4.8	-			50.3
21-29	16.7				2.5	0.3	15	7.8	-			39.3
29-41	15.6				3.9	0.3	25	9.8	-			47.4
41-57	23.5				4.5	0.4	19	72.0	0.2	-	-	63.6

Soil type: Nunn clay loam
Soil No.: S52Mont-56-21
Location: Yellowstone County, Montana; SE1/4 SE1/4 Section 19, T2N, R28E, near northwest corner of 40 in virgin roadside about 1/4 mile north of Huntley Cemetery. (Photo ZW-9G-191)
Parent material: Local alluvium from cretaceous shales and sandstones (mostly Bearpaw and younger).
Vegetation: Mixed perennial grasses. Position: Gently sloping convex fan terrace with good drainage.
Described by: W. C. Bourne, July 1952.

Horizon and Mandan Lab. Number	
A1 1000	0 to 3 inches. Pale brown (10YR 6/3) heavy loam, dark grayish brown (10YR 4/2) moist; moderate platy structure; soft, very friable, nonsticky and nonplastic; noncalcareous.
B2t 1001	3 to 13 inches. Brown (10YR 5/3) heavy clay loam, very dark grayish brown (10YR 4/3) moist; strong medium prismatic structure separating easily into strong medium and fine angular blocks having thick continuous clay films on all ped faces; hard, friable, slightly sticky and slightly plastic; noncalcareous.
B3ca 1002	13 to 21 inches. Light yellowish brown (2.5Y 6/3) silty clay loam, light olive brown (2.5Y 5/4) moist; moderate medium and coarse prismatic structure separating easily into moderate medium and fine angular blocks with distinct clay films on prism faces; hard, friable, slightly sticky and slightly plastic; calcareous with segregated lime in splotches and flecks.
C1 1003	21 to 29 inches. Light yellowish brown (2.5Y 6/3) sandy clay loam, light olive brown (2.5Y 5/4) moist; massive structure; slightly hard, friable, nonsticky and nonplastic; slightly calcareous.
C2 1004	29 to 41 inches. Light yellowish brown (2.5Y 6/3) sandy clay loam, light olive brown (2.5Y 5/3) moist; massive structure; hard, friable, nonsticky and nonplastic; texture varies from sandy loam to sandy clay with a concentration of pebbles in lower part of horizon; calcareous.
C3ca 1005	41 to 57 inches. Light yellowish brown (2.5Y 6/4) clay loam; olive brown (2.5Y 4/3) moist; massive structure; hard, friable, sticky and plastic; calcareous with spots of soft segregated lime.

SOIL SURVEY LABORATORY Mandan, N. Dak.

SOIL TYPE Nunn silty clay loam **LOCATION** Yellowstone County, Montana

SOIL NOS. S53Mont-56-4 **LAB. NOS.** 1711-1715

DEPTH INCHES	HORIZON	1R1a PARTICLE SIZE DISTRIBUTION (in mm.) (per cent) 3A1 VERY COARSE SAND 2-1	COARSE SAND 1-0.5	MEDIUM SAND 0.5-0.25	FINE SAND 0.25-0.10	VERY FINE SAND 0.10-0.05	SILT 0.05-0.002	CLAY < 0.002	0.2-0.02	0.02-0.002	2A2 > 2 (<19mm)	TEXTURAL CLASS
0-9	Ap	0.4	0.8	1.2	4.5	14.2	46.3	32.6	39.0	24.7	tr.	cl
9-16	B21t	-	1.0	1.2	3.7	10.9	33.5	49.7	29.5	17.4	tr.	c
16-22	B22t	0.5	1.0	1.6	4.7	14.4	40.1	37.7	39.9	17.7	tr.	cl
22-32	B3	0.3	0.7	1.1	4.4	18.5	44.7	30.3	48.1	18.2	tr.	cl
32-45	C1ca	0.8	0.7	0.7	6.7	23.1	39.1	28.9	50.3	17.3	1	cl

DEPTH INCHES	pH 8C1b SATURATED PASTE	pH 8C1a 1:5	pH 8C1a 1:10	ORGANIC MATTER 6A1a ORGANIC CARBON %	ORGANIC MATTER NITROGEN %	ORGANIC MATTER C/N	8A2 EST% SALT (BUREAU CUP)	ELECTRICAL CONDUCTIVITY EC×10³ MILLIMHOS PER CM 6A1a	6E1a $CaCO_3$ equivalent %	6F1a GYPSUM me./100g. SOIL	MOISTURE TENSIONS 1/10 ATMOS. %	MOISTURE TENSIONS 1/3 ATMOS. %	4B2 15 ATMOS. %
0-9	7.4	7.3	7.2	1.23			-	0.8	10a				11.2
9-16	7.1	7.5	7.5	0.67			-	0.8	-				18.3
16-22	7.3	7.6	7.6	0.48			-	1.1	-				15.0
22-32	8.0	8.6	8.8	0.28			-	1.4	13	-			11.2
32-45	8.1	8.8	9.0	0.19			-	1.2	12	-			10.0

5A1a CATION EXCHANGE CAPACITY NH_4OAc	5B1a CATIONS EXTRACTABLE 6N2b Ca	6O2b Mg	H	5B1b EXCHANGEABLE 6P2a Na	6Q2a K	5D2 EXCH. Na %	8A1 SATURATION EXTRACT SOLUBLE 6P1a Na	6Q1a K	8A MOISTURE AT SATURATION %
	milliequivalents per 100g. soil						milliequivalents per liter		
21.0	13.8	6.0		0.3	1.0	1	2.6	0.4	40.9
30.4	15.7	13.4		0.7	1.1	2	4.1	0.2	67.0
25.8	12.6	13.2		0.4	0.8	2	3.8	0.2	57.2
16.1		13.1		0.3	0.5	2	3.5	0.2	48.6
15.5				0.4	0.4	2	2.9	0.2	44.1

a. The $CaCO_3$ equivalent for the surface horizon may be in error; note that the extractable calcium does not exceed the cation exchange capacity.

Soil type: Nunn silty clay loam
Soil No.: S53Mont-56-4
Location: Yellowstone County, Montana; NW1/4 of SE1/4 Section 1, T1S, R24E, about 50 feet southwest of field gate which is a few hundred feet east of railroad.
Vegetation: Irrigated oat stubble; good cropland.
Parent material: Fine earth over gravel.
Physiographic position: Terrace; about 50 to 75 feet above Yellowstone River.
Relief: Nearly level.
Slope: 1 percent.
Drainage: Well drained.
Permeability: Slow.
Described by: W. C. Bourne, August 1953.

Horizon and Mandan Lab. Number	
Ap 1711	0 to 9 inches. Gray brown (10YR 5/2 dry) to very dark grayish brown (10YR 3/2 moist) silty clay loam; weak subangular blocky structure breaking to strong very fine crumb; soft when dry, firm when moist; abrupt smooth boundary.
B21t 1712	9 to 16 inches. Dark gray brown (10YR 4/2 dry) to very dark gray brown (10YR 3/2 moist), slightly darker than below, silty clay; strong medium and coarse prismatic structure breaking to medium and fine blocky; hard when dry, firm when moist; gradual wavy boundary.
B22t 1713	16 to 22 inches. Dark gray brown (10YR 4/2 dry) to very dark gray brown (10YR 3/2 moist) silty clay; strong medium and fine prismatic breaking to fine blocky; hard when dry, firm when moist; clear wavy boundary; noncalcareous.
B3 1714	22 to 32 inches. Brown (10YR 4/2.5 dry) to very dark gray brown (10YR 3/2 moist) silty clay loam; strong medium and fine blocky; soft when dry, friable when moist; clear wavy boundary; calcareous with white spots.
C1ca 1715	32 to 45 inches. Light gray (10YR 7/2 dry) to grayish brown (10YR 5/2 moist) silt loam; massive; soft when dry, friable when moist; clear irregular boundary; highly calcareous with white spots.
IIC2	45 to 55 inches. Calcareous gravelly fine earths (not sampled).

SOIL SURVEY LABORATORY Mandan, N. Dak.

SOIL TYPE Munn silty clay loam **LOCATION** Yellowstone County, Montana

SOIL NOS. S53Mont-56-11 **LAB. NOS.** 1752-1757

DEPTH INCHES	HORIZON	1B1a PARTICLE SIZE DISTRIBUTION (in mm.) (per cent) VERY COARSE SAND 2-1	COARSE SAND 1-0.5	MEDIUM SAND 0.5-0.25	FINE SAND 0.25-0.10	VERY FINE SAND 0.10-0.05	SILT 0.05-0.002	CLAY < 0.002	3A1 0.2-0.02	0.02-0.002	2A2 > 2 <19mm	TEXTURAL CLASS
0-7	Ap1	0.1	0.5	1.9	5.7	5.9	46.7	39.2	24.4	31.4	-	sicl
7-11	Ap2	0.2	0.4	2.0	6.2	6.5	48.7	36.0	26.0	32.8	-	sicl
11-17	B2t	-	0.4	2.8	10.2	7.5	28.4	50.7	25.0	16.7	-	c
17-27	B2ca	0.2	0.6	4.2	14.1	10.7	33.7	36.5	33.4	18.8	-	cl
27-31	C1ca	-	0.3	3.4	12.5	10.6	40.0	33.2	36.1	21.9	-	cl
31-38	C2	-	0.3	3.6	13.5	13.0	34.4	35.2	37.5	17.6	-	cl

DEPTH INCHES	8C1b pH SATURATED PASTE	8C1a pH 1:5	8C1a pH 1:10	6A1a ORGANIC MATTER ORGANIC CARBON %	NITROGEN %	C/N	8A2 EST% SALT (BUREAU CUP)	ELECTRICAL CONDUCTIVITY EC×10³ MILLIMHOS PER CM 8A1a	6E1a $CaCO_3$ equivalent %	6F1a GYPSUM me./100g. SOIL	MOISTURE TENSIONS 1/10 ATMOS. %	1/3 ATMOS. %	4B2 15 ATMOS. %
0-7	7.0	7.4	7.6	1.45			-	0.7	-				17.0
7-11	7.0	7.4	7.5	0.79			-	0.6	-				14.2
11-17	7.1	7.4	7.5	0.57			-	0.6	-				21.3
17-27	7.7	8.2	8.8	0.38			-	0.9	1	-			16.1
27-31	8.1	8.9	9.3	0.31			-	1.1	5	-			14.9
31-38	8.3	9.3	9.5	0.28			-	1.2	13	-			14.6

DEPTH INCHES	5A1a CATION EXCHANGE CAPACITY NH_4OAc	5B1a EXTRACTABLE CATIONS 6N2a Ca	6O2b Mg	H	5B1b EXCHANGEABLE CATIONS 6P2a Na	6Q2a K	5I2 EXCH. Na %	SATURATION EXTRACT SOLUBLE 6P1a Na	6Q1a K	8A1	8A MOISTURE AT SATURATION %
	← milliequivalents per 100g. soil →							← milliequivalents per liter →			
0-7	29.2	18.9	8.1		0.5	1.6	2	1.2	0.4		55.8
7-11	25.0	15.0	8.1		0.6	0.8	2	2.3	0.2		47.4
11-17	33.8	17.2	15.4		1.3	1.1	4	3.2	-		68.4
17-27	25.6	15.8	14.8		1.7	0.8	7	6.1	-		57.9
27-31	21.9				2.4	0.6	11	8.7	0.2		52.9
31-38	20.2				2.7	0.4	13	10.9	0.2		51.7

Soil type: Munn silty clay loam
Soil No.: S53Mont-56-11
Location: Yellowstone County, Montana; 40 feet east of road, northeast of corner of farmstead across road.
Vegetation: Cultivated to corn; crop is poor in some spots and good in others; heavy bindweed infection; field is irrigated from high line ditch of Huntley Project.
Physiographic position: High level bench.
Relief: Nearly level.
Slope: 1 percent.
Drainage: Well drained.
Permeability: Slow.
Described by: W. C. Bourne August 1953.

Horizon and Mandan Lab. Number	
Ap1 1752	0 to 7 inches. Dark gray brown (2.5Y 4.5/2 dry) to very dark gray brown (2.5Y 3/2 moist) silty clay loam; medium and fine angular fragments; hard when dry, firm when moist; abrupt smooth boundary; noncalcareous.
Ap2 1753	7 to 11 inches. Very dark gray brown (2.5Y 3/2 moist) silty clay loam; weak medium and fine crumb structure; firm when moist; clear smooth boundary; may be deep old plow layer; noncalcareous.
B2t 1754	11 to 17 inches. Dark gray brown (10YR 4/2 moist) silty clay; strong medium and fine prismatic structure breaking to strong medium and fine blocky; firm when moist; clear smooth boundary; noncalcareous.
B2ca 1755	17 to 27 inches. Very dark gray brown (10YR 3/2 moist) silty clay; strong medium prismatic structure breaking to medium and fine blocky; firm when moist; clear smooth boundary; horizon is calcareous; contains numerous corn roots.
C1ca 1756	27 to 31 inches. Dark gray brown (2.5Y 4/2 moist) heavy silty clay loam mottled with white lime splotches and lighter shades of gray brown; massive or very weak very coarse subangular blocky structure; friable when moist; gradual irregular boundary; calcareous; few corn roots were evident.
C2 1757	31 to 38 inches. Gray brown (2.5Y 5/2 moist) silty clay loam; massive; friable when moist; clear wavy boundary; calcareous, mostly disseminated.
D	38 inches plus. Loamy fine sand (not sampled).

SOIL SURVEY LABORATORY Lincoln, Nebr. 3/5/58

SOIL TYPE Promise clay **LOCATION** Treasure County, Montana

SOIL NOS. S56Mont-52-5-(1-6) **LAB. NOS.** 4798-4803

DEPTH INCHES	HORIZON	1B1a PARTICLE SIZE DISTRIBUTION (in mm.) (per cent) 3A1 VERY COARSE SAND 2-1	COARSE SAND 1-0.5	MEDIUM SAND 0.5-0.25	FINE SAND 0.25-0.10	VERY FINE SAND 0.10-0.05	SILT 0.05-0.002	CLAY < 0.002	0.2-0.02	0.02-0.002	2A2 > 2 (<19mm)	TEXTURAL CLASS
0-4	A1	1.5a	0.5b	0.3b	2.4b	9.5b	37.9	47.9	26.5	22.8	Tr.	c
4-10	B21	0.7	0.5b	0.4b	2.5b	9.3b	37.8	48.8	26.2	22.9	Tr.	c
10-20	B22	1.7	0.4b	0.3b	2.2b	7.9b	38.0	49.5	23.4	24.3	Tr.	c
20-34	C1cs	1.1	0.4c	0.2c	1.9c	6.4c	39.4	50.6	23.7	23.6	-	c
34-44	C2cs	0.3	0.1	0.2	1.3	6.8	45.1	46.2	24.1	28.9	-	sic
44-55	IIC3	0.4	0.2	0.1	0.7	2.8	30.9	64.9	10.6	23.6	-	c

8C1b SATURATED PASTE	pH 8C1a 1:5	8C1a 1:10	ORGANIC MATTER 6A1a ORGANIC CARBON %	6B1a NITROGEN %	C/N	8A2 EST% SALT (BUREAU CUP)	ELECTRICAL CONDUCTIVITY EC x 10^3 MILLIMHOS PER CM 8A1a	6E1a $CaCO_3$ equivalent %	6F1a GYPSUM me./100g. SOIL	MOISTURE TENSIONS 1/10 ATMOS. %	1/3 ATMOS. %	4B2 15 ATMOS. %
7.5	7.9	8.1	1.72	.123	14.0	<0.20	0.7	1				20.2
7.6	8.5	8.5	1.47	.097	15.2	<0.20	0.7	4				20.3
7.8	8.5	8.8	1.09	.063	17.3	<0.20	0.9	5	-			21.2
7.8	8.6	8.7	0.89	.049	18.2	0.22	2.2	5	-			20.7
7.6	7.9	8.4	0.66			0.56	7.0	4	50			19.8
7.4	8.3	8.5	2.86			0.29	3.0	1	-			24.6

5A1a CATION EXCHANGE CAPACITY NH_4Ac	EXTRACTABLE CATIONS 5B1a 6N2b Ca	6O2b Mg	6H1a H	6P2a Na	6Q2a K	5D2 EXCH. Na %	SATURATION EXTRACT SOLUBLE 8A1 6P1a Na	6Q1a K	8A MOISTURE AT SATURATION %
	milliequivalents per 100g. soil →						← milliequivalents per liter →		
40.4	32.5	9.8	-	0.4	0.8	1	1.2	0.1	70.2
39.1				1.5	0.6	3	3.5	0.1	71.6
37.5				3.5	0.6	8	6.2	0.1	74.3
36.5				4.8	0.6	10	13.8	0.1	83.4
35.9				5.1	0.5	8	31.5	0.4	70.7
53.4	36.6	18.0	2.2	6.7	0.8	10	19.8	0.3	82.5

a. Some organic matter.
b. Few smooth dk. brown concr. (Mn-Fe?) Also, few $CaCO_3$ concr.
c. Few $CaCO_3$ concr.

Soil type: Promise clay
Soil No.: S56Mont-52-5
Location: Treasure County, Montana; north side of road 660 feet east and 400 feet south of north quarter corner of Section 4, T3N, R36E.
Vegetation or crop: Western wheatgrass, bluebunch wheatgrass, green needlegrass, and big sagebrush.
Parent material: Clay shale weathered in situ (Lebo member of the Fort Union formation).
Physiography: Upland.
Relief: Gently rolling 6 percent slope, south aspect.
Elevation: About 3300 feet.
Drainage: Well drained.
Erosion: Slight or none.
Permeability: Very slow below a 20-inch depth.
Moisture: Dry.
Climate: Semiarid; rainfall about 14 inches, growing season about 125 days.
Note: This is native range in high good or excellent condition.
Described by: Dave R. Cawlfield, September 29, 1956.

Horizon and Lincoln Lab. Number	
A1 4798	0 to 4 inches. Very dark grayish brown (2.5Y 3/2) heavy clay, dark grayish brown (2.5Y 4/2) when dry; weak fine and medium platy breaking to moderate fine and very fine granular; hard, firm, very sticky and very plastic; pH 7.4 with phenol red; abundant roots; abrupt smooth boundary.
B21 4799	4 to 10 inches. Very dark grayish brown (2.5Y 3/2) heavy clay, olive gray (4Y 5/2) when dry; moderate very coarse prismatic breaking to moderate medium blocky structure; extremely hard, very firm, very sticky and very plastic; effervesces weakly; pH 8.2 with thymol blue; plentiful roots; moderate nearly continuous clay skins; gradual boundary.
B22 4800	10 to 20 inches. Dark grayish brown (2.5Y 3.5/2) heavy clay, olive gray (5Y 5/2) when dry; moderate very coarse prismatic breaking to weak medium and coarse blocky structure; extremely hard, very firm, very sticky and very plastic; effervesces; pH 8.8 with thymol blue; plentiful roots; moderate nearly continuous clay skins; clear irregular boundary.
C1cs 4801	20 to 34 inches. Dark grayish brown (2.5Y 4/2) clay to olive gray (5Y 5/2) when dry; massive; extremely hard, firm, very sticky and very plastic; effervesces; pH 8.6 with thymol blue; few roots; clear irregular boundary.
C2cs 4802	34 to 44 inches. Olive gray (5Y 3.5/2) clay with numerous fine shale chips to 5Y 5/2 when dry; massive; very hard, firm, very sticky and very plastic; effervesces; pH 7.8 with phenol red; very few roots; many gypsum crystals; gradual boundary.
IIC3 4803	44 to 55 inches. Partially weathered carbonaceous fissile shale slightly plastic; pH 8.2 with thymol blue.

SOIL SURVEY LABORATORY Lincoln, Nebr. 3/5/58

SOIL TYPE. Promise clay **LOCATION** Treasure County, Montana

SOIL NOS. S56Mont-52-6-(1-7) **LAB. NOS.** 4804-4810

DEPTH INCHES	HORIZON	1B1a PARTICLE SIZE DISTRIBUTION (in mm.) (per cent) VERY COARSE SAND 2-1	COARSE SAND 1-0.5	MEDIUM SAND 0.5-0.25	FINE SAND 0.25-0.10	VERY FINE SAND 0.10-0.05	SILT 0.05-0.002	CLAY < 0.002	3A1 0.2-0.02	0.02-0.002	2A2 > 2 (<19mm)	TEXTURAL CLASS
0-4	A1	2.2a	0.6a	1.0a	6.3a	11.2a	32.1	46.6	32.7	15.0	Tr.	c
4-9	B21	1.2a	0.6a	0.9a	5.0a	9.6a	32.2	50.5	29.8	15.4	Tr.	c
9-15	B22	1.0a	0.5a	0.8a	4.7a	9.3a	34.7	49.0	29.2	18.0	Tr.	c
15-24	B23	1.2a	0.5a	0.8a	4.5a	8.9a	36.3	47.8	28.6	19.7	Tr.	c
24-31	C1cs	0.3a	0.2a	0.6a	4.5a	9.2a	40.0	45.2	30.2	22.2	Tr.	sic
31-44	C2cs	0.2	0.2	1.1	9.8	17.8	36.9	34.0	42.8	19.0	-	cl
44-51+	C3cs	-	0.2	1.8	15.4	18.3	31.3	33.0	42.6	17.3	-	cl

8C1b pH SATURATED PASTE	8C1a pH 1:5	8C1a pH 1:10	ORGANIC MATTER 6A1a ORGANIC CARBON %	6B1a NITROGEN %	C/N	8A2 EST% SALT (BUREAU CUP)	ELECTRICAL CONDUCTIVITY EC·10³ MILLIMHOS PER CM 8A1a	6E1a $CaCO_3$ equivalent %	6F1a GYPSUM mg./100g. SOIL	MOISTURE TENSIONS 1/10 ATMOS. %	1/3 ATMOS. %	4B2 15 ATMOS. %
6.8	7.1	7.2	1.61	.132	12.2	<0.20	0.6	-				18.7
7.4	7.7	8.1	1.02	.088	11.6	<0.20	0.6	1				20.1
7.6	8.3	8.3	0.84	.071	11.8	<0.20	0.6	2				21.6
7.8	8.4	8.5	0.67	.062	10.8	<0.20	0.7	4	-			20.0
7.8	8.4	8.4	0.51			<0.20	1.2	5	-			19.1
7.9	8.4	8.6	0.37			<0.20	1.9	7	-			14.1
7.9	8.5	8.7	0.31			<0.20	1.8	7	-			13.4

5A1a CATION EXCHANGE CAPACITY NH_4Ac	EXTRACTABLE CATIONS 5B1a 6N2b Ca	6O2b Mg	6H1a H	6P2a Na	6Q2a K	5D2 EXCH. Na %	SATURATION EXTRACT SOLUBLE 8A1 6P1a Na	6Q1a K	8A MOISTURE AT SATURATION %
← milliequivalents per 100g. soil →							← milliequivalents per liter →		
34.7	21.1	14.6	1.3	0.1	1.3	-	0.3	0.3	68.6
36.8				0.4	0.6	1	1.1	0.1	72.2
35.2				0.9	0.6	2	2.1	0.1	73.2
33.4				1.6	0.6	4	4.0	0.1	70.4
30.8				2.0	0.6	5	6.9	0.1	75.6
23.8				1.6	0.5	5	8.5	0.2	61.4
25.0				1.7	0.5	5	8.0	0.3	59.4

a. Common shale-like material.

Soil type: Promise clay
Soil No.: S56Mont-52-6
Location: Treasure County, Montana; about 1400 feet south and 500 feet east of north quarter corner of Section 2, T3N, R36E.
Vegetation or crop: Native hay meadow; principal vegetation is western wheatgrass, sandberg bluegrass, green needlegrass and scattered big sagebrush.
Parent material: Clay shale weathered in situ.
Physiography: Upland.
Relief: Rolling 6 percent northeast slope.
Elevation: About 3250 feet.
Drainage: Well drained.
Erosion: Slight.
Permeability: Very slow below 24-inch depth.
Moisture: Dry.
Climate: Semiarid; rainfall about 14 inches, growing season about 125 days.
Note: This site has been mowed and vegetation is somewhat different than that of the matching sample.
Described by: Dave R. Cawlfield, September 29, 1956.

Horizon and Lincoln Lab. Number	
A1 4804	0 to 4 inches. Dark grayish brown (2.5Y 3.5/2) heavy clay, grayish brown (2.5Y 4.5/2) when dry; weak medium platy breaking to strong fine and very fine granular; hard, firm, very sticky and very plastic; pH 7.6 with phenol red; abundant roots; abrupt smooth boundary.
B21 4805	4 to 9 inches. Very dark grayish brown (1Y 3/2) heavy clay, dark grayish brown (1Y 4/2) when dry; weak very coarse prismatic breaking to moderate fine blocky structure; extremely hard, firm, very sticky and very plastic; effervesces weakly; pH 7.6 with phenol red; plentiful roots; very few very fine pores; moderate nearly continuous clay skins; gradual boundary.
B22 4806	9 to 15 inches. Dark grayish brown to olive brown (2.5Y 4/2.5) heavy clay, grayish brown to light olive brown (2.5Y 5/2.5) with a few fine white spots, when dry; weak very coarse prismatic to moderate medium blocky structure; extremely hard, firm, very sticky and very plastic; effervesces; pH 7.8 with phenol red; plentiful roots; very few very fine pores; gradual irregular boundary.
B23 4807	15 to 24 inches. Olive gray (4Y 4/2) heavy clay, olive gray (5Y 5/2) when dry; weak very coarse prismatic breaking to moderate medium blocky structure; extremely hard, very firm, very sticky and very plastic; effervesces; pH 8.4 with thymol blue; plentiful roots; very few very fine pores; diffuse boundary.
C1cs 4808	24 to 31 inches. Olive (4Y 4/3) heavy clay, olive gray (5Y 5/2.5) when dry with few coarse prominent white splotches of gypsum crystals; weak coarse blocky structure; extremely hard, very firm, very sticky and very plastic; effervesces strongly; pH 8.4; few roots; gradual boundary.
C2cs 4809	31 to 44 inches. Dark olive gray (5Y 3/2) clay, pale olive (5Y 6/3) dry with moderate medium-size prominent white splotches of gypsum and lime; massive; extremely hard, friable, sticky and plastic; effervesces strongly; pH 8.6 with thymol blue; very few roots; diffuse boundary.
C3cs 4810	44 to 51 inches plus. Olive (5Y 5/3) clay, pale olive (5Y 6/3) when dry with moderate medium prominent white splotches of gypsum and lime; massive; hard, friable, sticky and plastic; effervesces strongly; pH 8.4 with thymol blue.

SOIL SURVEY LABORATORY Lincoln, Nebr. April 1963

SOIL TYPE Snowy very gravelly loam **LOCATION** Golden Valley County, Montana

SOIL NOS. S61Mont-19-1-(1-7) **LAB. NOS.** 15779-15785

DEPTH INCHES	HORIZON	1B1a PARTICLE SIZE DISTRIBUTION (in mm.) (per cent) 3A1 VERY COARSE SAND 2-1	COARSE SAND 1-0.5	MEDIUM SAND 0.5-0.25	FINE SAND 0.25-0.10	VERY FINE SAND 0.10-0.05	SILT 0.05-0.002	CLAY < 0.002	0.2-0.02	0.02-0.002	2A2 > 2 (<19mm)	TEXTURAL CLASS
1-0	O	a	a	a	a	a	a	a	a	a	28	
0-2	A11	9.7b	3.4b	1.9b	4.4b	5.3b	50.6	24.7	30.1	28.1	42	sil/l
2-5	A12	14.3c	6.9c	2.0c	2.1d	8.4d	52.2	14.1	51.0	10.5	63	sil
5-11	AC	14.9c	6.2c	2.1c	2.8d	15.0d	38.3	20.7	35.6	19.1	58	l
11-29	C1ca	12.0c	5.1c	1.4c	1.6d	15.4d	41.7	22.8	37.1	20.8	51	l
29-43	C2ca	12.9c	10.1c	5.3c	8.7d	8.2d	36.8	18.0	27.6	21.9	43	l
43-52	C3	13.3c	10.2c	5.6c	9.8d	8.0d	36.7	16.4	29.7	20.1	27	l

8C1a pH 1:1		6C1a Ext. Iron as Fe %	ORGANIC MATTER 6A1a ORGANIC CARBON %	6H1a NITROGEN %	C/N	Bulk Density Field Moist 4B4 % M.	Field Moist 4A1a g/cc	30 Cm. 4B3 % M.	30 Cm. 4A1c g/cc	A.D. 4A1b g/cc	4A Db^{2}_{t} g/cc f	4B2 Water 15-Bar Sieved %
7.4e		0.7	17.7	1.30	14							43.1
7.4e		0.6	12.4	1.10	11	20.9	0.79			0.86	0.5	32.2
7.5		0.6	3.34	0.277	12							11.6
7.6		0.6	1.42	0.127	11							9.4
7.6		0.6	0.74	0.062	12	5.3	1.42	17.0	1.35	1.41	0.9	8.8
7.9		0.5	0.25									7.3
7.9		0.5	0.18									6.2

5A1a CATION EXCHANGE CAPACITY NH_4OAc	EXTRACTABLE CATIONS 5R1a Ca	Mg	6H1a H	6P2a Na	6Q2a K	3D1 Ratios to Clay 15-Atm Moist.	Cat. Exch. Cap.	Iron	Carbonate as $CaCO_3$ Whole Sample %	6E1c Clay-Size %
← milliequivalents per 100g. soil →										
50.3			5.4	Tr.	0.8				14	-
54.7				Tr.	0.5	1.30	2.21	.02	23	-
27.9				Tr.	0.2	0.82	1.98	.04	44	-
20.1				Tr.	0.2	0.45	0.97	.03	47	-
18.6				0.1	0.2	0.38	0.82	.03	41	-
11.8				Tr.	0.2	0.40	0.66	.03	62	1
10.6				Tr.	0.2	0.38	0.65	.03	65	1

a. No PSD due to high organic matter content.
b. Few fragments of carbonate.
c. Many fragments of carbonate.
d. Common fragments of carbonate.
e. 1:5 soil-water ratio due to high organic matter content.
f. Weight of fine-earth-per-unit volume of horizon, calculated for 30-cm. bulk density where available; otherwise, field moist bulk density.

Soil type: Snowy very gravelly loam
Soil No.: S61Mont-19-1
Location: Golden Valley County, Montana; 300 feet west of the southeast corner of Section 3, T11N, R19E; aerial photo MASA-149, 8/7/44, scale 1 inch = 1 mile.
Slope: 6 percent north face; elevation 8750 feet.
Physiography: Sampled on bedrock plateau of Big Snow Mountains in an area mantled with 4 feet or more of stony loam with a few rock outcrops occurring locally; 200 feet back (south) from the top edge of a canyon wall, 170 feet below (north) of a drainage divide on the slope of a very shallow drainage way. 30 feet south is an extensive area of "patterned gravel-dryas island". Rock outcrops are prominent on the low (relief in tens of feet) ridges; there are a few small "karst" sinks in the vicinity.
Parent rock: Limestone.
Vegetation: Avens, sedge, and dryas meadow.
Drainage: Well drained.
Climate: Cold semiarid; 50° F. at 42 inches.
Sampled by: R. C. McConnell, T. J. Nimlos, R. D. Taber and C. A. Mogen, August 29, 1961.

Horizon and Lincoln Lab. Number	
O 15779	1 to 0 inch. Very dark brown (10YR 2/2 dry) gravelly loam, 10YR 1/2 when moist; weak very fine granular structure; loose when dry, very friable, nonsticky and nonplastic; turf with abundant roots estimated at over 50 percent of material volume; very porous, estimated 60 percent pore space without distinct pores; abundant clear sand grains; clear lower boundary.
A11 15780	0 to 2 inches. Very dark brown (10YR 2/2 dry) gravelly loam, 10YR 1/2 moist; weak medium and large crumb structure; soft, very friable, nonsticky and nonplastic; abundant roots well distributed; very porous, estimated 50 percent pore space without distinct pores; abundant clear grains; large gravel and cobbles, flat-shaped, having prominent stalactites on underside; clear lower boundary.
A12 15781	2 to 5 inches. Dark brown (10YR 3/3 dry) gravelly loam, 10YR 2/3 when moist; the rest of the horizon is the same as A11; pebbles of gravel with remnant of lime casts on underside; clear wavy lower boundary.
AC 15782	5 to 11 inches. Brown (10YR 5/3 dry) gravelly loam, 10YR 4/3 when moist; weak fine crumb structure; soft, very friable, slightly sticky and slightly plastic; abundant roots well distributed; porous, estimated 40 percent pore space without distinct pores; a few remnants of lime casts on under sides of gravel and some dark and very dark brown staining on under sides of gravel 7.5YR 3/3; calcareous; occasional threads of lime; gradual wavy lower boundary.
C1ca 15783	11 to 29 inches. Pale brown (10YR 6/3) gravelly loam, containing abundant white threads and films of segregated lime; mass of horizon is 10YR 4/3 moist; abundant white threads of very fine granular lime; moderate fine angular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; plentiful roots; many fine pores; thin lime encrustation around most rocks; clear irregular lower boundary.
C2ca 15784	29 to 43 inches. Yellowish brown (10YR 5/4 moist) stony very gravelly loam, 10YR 7/3 dry; moderate fine angular blocky structure arranged in moderate coarse plates; slightly hard, friable, slightly sticky and slightly plastic; calcareous with many white threads of very fine granular lime (or calcareous gypsum crystals); few roots; common very fine pores; lime crusts on all sides of rocks; gradual irregular lower boundary.
C3 15785	43 to 52 inches. Pale brown (10YR 6/3 dry) very stony loam, 10YR 5/4 moist; moderate fine angular blocky structure arranged in moderate coarse plates; hard, friable, slightly sticky and slightly plastic; no roots; few fine pores; lime crusts on undersides of stones.

Note: Estimated 35 percent coarse fragments to depth of 30 inches with 25 percent gravel and 10 percent stones; gravel and stones are angular in shape. Estimated 80 percent coarse fragments below 30 inches, including 50 percent larger than 3-inch diameter.

MICROMORPHOLOGY:

Thin Sections: (Method 4E1)

The matrix of the A11 horizon is composed of loosely packed, brown, organic aggregates less than 1-mm. in size; these give a micro-crumb structure to the soil. Most of the organic particles in the aggregates are decomposed beyond recognition. Silt-size mineral grains are contained within the aggregates and rock fragments and sand-size mineral grains are incorporated within the matrix. A few plant roots penetrate the matrix in seemingly random fashion.

The C1ca horizon has subangular peds surrounded by a continuous network of pores. Many of these pores are filled with strings of clean, rhombic, sand-size calcite crystals. These are probably the "white threads" of lime described in the field. The manner in which they are segregated into pore spaces suggests that they are of secondary origin. Fragments of oölitic limestone are present in this horizon.

Most rock fragments and primary minerals in the thin sections are relatively fresh, although some weathering is apparent in the A and B horizons. Amphiboles and platy minerals are weathered along fractures and cleavage lines. Brown stains in these areas suggest that iron is being released. The "platy" minerals are described more fully under Grain Studies. Limestone fragments in the surface are considerably weathered.

Grain Studies: (Method 7B1)

Quartz and feldspar dominate the very fine sand of the surface horizon. A trace of glass is present. There is about 10 percent chloritic minerals, 5 percent hypersthene, 5 percent zoisite, and 2 to 5 percent calcite. The majority of the calcite shows evidence of weathering. The C horizon contains about 90 percent calcite, much of which appears secondary. Quartz, feldspar, and chloritic minerals dominate the remaining fraction. There is a trace of pyroxenes. No glass was observed at this depth.

SOIL SURVEY LABORATORY Lincoln, Nebr. April, 1963

SOIL TYPE Snowy very gravelly loam **LOCATION** Golden Valley County, Montana

SOIL NOS. 861Mont-19-2-(1-7) **LAB. NOS.** 15786-15792

DEPTH INCHES	HORIZON	1B1a PARTICLE SIZE DISTRIBUTION (in mm.) (per cent) 3A1 VERY COARSE SAND 2-1	COARSE SAND 1-0.5	MEDIUM SAND 0.5-0.25	FINE SAND 0.25-0.10	VERY FINE SAND 0.10-0.05	SILT 0.05-0.002	CLAY < 0.002	0.2-0.02	0.02-0.002	2A2 > 2 (<19mm)	TEXTURAL CLASS
1-0	O	a	a	a	a	a	a	a	a	a	50	
0-3	A11	5.0c	2.6c	2.1c	5.6d	6.9d	53.3	24.5	34.2	28.8	56	sil
3-5	A12	4.2c	2.5c	1.0c	1.5d	8.0d	55.1	27.7	34.6	29.3	40	sicl
5-12	AC	7.3c	4.0c	1.3c	1.4d	14.3d	52.2	19.5	40.4	26.7	48	sil
12-21	C1ca	7.3c	4.9c	2.2c	3.6d	20.1d	41.0	20.9	43.5	19.3	44	l
21-32	C2ca	9.2c	8.4c	5.4c	9.0d	16.9d	36.4	14.7	38.6	19.1	31	l
32-43	C3	10.1c	11.1c	6.7c	11.6d	8.5d	37.0	15.0	30.4	20.7	32	l

8C1a pH 1:1	6C1a Ext. Iron as Fe %	ORGANIC MATTER 6A1a ORGANIC CARBON %	6B1a NITROGEN %	C/N	Bulk Density Field Moist % M.	Field Moist g/cc	30 Cm. % M.	30 Cm. g/cc	A.D. g/cc	4B2 Water 15-Bar Sieved %
7.5e	0.6	12.0	1.05	11						33.4
7.4e	0.7	10.9	0.985	11						31.1
7.4	1.0	2.58	0.230	11						13.7
7.5	0.8	1.32	0.106	12						9.6
7.6	0.7	0.93	0.075	12						8.1
7.8	0.7	0.54	0.041	13						6.3
7.8	1.0	0.21								5.4

5A1a CATION EXCHANGE CAPACITY NH_4OAc	EXTRACTABLE CATIONS Ca	Mg	H	6P2a Na	6Q2a K	8D1 Ratios to Clay 15-Atm. Moist.	Cat. Exch. Cap.	Iron	Carbonate as $CaCO_3$ Whole Sample %	6E1c Clay-Size %
← milliequivalents per 100g. soil →										
47.0				0.1	0.7				26	-
49.6				0.1	0.5	1.27	2.02	.03	22	-
28.6				0.1	0.2	0.49	1.03	.04	19	-
20.2				0.1	0.2	0.49	1.04	.04	34	-
16.7				0.1	0.2	0.39	0.80	.03	44	-
11.6				Tr.	0.2	0.43	0.79	.05	63	2
10.4				Tr.	0.2	0.36	0.69	.07	68	-

a. No PSD due to high organic matter content.
c. Many fragments of carbonate.
d. Common fragments of carbonate.
e. 1:5 soil-water ratio due to high organic matter content.

Soil type: Snowy very gravelly loam
Soil No.: S61Mont-19-2
Location: Golden Valley County, Montana; 200 feet west of the southeast corner of Section 2, T11N, R19E; aerial photo MASA-149, 8/7/44, scale 1 inch = 1 mile.
Slope: 8 percent north-northeast; elevation 8550 plus 200 feet.
Physiography: Sampled on limestone bedrock plateau of Big Snowy Mountains in an area mantled with about four feet of stony loam; on the brow of the slope of the plateau top on the edge of a 15-percent slope down 15 feet to a narrow stony loam mantled bedrock terrace that forms the lip of a rocky canyon wall on the north, approximately 400 feet south of the edge of the canyon wall. "Patterned gravel-dryas island" areas occur locally; rock outcrops are prominent on the ridges and edges of rock terraces. There are a few small "karst" sinks in the vicinity.
Parent rock: Limestone.
Drainage: Well drained.
Vegetation: Avens, sedge, and dryas meadow.
Climate: Cold semiarid.
Sampled by: R. C. McConnell, T. J. Nimlos, R. D. Taber and C. A. Mogen, August 29, 1961.

Horizon and Lincoln Lab. Number	
O 15786	1 to 0 inch. Very dark brown (10YR 2/2 dry) gravelly loam, 10YR 1/2 when moist; weak very fine granular structure; loose, very friable, nonsticky and nonplastic; turf with abundant roots, estimated 50 percent; very porous, estimated 60 percent pore space without distinct pores; abundant clear sand grains; some gravel with stalactites on underside; clear lower boundary.
A11 15787	0 to 3 inches. Very dark brown (10YR 2/2 dry) very gravelly loam, 10YR 1/2 when moist; weak medium granular structure; soft, very friable, nonsticky and nonplastic; abundant roots; estimated 50 percent pore space without distinct pores; abundant clear sand grains; some gravel with stalactites on under sides; clear wavy lower boundary with tongues extending to 6 inches at intervals of 10 inches in east-west direction; horizon ranges in thickness from 1 to 5 inches, including tonguing.
A12 15788	3 to 5 inches. Brown (10YR 4/3 dry) very gravelly loam, 10YR 2/3 when moist; the rest of the horizon is like the A11; some lime casts and stalactites under some rocks; clear wavy lower boundary.
AC 15789	5 to 12 inches. Brown (10YR 5/3 dry) gravelly loam, 10YR 3.4/3 when moist; weak fine and medium granular structure; slightly hard, friable, slightly sticky and slightly plastic; weakly calcareous; plentiful roots; 30 percent estimated pore space with many fine pores; lime casts on undersides of most pebbles; a few white threads of lime; gradual wavy lower boundary.
C1ca 15790	12 to 21 inches. Light yellowish brown (10YR 6/4 dry) very gravelly loam, 10YR 4/4 moist; contains abundant white threads and films of granular lime and other salt; moderate fine angular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; 80 percent coarse fragments; plentiful roots and many very fine pores; lime encrustations around the rocks; gradual lower boundary.
C2ca 15791	21 to 32 inches. Dark yellowish brown (10YR 4/4 moist) stony very gravelly loam with many white threads of very fine granular salt (calcareous gypsum); moderate fine angular blocks arranged in coarse plates; slightly hard, friable, slightly sticky and slightly plastic; few roots; many very fine pores; lime crust on all sides of fragments; clear irregular lower boundary.
C3 15792	32 to 43 inches. Dark yellowish brown (10YR 4/6 moist) very stony gravelly loam; moderate fine angular blocks arranged in moderate coarse plates; hard, friable, slightly sticky and slightly plastic; no roots; few fine pores; lime crusts on undersides of stones.

Note: Estimated 60 percent coarse fragments from 1 to 22 inches, including less than 10 percent larger than 3-inch diameter. Estimated 80 percent coarse fragments below 22 inches including 50 percent larger than 3-inch diameter and 10 percent larger than 1-foot diameter. Large boulders limited depth of sampling.

MICROMORPHOLOGY:

Grain Studies: (Method 7B1)

Quartz and feldspar dominate the very fine sand of the surface horizon. A trace of glass is present. There is about 10 percent chloritic minerals, 5 percent hypersthene, 5 percent zoisite, and 2 to 5 percent calcite.. The majority of the calcite shows evidence of weathering. The C horizon contains about 90 percent calcite, much of which appears secondary. Quartz, feldspar, and chloritic minerals dominate the remaining fraction. There is a trace of pyroxenes. No glass was observed at this depth.

SOIL SURVEY LABORATORY Mandan, N. Dak.

SOIL TYPE Straw loam variant **LOCATION** Roosevelt County, Montana

SOIL NOS. S51Mont-43-7 **LAB. NOS.** 835-842

DEPTH INCHES	HORIZON	1B1a PARTICLE SIZE DISTRIBUTION (in mm.) (per cent) 3A1									2A2	TEXTURAL CLASS
		VERY COARSE SAND 2-1	COARSE SAND 1-0.5	MEDIUM SAND 0.5-0.25	FINE SAND 0.25-0.10	VERY FINE SAND 0.10-0.05	SILT 0.05-0.002	CLAY < 0.002	0.2-0.02	0.02-0.002	> 2	
0-5	A1	0.2	0.5	0.7	2.0	14.0	54.3	28.3	44.3	25.2	-	sicl
5-11	C1	0.1	0.3	0.7	2.7	37.7	40.6	17.9	67.0	13.1	-	l
11-18	C2	-	0.2	0.5	6.2	44.0	32.9	16.2	70.8	11.7	-	l
18-23	C3	0.1	0.2	0.3	1.5	12.5	54.3	31.1	36.8	30.9	-	sicl
23-33	C4	0.1	0.3	0.6	2.3	29.6	47.8	19.3	61.4	17.6	-	l
33-41	C5	0.1	0.2	0.8	2.2	22.9	54.2	19.6	59.4	19.1	-	sil
41-52	C6	0.1	0.1	0.6	4.3	36.3	40.0	18.6	65.7	14.4	-	l
52-57	C7	0.1	0.1	0.3	5.7	4.7	56.3	32.8	26.3	39.6	-	sicl

	pH		ORGANIC MATTER			8A2	ELECTRICAL CONDUCTIVITY EC×10³ MILLIMHOS PER CM 8A1a	6E1a	6F1a	MOISTURE TENSIONS		4B2
8C1b SATURATED PASTE	8C1a 1:5	8C1a 1:10	6A1a ORGANIC CARBON %	6B1a NITROGEN %	C/N	EST% SALT (BUREAU CUP)		$CaCO_3$ equivalent %	GYPSUM me./100g. SOIL	1/10 ATMOS. %	1/3 ATMOS. %	15 ATMOS. %
7.6	8.3	8.5	3.10	0.264	11.7	-	0.7	5	-			15.2
7.8	8.7	8.8	0.97	0.076	12.8	-	0.6	7	-			8.5
7.8	8.9	9.0	0.59	0.047	12.6	-	0.6	6	-			7.8
7.9	8.6	8.8	1.18	0.098	12.0	-	1.7	5	-			13.6
7.9	8.6	8.9	0.55	0.045	12.2	-	1.4	6	-			8.7
7.7	8.5	8.8	0.48	0.044	10.9	-	2.2	7	-			8.8
7.7	8.6	8.8	0.45	0.039	11.5	-	1.8	6	-			8.2
7.6	8.1	8.4	0.62	0.060	10.3	0.22	3.8	4	3			14.7

5A1a	EXCHANGEABLE CATIONS			5B1b		5D2	SATURATION EXTRACT SOLUBLE		8A1			8A
CATION EXCHANGE CAPACITY NH_4OAc	Ca	Mg	H	6P2a Na	6Q2a K	EXCH. Na %	6P1a Na	6Q1a K				MOISTURE AT SATURATION %
← milliequivalents per 100g. soil →							← milliequivalents per liter →					
28.2				0.3	1.4	1	0.2	1.3				60.9
16.0				0.3	0.7	2	0.2	0.9				46.2
13.9				0.3	0.4	2	0.9	0.5				42.7
23.7				0.6	0.5	2	5.6	0.5				60.6
15.6				0.5	0.4	3	5.6	0.8				46.2
15.9				0.7	0.4	4	8.3	0.8				48.6
15.0				0.8	0.4	5	9.1	0.5				45.8
23.9				1.4	0.5	6	15.4	0.9				62.3

Soil type: Straw loam, variant
Soil No.: S51Mont-43-7
Location: Roosevelt County, Montana; NE1/4 NW1/4 Section 21, T27N, R48E.
Topography: Low terrace; undulating terrace.
Drainage: Good.
Parent material: Missouri River Alluvium.
Vegetative cover: Sagebrush and short grass.

The soil area from which this sample was taken lies on the intermediate terrace levels of the present Missouri River Terrace system and is included in age group III as tentatively classified by the field party, i.e., it is of older age than the lower lying terrace levels on which Alluvial soils are developing and is more youthful than those terraces that lie adjacent to the upland slopes. The sample pit was dug approximately three hundred feet from the terrace break to the next lowest terrace level and is about 1/4-mile from the present river channel. No deposition has occurred in this area since the completion of Fort Peck Dam and prior to that the area was flooded only infrequently. There is no evidence of accelerated erosion in the sample area and the water table in this part of the river valley lies at about 20 to 25 feet. The area sampled is used as pasture land and supports a fair cover of chokecherry bushes, sage, western wheatgrass and buffalo berry.

Described by: A. J. Cline, September 6, 1951.

Horizon and Mandan Lab. Number	
A1 835	0 to 5 inches. Grayish brown (2.5Y 5/2 dry) to very dark grayish brown (2.5Y 3.5/2 moist) fine granular calcareous silty clay loam; soft when dry and very friable when moist.
C1 836	5 to 11 inches. Grayish brown (2.5Y 5/2 dry) to dark grayish brown (2.5Y 4/2 moist) calcareous prismatic loam; structure is weakly developed; soft when dry and very friable when moist.
C2 837	11 to 18 inches. Light brownish gray (2.5Y 6/2 dry) to grayish brown (2.5Y 5/2 moist) calcareous very fine sandy loam; poorly developed subangular blocky structure and contains some accumulation of calcium carbonate chiefly in myceliated forms; soft when dry and very friable when moist.
C3 838	18 to 23 inches. Grayish brown (2.5Y 5/2 dry) to dark grayish brown (2.5Y 4/2 moist) calcareous silty clay loam stratified with lenses of silty clay; poorly developed subangular blocky structure and contains moderate amounts of accumulated calcium carbonate in nodular and myceliated forms; slightly hard when dry and firm when moist; grades rapidly to C4.
C4 839	23 to 33 inches. Light brownish gray (2.5Y 6/2 dry) to dark grayish brown (2.5Y 4/2 moist) massive calcareous loam; soft when dry and very friable when moist.
C5 840	33 to 41 inches. Light brownish gray (2.5Y 6/2 dry) to grayish brown (2.5Y 5/2 moist) massive calcareous very fine sandy loam; soft when dry and very friable when moist.
C6 841	41 to 52 inches. Light brownish gray (2.5Y 6/2 dry) to dark grayish brown (2.5Y 4/2 moist) calcareous massive loam; contains a few very thin lenses of silty clay but is soft when dry and very friable when moist.
C7 842	52 to 57 inches. Light brownish gray (2.5Y 6/2 dry) to dark grayish brown (2.5Y 4/2 moist) massive calcareous silty clay loam intensely stratified with loam; soft when dry and very friable when moist.
C8	57 to 60 inches. Light brownish gray (2.5Y 6/2 dry) to grayish brown (2.5Y 5/2 moist) massive calcareous fine sandy loam; soft when dry and very friable when moist; intensely stratified and though the strata are too small to be segregated the composite texture is approximately a fine sandy loam although it varies from place to place. (Not sampled.)

SOIL SURVEY LABORATORY Lincoln, Nebr. 4/19/57

SOIL TYPE Sula silt loam **LOCATION** Ravalli County, Montana

SOIL NOS. S55Mont-41-3 **LAB. NOS.** 2966-2970

DEPTH INCHES	HORIZON	1B1a PARTICLE SIZE DISTRIBUTION (in mm.) (per cent) VERY COARSE SAND 2-1	COARSE SAND 1-0.5	MEDIUM SAND 0.5-0.25	FINE SAND 0.25-0.10	VERY FINE SAND 0.10-0.05	SILT 0.05-0.002	CLAY < 0.002	3A1 0.2-0.02	0.02-0.002	2A2 > 2 (<19mm)	TEXTURAL CLASS
0-8	Ap	3.7	3.3	1.5	3.1	8.7	61.6	18.1	41.6	30.7	4	sil
8-12	B2	2.8	2.2	1.1	2.4	9.1	63.7	18.7	44.6	29.8	3	sil
12-19	B3	5.4	3.4	1.4	2.8	9.5	60.2	17.3	47.4	24.2	8	sil
19-31	IIB2b	41.3	14.7	4.5	5.9	4.8	8.9	19.9	13.6	3.4	42	cosl
31-44	IIB3b	45.5	16.0	4.8	6.3	5.0	10.9	11.5	13.3	6.2	47	cosl

DEPTH INCHES	pH 8C1a 1:1	1:5	1:10	ORGANIC MATTER 6A1a ORGANIC CARBON %	6B1a NITROGEN %	C/N	EST% SALT (BUREAU CUP)	ELECTRICAL CONDUCTIVITY EC×10³ MILLIMHOS PER CM @25°C.	6E1a $CaCO_3$ equivalent %	GYPSUM me./100g. SOIL	MOISTURE TENSIONS 1/10 ATMOS. %	1/3 ATMOS. %	4B2 15 ATMOS. %
0-8	5.9	6.2	6.2	2.43	.193	12.6							10.2
8-12	5.9	6.2	6.2	1.02	.102	10.0							9.0
12-19	6.1	6.4	6.5	0.52	.055	9.4							7.8
19-31	6.5	6.6	6.5	0.30	.027	11.1							7.4
31-44	6.7	6.8	6.6	0.14	.012								6.5

DEPTH INCHES	5A1a CATION EXCHANGE CAPACITY NH_4Ac	EXTRACTABLE CATIONS 6N2b Ca	6O2b Mg	6H1a H	6P2a Na	6Q2a K	BASE SAT. % 5C1	SATURATION EXTRACT SOLUBLE Na	K	MOISTURE AT SATURATION %
	←	milliequivalents per 100g. soil →						← milliequivalents per liter →		
0-8	19.0	12.1	2.1	7.0	0.1	0.3	77			
8-12	16.5	10.9	2.0	5.2	0.2	0.2	81			
12-19	15.9	11.2	2.6	3.4	0.2	0.1	89			
19-31	14.5	10.7	2.5	2.1	0.1	0.2	93			
31-44	14.3	11.5	2.1	1.6	0.1	0.1	96			

Soil type: Sula silt loam
Soil No.: S55Mont-41-3
Location: Ravalli County, Montana; SW, NW, NE of Section 2, T2N, R21W.
Vegetation: Run-out clover and timothy meadow with considerable quackgrass.
Parent material: Silty loess 19 inches thick over strongly weathered gneiss and granite outwash of probable Pleistocene Age.
Physiography: High old fan terrace.
Relief: Smooth to convex, 2 percent east-facing slope.
Drainage: Well drained.
Root distribution: Abundant to 8 inches, plentiful to 20 inches, and few to 50 inches.
Collected by: W. C. Bourne, James Allen, R. A. Campanella, and Dave Gardiner, August 25, 1955.
Described by: W. C. Bourne.

Horizon and Mandan Lab. Number	
Ap 2966	0 to 8 inches. Dark grayish brown (10YR 4/2 dry) to very dark brown (10YR 2/2 moist) silt loam; coarse platy and moderate coarse granular; hard when dry, friable when moist; clear boundary.
B2 2967	8 to 12 inches. Very dark grayish brown (10YR 3/2 moist) silt loam; medium blocky; hard when dry, friable when moist; some mixture of colors from above and below; earthworms moderately active; gradual boundary.
B3 2968	12 to 19 inches. Dark brown (10YR 4/3 moist) silt loam; medium and coarse subangular blocky; hard when dry, friable when moist; some gray leachings on structure planes; clear boundary.
IIB2b 2969	19 to 31 inches. Dark brown (7.5YR 3/4 moist) gravelly coarse sandy clay loam; moderate coarse and medium subangular blocky; friable when moist, sticky and plastic when wet; clear boundary.
IIB3b 2970	31 to 44 inches. Strong brown (7.5YR 4/5 moist) gravelly coarse sandy clay loam between very strongly weathered cobbles of gneiss; friable when moist, sticky and plastic when wet; gradual boundary.
IIICb	44 to 48 inches plus. Weathered cobbles and boulders. (Not sampled).

SOIL SURVEY LABORATORY Lincoln, Nebr. 4/19/57

SOIL TYPE Sula silt loam **LOCATION** Ravalli County, Montana

SOIL NOS. S55Mont-41-5 **LAB. NOS.** 2975-2979

DEPTH INCHES	HORIZON	1B1a PARTICLE SIZE DISTRIBUTION (in mm.) (per cent) VERY COARSE SAND 2-1	COARSE SAND 1-0.5	MEDIUM SAND 0.5-0.25	FINE SAND 0.25-0.10	VERY FINE SAND 0.10-0.05	SILT 0.05-0.002	CLAY < 0.002	3A1 0.2-0.02	0.02-0.002	2A2 > 2 (<19mm)	TEXTURAL CLASS
0-8	Ap	3.9	4.1	2.5	4.8	14.8	55.2	14.7	49.5	23.5	3	sil
8-13	B2	2.9	3.5	2.2	4.0	15.7	56.7	15.0	51.0	24.0	2	sil
13-22	B3	4.6	3.0	1.8	4.3	16.7	54.9	14.7	52.2	22.4	6	sil
22-29	IIB2b	40.9	14.6	4.9	6.6	4.9	12.1	16.0	14.2	6.4	37	cosl
29-42	IIB3b	39.8	18.4	6.0	7.3	5.0	12.7	10.8	13.2	8.6	23	cosl

	pH 8C1a		ORGANIC MATTER 6A1a	6B1a		EST% SALT (BUREAU CUP)	ELECTRICAL CONDUCTIVITY EC×10³ MILLIMHOS PER CM @25°C.	6E1a		MOISTURE TENSIONS		4B2
1:1	1:5	1:10	ORGANIC CARBON %	NITROGEN %	C/N			$CaCO_3$ equivalent %	GYPSUM me./100g. SOIL	1/10 ATMOS. %	1/3 ATMOS. %	15 ATMOS. %
6.3	6.6	6.7	1.98	.141	14.0							7.9
6.2	6.4	6.5	0.72	.072	10.0							7.0
6.2	6.5	6.5	0.26	.033	7.8							5.9
6.9	7.1	7.2	0.28	.028	10.0							9.0
8.3	8.7	8.8	0.16	.018				3				7.6

5A1a	EXTRACTABLE CATIONS 5B1a					BASE SAT. % 5C1	SATURATION EXTRACT SOLUBLE		MOISTURE AT SATURATION %
CATION EXCHANGE CAPACITY NH_4Ac	6N2b Ca	6G2b Mg	6H1a H	6P2a Na	6Q2a K		Na	K	
←	milliequivalents per 100g. soil →						← milliequivalents per liter →		
15.0	10.4	1.5	4.4	0.2	0.6	85			
12.1	8.5	1.4	3.4	0.2	0.3	86			
11.6	8.5	2.0	2.0	0.2	0.2	94			
16.1	13.2	2.9		0.1	0.3				
9.4				0.2	0.1				

Soil type: Sula silt loam
Soil No.: S55Mont-41-5
Location: Ravalli County, Montana; SW, SW, SW of Section 23, T3N, R21W.
Vegetation: Alfalfa and quackgrass.
Parent material: Silty loess 22 inches thick over strongly weathered gneiss outwash.
Physiography: Old high bench, presumably Pleistocene Age.
Relief: Smooth, convex, 2 percent east-facing slope.
Drainage: Well drained.
Root distribution: Good to depth sampled.
Collected by: W. C. Bourne, James Allen, R. A. Campanella, and Dave Gardiner, August 25, 1955.
Described by: W. C. Bourne.

Horizon and Mandan Lab. Number	
Ap 2975	0 to 8 inches. Grayish brown (10YR 5/2 dry) to very dark brown (10YR 2/2 moist) silt loam; moderate fine platy to 3 inches and with fine subangular blocky 3 to 5 inches; slightly hard when dry, friable when moist; clear boundary.
B2 2976	8 to 13 inches. Pale brown (10YR 6/3 dry) to brown (10YR 5/3 moist) silt loam; medium subangular blocky; slightly hard when dry, friable when moist; some mixing of darker material from above; gray sprinklings on some of the ped surfaces; gradual boundary.
B3 2977	13 to 22 inches. Very pale brown (10YR 7/3 dry) to brown (10YR 5.5/3 moist) silt loam; medium and coarse subangular blocky; slightly hard when dry, friable when moist; gray sprinklings on some ped surfaces; clear boundary.
IIB2b 2978	22 to 29 inches. Dark brown (7.5YR 4/4 moist) coarse sandy clay loam; moderate medium and coarse subangular blocky; hard when dry, friable when moist; about 20 to 30 percent gravel; clear boundary.
IIB3b 2979	29 to 42 inches. Brown (7.5YR 5/4 moist) gravelly coarse sandy loam; massive; very friable when moist; strongly calcareous on structure planes and weakly calcareous in centers of peds; lime horizon of upper soil; about 20 to 30 percent gravel; abrupt boundary.
IICcab	42 to 45 inches plus. (Not sampled) Lime hard pan beginning abruptly.

SOIL SURVEY LABORATORY Lincoln, Nebr. 4/19/57

SOIL TYPE Sula silt loam **LOCATION** Ravalli County, Montana

SOIL NOS. S55Mont-41-6 **LAB. NOS.** 2980-2986

DEPTH INCHES	HORIZON	1Bla PARTICLE SIZE DISTRIBUTION (in mm.) (per cent) VERY COARSE SAND 2-1	COARSE SAND 1-0.5	MEDIUM SAND 0.5-0.25	FINE SAND 0.25-0.10	VERY FINE SAND 0.10-0.05	SILT 0.05-0.002	CLAY < 0.002	3A1 0.2-0.02	0.02-0.002	2A2 > 2 (<19mm)	TEXTURAL CLASS
0-8	Ap	1.0	1.8	1.4	3.3	12.6	63.5	16.4	48.6	29.7	1	sil
8-12	B2	1.0	1.9	1.2	2.9	13.1	64.5	15.4	50.8	28.8	2	sil
12-22	B3	1.1	1.5	1.0	3.2	15.7	64.1	13.4	59.0	23.1	3	sil
22-30	IIAb1	5.2	3.9	2.2	5.8	15.2	48.1	19.6	46.4	20.9	2	l
30-36	IIAb2	3.6	5.3	3.4	8.0	16.0	40.9	22.8	45.4	16.7	5	l
36-42	IIB2b	5.2	6.8	4.8	9.1	10.2	24.7	39.2	29.4	11.0	5	cl
42-50	IIB3b	18.4	11.7	7.2	13.8	7.8	17.0	24.1	24.3	8.4	20	scl

pH 8Cla 1:1	pH 1:5	pH 1:10	ORGANIC MATTER 6Ala ORGANIC CARBON %	6Bla NITROGEN %	C/N	EST% SALT (BUREAU CUP)	ELECTRICAL CONDUCTIVITY EC×10³ MILLIMHOS PER CM @25°C.	6Ela $CaCO_3$ equivalent %	GYPSUM me./100g. SOIL	MOISTURE TENSIONS 1/10 ATMOS. %	1/3 ATMOS. %	4B2 15 ATMOS. %
5.7	6.0	6.0	1.77	.148	12.0							8.4
5.9	6.3	6.4	0.57	.062	9.2							7.1
7.5	8.0	8.1	0.22	.030								6.5
8.2	8.7	8.6	0.18	.028								9.4
8.5	8.9	9.0	0.15	.024								9.6
8.4	8.9	9.0	0.21	.021								16.6
8.6	9.0	8.9	0.11	.013				7				10.9

5Ala CATION EXCHANGE CAPACITY NH_4Ac	EXTRACTABLE CATIONS 5Bla 6N2b Ca	6O2b Mg	6Hla H	6P2a Na	6Q2a K	BASE SAT. % 5Cl	SATURATION EXTRACT SOLUBLE Na	K	MOISTURE AT SATURATION %
←	milliequivalents per 100g. soil →						← milliequivalents per liter →		
15.1	8.3	1.8	7.0	0.3	0.2	70			
11.8	5.9	2.1	4.8	0.6	0.2	74			
11.5	5.6	3.6	1.6	1.5	0.2	95			
17.7	8.9	6.8		1.8	0.3				
15.7		6.3		0.8	0.2				
29.9		14.0		1.8	0.4				
17.6				0.7	0.2				

Soil type: Sula silt loam
Soil No.: S55Mont-41-6
Location: Ravalli County, Montana; SW, SW, SW of Section 14, T3N, R21W.
Vegetation: Thin alfalfa and grass.
Parent material: Silty loess 22 inches thick over weathered gneiss outwash.
Physiography: Old high fan terrace of probable Pleistocene Age.
Relief: Smooth, convex, 2 percent southwest-facing slope.
Drainage: Well drained.
Collected by: W. C. Bourne, James Allen, R. A. Campanella, and Dave Gardiner, August 26, 1955.
Described by: W. C. Bourne.

Horizon and Mandan Lab. Number	
Ap 2980	0 to 8 inches. Very dark grayish brown (10YR 3/2 moist) silt loam; weak thick platy; friable when moist; abrupt boundary.
B2 2981	8 to 12 inches. Dark grayish brown (10YR 4/2 moist) silt loam; moderate medium and fine subangular blocky; friable when moist; some mixing of material from horizon above; color grades from darker to light; clear boundary.
B3 2982	12 to 22 inches. Brown (10YR 5/3 moist) silt loam; moderate medium subangular blocky; friable when moist; some light colored leachings on ped faces; clear boundary.
IIAb1 2983	22 to 30 inches. Dark brown (7.5YR 3/4 moist) light clay loam; moderate coarse subangular blocky; friable when moist; sticky and plastic when wet; clear boundary.
IIAb2 2984	30 to 36 inches. Brown (7.5YR 4/4 moist) light clay loam; moderate medium subangular blocky; friable when moist, sticky and plastic when wet; calcareous both as disseminated lime and with coatings on peds; clear boundary.
IIB2b 2985	36 to 42 inches. Strong brown and white (7.5YR 4/6 and 9/2 moist) clay loam; moderate medium subangular blocky; firm when moist, sticky and plastic when wet; strongly calcareous with some white lime coatings on ped surfaces; clear boundary.
IIIB3b 2986	42 to 50 inches. Strong brown and white (7.5YR 5/6 and 9/2 moist) sandy loam; weak blocky; friable when moist; very strongly calcareous with strong white lime coatings on ped surfaces; abrupt boundary.
IIICcab	50 to 53 inches. (Not sampled) Lime hard pan.

SOIL SURVEY LABORATORY Lincoln, Nebr. 4/19/57

SOIL TYPE Sweetgrass clay loam **LOCATION** Stillwater County, Montana

SOIL NOS. S55Mont-48-1 **LAB. NOS.** 3004-3010

DEPTH INCHES	HORIZON	1B1a PARTICLE SIZE DISTRIBUTION (in mm.) (per cent) 3A1 VERY COARSE SAND 2-1	COARSE SAND 1-0.5	MEDIUM SAND 0.5-0.25	FINE SAND 0.25-0.10	VERY FINE SAND 0.10-0.05	SILT 0.05-0.002	CLAY < 0.002	0.2-0.02	0.02-0.002	2A2 > 2 <19mm	TEXTURAL CLASS
0-3	A1	2.2	3.1	2.7	12.5	14.9	30.2	34.4	38.6	14.5	1	cl
3-7	B21t	1.4	1.4	1.6	11.3	16.3	27.1	40.9	39.8	11.4	Tr.	c
7-11	B22t	4.4	2.9	2.5	13.9	17.8	25.5	33.0	41.3	11.2	6	cl
11-15	B23t	6.8	5.8	5.0	18.2	15.3	22.6	26.3	39.8	9.2	11	scl
15-25	C1ca	6.0	6.4	4.0	10.3	11.5	23.3	38.5	29.0	11.7	10	cl
25-38	IIC2ca	27.1	19.9	7.8	12.2	8.0	13.0	12.0	21.5	5.8	29	cosl
38-48	IIC3	37.3	29.0	8.2	11.7	5.7	6.4	1.7	15.8	2.2	35	cos

DEPTH INCHES	pH 8C1a 1:1	1:5	1:10	ORGANIC MATTER 6A1a ORGANIC CARBON %	6B1a NITROGEN %	C/N	EST% SALT (BUREAU CUP)	ELECTRICAL CONDUCTIVITY EC x 10³ MILLIMHOS PER CM @25°C.	6E1a $CaCO_3$ equivalent %	GYPSUM me./100g. SOIL	MOISTURE TENSIONS 1/10 ATMOS. %	1/3 ATMOS. %	4B2 15 ATMOS. %
0-3	6.5	6.9	6.7	1.85	.170	10.9							12.8
3-7	6.7	7.1	7.0	1.25	.118	10.6							16.7
7-11	6.7	7.1	7.0	1.03	.096	10.7							14.5
11-15	6.9	7.4	7.3	0.82	.075	10.9			1				11.6
15-25	8.2	8.6	8.8	0.53	.046	11.5			41				12.0
25-38	8.4	9.0	9.2	0.25					17				5.0
38-48	8.9	9.4	9.5	0.03					2				1.6

DEPTH INCHES	5A1a CATION EXCHANGE CAPACITY NH_4Ac	EXTRACTABLE CATIONS 5B1a 6N2b Ca	6O2b Mg	6H1a H	6P2a Na	6Q2a K	BASE SAT. % 5C1	SATURATION EXTRACT SOLUBLE	MOISTURE AT SATURATION %
	← milliequivalents per 100g. soil →							← milliequivalents per liter →	
0-3	27.0	19.4	4.2	3.8	0.1	1.0	91		
3-7	36.6	27.6	5.9	3.5	0.1	0.6	93		
7-11	31.5	24.4	4.8	3.0	0.1	0.4	94		
11-15	25.8	20.7	3.6	1.4	0.1	0.4	96		
15-25	10.2				0.1	0.1			
25-38	5.2				0.1	0.1			
38-48	1.4				0.1	0.1			

Soil type: Sweetgrass clay loam
Soil No.: S55Mont-48-1
Location: Stillwater County, Montana; 1 mile south of Absarokee SW, NE, NW of Section 7, T4S, R19E.
Vegetation: Bluebunch wheatgrass, junegrass, bluegrass, blue grama, silver sagewort, and silver sage.
Parent material: Strongly weathered old alluvium derived from granitic and some sedimentary rocks.
Physiography: High smooth bench of Pleistocene or Tertiary Age.
Relief: Smooth, 1 percent northeast-facing slope.
Drainage: Well drained.
Root distribution: Plentiful to 25 inches.
Stoniness: Scattered cobbles on surface.
Collected by: W. C. Bourne, J. S. Allen, R. L. Moshier, and A. G. Fielder, August 30, 1955.
Described by: W. C. Bourne.

Horizon and Mandan Lab. Number	
A1 3004	0 to 3 inches. Dark grayish brown (10YR 4/2 dry) to very dark grayish brown (10YR 3/2 moist) clay loam; moderate medium platy; hard when dry, friable when moist, slightly sticky and slightly plastic when wet; clear boundary.
B21t 3005	3 to 7 inches. Dark grayish brown (10YR 4/2 dry) to very dark grayish brown (10YR 3/2 moist) clay loam; weak coarse prismatic breaking to moderate medium and coarse blocky; very hard when dry, firm when moist, sticky and plastic when wet; clear boundary.
B22t 3006	7 to 11 inches. Brown (10YR 4/3 dry) to dark brown (10YR 3/3 moist) heavy clay loam; moderate medium prismatic breaking to strong fine blocky; very hard when dry, firm when moist, sticky and plastic when wet; gradual boundary.
B23t 3007	11 to 15 inches. Yellowish brown (10YR 5/4 dry) to brown (10YR 4/3 moist) clay loam; moderate medium prismatic breaking to strong fine blocky; very hard when dry, firm when moist, sticky and plastic when wet; abrupt boundary.
C1ca 3008	15 to 25 inches. White (10YR 9/2 dry) to light gray (10YR 7/2 moist) gravelly loam; massive; weakly stratified with lime; heavy lime accumulation on gravel and cobbles; 10 to 15 percent gravel and cobbles; clear boundary.
IIC2ca 3009	25 to 38 inches. Loamy sand and gravel; loose; very strongly calcareous with soft lime accumulations around gravel; pebbles and cobbles strongly undercoated with cemented sand grains; gradual boundary.
IIC3 3010	38 to 48 inches. Loose sand and gravel; strongly calcareous; 15 to 25 percent cobble-size fragments strongly weathered mostly granitic with some lava and sedimentary rocks; lime coatings on underside of coarse gravel and cobbles; definitely below the lime horizon.

SOIL SURVEY LABORATORY Lincoln, Nebr. 4/19/57

SOIL TYPE Sweetgrass clay loam **LOCATION** Stillwater County, Montana

SOIL NOS. S55Mont-48-2 **LAB. NOS.** 3011-3016

DEPTH INCHES	HORIZON	1B1a PARTICLE SIZE DISTRIBUTION (in mm.) (per cent) 3A1 VERY COARSE SAND 2-1	COARSE SAND 1-0.5	MEDIUM SAND 0.5-0.25	FINE SAND 0.25-0.10	VERY FINE SAND 0.10-0.05	SILT 0.05-0.002	CLAY < 0.002	0.2-0.02	0.02-0.002	2A2 > 2 <19mm	TEXTURAL CLASS
0-4	Ap	7.4	7.1	4.2	10.2	11.0	31.1	29.0	32.4	15.5	3	cl
4-9	B21t	2.9	2.8	1.8	5.8	11.9	32.6	42.2	33.7	14.5	1	c
9-15	B22t	5.7	5.5	3.1	8.4	12.8	30.5	34.0	35.5	12.8	6	cl
15-25	C1ca	16.4	11.3	5.0	10.0	8.3	19.4	29.6	21.7	11.6	20	scl
25-34	IIC2ca	28.1	28.4	9.9	14.4	7.1	8.5	3.6	19.4	3.4	38	cos
34-44	IIC3	60.5	22.8	3.8	4.4	2.1	4.5	1.9	6.5	2.2	39	cos

	pH 8C1a		ORGANIC MATTER 6A1a ORGANIC CARBON	6B1a NITROGEN		EST% SALT (BUREAU CUP)	ELECTRICAL CONDUCTIVITY EC×10³ MILLIMHOS PER CM @25°C.	6E1a		MOISTURE TENSIONS 1/10 ATMOS.	1/3 ATMOS.	4B2 15 ATMOS.
	1:5	1:10	C/N					$CaCO_3$ equivalent	GYPSUM me./100g. SOIL			
1:1			%	%				%		%	%	%
6.4	6.8	6.9	2.89	.234	12.4							12.4
6.5	7.3	7.0	1.28	.112	11.4							16.9
6.8	7.2	7.4	0.95	.087	10.9			1				13.6
8.1	8.7	9.0	0.48	.045	10.7			50				10.2
8.6	9.1	9.2	0.06					7				2.3
8.6	9.2	9.3	0.02					4				2.1

5A1a CATION EXCHANGE CAPACITY NH_4Ac	EXTRACTABLE CATIONS 5B1a 6N2b Ca	6O2b Mg	6H1a H	6P2a Na	6Q2a K	BASE SAT. % 5C1	SATURATION EXTRACT SOLUBLE					MOISTURE AT SATURATION %
← milliequivalents per 100g. soil →							← milliequivalents per liter →					
24.0	17.8	2.3	4.2	0.1	1.3	90						
35.7	28.6	3.5	4.1	0.1	0.7	92						
30.4	25.5	2.6	3.3	0.1	0.5	94						
6.7				0.1	0.1							
2.9				0.1	0.1							
2.5				0.1	0.1							

Soil type: Sweetgrass clay loam
Soil No.: S55Mont-48-2
Location: Stillwater County, Montana; 2.5 miles south of Absarokee SE, SE, NE of Section 13, T4S, R18E.
Vegetation: Abandoned cropland returned to western wheatgrass, bluebunch wheatgrass, and associated grasses.
Parent material: Strongly weathered old alluvium, the coarse fragments being chiefly igneous.
Physiography: Smooth, high bench of Pleistocene or Tertiary Age.
Relief: Smooth, 1 percent northeast-facing slope.
Drainage: Well drained. Collected by: W. C. Bourne, James Allen, R. L. Moshier, and A. G. Fielder, August 30, 1955.
Root distribution: Plentiful to 25 inches.
Stoniness: Scattered cobbles on surface. Described by: W. C. Bourne.

Horizon and Mandan Lab. Number	
Ap 3011	0 to 4 inches. Dark grayish brown (10YR 4/2 dry) to very dark grayish brown (10YR 3/2 moist) light clay loam; moderate medium platy; hard when dry, friable when moist, slightly sticky and slightly plastic when wet; clear boundary.
B21t 3012	4 to 9 inches. Dark grayish brown (10YR 4/2 dry) to very dark grayish brown (10YR 3/2.5 moist) clay loam; moderate medium prismatic breaking to strong fine blocky structure; very hard when dry, firm when moist, sticky and plastic when wet; the peds have strong clay skins; the crushed color is slightly lighter than given; clear boundary.
B22t 3013	9 to 15 inches. Brown (10YR 4/3 dry) to dark brown (10YR 3/3 moist) heavy clay loam; moderate medium prismatic breaking to strong fine blocky; very hard when dry, firm when moist, sticky and plastic when wet; strong clay skins on peds; crushed color is slightly lighter than given; abrupt boundary.
C1ca 3014	15 to 25 inches. White (10YR 9/2 dry) to light gray (10YR 7/2 moist) gravelly loam; massive; weakly stratified with an abundance of lime; 35 to 40 percent gravel; clear boundary.
IIC2ca 3015	25 to 34 inches. Sand and gravel; 85 percent strongly weathered granitic cobbles; lime and fine earth surround the cobbles; diffuse boundary.
IIC3 3016	34 to 44 inches. Sand and gravel from strongly weathered granitic cobbles and gravel; strongly calcareous.

SOIL SURVEY LABORATORY Lincoln, Nebr. February 1959

SOIL TYPE Terrad silty clay **LOCATION** Judith Basin County, Montana

SOIL NOS. S58Mont-23-2-(1-7) **LAB. NOS.** 8373-8379

DEPTH INCHES	HORIZON	1B1a PARTICLE SIZE DISTRIBUTION (in mm.) (per cent) VERY COARSE SAND 2-1	COARSE SAND 1-0.5	MEDIUM SAND 0.5-0.25	FINE SAND 0.25-0.10	VERY FINE SAND 0.10-0.05	SILT 0.05-0.002	CLAY < 0.002	3A1 0.2-0.02	0.02-0.002	2A2 > 2 (<19mm)	TEXTURAL CLASS
0-3½	A1	2.6	1.1	1.1	4.5a	11.0a	41.2	38.5	31.1	23.5	Tr.	sicl
3½-11	B21	0.6	0.6	0.8	1.8a	10.1a	33.3	52.8	24.1	19.4	2	c
11-23	B22	0.5	0.3	0.4	3.9a	7.8a	34.0	53.1	24.2	20.5	Tr.	c
23-37	B23ca	0.3	0.2	0.2	0.6a	7.9a	43.7	47.1	23.9	27.8	-	sic
37-45	B3ca	<0.1	0.2	0.3	0.9a	4.3a	45.2	49.1	14.1	35.9	-	sic
b45-55	C1	<0.1	0.1	0.2	2.2a	10.1a	45.3	42.1	21.7	35.4	-	sic
b55-65	C2	<0.1	0.1	0.1	2.3a	12.0a	50.6	34.9	27.4	37.0	-	sicl

	pH 8C1a		ORGANIC MATTER 6A1a	6B1a		Free Iron	ELECTRICAL CONDUCTIVITY	6E1a	6F1a	MOISTURE TENSIONS		4B2
1:1	1:5	1:10	ORGANIC CARBON %	NITROGEN %	C/N	Fe_2O_3% 6C1a	EC×10³ MILLIMHOS PER CM 8A1a	$CaCO_3$ equivalent %	GYPSUM me./100g. SOIL	1/10 ATMOS. %	1/3 ATMOS. %	15 ATMOS. %
6.1			5.46	0.367	14.9	2.4	0.4					15.9
6.2			1.56	0.153	10.2	2.7	0.4					17.3
7.3			0.81	0.081	10	3.2	0.8	1				16.9
8.1			0.24	0.051		3.1	2.1	7	<1			14.6
8.1			0.17			3.6	2.9	4	<1			14.3
7.9			0.13			0.9	5.5	2	<1			16.1
8.0			0.31			0.2	2.6	2	<1			21.0

5A1a	EXTRACTABLE CATIONS 5B1a					5D2	8A1 SATURATION EXTRACT SOLUBLE			8A
CATION EXCHANGE CAPACITY NH_4Ac	6N2b Ca	6O2b Mg	6H1a H	6P2a Na	6Q2a K	EXCH. Na %	6P1a Na	6Q1a K		MOISTURE AT SATURATION %
← milliequivalents per 100g. soil →							← milliequivalents per liter →			
27.9	17.1	4.5	9.4	<0.1	2.1	<1	0.5	0.8		85.8
30.0	17.8	7.7	7.6	0.1	2.0	<1	0.5	0.4		67.1
29.6				0.4	1.2	1	1.8	0.2		65.6
25.1				1.3	0.6	3	7.5	0.1		61.5
23.1				1.6	0.4	4	11.1	0.2		61.3
36.2				2.6	0.6	4	17.2	0.2		71.0
53.2				3.5	0.8	5	12.4	0.3		75.5

a. Common, smooth brown to black concr. (Fe-Mn?)
b. Determination questionable - unable to obtain proper sample dispersion

Soil type: Terrad silty clay
Soil No.: 58Mont-23-2
Location: Judith Basin County, Montana; 700 feet east and 200 feet north of east quarter corner of Section 12, T17N, R8E.
Vegetation: Western wheatgrass, Idaho fescue, junegrass, fringed sagewort, cudweed sagewort, fringed threadlead sedge, deathcamas, and annuals.
Elevation: 4250 feet, approximately.
Parent material: Red shale of Kootenai formation.
Physiography: Gently rolling upland.
Relief: 10 to 20 feet.
Slope: 4 percent.
Aspect: North.
Drainage: Good.
Ground water: Deep.
Salt or alkali: None.
Moisture: Moist to 11 inches.
Root distribution: Plentiful to 37 inches, few below.
Erosion: None apparent or slight.
Permeability: Moderately slow.
Stoniness: None.
Sampled by: James Allen, Dave Cawlfield, Ernest Hogan, and John Parker.
Described by: Dave R. Cawlfield, June 23, 1958.

Horizon and Lincoln Lab. Number	
A1 8373	0 to 3½ inches. Dark gray (5YR 4/1 dry, 3/2 moist) heavy clay loam; moderate fine granular structure; soft, friable, sticky and plastic; abundant roots; clear smooth boundary.
B21 8374	3½ to 11 inches. Dark reddish gray (5YR 4/2 dry, 2.5YR 3/2 moist) sandy clay; weak medium prismatic and strong fine subangular blocky structure; hard, firm, very sticky and very plastic; continuous distinct clay skins on all faces; plentiful roots; clear boundary.
B22 8375	11 to 23 inches. Weak red (2.5YR 4/2 dry, 2/4 moist) sandy clay; moderate coarse prismatic and strong medium coarse angular blocky structure; some evidences of slickensides on both vertical and horizontal faces, more on horizontal faces; extremely hard, very firm, very sticky and very plastic; continuous distinct clay films on all faces; plentiful roots; gradual boundary.
B23ca 8376	23 to 37 inches. Weak red (2.5YR 4/2 dry, 2/4 moist) clay; moderate coarse prismatic and moderate coarse and medium angular blocky structure; some evidences of slickensides on both vertical and horizontal faces, more on horizontal faces; extremely hard, very firm, very sticky and very plastic; continuous distinct clay films on vertical faces and patches on horizontal faces; effervesces strongly; scattered lime nodules; plentiful roots, less than above; gradual boundary.
B3ca 8377	37 to 45 inches. Weak red (2.5YR 4/2 dry, 3/4 moist) clay; weak coarse angular blocky structure; some evidences of slickensides on both vertical and horizontal faces, more on horizontal faces; extremely hard, very firm, sticky and very plastic; continuous distinct clay films on vertical faces and patches on horizontal faces; effervesces strongly; few roots; clear irregular boundary.
C1 8378	45 to 55 inches. Gray and weak red (5Y 6/1 and 2.5YR 5/2 dry, 5Y 5/1 and 2.5YR 4/2 moist) clay; massive; hard, firm, sticky and very plastic; effervesces strongly; few roots; gradual boundary.
C2 8379	55 to 65 inches. Gray (5Y 5/1 dry, 4/1 moist) contains a few streaks of 2.5YR 4/2 moist, 5/2 dry, clay loam with numerous shale fragments; massive; hard, firm, sticky and plastic; slight effervescence; very few roots; gradual boundary.

Note: Horizons A1, B22, and C2 sampled for Bureau of Public Roads.

SOIL SURVEY LABORATORY Lincoln, Nebr. February 1959

SOIL TYPE Terrad clay **LOCATION** Judith Basin County, Montana

SOIL NOS. S58Mont-23-3-(1-7) **LAB. NOS.** 8380-8386

DEPTH INCHES	HORIZON	1B1a PARTICLE SIZE DISTRIBUTION (in mm.) (per cent) 3A1 VERY COARSE SAND 2-1	COARSE SAND 1-0.5	MEDIUM SAND 0.5-0.25	FINE SAND 0.25-0.10	VERY FINE SAND 0.10-0.05	SILT 0.05-0.002	CLAY < 0.002	0.2-0.02	0.02-0.002	2A2 > 2 (<19mm)	TEXTURAL CLASS
0-4	A1	0.9	2.2	3.6	7.3a	8.0a	36.2	41.8	25.2	23.4	-	c
4-9	B21	0.2	1.3	3.2	7.0a	7.4a	31.4	49.5	23.9	19.1	-	c
9-16	B22	0.4	1.3	2.2	4.4a	4.7a	28.7	58.3	15.8	20.2	-	c
16-23	B23ca	0.3	1.1	2.0	4.1a	4.5a	30.3	57.7	16.0	21.2	-	c
23-36	B31ca	0.4	0.9	1.8	3.9a	3.9a	31.8	57.3	14.5	23.5	-	c
36-49	B32	0.2	0.7	0.8	1.8a	1.7a	23.0	71.8	6.4	19.4	-	c
49-59	C1	<0.1	0.2	0.2	0.7a	0.7a	24.7	73.5	2.9	22.9	-	c

	pH 8C1a		ORGANIC MATTER 6A1a ORGANIC CARBON	6B1a NITROGEN		Free Iron Fe_2O_3% 6C1a	ELECTRICAL CONDUCTIVITY EC×10³ MILLIMHOS PER CM 8A1a	6E1a $CaCO_3$ equivalent	6F1a GYPSUM me./100g. SOIL	MOISTURE TENSIONS 1/10 ATMOS.	1/3 ATMOS.	4B2 15 ATMOS.
1:1	1:5	1:10	%	%	C/N			%		%	%	%
6.1			3.88	0.325	11.9	2.8	0.5					17.0
6.1			1.96	0.166	11.8	3.1	0.4					17.1
7.2			1.00	0.086	11.6	3.4	0.7	1				18.6
7.8			0.73	0.079	9	3.4	0.7	3				17.6
8.1			0.46	0.054	8	3.4	1.4	7				16.2
7.8			0.21			3.5	4.0	3	3			16.5
7.9			0.12			2.5	3.6	1	1			14.8

5A1a	EXTRACTABLE CATIONS 5B1a					5D2	8A1a SATURATION EXTRACT SOLUBLE			8A
CATION EXCHANGE CAPACITY NH_4Ac	6N2b Ca	6O2b Mg	6H1a H	6P2a Na	6Q2a K	EXCH. Na %	6P1a Na	6Q1a K		MOISTURE AT SATURATION %
← milliequivalents per 100g. soil →							← milliequivalents per liter →			
25.8	17.4	4.5	8.0	<0.1	2.0	<1	0.4	0.8		74.1
26.0	16.4	5.7	5.6	0.1	1.5	<1	0.5	0.4		63.0
26.9				0.2	1.2	1	0.5	0.2		73.9
25.3				0.4	0.9	1	1.7	0.1		73.0
23.0				0.8	0.6	2	3.8	0.1		74.5
21.0				1.1	0.6	2	7.6	0.3		87.9
22.1				1.0	0.5	2	7.5	0.4		74.2

a. Common smooth brown to black concr. (Fe-Mn?)

Soil type: Terrad clay
Soil No.: S58Mont-23-3
Location: Judith Basin County, Montana; 600 feet west and 200 feet north of southeast corner of Section 7, T17N, R9E.
Vegetation: Bluebunch wheatgrass, Idaho fescue, western wheatgrass, prairie junegrass, fringed sagewort, cudweed sagewort.
Elevation: About 4380 feet.
Parent material: Red shales of Kootenai formation.
Physiography: Rolling upland.
Relief: 10 to 25 feet.
Slope: 5 percent.
Aspect: North.
Drainage: Good.
Ground water: Deep.
Salt or alkali: None.
Moisture: Moist to 9 inches, slightly moist below.
Root distribution: Plentiful to 16 inches, few to 49 and very few to 59 inches.
Erosion: Little or none.
Permeability: Moderately slow.
Stoniness: None; a few gravel and stone scattered through profile.
Sampled by: James Allen, Dave Cawlfield, Ernest Hogan, and John Parker.
Described by: Dave R. Cawlfield, June 24, 1958.

Horizon and Lincoln Lab. Number	
A1 8380	0 to 4 inches. Reddish gray (5YR 5/2 dry, 3/2 moist) silty clay loam; soft, friable, sticky and plastic; does not effervesce; roots abundant; clear boundary.
B21 8381	4 to 9 inches. Dark reddish gray (5YR 4/2 dry, 3/3 moist) silty clay; strong fine subangular blocky structure; hard, firm, very sticky and very plastic; continuous distinct clay films on all faces; does not effervesce; plentiful roots; clear boundary.
B22 8382	9 to 16 inches. Dark reddish gray (5YR 4/2 dry, 3/2 moist) silty clay; moderate coarse prismatic and strong medium angular blocky structure; few gravel and stone throughout profile; very hard, very firm, very sticky and very plastic; continuous distinct clay films on all faces; does not effervesce; plentiful roots with some concentration on structure face; gradual boundary.
B23ca 8383	16 to 23 inches. Weak red (2.5YR 4/2 dry, 5YR 3/3 moist) silty clay; strong coarse angular blocky structure; some evidence of slickensides on both vertical and horizontal faces, more on horizontal surfaces; extremely hard, very firm, very sticky and very plastic; continuous distinct clay films on all faces; slight effervescence; few roots; gradual boundary.
B31ca 8384	23 to 36 inches. Weak red (2.5YR 4/2, dry) silty clay; weak coarse angular blocky structure; some evidence of slickensides on both vertical and horizontal faces--more on horizontal surfaces; extremely hard, firm, very sticky and very plastic; continuous distinct clay films on vertical faces and patches on horizontal faces; effervesces strongly (in nodules and splotches); few roots; gradual boundary.
B32 8385	36 to 49 inches. Weak red (2.5YR 4/2 dry, 3/4 moist) silty clay; weak medium and coarse angular blocky structure; extremely hard, very firm, very sticky and very plastic; continuous distinct clay films on vertical faces and patches on horizontal faces; slight effervescence; few roots; clear wavy boundary.
C1 8386	49 to 59 inches. Weak red and gray (10R 5/2 and 5Y 5/1 dry, 10Y 5/1 moist, 5Y color is for shale with greenish gray appearance) shaley clay loam; massive shaley structure; hard, firm, sticky and plastic; effervesces slightly; very few roots.

Notes: Horizons A1, B21, and C1 sampled for Bureau of Public Roads.

SOIL SURVEY LABORATORY Lincoln, Nebr. February 1959

SOIL TYPE Teton loam **LOCATION** Judith Basin County, Montana

SOIL NOS. S58Mont-23-1-(1-7) **LAB. NOS.** 8367-8372

DEPTH INCHES	HORIZON	1B1a PARTICLE SIZE DISTRIBUTION (in mm.) (per cent) 3A1 VERY COARSE SAND 2-1	COARSE SAND 1-0.5	MEDIUM SAND 0.5-0.25	FINE SAND 0.25-0.10	VERY FINE SAND 0.10-0.05	SILT 0.05-0.002	CLAY < 0.002	0.2-0.02	0.02-0.002	2A2 > 2 (<19mm)	TEXTURAL CLASS
0-5	A11	2.0	2.4	3.8	9.7	14.4	36.1	31.6	35.5	18.6	6	cl
5-9	A12	1.5	2.4	4.2	14.3	10.9	36.2	30.5	35.8	18.9	16	cl
9-15	B1	2.9	3.4	5.8	15.9	8.4	34.2	29.4	33.6	17.1	24	cl
15-22	B21	1.6	3.1	5.1	14.1	11.3	32.6	32.2	33.6	16.8	18	cl
22-31	B22	0.9	2.7	5.8	19.2	11.3	29.8	30.3	35.6	15.8	17	cl
31-47	B3	1.1	3.3	7.7	20.8	12.0	23.8	31.3	25.7	19.5	31	cl/scl

	pH 8C1a		ORGANIC MATTER 6A1a	6B1a		Free Iron Fe_2O_3% 6C1a	ELECTRICAL CONDUCTIVITY EC×10³ MILLIMHOS PER CM 25°C.	6E1a		MOISTURE TENSIONS		4B2
1:1	1:5	1:10	ORGANIC CARBON %	NITROGEN %	C/N			$CaCO_3$ equivalent %	GYPSUM me./100g. SOIL	1/10 ATMOS. %	1/3 ATMOS. %	15 ATMOS. %
	6.3		10.04	0.711	14.1	2.1						23.0
5.7			4.93	0.365	13.5	2.4						14.8
5.8			2.18	0.197	11.1	2.4						12.1
6.0			0.89	0.079	11	2.6						12.7
6.2			0.64	0.055	12	2.6						12.1
6.6			0.34			2.5		<1				12.4

5A1a CATION EXCHANGE CAPACITY NH_4Ac	EXTRACTABLE CATIONS 6N2b Ca	6O2b Mg	6H1a H	6P2a Na	5B1a 6Q2a K	5C1 Base Sat. % NH_4Ac Exch.	5C3 Base Sat. % on Sum Cations	5B1a Sum Ext. Bases	5A3a Sum Ext. Cations	8D3 Ca/Mg
←	milliequivalents per 100g. soil				→			me/100 g.		
41.2	28.5	6.0	15.8	<0.1	2.1	89	70	36.6	52.4	4.8
30.4	15.7	3.4	16.0	<0.1	0.8	69	57	20.9	36.9	4.9
24.4	14.5	4.0	11.2	<0.1	0.7	79	63	19.2	30.4	3.6
28.8	18.7	7.1	7.1	<0.1	0.3	91	79	26.1	33.2	2.6
29.6	20.1	8.4	5.6	0.1	0.2	97	84	28.8	34.4	2.4
29.9	21.8	8.1	3.8	0.1	0.2	101	89	30.2	34.0	2.7

Soil type: Teton loam
Soil No.: S58Mont-23-1
Location: Judith Basin County, Montana; 1420 feet north and 220 feet west of south quarter corner of Section 9, T16N, R9E.
Vegetation: Rough fescue, Idaho fescue, mountain brome, shrubby cinquefoil, lupine, and annuals; range is in excellent condition.
Climate: Moist, cool, and subhumid.
Elevation: 5400 feet.
Parent material: Sandstone (Jurassic).
Physiography: Rolling upland.
Relief: 50 feet.
Slope: 7 percent.
Aspect: North.
Drainage: Well.
Ground water: Deep.
Salt or alkali: None.
Moisture: Moist throughout.
Erosion: None apparent.
Permeability: Moderately rapid.
Stoniness: Scattered small stones on surface and through the profile.
Sampled by: James Allen, Dave Cawlfield, Clint Mogen, and John Parker.
Described by: Dave R. Cawlfield, June 23, 1958.

Horizon and Lincoln Lab. Number	
A11 8367	0 to 5 inches. Black (10YR 2/1 dry, 2/1 moist) loam; moderate fine granular structure; soft, very friable, nonsticky and slightly plastic; does not effervesce; mat of fine roots; clear boundary.
A12 8368	5 to 9 inches. Very dark brown (10YR 2/2 dry, 2/1 moist) loam; weak medium and fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; does not effervesce; abundant roots; clear boundary.
B1 8369	9 to 15 inches. Very dark grayish brown (10YR 3/3 dry, 2/2 moist) clay loam, approximately 15 percent angular gravels and cobbles more than 3/4-inch in diameter; moderate fine to medium subangular blocky structure; slightly hard, friable, sticky and plastic; does not effervesce; patches of clay skins on vertical faces; abundant roots; clear wavy boundary.
B21 8370	15 to 22 inches. Brown (10YR 5/3 dry, 4/3 moist) silt loam, approximately 15 percent angular gravels and cobbles more than 3/4-inch in diameter; strong fine angular blocky structure; hard, firm, very sticky and very plastic; continuous distinct clay films on all faces; does not effervesce; plentiful roots; gradual boundary.
B22 8371	22 to 31 inches. Brown (10YR 5/3 dry, 4/3 moist) clay, approximately 15 percent angular gravels and cobbles more than 3/4-inch in diameter; strong medium and fine angular blocky structure; hard, firm, very sticky and very plastic; continuous distinct clay skins on all faces; does not effervesce; plentiful roots; gradual boundary.
B3 8372	31 to 47 inches. Brown (10YR 5/3 dry, 4/3 moist) clay loam, approximately 50 to 60 percent angular gravels and cobbles more than 3/4-inch in diameter; moderate fine subangular blocky structure; hard, firm, sticky and very plastic; continuous distinct clay films on all faces; does not effervesce; few roots; clear wavy boundary.
IIR	47 inches plus. Sandstone; strongly calcareous at 52 inches. (Not sampled.)

SOIL SURVEY LABORATORY Mandan, N. Dak.

SOIL TYPE Vananda silty clay **LOCATION** Roosevelt County, Montana

SOIL NOS. 850Mont-43-6 **LAB. NOS.** 193-200

DEPTH INCHES	HORIZON	1B1a PARTICLE SIZE DISTRIBUTION (in mm.) (per cent) 3A1 VERY COARSE SAND 2-1	COARSE SAND 1-0.5	MEDIUM SAND 0.5-0.25	FINE SAND 0.25-0.10	VERY FINE SAND 0.10-0.05	SILT 0.05-0.002	CLAY < 0.002	0.2-0.02	0.02-0.002	2A2 > 2	TEXTURAL CLASS
0-2	A11	0.2	0.6	0.4	0.9	1.2	49.9	46.8	12.4	39.2	-	sic
2-6	A12	0.1	0.3	0.2	0.4	0.7	45.2	53.1	8.8	37.3	-	sic
6-15	Ccs1	0.1	-	-	0.2	1.3	50.0	48.4	12.4	38.8	-	sic
15-24	Ccs2	-	-	0.1	0.1	0.1	52.9	46.8	8.0	45.1	-	sic
24-44	Ccs3	-	0.1	0.1	0.5	1.4	43.2	54.7	9.8	35.2	-	sic
44-52	C4	-	-	0.1	0.6	3.4	43.4	52.5	15.3	32.0	-	sic
52-62	Cg5	0.1	0.1	0.5	7.1	5.4	33.6	53.2	17.7	26.5	-	c
62-84	Cg6	0.1	0.1	0.3	12.4	35.6	34.6	16.9	68.7	13.5	-	l

	pH		ORGANIC MATTER			8A2	ELECTRICAL	6E1a	6F1a	MOISTURE TENSIONS		
8C1b SATURATED PASTE	8C1a 1:5	8C1a 1:10	6A1a ORGANIC CARBON %	6B1a NITROGEN %	C/N	EST% SALT (BUREAU CUP)	CONDUCTIVITY EC×10³ MILLIMHOS PER CM 8A1a	$CaCO_3$ equivalent %	GYPSUM me./100g. SOIL	1/10 ATMOS. %	1/3 ATMOS. %	15 ATMOS. %
8.0	9.2	9.4	2.41	.206	11.7	-	1.4	2	-			
8.5	9.4	9.8	1.54	.137	11.2	0.25	2.4	2	-			
8.0	8.2	8.4	1.04	.101	10.3	0.63	10.5	4	18			
8.2	8.4	8.7	0.71	.071	10.0	0.84	11.0	4	6			
8.2	8.4	8.6	0.68	.068	10.0	0.66	11.0	2	9			
8.5	9.4	9.7	0.57	.061	9.3	0.42	3.3	5	-			
8.5	9.5	9.8	0.59	.063	9.4	0.35	4.9	3	-			
8.3	9.6	9.8	0.20	.028		0.29	5.2	7	-			

5A1a	EXCHANGEABLE CATIONS 5B1b					5D2	8A1 SATURATION EXTRACT SOLUBLE					8A
CATION EXCHANGE CAPACITY NH_4OAc	Ca	Mg	H	6P2a Na	6Q2a K	EXCH. Na %	6P1a Na	6Q1a K				MOISTURE AT SATURATION %
← milliequivalents per 100g. soil →							← milliequivalents per liter →					
33.8				7.3	2.8	22	15.2	2.7				84.1
35.8				11.7	2.6	33	32.7	4.4				113.6
31.4				12.2	2.5	39	105.0	6.8				80.2
29.8				13.0	2.8	44	125.5	7.2				81.1
32.6				19.4	2.6	59	127.9	6.3				97.1
30.9				22.4	1.0	73	34.0	4.4				146.5
32.2				22.3	1.6	69	35.1	5.1				131.9
13.5				10.7	1.1	79	44.6	4.3				57.9

Soil type: Vananda silty clay
Soil No.: S50Mont-43-6
Location: Roosevelt County, Montana; 0.25 mile east of west quarter corner, Section 29, T27N, R46E.
Topography: Missouri River terrace; little slope.
Drainage: Poor.
Erosion: Some wind erosion.
Parent material: Missouri River terrace alluvium high in clay.
Vegetative cover: Pasture; sage (valley) western wheatgrass (Agropyron smithii) and weeds.
Described by: A. J. Cline, June 6, 1950.

Horizon and Mandan Lab. Number	
A11 193	0 to 2 inches. Gray (5Y 6/1) clay, dark gray (5Y 4/1) moist; blocky structure; very hard, firm, very sticky and very plastic; calcareous; clear boundary.
A12 194	2 to 6 inches. Dark olive gray (5Y 3/1.5) moist clay; weak blocky structure; very hard, firm, very sticky and very plastic; calcareous; crystals of salt visible.
Ccs1 195	6 to 15 inches. Very dark gray (2.5Y 3/1) grading to dark grayish brown (2.5Y 4/2) moist clay; massive structure; hard, friable, sticky and plastic; calcareous with plentiful gypsum crystals; abrupt boundary.
Ccs2 196	15 to 24 inches. Very dark grayish brown (2.5Y 3/2) moist clay and thin light brownish gray (2.5Y 6/2) moist layers of silt loam; massive structure; calcareous with common crystals of gypsum; abrupt boundary.
Ccs3 197	24 to 44 inches. Very dark grayish brown (2.5Y 3/2) moist clay; massive structure; hard, firm, sticky and plastic; calcareous with many gypsum crystals.
C4 198	44 to 52 inches. Very dark grayish brown (2.5Y 3/2) moist clay; massive structure; hard, firm, sticky and plastic; calcareous with few salt crystals; abrupt boundary.
Cg5 199	52 to 62 inches. Very dark grayish brown (2.5Y 3/2) moist clay with pale brown (10YR 6/3) moist layers; massive structure; hard, firm, sticky and plastic; calcareous with few salt crystals.
Cg6 200	62 to 84 inches. Pale olive (5Y 6/3) moist fine sandy loam, mottled with brown (10YR 4/3) moist; massive structure; slightly hard, friable, nonsticky and nonplastic; calcareous.

SOIL SURVEY LABORATORY Lincoln, Nebr. 3/4/58

SOIL TYPE Vananda silty clay **LOCATION** Treasure County, Montana

SOIL NOS. S56Mont-52-1-(1-7) **LAB. NOS.** 4770-4776

DEPTH INCHES	HORIZON	1B1a PARTICLE SIZE DISTRIBUTION (in m.m.) (per cent) VERY COARSE SAND 2-1	COARSE SAND 1-0.5	MEDIUM SAND 0.5-0.25	FINE SAND 0.25-0.10	VERY FINE SAND 0.10-0.05	SILT 0.05-0.002	CLAY < 0.002	3A1 0.2-0.02	0.02-0.002	2A2 > 2 (<19mm)	TEXTURAL CLASS
0-2½	A1	0.6a	0.3	0.4	1.7	4.2	40.7	52.1	19.5	26.5	Tr.	sic
2½-12	B21	0.3	0.2b	0.4b	1.3b	3.4b	40.8	53.6	18.3	26.7	Tr.	sic
12-20	B22	0.1	0.3b	0.3b	1.1b	3.1b	40.0	55.1	17.3	26.5	Tr.	sic
20-30	C1	0.1	0.2b	0.3b	0.9b	2.8b	41.0	54.7	17.6	26.8	Tr.	sic
30-34	C2	0.1	0.2b	0.2b	0.8b	2.9b	40.9	54.9	18.4	25.9	Tr.	sic
34-46	C3cs	0.2	0.1b	0.2b	0.9b	2.7b	43.7	52.2	18.3	28.7	-	sic
46-60+	C4cs	0.1	-	0.2b	0.6b	2.2b	47.7	49.2	16.9	33.4	-	sic

DEPTH INCHES	8C1b SATURATED PASTE	pH 8C1a 1:5	8C1a 1:10	ORGANIC MATTER 6A1a ORGANIC CARBON %	6B1a NITROGEN %	C/N	8A2 EST% SALT (BUREAU CUP)	ELECTRICAL CONDUCTIVITY EC×10³ MILLIMHOS PER CM 8A1a	6E1a $CaCO_3$ equivalent %	6F1a GYPSUM me./100g. SOIL	MOISTURE TENSIONS 1/10 ATMOS. %	1/3 ATMOS. %	4B2 15 ATMOS. %
0-2½	7.5	8.0	8.0	1.75	.153	11.4	<0.20	0.9	1				16.7
2½-12	8.0	8.8	8.8	0.72	.065	11.1	<0.20	0.9	2				19.2
12-20	8.0	8.6	9.1	0.71	.069	10.3	<0.20	1.7	2				22.2
20-30	8.0	8.7	9.0	0.53	.057	9.3	0.26	3.3	2				20.0
30-34	8.0	8.5	8.9	0.34			0.48	4.6	2				20.0
34-46	7.8	8.0	8.1	0.26			0.56	6.9	2	16			19.1
46-60+	7.8	8.0	8.1	0.26			0.56	6.6	1	9			22.0

DEPTH INCHES	5A1a CATION EXCHANGE CAPACITY NH_4Ac	EXTRACTABLE CATIONS Ca	6D2b Mg	6H1a H	6P2a Na	5B1a 6Q2a K	5D2 EXCH. Na %	SATURATION EXTRACT SOLUBLE 6P1a Na	6Q1a K	8A1			8A MOISTURE AT SATURATION %
	← milliequivalents per 100g. soil →							← milliequivalents per liter →					
0-2½	24.3		8.2	1.3	0.7	2.0	2	2.3	0.3				63.0
2½-12	30.8				3.5	0.8	10	7.2	-				65.6
12-20	30.6				5.7	0.9	15	13.3	0.1				72.0
20-30	29.5				6.9	1.1	17	25.0	0.1				76.8
30-34	29.0				6.8	1.2	15	33.8	0.2				75.1
34-46	27.7				6.6	1.1	13	41.5	0.4				70.2
46-60+	27.4				6.4	1.1	12	44.0	0.4				70.8

a. Some organic matter.
b. Few smooth dk. brown concr. (Mn-Fe?)

Soil type: Vananda silty clay
Soil No.: S56Mont-52-1
Location: Treasure County, Montana; 300 feet north and 100 feet west of center of Section 16, T7N, R36E.
Vegetation or crop: Native range, consisting of western wheatgrass, sandberg bluegrass, big sage and scattering plants of plains pricklypear.
Parent material: Local clay alluvium derived from cretaceous shales (Bearpaw formation).
Physiography: Broad alluvial fan.
Relief: Smooth, 2 percent slope.
Elevation: About 2650 feet.
Drainage: Well drained.
Erosion: Slight.
Permeability: Very slow.
Moisture: Dry.
Climate: Semiarid; rainfall about 11 inches, growing season about 135 days.
Note: Mapping unit includes some spots indicating sodium dispersion on the surface.
Described by: Dave R. Cawlfield, September 28, 1956.

Horizon and Lincoln Lab. Number	
A1 4770	0 to 2½ inches. Dark grayish brown to olive brown (2.5Y 4.5/3) heavy clay, grayish brown (2.5Y 5.5/2) when dry; weak thick platy to moderate very fine granular structure; slightly hard, firm, very sticky and very plastic; effervesces weakly with HCl, pH 8.2 with thymol blue; abundant roots; abrupt smooth boundary.
B21 4771	2½ to 12 inches. Dark grayish brown to olive brown (2.5Y 4/3) heavy clay, grayish brown to light olive brown (2.5Y 5/3) when dry; moderate coarse angular blocky structure; extremely hard, firm, very sticky and very plastic; effervesces weakly; pH 8.4; abundant roots; thin patchy clay skins; clear wavy boundary.
B22 4772	12 to 20 inches. Dark grayish brown to light olive brown (2.5Y 4.5/3) heavy clay, light olive brown (2.5Y 5/3) when dry; moderate medium and coarse angular blocky structure; extremely hard, firm, very sticky and very plastic; effervesces weakly; pH 9.0; plentiful roots; thin patchy clay skins; gradual boundary.
C1 4773	20 to 30 inches. Olive brown to light olive brown (2.5Y 4.5/4) heavy clay, light brownish gray (2.5Y 6/3) when dry; weak medium angular blocky structure; extremely hard, firm, very sticky and very plastic; effervesces weakly; pH 8.8 with thymol blue; plentiful roots; gradual boundary.
C2 4774	30 to 34 inches. Olive brown to light olive brown (2.5Y 4.5/2) heavy clay, light brownish gray (2.5Y 6/3) when dry; very weak medium and fine angular blocky structure; extremely hard, very firm, very sticky and very plastic; effervesces strongly; pH 9.2 with thymol blue; few roots; gradual boundary.
C3cs 4775	34 to 46 inches. Olive brown to light olive brown (2.5Y 4.5/2) heavy clay, light brownish gray (2.5Y 6/2) when dry; very weak medium and fine blocky structure; extremely hard, very firm, very sticky and very plastic; effervesces strongly; pH 8.2 with thymol blue; abundant gypsum crystals; gradual boundary.
C4cs 4776	46 to 60 inches plus. Olive (5Y 4/3) heavy clay, pale olive (5Y 6/3) when dry; very weak medium and fine blocky structure; very hard, firm, very sticky and very plastic; effervesces weakly in spots; pH 8.0 with thymol blue; common gypsum crystals; few roots.

SOIL SURVEY LABORATORY Lincoln, Nebr. 2/4/58

SOIL TYPE Vananda silty clay **LOCATION** Treasure County, Montana

SOIL NOS. S56Mont-52-2-(1-8) **LAB. NOS.** 4777-4784

DEPTH INCHES	HORIZON	1B1a PARTICLE SIZE DISTRIBUTION (in mm.) (per cent) 3A1 VERY COARSE SAND 2-1	COARSE SAND 1-0.5	MEDIUM SAND 0.5-0.25	FINE SAND 0.25-0.10	VERY FINE SAND 0.10-0.05	SILT 0.05-0.002	CLAY < 0.002	0.2-0.02	0.02-0.002	2A2 > 2 mm.	TEXTURAL CLASS
0-3	A1	0.2	0.1	0.1	0.5	2.1	38.0	59.0	13.6	26.8	-	c
3-10	B21	-	0.1	0.1	0.3	1.9	38.0	59.6	12.6	27.5	-	c
10-17	B22	-	0.1	0.1	0.3	1.9	37.0	60.6	12.1	27.0	-	c
17-24	B3	0.1	0.1	0.1	0.3	1.8	37.2	60.4	12.0	27.2	-	c
24-31	C1	-	0.1	0.1	0.3	2.3	36.7	60.5	12.7	26.5	-	c
31-38	C2cs	-	-	0.1	0.5	2.9	37.9	58.6	15.4	25.7	-	c
38-54	C3cs	-	-	0.2	0.8	4.0	39.4	55.6	18.6	25.3	-	c
54-60+	C4cs	0.1	0.1	0.4	1.4	4.5	40.1	53.4	20.3	25.1	-	sic

pH 8C1b SATURATED PASTE	pH 8C1a 1:5	pH 8C1a 1:10	ORGANIC MATTER 6A1a ORGANIC CARBON %	ORGANIC MATTER 6R1a NITROGEN %	C/N	8A2 EST% SALT (BUREAU CUP)	ELECTRICAL CONDUCTIVITY EC×10³ MILLIMHOS PER CM 8A1a	6E1a $CaCO_3$ equivalent %	6F1a GYPSUM me./100g. SOIL	MOISTURE TENSIONS 1/10 ATMOS. %	MOISTURE TENSIONS 1/3 ATMOS. %	4B2 15 ATMOS. %
7.6	8.0	8.1	1.13	.095	11.9	<0.20	0.7	1				19.2
8.0	8.4	8.8	0.75	.065	11.5	<0.20	0.8	2				22.7
8.1	8.8	9.0	0.67	.058	11.6	0.22	2.2	2				22.9
8.1	8.8	9.0	0.64	.061	10.5	0.33	3.4	2				23.5
8.1	8.8	9.0	0.49			0.36	3.8	2	-			23.8
7.9	8.2	8.3	0.34			0.65	7.5	2	5			21.7
7.8	8.1	8.2	0.26			0.65	7.6	2	7			20.4
7.8	8.0	8.5	0.26			0.60	7.1	1	1			18.6

5A1a CATION EXCHANGE CAPACITY NH_4Ac	EXTRACTABLE CATIONS 6N2b Ca	6O2b Mg	6H1a H	6P2a Na	6Q2a K	5B1a EXCH. Na %	5D2 SATURATION EXTRACT SOLUBLES 6P1a Na	6Q1a K	8A1	8A MOISTURE AT SATURATION %
	milliequivalents per 100g. soil						milliequivalents per liter			
35.7	25.7	13.6	0.4	1.3	1.9	3	3.4	0.2		64.4
36.0				3.3	1.1	8	5.9	0.1		71.0
34.2				7.3	1.0	17	16.8	0.1		84.5
34.0				8.6	1.3	18	26.9	0.1		89.0
33.6				8.5	1.4	18	28.9	0.2		90.3
32.6				8.4	1.4	13	48.0	0.3		88.3
31.2				7.8	1.3	12	49.5	0.3		78.2
29.4				7.2	1.2	13	47.0	0.4		71.5

Soil type: Vananda silty clay
Soil No.: S56Mont-52-2
Location: Treasure County, Montana; 280 feet south and 80 feet west of northeast corner of Section 18, T7N, R36E.
Vegetation or crop: Western wheatgrass, sandberg bluegrass, big sagebrush and plains pricklypear.
Parent material: Local clay alluvium from cretaceous shales.
Physiography: Broad alluvial fan.
Relief: Smooth, 2 percent slope.
Elevation: About 2650 feet.
Drainage: Well drained.
Erosion: Slight.
Permeability: Very slow.
Moisture: Dry.
Climate: Semiarid; rainfall about 11 inches, growing season about 135 days.
Note: Mapping unit contains some spots indicating sodium dispersion.
Described by: Dave R. Cawlfield, September 28, 1956.

Horizon and Lincoln Lab. Number	
A1 4777	0 to 3 inches. Dark grayish brown (2.5Y 4/2) heavy clay, gray (2.5Y 6/1) when dry; moderate thick platy structure breaking to strong very fine granular; slightly hard, friable, very sticky and very plastic; pH 7.4 with phenol red; abundant roots; abrupt smooth boundary.
B21 4778	3 to 10 inches. Olive brown (2.5Y 4/3) heavy clay, olive gray (5Y 5/2) when dry; moderate coarse angular blocky structure; extremely hard, firm, sticky and very plastic; effervesces weakly in spots; pH 9.0 with thymol blue; abundant roots; few fine and very fine pores; thin patchy clay skins; clear irregular boundary.
B22 4779	10 to 17 inches. Olive brown (2.5Y 4.5/3) heavy clay, olive gray (5Y 5/2) when dry; moderate medium and fine angular blocky structure; extremely hard, very firm, very sticky and very plastic; effervesces in spots; plentiful roots; few fine and very fine pores; moderate patchy clay skins; diffuse boundary.
B3 4780	17 to 24 inches. Olive brown (2.5Y 4.5/3) heavy clay, light olive gray (5Y 6/2) when dry; weak medium and fine angular blocky structure; extremely hard, very firm, very sticky and very plastic; effervesces; pH 9.0 with thymol blue; plentiful fine and very fine roots; very few very fine pores; gradual boundary.
C1 4781	24 to 31 inches. Olive brown (2.5Y 4.5/3) heavy clay, light brownish gray (2.5Y 6/2) when dry; massive to very weak medium angular blocky structure; extremely hard, extremely firm, very sticky and very plastic; effervesces; pH 9.2 with thymol blue; few roots; gradual boundary.
C2cs 4782	31 to 38 inches. Olive brown (2.5Y 4.5/4) heavy clay, light brownish gray (2.5Y 6/2) when dry; massive to very weak angular blocky structure; extremely hard, firm, very sticky and very plastic; effervesces; pH 8.8 with thymol blue; few roots; common crystals of gypsum; gradual boundary.
C3cs 4783	38 to 54 inches. Olive brown (2.5Y 4/3) heavy clay, pale olive (5YR 6/3) when dry; massive to very weak medium angular blocky structure; very hard, firm, very sticky, and very plastic; effervesces; pH 8.2 with thymol blue; common crystals of gypsum; few roots; gradual boundary.
C4cs 4784	54 to 60 inches plus. Olive brown (2.5Y 4/3) heavy clay, pale olive (5Y 6/3) when dry; massive clay; very hard, firm, very sticky and very plastic; effervesces; pH 8.8 with thymol blue; few crystals of gypsum; very few roots.

SOIL SURVEY LABORATORY Lincoln, Nebr. 3/5/58

SOIL TYPE Vananda silty clay **LOCATION** Treasure County, Montana

SOIL NOS. S56Mont-52-3-(1-7) **LAB. NOS.** 4785-4791

DEPTH INCHES	HORIZON	1B1a PARTICLE SIZE DISTRIBUTION (in mm.) (per cent) 3A1 VERY COARSE SAND 2-1	COARSE SAND 1-0.5	MEDIUM SAND 0.5-0.25	FINE SAND 0.25-0.10	VERY FINE SAND 0.10-0.05	SILT 0.05-0.002	CLAY < 0.002	0.2-0.02	0.02-0.002	2A2 > 2 (<19mm)	TEXTURAL CLASS
0-4	A1	0.9	0.6	0.3	0.9	4.7	45.3	47.3	24.2	26.4	Tr.	sic
4-11	B21	0.2	0.2	0.1	0.7	4.1	41.3	53.4	21.1	24.8	Tr.	sic
11-19	B22	0.1	0.1a	0.1a	0.6a	3.7a	40.7	54.7	20.4	24.4	Tr.	sic
19-26	B3	0.2	0.2a	0.1a	0.6a	3.5a	40.6	54.8	19.3	25.2	-	sic
26-34	C1cs	-	0.1a	0.1a	0.5a	5.9a	41.2	52.2	23.3	24.2	-	sic
34-46	C2	-	-	0.1a	0.3a	5.8a	45.4	48.4	24.8	26.6	-	sic
46-60	C3	-	-	-	0.2	7.4	45.0	47.4	26.2	26.3	-	sic

pH 8C1b SATURATED PASTE	pH 8C1a 1:5	pH 8C1a 1:10	ORGANIC MATTER 6A1a ORGANIC CARBON %	ORGANIC MATTER 6B1a NITROGEN %	ORGANIC MATTER C/N	8A2 EST% SALT (BUREAU CUP)	ELECTRICAL CONDUCTIVITY EC x 10³ MILLIMHOS PER CM 8A1a	6E1a $CaCO_3$ equivalent %	6F1a GYPSUM me./100g. SOIL	MOISTURE TENSIONS 1/10 ATMOS. %	MOISTURE TENSIONS 1/3 ATMOS. %	4B2 15 ATMOS. %
7.2	7.6	7.8	1.88	.158	11.9	0.24	3.0	1				18.7
7.8	8.7	8.8	0.78	.071	11.0	<0.20	1.0	2				20.8
7.9	8.7	9.0	0.66	.056	11.8	<0.20	2.0	2				22.1
7.8	8.4	8.6	0.66	.060	11.0	0.39	4.3	2	-			20.7
7.7	8.0	8.1	0.36			0.56	6.5	2	120			20.0
7.6	8.0	8.3	0.34			0.56	6.5	2	5			17.8
7.7	8.5	9.0	0.38			0.33	3.7	2	-			17.4

5A1a CATION EXCHANGE CAPACITY NH_4Ac	EXTRACTABLE CATIONS 5B1a Ca	6O2b Mg	6H1a H	6P2a Na	6Q2a K	5D2 EXCH. Na %	SATURATION EXTRACT SOLUBLE 8A1 6P1a Na	6Q1a K	8A MOISTURE AT SATURATION %
← milliequivalents per 100g. soil →							← milliequivalents per liter →		
34.8		11.1	-	0.8	1.7	1	4.8	0.5	69.5
34.6				2.9	0.8	7	6.6	-	73.0
33.6				5.0	0.9	12	14.0	0.1	76.5
33.5				6.0	1.0	11	28.2	0.2	81.5
29.3				5.4	0.8	9	39.0	0.4	74.2
30.7				6.2	0.7	11	37.5	0.6	74.6
30.9				6.2	0.7	14	25.0	0.4	76.3

a. Few $CaCO_3$ concr.

Soil type: Vananda silty clay
Soil No.: 856Mont-52-3
Location: Treasure County, Montana; 720 feet north and 20 feet west of southeast corner of Section 6, T7N, R36E.
Vegetation or crop: Western wheatgrass, sandberg bluegrass, green needlegrass, big sagebrush, gardener saltbush, scattered greasewood and pricklypear.
Parent material: Clay shale weathered in situ (Bearpaw formation).
Physiography: Uplands.
Relief: Undulating to rolling, 1 to 3 percent slopes in area sampled.
Elevation: About 2675 feet.
Drainage: Well drained.
Erosion: Slight.
Permeability: Very slow.
Moisture: Dry.
Climate: Semiarid; rainfall about 11 inches, growing season about 135 days.
Described by: Dave R. Cawlfield, September 28, 1956.

Horizon and Lincoln Lab. Number	
A1 4785	0 to 4 inches. Olive gray (4Y 4/2) heavy clay, light olive gray (5Y 5.5/2) when dry; weak thick platy breaking to strong very fine granular structure; slightly hard, firm, very sticky, and very plastic; pH 7.6 with phenol red; abundant roots; clear smooth boundary.
B21 4786	4 to 11 inches. Dark grayish brown to grayish brown (2.5Y 4.5/2) heavy clay, pale olive (5Y 6/3) when dry; weak medium to coarse angular blocky structure; extremely hard, very firm, very sticky and very plastic; effervesces; pH 8.9 with thymol blue; plentiful roots; few very fine pores; thin patchy clay skins; clear irregular boundary.
B22 4787	11 to 19 inches. Olive brown (2.5Y 4/3) heavy clay, pale olive (5Y 6/3) when dry; weak medium and coarse angular blocky structure; extremely hard, extremely firm, very sticky and very plastic; effervesces; pH 9.0 with thymol blue; numerous roots along structure face; very few extremely fine pores; moderate patchy clay skins; gradual boundary.
B3 4788	19 to 26 inches. Dark grayish brown (2.5Y 4/2) heavy clay, pale olive (5Y 6/3) when dry; weak fine blocky structure; extremely hard, extremely firm; very sticky and very plastic; effervesces; pH 9.0 with thymol blue; few fine roots; very few extremely fine pores; gradual boundary.
C1cs 4789	26 to 34 inches. Dark olive gray to olive gray (5Y 3.5/2) heavy clay with a few unweathered shale fragments, olive gray and olive (5Y 5/2 and 5/3) when dry; many strong prominent white splotches of gypsum crystals; weak medium and fine angular blocky structure; hard, firm, very sticky and very plastic; effervesces; pH 7.8 with phenol red; few roots; gradual irregular boundary.
C2 4790	34 to 46 inches. Dark olive gray (5Y 3/2) clay mixed with shale fragments; olive (5Y 5/3) when dry with many fineprominent white splotches of gypsum crystals; massive; hard, firm, sticky and very plastic. effervesces; pH 7.9 with thymol blue and phenol red; few roots; diffuse boundary.
C3 4791	46 to 60 inches. Dark olive gray (5Y 3/2) clay mixed with numerous shale fragments; olive gray(5Y 5/2) when dry; many fine to coarse yellow and brown mottlings; massive; hard, firm, very sticky and plastic; effervesces in spots; pH 8.6 with thymol blue; few roots.

SOIL SURVEY LABORATORY Lincoln, Nebr. 3/5/58

SOIL TYPE Vananda silty clay **LOCATION** Treasure County, Montana

SOIL NOS. S56Mont-52-4-(1-6) **LAB. NOS.** 4792-4797

DEPTH INCHES	HORIZON	1B1a PARTICLE SIZE DISTRIBUTION (in mm.) (per cent) VERY COARSE SAND 2-1	COARSE SAND 1-0.5	MEDIUM SAND 0.5-0.25	FINE SAND 0.25-0.10	VERY FINE SAND 0.10-0.05	SILT 0.05-0.002	CLAY < 0.002	3A1 0.2-0.02	0.02-0.002	2A2 > 2 (<19mm)	TEXTURAL CLASS
0-4	A1	0.5a	0.3	0.5	3.0	5.0	41.8	48.9	21.4	27.4	Tr.	sic
4-12	B21	0.2b	0.3b	0.5b	2.5b	4.6b	38.9	53.0	19.2	25.9	Tr.	c
12-20	B22	0.2b	0.3b	0.5b	1.9b	3.5b	37.5	56.1	16.5	25.7	-	c
20-26	C1cs	0.1b	0.2b	0.3b	1.8b	3.0b	38.4	56.2	16.0	26.6	Tr.	c
26-40	C2	0.1b	0.1b	0.3b	1.7b	3.0b	38.6	56.2	14.4	28.3	-	c
40-60+	C3	0.1c	0.1c	0.3c	1.9c	3.2c	32.2	57.2	14.1	27.5	Tr.	c

pH 8C1b SATURATED PASTE	8C1a 1:5	8C1a 1:10	ORGANIC MATTER 6A1a ORGANIC CARBON %	6B1a NITROGEN %	C/N	8A2 EST% SALT (BURCAU CUP)	ELECTRICAL CONDUCTIVITY EC×10³ MILLIMHOS PER CM. 8A1a	6E1a $CaCO_3$ equivalent %	6F1a GYPSUM me./100g. SOIL	MOISTURE TENSIONS 1/10 ATMOS. %	1/3 ATMOS. %	4B2 15 ATMOS. %
7.7	8.3	8.6	0.98	.087	11.3	<0.20	0.8	1				17.1
7.9	8.5	8.8	0.72	.055	13.1	<0.20	1.2	2				19.6
8.0	8.8	9.1	0.62	.060	10.3	0.22	2.2	2	-			20.7
7.7	8.0	8.1	0.44	.043	10.2	0.56	6.9	1	81			20.1
7.7	8.0	8.1	0.41			0.56	6.9	1	7			19.2
7.7	8.1	8.3	0.36			0.56	7.0	1	3			18.6

5A1a CATION EXCHANGE CAPACITY NH_4Ac	EXTRACTABLE CATIONS 5B1a Ca	6O2b Mg	6H1a H	6P2a Na	6Q2a K	5D2 EXCH. Na %	SATURATION EXTRACT SOLUBLE 6P1a Na	6Q1a K	8A1	8A MOISTURE AT SATURATION %
← milliequivalents per 100g. soil →							← milliequivalents per liter →			
32.7		8.7	-	1.6	1.3	4	4.2	0.1		62.1
32.3				4.5	0.8	12	8.7	-		69.7
32.7				6.8	1.0	17	17.2	0.1		78.0
29.3				6.7	0.9	12	42.5	0.3		78.7
30.2				7.2	1.0	13	42.5	0.3		75.9
29.4				7.2	0.9	14	45.3	0.3		71.8

a. Some organic matter.
b. Few smooth dk. brown concr. (Mn-Fe?)
c. Few smooth dk. brown concr. (Mn-Fe?) Also, few $CaCO_3$ concr.

Soil type: Vananda silty clay
Soil No.: S56Mont-52-4
Location: Treasure County, Montana; 200 feet north and 100 feet west of east quarter corner of Section 31, T8N, R35E.
Vegetation or crop: Western wheatgrass, sandberg bluegrass, big sagebrush, gardener saltbush, and plains pricklypear.
Parent material: Clay shale weathered in situ (Bearpaw formation).
Physiography: Upland.
Relief: Undulating to rolling, 6 percent slope in area sampled.
Elevation: About 2700 feet.
Drainage: Well drained.
Erosion: Slight.
Permeability: Very slow.
Moisture: Dry.
Climate: Semiarid; rainfall about 11 inches, growing season 135 days.
Described by: Dave R. Cawlfield, September 28, 1956.

Horizon and Lincoln Lab. Number	
A1 4792	0 to 4 inches. Olive brown to light olive brown (2.5Y 4.5/3) heavy clay, olive gray (5Y 5/2.5) when dry; weak thick platy breaking to strong very fine granular structure; hard, firm, very sticky and very plastic; effervesces in spots; pH 8.2 with thymol blue; abundant roots; abrupt smooth boundary.
B21 4793	4 to 12 inches. Olive gray (4Y 5/2) heavy clay; light olive gray (5Y 5.5/2) when dry; moderate medium to fine angular blocky structure; extremely hard, very firm, very sticky and very plastic; effervesces weakly; pH 9.0 with thymol blue; few very fine pores; moderate patchy clay skins; clear irregular boundary; plentiful roots.
B22 4794	12 to 20 inches. Olive gray (4Y 5/2) heavy clay, light olive gray (5Y 5.5/2) when dry; moderate medium to fine angular blocky structure; extremely hard, very firm, sticky and very plastic; effervesces; pH 9.2 with thymol blue; few roots; few very fine pores; thin patchy clay skins; clear irregular boundary.
C1cs 4795	20 to 26 inches. Olive (5Y 4/2.5) heavy clay, olive gray (5Y 5/2) when dry; moderate medium to coarse white splotches of gypsum crystals; weak medium angular blocky structure; very hard, very firm, very sticky and plastic; effervesces; pH 8.0 with thymol blue; very few roots; gradual irregular boundary.
C2 4796	26 to 40 inches. Olive gray (5Y 4/2) heavy clay to 5Y 5/2 when dry with common medium prominent white splotches; weak medium angular blocky to massive; very hard, very firm, very sticky and very plastic; effervesces; pH 8.1; very few roots; diffuse boundary.
C3 4797	40 to 60 inches plus. Olive gray (5Y 4/2) heavy clay, light olive gray (5Y 6/2) when dry; weak medium blocky to massive structure; very hard, very firm, very sticky and very plastic; effervesces; pH 8.3 with thymol blue; few roots in upper portion.

SOIL SURVEY LABORATORY Mandan, N. Dak.

OIL TYPE *Wolf Point silty clay **LOCATION** Roosevelt County, Montana

SOIL NOS. S50Mont-43-4 **LAB. NOS.** 180-187

DEPTH INCHES	HORIZON	1B1a PARTICLE SIZE DISTRIBUTION (in mm.) (per cent) 3A1 VERY COARSE SAND 2-1	COARSE SAND 1-0.5	MEDIUM SAND 0.5-0.25	FINE SAND 0.25-0.10	VERY FINE SAND 0.10-0.05	SILT 0.05-0.002	CLAY < 0.002	0.2-0.02	0.02-0.002	2A2 > 2	TEXTURAL CLASS
0-5	A11	0.1	0.1	0.1	0.2	0.8	47.8	50.9	8.4	40.3	-	sic
5-11	A12	0.1	0.1	-	0.1	0.1	43.4	56.1	4.9	38.8	-	sic
11-18	C1	-	-	-	-	0.1	49.8	50.1	2.9	46.8	-	sic
18-29	C2	0.1	0.1	0.1	0.2	0.5	50.6	48.4	7.0	44.3	-	sic
29-42	C3	-	0.1	0.1	0.4	0.7	44.0	54.7	6.6	38.4	-	sic
42-48	C4	0.1	-	0.1	0.3	0.4	39.9	59.2	5.1	35.5	-	c
48-56	C5	-	-	-	0.1	0.2	60.7	39.0	22.1	38.9	-	sicl
56-62	C6	-	-	-	0.1	0.3	37.3	62.3	5.7	31.9	-	c

8C1b SATURATED PASTE	pH 8C1a 1:5	8C1a 1:10	ORGANIC MATTER 6A1a ORGANIC CARBON %	6B1a NITROGEN %	C/N	8A2 EST% SALT (BUREAU CUP)	ELECTRICAL CONDUCTIVITY EC×10³ MILLIMHOS PER CM 8A1a	6E1a $CaCO_3$ equivalent %	6F1a GYPSUM me./100g. SOIL	MOISTURE TENSIONS 1/10 ATMOS. %	1/3 ATMOS. %	15 ATMOS. %
7.2	8.0	7.9	2.29	.215	10.6	-	0.7	1	-			
8.0	8.6	8.9	1.16	.120	9.7	-	0.9	3	-			
7.9	8.9	9.1	0.86	.089	9.7	-	1.3	5	-			
8.2	9.3	9.5	0.77	.073	10.5	-	1.2	5	-			
7.9	8.4	8.7	0.78	.078	10.0	0.56	7.5	3	4			
8.0	8.3	8.5	1.17	.118	9.9	0.63	9.5	2	5			
8.0	8.4	8.7	0.64	.073	8.8	0.58	9.0	6	12			
7.9	8.3	8.3	0.56	.059	9.5	0.64	9.0	3	12			

5A1a CATION EXCHANGE CAPACITY NH_4OAc	EXCHANGEABLE CATIONS 5B1b Ca	Mg	H	6P2a Na	6Q2a K	5D2 EXCH. Na %	8A1 SATURATION EXTRACT SOLUBLE 6P1a Na	6Q1a K			8A MOISTURE AT SATURATION %
← milliequivalents per 100g. soil →							← milliequivalents per liter →				
36.1				1.3	2.0	4	4.7	2.0			81.1
36.0				1.1	1.1	3	6.7	1.4			76.0
31.7				1.3	1.7	4	10.0	2.8			78.7
30.6				5.1	2.0	17	11.9	1.9			88.9
33.5				10.7	1.8	32	73.1	5.5			86.0
36.9				5.8	2.4	16	121.9	5.7			92.9
26.1				3.1	2.0	12	96.0	4.0			70.5
36.4				5.8	2.2	16	101.6	4.7			95.8

Soil type: *Wolf Point silty clay
Soil No.: S50Mont-43-4
Location: Roosevelt County, Montana; 0.25 mile south and 100 feet west of northeast corner of Section 31, T27N, R46E.
Topography: Missouri River terrace of intermediate level; slope less than 1 percent.
Drainage: Imperfect.
Erosion: None.
Parent material: Missouri River alluvium from shales and drift of shaly nature.
Vegetative cover: Western wheatgrass (Agropyron smithii) and sedge (Carex).
Described by: A. J. Cline, June 5, 1950.

Horizon and Mandan Lab. Number	
A11 180	0 to 5 inches. Gray (2.5Y 5/1) clay, very dark gray (2.5Y 3/1) moist; moderate very fine platy structure on surface, weak granular structure below surface inch; slightly hard, friable, sticky and plastic; weakly calcareous.
A12 181	5 to 11 inches. Very dark grayish brown (2.5Y 3/2) moist clay; weak granular structure; hard, friable, sticky and plastic; calcareous; abrupt boundary.
C1 182	11 to 18 inches. Dark grayish brown (2.5Y 4/2) moist silty clay; massive structure; hard, friable, sticky and plastic; calcareous.
C2 183	18 to 29 inches. Olive brown (2.5Y 4/3) moist clay with common dark gray (5Y 4/1) mottlings moist; massive; hard, friable, sticky and plastic; calcareous with a few crystals of gypsum.
C3 184	29 to 42 inches. Dark grayish brown (2.5Y 4/2) moist clay with common dark gray (5Y 4/1) moist mottlings; massive structure; hard, friable, sticky and plastic; calcareous; gypsum crystals; abrupt boundary.
C4 185	42 to 48 inches. Very dark grayish brown (2.5Y 3/2) moist clay; massive structure; very hard, firm, sticky and plastic; calcareous with many gypsum crystals; abrupt boundary.
C5 186	48 to 56 inches. Dark grayish brown (2.5Y 4/2) moist clay; massive structure; hard, friable, slightly sticky and slightly plastic; strongly calcareous with many gypsum crystals; abrupt boundary.
C6 187	56 to 62 inches. Very dark grayish brown (2.5Y 3/2) moist clay; massive structure; very hard, firm, very sticky and plastic; calcareous with common gypsum crystals.

SOIL SURVEY LABORATORY Mandan, N. Dak.

SOIL TYPE *Wolf Point silty clay **LOCATION** Roosevelt County, Montana

SOIL NOS. S51Mont-43-4 **LAB. NOS.** 819-822

DEPTH INCHES	HORIZON	1B1a PARTICLE SIZE DISTRIBUTION (in mm.) (per cent) 3A1 VERY COARSE SAND 2-1	COARSE SAND 1-0.5	MEDIUM SAND 0.5-0.25	FINE SAND 0.25-0.10	VERY FINE SAND 0.10-0.05	SILT 0.05-0.002	CLAY < 0.002	0.2-0.02	0.02-0.002	2A2 > 2	TEXTURAL CLASS
0-4	A1	0.2	0.2	0.2	0.5	1.8	44.7	52.4	10.5	36.3	-	sic
4-11	C1	0.1	0.1	0.1	0.2	0.4	37.9	61.2	4.5	33.9	-	c
11-25	C2	-	-	-	0.1	0.5	37.9	61.5	3.6	34.9	-	c
25-33	C3	0.1	0.2	0.5	2.7	9.7	47.0	39.8	30.6	28.2	-	sicl

pH 8C1b SATURATED PASTE	pH 8C1a 1:5	pH 8C1a 1:10	ORGANIC MATTER 6A1a ORGANIC CARBON %	6B1a NITROGEN %	C/N	8A2 EST% SALT (BUREAU CUP)	ELECTRICAL CONDUCTIVITY EC×10³ MILLIMHOS PER CM 8A1a	6E1a $CaCO_3$ equivalent %	6F1a GYPSUM me./100g. SOIL	MOISTURE TENSIONS 1/10 ATMOS. %	1/3 ATMOS. %	4B2 15 ATMOS. %
7.5	8.5	8.7	2.00	0.151	13.2	-	0.7	3	-			22.2
7.5	8.6	8.8	1.03	0.079	13.0	-	0.6	2	-			22.9
7.7	8.7	9.0	0.72	0.057	12.6	-	1.0	3	-			22.5
7.5	8.3	8.6	0.70	0.058	12.1	-	3.8	4	-			16.0

5A1a CATION EXCHANGE CAPACITY NH_4OAc	EXCHANGEABLE CATIONS 5B1b Ca	Mg	H	6P2a Na	6Q2a K	5D2 EXCH. Na %	SATURATION EXTRACT SOLUBLE 8A1 6P1a Na	6Q1a K	8A MOISTURE AT SATURATION %
←	milliequivalents per 100g. soil →						← milliequivalents per liter →		
35.1				0.2	1.8	-	1.3	0.9	78.7
36.5				0.5	1.3	1	1.7	0.2	90.8
34.9				1.6	1.0	4	5.6	0.5	86.8
26.4				1.7	0.5	6	20.0	0.8	65.3

Soil type: *Wolf Point silty clay
Soil No.: S51Mont-43-4
Location: Roosevelt County, Montana; SE1/4 Section 30, T27N, R47E.
Topography: Low terrace; level terrace.
Drainage: Moderately good.
Parent material: Missouri River Alluvial.
Vegetative cover: Cottonwood, brush, and weeds.

This sample was taken on the flood plain of the present Missouri River. The sample pit was dug on the first terrace level above the present river bed and about 200 feet from the edge of the channel. It is representative of the areas of recent deposition but is of greater age than areas mapped as riverwash. It was subject to yearly overflow prior to the completion of Fort Peck Dam and is still occasionally flooded during periods of peak discharge. The area from which the sample was taken has a nearly level to gently sloping concave relief with the direction of slope running away from the river channel. Surface drainage is moderately slow but water does not pond. The area is used as pasture land and supports a fairly dense cover of cottonwood, buckbrush, willow, western wheatgrass, and berry bushes. The area shows no evidence of accelerated erosions. It has a fluctuating water table that seasonally may come within four feet of the surface of the ground for short periods of time.

Described by: A. J. Cline, September 5, 1951.

Horizon and Mandan Lab. Number	
A1 819	0 to 4 inches. Olive gray (5Y 4.5/2 dry) to dark olive gray (5Y 3.5/2 moist) calcareous fine granular silty clay; soft when dry, very friable when moist, but extremely plastic when wet.
C1 820	4 to 11 inches. Olive gray (5Y 4/2 dry) to dark gray (5Y 4/1 moist) calcareous clay; strongly developed fine platy or chip-like structure which is one of the differentiating features of this soil series. The horizon breaks down to relatively hard and stable aggregates 5- to 6-mm. in size that are plate-like in form but whose edges are beveled so that the aggregate often assumes the general appearance of a sunflower seed. These chip-like aggregates are loosely arranged within the horizon with their longest axis generally nearly horizontal; however, it is not uncommon to find some sections of the profile in which the aggregates lie at oblique, and on occasion nearly vertical, angles. The faces of the individual aggregates have a colloidal sheen. Frequently thin lenses of fine sandy loam or loamy fine sand are interbedded between the plate-like strata of clay; soft when dry, very friable when moist, but extremely plastic when wet.
C2 821	11 to 25 inches. Olive gray (5Y 4/2 dry) (5Y 4/1.5 moist) calcareous clay; platy or chip-like structure described in the horizon above is soft when dry, very friable when moist, and extremely plastic when wet.
C3 822	25 to 33 inches. Olive gray (5Y 5/2 dry) (5Y 4/1.5 moist) calcareous clay stratified with lenses of silty clay and silty clay loam; heavy-textured strata of the horizon retain the chip-like structure described in detail for the C1 horizon but it is not as pronounced as in the horizons above; the stratifying layers of silty clay and silty clay loam are massive in structure and light brownish gray (2.5Y 6/2 dry) to dark grayish brown (2.5Y 4/2 moist); slightly hard when dry and friable when moist; abrupt boundary.
IIC4	33 to 60 inches. Light brownish gray (2.5Y 6/2 dry) to grayish brown (2.5Y 5/2 moist) loose single grained calcareous loamy fine sand or fine sand; contains a few small indistinct brown mottles and stains. (Not sampled.)

Remarks: Since the loamy fine sand beds that occur below this profile are not considered to be parent material of the soil itself, J. R. McHenry did not sample the 33- to 60-inch horizon. It is described above because it is the differentiating characteristic of the 5-foot profile that causes the classification unit of Wolf Point silty clay, medium depth over sand to be applied to the sample locality.

* U. S. GOVERNMENT PRINTING OFFICE : 1966 O - 223-956