Soil Survey Investigations Report No. 31

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

... IOWA

SOIL CONSERVATION SERVICE U.S. DEPARTMENT OF AGRICULTURE
In cooperation with
IOWA AGRICULTURE AND HOME ECONOMICS EXPERIMENT STATION

Soil survey investigations reports already published:

SSIR No. 1	Soil Survey Laboratory Methods and Procedures for Collecting Soil Samples
	Soil Survey Laboratory Data and Descriptions for Some Soils of:
SSIR No. 2	North Dakota
SSIR No. 3	Iowa
SSIR No. 4	Kansas
SSIR No. 5	Nebraska
SSIR No. 6	Arkansas, Louisiana, and Missouri
SSIR No. 7	Montana
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SSIR No. 9	Minnesota
SSIR No. 10	Colorado
SSIR No. 11	Oklahoma
SSIR No. 12	Puerto Rico and the Virgin Islands
SSIR No. 13	Mississippi
SSIR No. 14	Kentucky
SSIR No. 15	Tennessee
SSIR No. 16	North Carolina, South Carolina, and Georgia
SSIR No. 17	Wisconsin
SSIR No. 18	Indiana
SSIR No. 19	Illinois
SSIR No. 20	New England States
SSIR No. 21	A Toposequence of Soils in Tonalite Grus in the Southern California Peninsular Range
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SSIR No. 22	Alabama and Florida
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SSIR No. 28	Arizona
SSIR No. 29	Hawaii
SSIR No. 30	Texas

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MAY 1978

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PREFACE

The Soil Survey Investigations Report (SSIR) Series was established to preserve and make available technical information resulting from soil survey investigations. SSIR No. 1, "Soil Survey Laboratory Methods and Procedures for Collecting Soil Samples," revised April 1972, describes in detail the methods used in the soil survey laboratories. One report involves a single specific study. Other reports in the series contain pedon descriptions and data from the individual states and Puerto Rico and the Virgin Islands. The entire series is listed on the inside front cover.

This report contains pedon descriptions and data obtained in Iowa from 1959 to 1971. The majority of laboratory analyses were conducted at the Soil Survey Investigations Unit, Lincoln, Nebraska and Iowa State University, Ames, Iowa.

Laboratory data for different soils cannot always be compared without allowance for the method. Methods are indexed by code or footnote in data sheet column headings and are identified briefly on the following two pages. Detailed explanations of coded procedures are in SSIR No. 1.

Many of the soil descriptions published herein were prepared as working documents, not necessarily for publication. Some contain unusually detailed information pertinent to specific soil survey investigations. Such information, including older concepts of soil series, relationships among pedons, and field estimates of properties, is useful in a publication of this type. Editing is, therefore, minimal with emphasis toward preservation of descriptive data.

Many pedons no longer represent the soil series with which they were originally identified; a few represent series being considered for reclassification (these are footnoted on pages where they occur). All were classified during the period 1970 to 1975 and were checked against series classification as of February 1976. The Arbor series was officially reclassified in August 1976. Some series names changed and are footnoted where the original name carries useful connotations. Pedons that are not included within the limits of recognized series are footnoted; some pedons are called taxadjuncts to or variants of a series. All pedons are classified to the family level. In the taxonomic and geographic indexes pedons are arranged by taxonomic unit.

METHODS CODE SYMBOLS

1. SAMPLE COLLECTION AND PREPARATION
   A. Field sampling
      1. Site selection
      2. Soil sampling
         a. Stony soils
         b. Marsh and swamp 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
      5. See appended section for Iowa State University samples
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
      - : analysis run but not detected
      blank: analysis not run
      nd: analysis not run
      <: less than reported amount or none present
3. PARTICLE-SIZE ANALYSES
   A. Particles <2-mm (pipet method)
      1. Airdry samples
         a. Carbonate and noncarbonate clay
         b. Fine clay
         c. Water-dispersible clay
   B. Particles >2-mm
      1. Weight estimates
         a. By field and laboratory weighing
         b. From volume and weight estimates
      2. Volume estimates
4. FABRIC-RELATED ANALYSES
   A. Bulk density
      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
      3. Cores
         a. Field moist
   B. Water retention
      1. Pressure-plate extraction (1/3 or 1/10 bar)
         a. Sieved samples
         b. Soil pieces
         c. Natural clods
      2. Pressure-membrane extraction (15 bars)
         a. Field-moist samples
      3. Sand-table absorption
      4. Field state
      5. Airday
   C. Water-retention difference
      1. 1/3 bar to 15 bars
      2. 1/10 bar to 15 bars
   D. Linear extensibility
      1. Dry to moist
   E. Micromorphology
      1. Thin sections
         a. Preparation
         b. Interpretation
         c. Moved-clay percentage
   F. Plasticity index
      1. Liquid limit
      2. Plastic limit
5. ION-EXCHANGE ANALYSES
   A. Cation-exchange capacity
      1. NH_4OAc, pH 7.0
         a. Direct distillation
      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
         b. Sum of bases plus Al
      6. NH_4OAc, pH 7.0 leaching tube
         a. Direct distillation
   B. Extractable bases
      1. NH_4OAc extraction
         a. Uncorrected
         b. Corrected (exchangeable)
         c. See 5B4
      2. KCl-TEA extraction, pH 8.2
      3. KCl-TEA, pH 8.2 (revised)
         a. Uncorrected
         b. Corrected (exchangeable)
      4. NH_4OAc, pH 7.0 (modified)
         a. Uncorrected
         b. Corrected (exchangeable)
   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
   F. Calcium saturation
      1. NH_4OAc, pH 7.0
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
   B. Nitrogen
      1. Kjeldahl digestion
         a. Ammonia distillation
   C. Iron
      1. Dithionite extraction
         a. Dichromate titration
         b. EDTA titration
      2. Dithionite-citrate extraction
         a. Orthophenanthroline colorimetry
         b. Atomic absorption
      3. Dithionite-citrate-bicarbonate extraction
         a. Potassium thiocyanate colorimetry
      4. Pyrophosphate-dithionite extraction
      5. Sodium-pyrophosphate extraction
         a. Atomic absorption
      6. Ammonium oxalate extraction
         a. Atomic absorption
   E. Calcium carbonate
      1. HCl treatment
         a. Gas volumetric
         b. Manometric
         c. Weight loss
         e. Titrimetric
      2. Sensitive qualitative method
         a. Visual, gas bubbles
   G. Aluminum
      1. KCl extraction I, 30 min.
         a. Aluminon I
         b. Aluminon II
         c. Aluminon III
         d. Fluoride titration
         e. Atomic absorption
      2. KCl extraction II, overnight
         a. Aluminon I

6. CHEMICAL ANALYSES (cont.)
   3. NH_4OAc extraction
      a. Aluminon III
   4. NaOAc extraction
      a. Aluminon III
   5. Sodium pyrophosphate extraction
      a. Atomic absorption
   6. Ammonium oxalate extraction
      a. Atomic absorption
   7. Dithionite-citrate extraction
      a. Atomic absorption
H. Extractable acidity
   1. $BaCl_2$-triethanolamine I
      a. Back-titration with HCl
   2. $BaCl_2$-triethanolamine II
      a. Back-titration with HCl
I. Carbonate
   1. Saturation extract
      a. Acid titration
J. Bicarbonate
   1. Saturation extract
      a. Acid titration
K. Chloride
   1. Saturation extract
      a. Mohr titration
      b. Potentiometric titration
L. Sulfate
   1. Saturation extract
      a. Gravimetric, $BaSO_4$
      b. EDTA titration
   2. NH_4OAc extraction
      a. Gravimetric, $BaSO_4$
M. Nitrate
   1. Saturation extract
      a. PDS acid colorimetry
      b. Diphenylamine
N. Calcium
   1. Saturation extract
      a. EDTA titration
      b. Atomic absorption
   2. NH_4OAc extraction
      a. EDTA-alcohol separation
      b. Oxalate-permanganate I
      c. Oxalate-permanganate II
         Fe, Al, and Mn removed
      d. Oxalate-cerate
      e. Atomic absorption
   3. NH_4Cl-EtOH extraction
      a. EDTA titration
   4. KCl-TEA extraction
      a. Oxalate-permanganate
      b. EDTA titration
      c. Atomic absorption
O. Magnesium
   1. Saturation extract
      a. EDTA titration
      b. Atomic absorption
   2. NH_2OAc extraction
      a. EDTA-alcohol separation
      b. Phosphate titration
      d. Atomic absorption
   3. NH_4Cl-EtOH extraction
      a. EDTA titration
   4. KCl-TEA extraction
      a. Phosphate titration
      b. EDTA titration
      c. Atomic absorption
P. Sodium
   1. Saturation extract
      a. Flame photometry
      b. Atomic absorption

6. CHEMICAL ANALYSES (cont.)
   2. NH_4OAc extraction
      a. Flame photometry
      b. Atomic absorption
Q. Potassium
   1. Saturation extract
      a. Flame photometry
      b. Atomic absorption
   2. NH_4OAc extraction
      a. Flame photometry
      b. Atomic absorption
R. Sulfur
   1. $NaHCO_3$ extract, pH 8.5
      a. Methylene blue
   2. HCl release (sulfide)
      a. Iodine titration
S. Total phosphorus
   1. Perchloric acid digestion
      a. Molybdovanadophosphoric acid colorimetry
T. Available phosphorus
   1. See appended section for Iowa State University samples
7. MINERALOGY
A. Instrumental analysis
   1. Preparation
      a. Carbonate removal
      b. Organic-matter removal
      c. Iron removal
      d. Particle-size fractionation
      e. PSDA pretreatment
   2. X-ray diffraction
      a. Thin film on glass, solution pretreatment
      b. Thin film on glass, resin pretreatment
      c. Thin film on glass, $NaPO_3$ pretreatment
      g. Powder mount, diffractometer recording
      h. Powder mount, camera recording
   3. Differential thermal analysis
B. Optical analysis
   1. Grain studies
   2. Electron microscopy
C. Total analysis
   1. Chemical
   2. X-ray emission spectrography
D. Surface area
   1. Glycerol retention
8. MISCELLANEOUS
A. Saturated paste, mixed
   1. Saturation extract
      a. Conductivity
      b. Conductivity, quick test
   2. Bureau of Soils cup, resistance
B. Saturated paste, capillary rise
   1. Saturation extract
      a. Conductivity
C. pH
   1. Soil suspensions
      a. Water dilution
      b. Saturated paste
      c. KCl
      e. $CaCl_2$
D. Ratios and estimates
   1. To total clay
   2. To noncarbonate clay
   3. Ca to Mg (extractable)
   4. Estimated clay percentage
   5. Estimated total salt
E. Soil resistivity
   1. Saturated paste

Iowa State University Soil Testing Laboratory

I. Receiving and storing soil samples in the laboratory.

Soil samples are received in plastic-lined bags to prevent drying. Samples are stored in a refrigerated room (34° to 36° F, 1° to 2° C) until the analyses are completed.

II. Laboratory procedures

A. Subsampling the soil sample for analyses

1. Reagents

1.1 Deionized, distilled water

2. Procedure

The sample is screened through a 1/4-inch screen and thoroughly mixed. The moisture content of the moist soil sample is estimated and a subsample of the moist soil equivalent to 100 g of ovendry (110 C°) soil is weighed out and placed in a mixing cylinder. An amount of deionized, distilled water sufficient to provide 200 ml of water per 100 g of ovendry soil is added to the soil in the cylinder. The soil and water are stirred until a uniform suspension of soil in water is obtained. Subsamples of this suspension are drawn off in the amounts needed for each analysis.

B. Phosphorus

1. Reagents

1.1 Extracting solution (commonly called Bray No. 1 phosphorus extractant)

Add 45.5 ml of concentrated HCl in about 17 liters of distilled water. Dissolve 25 g of NH_4F in about 200 ml of distilled water. Filter and add to the HCl solution. Make up to 18 liter volume with distilled water. This solution is 0.025 N HCl and 0.03 N NH_4F after it is added to the soil-water suspension sample.

2.1 Molybdate solution

Dissolve 72.25 g of ammonium molybdate in 400 ml of distilled water heated to 60 C. Cool the solution and add 1,500 Ml of HCl (sp. gr. 1.19, 37.5 pct.) Dilute the solution to 2000 ml with distilled water. Store in a glass-stoppered brown bottle containing 100 g of boric acid (H_3BO_3).

3.1 Stock (dry) reducing agent

Mix 25 g of 1-amino-2-naphthol-4-sulfonic acid with 50 g of sodium sulfite and 1,462.5 g of sodium pyrosulfite. Grind the mixture to a fine powder in a ball mill and store in a sealed brown bottle in a cool place. This reagent may be kept for a year under these conditions.

4.1 Dilute reducing agent

Dissolve 80 g of the dry reducing agent in 500 ml of distilled water heated to 60 C°. Cool the solution and store in a brown dropper bottle. Replace this solution every 3 weeks.

5.1 Standard phosphorus solutions

Dissolve 0.2195 g of pure potassium dihydrogen phosphate in distilled water and dilute to 1,000 ml with distilled water. This solution contains 50 ppm of P. Prepare other P standards by dilution.

6.1 Filter paper

Use S & S, 11 cm, No. 402 single acid-washed filter paper. Each lot of filter paper must be checked for "phosphorus or arsenic" contamination by running a blank.

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ARGIAQUOLL

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Fine, montmorillonitic, mesic
Taintor silty clay loam 30/ 175*
Winterset silty clay loam 179*
Winterset silty clay loam 181*

Fine, montmorillonitic, mesic, sloping
Clarinda silty clay 3/ 15*

HAPLAQUOLL

Typic Haplaquoll
Fine-loamy, mixed, mesic
Clyde silt loam 23*
Clyde silt loam 25*

Fine, montmorillonitic, mesic
Chequest silty clay loam 9
Marcus silty clay loam, taxadjunct 5/ 79*
Marna silty clay loam 33
Marna silty clay loam 35
Taintor silty clay loam, taxadjunct 29/ 173*

Cumulic Haplaquoll
Fine, montmorillonitic, mesic
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Vertic Haplaquoll
Very fine, montmorillonitic, mesic
Luton silty clay 31

UDOLL

ARGIUDOLL

Typic Argiudoll
Fine-loamy, mixed, mesic
Cresco loam 27*
Shelby clay loam 159*

Fine-silty, mixed, mesic
Tama silty clay loam 177*

Fine, montmorillonitic, mesic
Adair silty clay loam, silty variant 3*
Otley silty clay loam 121*
Otley silty clay loam 123*
Sharpsburg silty clay loam 23/ 149*
Sharpsburg silt loam 25/ 155*

Aquic Argiudoll
Fine-loamy, mixed, mesic
Cresco loam, taxadjunct 29*
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Fine, montmorillonitic, mesic
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HAPLUDOLL

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Fine-loamy, mixed, mesic
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Everly silt loam 39*
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Kamrar clay loam 21
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MOLLISOL (Continued)

UDOLL (Continued)

HAPLUDOLL (Continued)

Aquic Hapludoll

Fine-loamy, mixed, mesic

Readlyn loam 133*

Readlyn loam 135*

Fine-silty, mixed, mesic

Klinger silty clay loam 59*

Klinger silt loam 61*

Muscatine silty clay loam 109*

Muscatine silty clay loam 111*

Primghar silty clay loam 125*

Primghar silty clay loam 127*

Fine, montmorillonitic, mesic

Guckeen clay loam 13

Guckeen clay loam 15

Macksburg silty clay loam, taxadjunct 2/ 67*

Macksburg silty clay loam, taxadjunct 2/ 69*

Macksburg silty clay loam, taxadjunct 2/ 71*

Cumulic Hapludoll

Fine-loamy, mixed, mesic

Olmitz silty clay loam, taxadjunct 14/ 117*

Olmitz silty clay loam 119*

Fine-silty, mixed, mesic

Napier silt loam, taxadjunct 12/ 113*

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*Page number refers to SSIR No. 3

2/ through 30/--see SOIL SERIES INDEX footnotes.

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ALFISOL

AQUALF

OCHRAQUALF

Udollic Ochraqualf
Fine-loamy, mixed, mesic
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Riceville loam 139

UDALF

HAPLUDALF

Typic Hapludalf
Fine-loamy, mixed, mesic
Series not designated (sampled as Bonair loam) 16/ 11
Series not designated (sampled as Bonair loam) 16/ 13

Fine-silty, mixed, mesic
Fayette silt loam 41
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Lourdes loam 65

Mollic Hapludalf
Fine, montmorillonitic, mesic
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ENTISOL

ORTHENT

UDORTHENT

Typic Udorthent
Coarse-silty, mixed (calcareous), mesic
Hamburg silt loam 47
Ida silt loam, taxadjunct 4/ 53

Fine-silty, mixed (calcareous), mesic
Ida silt loam 49

INCEPTISOL

AQUEPT

HAPLAQUEPT

Typic Haplaquept
Fine, montmorillonitic, mesic, sloping
Series not designated (sampled as Clarinda) 17/ 17

OCHREPT

EUTROCHREPT

Typic Eutrochrept
Fine-loamy, mixed, mesic
Series not designated (sampled as Shelby) 19/ 167

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MOLLISOL

ALBOLL

ARGIALBOLL

Typic Argialboll
Fine, montmorillonitic, mesic
Edina silt loam 35

AQUOLL

ARGIAQUOLL

Typic Argiaquoll
Fine, montmorillonitic, mesic
Taintor silty clay loam 30/ 175
Winterset silty clay loam 179
Winterset silty clay loam 181

Fine, montmorillonitic, mesic, sloping
Clarinda silty clay 3/ 15

HAPLAQUOLL

Typic Haplaquoll
Fine-loamy, mixed, mesic
Clyde silt loam 23
Clyde silt loam 25

Fine, montmorillonitic, mesic
Marcus silty clay loam, taxadjunct 5/ 79
Taintor silty clay loam, taxadjunct 29/ 173

Cumulic Haplaquoll
Fine, montmorillonitic, mesic
Marcus silty clay loam, taxadjunct 6/ 81

UDOLL

ARGIUDOLL

Typic Argiudoll
Fine-loamy, mixed, mesic
Cresco loam 27
Shelby clay loam 159

Fine-silty, mixed, mesic
Tama silty clay loam 177

Fine, montmorillonitic, mesic
Adair silty clay loam, variant 3
Otley silty clay loam 121
Otley silty clay loam 123
Sharpsburg silty clay loam 23/ 149
Sharpsburg silty clay loam 25/ 155

Aquic Argiudoll
Fine-loamy, mixed, mesic
Cresco loam, taxadjunct 29
Protivin loam 129
Protivin loam 131

Fine, montmorillonitic, mesic
Macksburg silty clay loam 73
Mahaska silty clay loam 75
Mahaska silty clay loam 77

HAPLUDOLL

Typic Hapludoll
Fine-loamy, mixed, mesic
Arbor silty clay loam 7
Arbor silt loam 9
Everly silt loam 37
Everly silt loam 39
Kenyon loam 55
Kenyon loam 57

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MOLLISOL (Continued)

UDOLL (Continued)

HAPLUDOLL (Continued)

Typic Hapludoll (Continued)

Fine-loamy, mixed, mesic

Shelby clay loam, taxadjunct 27/ 163
Shelby clay loam, variant 28/ 165
Shelby loam, taxadjunct 2/ 169

Fine-silty, mixed, mesic

Dinsdale silty clay loam, taxadjunct 2/ 31
Dinsdale silty clay loam, taxadjunct 2/ 33
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Monona silt loam, acid variant 83
Monona silt loam, shallow to carbonates variant 7/ 85
Monona silt loam 87
Monona silt loam 89
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Monona silt loam, variant 7/ 97
Monona silt loam, acid variant 10/ 99
Monona silt loam, acid variant 10/ 101
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Monona silt loam 11/ 105
Monona silt loam, variant 7/ 107
Sac silty clay loam 141
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Sharpsburg silty clay loam, taxadjunct 21/ 145
Sharpsburg silty clay loam, gray subsoil variant 24/ 151
Sharpsburg silty clay loam, taxadjunct 21/ 153

Fine, montmorillonitic, mesic

Sharpsburg silty clay loam, taxadjunct 22/ 147
Shelby clay loam, taxadjunct 26/ 157
Shelby clay loam, taxadjunct 26/ 161

Aquic Hapludoll

Fine-loamy, mixed, mesic

Readlyn loam 133
Readlyn loam 135

Fine-silty, mixed, mesic

Klinger silty clay loam 59
Klinger silt loam 61
Muscatine silty clay loam 109
Muscatine silty clay loam 111
Primghar silty clay loam 125
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Fine, montmorillonitic, mesic

Macksburg silty clay loam, taxadjunct 2/ 67
Macksburg silty clay loam, taxadjunct 2/ 69
Macksburg silty clay loam, taxadjunct 2/ 71

Cumulic Hapludoll

Fine-loamy, mixed, mesic

Olmitz silty clay loam, taxadjunct 14/ 117
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Fine-silty, mixed, mesic

Napier silt loam, taxadjunct 12/ 113
Napier silt loam, variant 13/ 115

2/ through 30/--see SOIL SERIES INDEX footnotes.

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Classification	Soil Series	Page
ADAIR COUNTY		
Inceptisol		
Ochrept		
Eutrochrept	Series not designated (sampled as Shelby) 19/	167*
Mollisol		
Udoll		
Argiudoll	Sharpsburg silty clay loam 23/	149*
	Shelby clay loam	159*
Hapludoll	Arbor silty clay loam	7*
	Arbor silt loam	9*
	Macksburg silty clay loam, taxadjunct 2/	67*
	Macksburg silty clay loam, taxadjunct 2/	69*
	Macksburg silty clay loam, taxadjunct 2/	71*
	Olmitz silty clay loam, taxadjunct 14/	117*
	Olmitz silty clay loam	119*
	Sharpsburg silty clay loam, taxadjunct 21/	145*
	Sharpsburg silty clay loam, taxadjunct 22/	147*
	Sharpsburg silty clay loam, gray subsoil variant 24/	151*
	Sharpsburg silty clay loam, taxadjunct 21/	153*
	Shelby clay loam, taxadjunct 26/	157*
	Shelby clay loam, taxadjunct 26/	161*
	Shelby clay loam, taxadjunct 27/	163*
	Shelby clay loam, variant 28/	165*
APPANOOSE COUNTY		
Alfisol		
Aqualf		
Albaqualf	Appanoose silt loam	5
	Appanoose silt loam	7
Ochraqualf	Choppock silt loam	11
	Kniffin silt loam	27
	Rathbun silt loam	53
Mollisol		
Aquoll		
Haplaquoll	Chequest silty clay loam	9
BENTON COUNTY		
Mollisol		
Udoll		
Hapludoll	Muscatine silty clay loam	109*
BLACK HAWK COUNTY		
Mollisol		
Udoll		
Hapludoll	Dinsdale silty clay loam, taxadjunct 2/	31*
BREMER COUNTY		
Mollisol		
Udoll		
Hapludoll	Kenyon loam	55*
	Kenyon loam	57*
	Klinger silty clay loam	59*
	Klinger silt loam	61*
	Readlyn loam	133*
	Readlyn loam	135*
CASS COUNTY		
Mollisol		
Udoll		
Hapludoll	Marshall silty clay loam	37
	Marshall silty clay loam	39
	Marshall silty clay loam	41
CLAY COUNTY		
Mollisol		
Aquoll		
Haplaquoll	Marcus silty clay loam, taxadjunct 5/	79*
Udoll		
Hapludoll	Everly silt loam	37*
	Everly silt loam	39*
	Primghar silty clay loam	125*
	Sac silty clay loam	141*
	Sac silt loam	143*
	Wadena loam	71
	Wadena loam	73
CLAYTON COUNTY		
Alfisol		
Udalf		
Hapludalf	Fayette silt loam	1*
FREMONT COUNTY		
Entisol		
Orthent		
Udorthent	Hamburg silt loam	47*
	Ida silt loam	49*
GRUNDY COUNTY		
Mollisol		
Udoll		
Hapludoll	Dinsdale silty clay loam taxadjunct 2/	33*
	Muscatine silty clay loam	111*
HAMILTON COUNTY		
Mollisol		
Aquoll		
Haplaquoll	Marna silty clay loam	35
Udoll		
Hapludoll	Guckeen clay loam	13
	Kamrar clay loam	21
	Kamrar clay loam	23
HARRISON COUNTY		
Entisol		
Orthent		
Udorthent	Ida silt loam, taxadjunct 4/	53*
Mollisol		
Udoll		
Hapludoll	Series not designated (sampled as Ida) 28/	51*
	Monona silt loam, acid variant	83*
	Monona silt loam, shallow to carbonates variant 7/	85*
	Monona silt loam	87*
	Monona silt loam	89*
	Monona silt loam	91*
	Monona silt loam 8/	93*
	Monona silt loam, variant 9/	95*
	Monona silt loam, variant 7/	97*
	Monona silt loam, acid variant 10/	99*
	Monona silt loam, acid variant 10/	101*

Classification	Soil Series	Page
HARRISON COUNTY (Continued)		
Mollisol (Continued)		
Udoll (Continued)		
Hapludoll (Continued)		
	Monona silt loam, acid variant 10/	103*
	Monona silt loam 11/	105*
	Monona silt loam, variant 7/	107*
	Napier silt loam, taxadjunct 12/	113*
	Napier silt loam, taxadjunct 13/	115*
HOWARD COUNTY		
Alfisol		
Aqualf		
Ochraqualf	Riceville loam	137*
	Riceville loam	139*
Udalf		
Hapludalf	Series not designated (sampled as Bonair)	11*
	Series not designated (sampled as Bonair)	13*
	Lourdes loam	63*
	Lourdes loam	65*
Mollisol		
Aquoll		
Haplaquoll	Clyde silt loam	23*
	Clyde silt loam	25*
Udoll		
Argiudoll	Cresco loam	27*
	Cresco loam	29*
	Protivin loam	129*
	Protivin loam	131*
JACKSON COUNTY		
Alfisol		
Udalf		
Hapludalf	Fayette silt loam	43*
KEOKUK COUNTY		
Mollisol		
Aquoll		
Haplaquoll	Taintor silty clay loam, taxadjunct 29/	173*
Udoll		
Argiudoll	Mahaska silty clay loam	75*
	Otley silty clay loam	121*
LINN COUNTY		
Alfisol		
Udalf		
Hapludalf	Fayette silt loam	45*
LUCAS COUNTY		
Alfisol		
Udalf		
Hapludalf	Weller silt loam	77
MADISON COUNTY		
Mollisol		
Aquoll		
Argiaquoll	Winterset silty clay loam	179*
	Winterset silty clay loam	181*
Udoll		
Argiudoll	Macksburg silty clay loam	73*
MONONA COUNTY		
Entisol		
Aquent		
Fluvaquent	Albaton silty clay	3
Fluvent		
Udifluvent	Haynie silt loam	17
	Modale silt loam	49
Mollisol		
Aquoll		
Haplaquoll	Luton silty clay	31
Udoll		
Hapludoll	Keg silt loam	25
MONROE COUNTY		
Alfisol		
Aqualf		
Ochraqualf	Pershing silt loam	51
Udalf		
Hapludalf	Weller silt loam	75
O'BRIEN COUNTY		
Mollisol		
Aquoll		
Haplaquoll	Marcus silty clay loam, taxadjunct 6/	81*
Udoll		
Hapludoll	Primghar silty clay loam	127*
POLK COUNTY		
Mollisol		
Udoll		
Argiudoll	Sharpsburg silt loam 25/	155*
SHELBY COUNTY		
Alfisol		
Udalf		
Hapludalf	Series not designated (sampled as Adair) 15/	5*
	Series not designated (sampled as Shelby) 20/	171*
Inceptisol		
Aquept		
Haplaquept	Series not designated (sampled as Clarinda) 17/	17*
Mollisol		
Aquoll		
Argiaquoll	Clarinda silty clay 3/	15*
Udoll		
Argiudoll	Adair silty clay loam, silty variant	3*
Hapludoll	Marshall silty clay loam	43
	Marshall silty clay loam	45
	Marshall silty clay loam	47
	Shelby loam, taxadjunct 2/	169*
TAMA COUNTY		
Mollisol		
Udoll		
Argiudoll	Tama silty clay loam	177*

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Classification	Soil Series	Page
WASHINGTON COUNTY		
Alfisol		
Udalf		
Hapludalf	Clinton silt loam	19*
	Clinton silt loam	21*
Mollisol		
Aquoll		
Argiaquoll	Taintor silty clay loam 30/	175*
Udoll		
Argiudoll	Mahaska silty clay loam	77*
	Otley silty clay loam	123*
WAYNE COUNTY		
Alfisol		
Aqualf		
Ochraqualf	Kniffin silt loam	29
	Rathbun silt loam	55
	Series not designated (sampled as Seymour)	57
	Series not designated (sampled as Seymour)	59
	Series not designated (sampled as Seymour)	61
Mollisol		
Alboll		
Argialboll	Edina silt loam	35*
	Humeston silty clay loam	19
	Vesser silt loam	69
Aquoll		
Haplaquoll	Zook silty clay loam	79
Udoll		
Argiudoll	Seymour silt loam	63
	Seymour silt loam	65
	Seymour silt loam	67
WEBSTER COUNTY		
Mollisol		
Aquoll		
Haplaquoll	Marna silty clay loam	33
Udoll		
Hapludoll	Guckeen clay loam	15

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Adair silty clay loam, silty variant	S53IA-83-2	Argiudoll	3*
Albaton silty clay	S70IA-67-5	Fluvaquent	3
Appanoose silt loam	S69IA-4-1	Albaqualf	5
Appanoose silt loam	S69IA-4-3	Albaqualf	7
Arbor silty clay loam, taxadjunct	S56IA-1-1	Hapludoll	7*
Arbor loam, taxadjunct	S56IA-1-2	Hapludoll	9*
Chequest silty clay loam	S71IA-4-2	Haplaquoll	9
Clarinda silty clay	S53IA-83-4	Argiaquoll 3/	15*
Clinton silt loam	Z-1-2-8-(245-254)	Hapludalf	19*
Clinton silt loam	Z-1-2-8-(264-273)	Hapludalf	21*
Clyde silt loam	S56IA-45-4	Haplaquoll	23*
Clyde silt loam	S56IA-45-10	Haplaquoll	25*
Coppock silt loam	S71IA-4-1	Ochraqualf	11
Cresco loam	S56IA-45-1	Argiudoll	27*
Cresco loam	S56IA-45-9	Argiudoll	29*
Dinsdale silty clay loam, taxadjunct	S60IA-7-1	Hapludoll 2/	31*
Dinsdale silty clay loam, taxadjunct	S60IA-38-2	Hapludoll 2/	33*
Edina silt loam	S56IA-93-1	Argialboll	35*
Everly silt loam	S59IA-21-7	Hapludoll	37*
Everly silt loam	S59IA-21-8	Hapludoll	39*
Fayette silt loam	S59IA-22-1	Hapludalf	41*
Fayette silt loam	Z-1-2-8 (223-233)	Hapludalf	43*
Fayette silt loam	Z-1-2-8 (285-295)	Hapludalf	45*
Guckeen clay loam	S64IA-40-3	Hapludoll	13
Guckeen clay loam	S64IA-94-2	Hapludoll	15
Hamburg silt loam	S61IA-36-1	Udorthent	47*
Haynie silt loam	S70IA-67-3	Udifluvent	17
Humeston silty clay loam	S71IA-93-2	Argialboll	19
Ida silt loam	S61IA-36-2	Udorthent	49*
Ida silt loam, taxadjunct	S59IA-43-7	Udorthent 4/	53*
Kamrar clay loam	S64IA-40-1	Hapludoll	21
Kamrar clay loam	S64IA-40-2	Hapludoll	23
Keg silt loam	S70IA-67-2	Hapludoll	25
Kenyon loam	S60IA-9-1	Hapludoll	55*
Kenyon loam	S60IA-9-3	Hapludoll	57*
Klinger silty clay loam	S60IA-9-5	Hapludoll	59*
Klinger silt loam	S60IA-9-6	Hapludoll	61*
Kniffin silt loam	S69IA-4-2	Ochraqualf	27
Kniffin silt loam	S69IA-93-1	Ochraqualf	29
Lourdes loam	S56IA-45-5	Hapludalf	63*
Lourdes loam	S56IA-45-7	Hapludalf	65*
Luton silty clay	S70IA-67-1	Haplaquoll	31
Macksburg silty clay loam, taxadjunct	S61IA-1-1	Hapludoll 2/	67*
Macksburg silty clay loam, taxadjunct	S55IA-1-1	Hapludoll 2/	69*
Macksburg silty clay loam, taxadjunct	S55IA-1-2	Hapludoll 2/	71*
Macksburg silty clay loam	S61IA-61-1	Argiudoll	73*
Mahaska silty clay loam	S61IA-54-1	Argiudoll	75*
Mahaska silty clay loam	S61IA-92-2	Argiudoll	77*
Marcus silty clay loam, taxadjunct	S59IA-21-3	Haplaquoll 5/	79*
Marcus silty clay loam, taxadjunct	S59IA-71-1	Haplaquoll 6/	81*
Marna silty clay loam	S64IA-94-1	Haplaquoll	33
Marna silty clay loam	S64IA-40-4	Haplaquoll	35
Marshall silty clay loam	S63IA-15-1	Hapludoll	37
Marshall silty clay loam	S63IA-15-2	Hapludoll	39
Marshall silty clay loam	S63IA-15-3	Hapludoll	41
Marshall silty clay loam	S63IA-83-1	Hapludoll	43
Marshall silty clay loam	S63IA-83-2	Hapludoll	45
Marshall silty clay loam	S63IA-83-3	Hapludoll	47
Modale silt loam	S70IA-67-4	Udifluvent	49
Monona silt loam, acid variant	S58IA-43-1	Hapludoll	83*
Monona silt loam, shallow carbonate variant	S58IA-43-2	Hapludoll 7/	85*
Monona silt loam	S58IA-43-3	Hapludoll	87*
Monona silt loam	S58IA-43-4	Hapludoll	89*
Monona silt loam	S58IA-43-7	Hapludoll	91*
Monona silt loam	S58IA-43-8	Hapludoll 8/	93*
Monona silt loam, variant	S59IA-43-1	Hapludoll 9/	95*
Monona silt loam, variant	S59IA-43-2	Hapludoll 7/	97*
Monona silt loam, acid variant	S59IA-43-3	Hapludoll 10/	99*

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Series	Soil Survey No. 1/	Classification	Page
Monona silt loam, acid variant	S59IA-43-4	Hapludoll 10/	101*
Monona silt loam, acid variant	S59IA-43-5	Hapludoll 10/	103*
Monona silt loam	S59IA-43-6	Hapludoll 11/	105*
Monona silt loam, variant	S59IA-43-8	Hapludoll 7/	107*
Muscatine silty clay loam	S60IA-6-1 (1-15)	Hapludoll	109*
Muscatine silty clay loam	S60IA-38-1 (1-11)	Hapludoll	111*
Napier silt loam, taxadjunct	S58IA-43-6	Hapludoll 12/	113*
Napier silt loam, variant	S58IA-43-9	Hapludoll 13/	115*
Olmitz silty clay loam, taxadjunct	S56IA-1-3	Hapludoll 14/	117*
Olmitz silty clay loam	S56IA-1-4	Hapludoll	119*
Otley silty clay loam	S61IA-54-2	Argiudoll	121*
Otley silty clay loam	S61IA-92-1	Argiudoll	123*
Pershing silt loam	S69IA-68-2	Ochraqualf	51
Primghar silty clay loam	S59IA-21-4 (1-10)	Hapludoll	125*
Primghar silty clay loam	S59IA-71-2 (1-9)	Hapludoll	127*
Protivin loam	S56IA-45-2 (1-9)	Hapludoll	129*
Protivin loam	S56IA-45-3 (1-11)	Argiudoll	131*
Rathbun silt loam	S69IA-4-4	Ochraqualf	53
Rathbun silt loam	S69IA-93-2	Ochraqualf	55
Readlyn loam	S60IA-9-2 (1-9)	Hapludoll	133*
Readlyn loam	S60IA-9-4 (1-11)	Hapludoll	135*
Riceville loam	S56IA-45-6 (1-11)	Ochraqualf	137*
Riceville loam	S56IA-45-8 (1-10)	Ochraqualf	139*
Sac silty clay loam	S59IA-21-5 (1-8)	Hapludoll	141*
Sac silt loam	S59IA-21-6 (1-8)	Hapludoll	143*
Series not designated (sampled as Adair)	S55IA-83-2	Hapludalf 15/	5*
Series not designated (sampled as Bonair)	S56IA-45-11 (1-10)	Hapludalf 16/	11*
Series not designated (sampled as Bonair)	S56IA-45-12 (1-11)	Hapludalf 16/	13*
Series not designated (sampled as Clarinda)	S55IA-83-1	Haplaquept 17/	17*
Series not designated (sampled as Ida)	S58IA-43-5	Hapludoll 18/	51*
Series not designated (sampled as Seymour)	S62IA-93-1	Ochraqualf	57
Series not designated (sampled as Seymour)	S62IA-93-4	Ochraqualf	59
Series not designated (sampled as Seymour)	S62IA-93-5	Ochraqualf	61
Series not designated (sampled as Shelby)	S56IA-1-10	Eutrochrept 19/	167*
Series not designated (sampled as Shelby)	S53IA-83-3	Hapludalf 20/	171*
Seymour silt loam	S62IA-93-2	Argiudoll	63
Seymour silt loam	S62IA-93-3	Argiudoll	65
Seymour silt loam	S62IA-93-6	Argiudoll	67
Sharpsburg silty clay loam, taxadjunct	S55IA-1-3	Hapludoll 21/	145*
Sharpsburg silty clay loam, taxadjunct	S55IA-1-4	Hapludoll 22/	147*
Sharpsburg silty clay loam	S55IA-1-5	Argiudoll 23/	149*
Sharpsburg silty clay loam, gray subsoil variant	S55IA-1-6	Hapludoll 24/	151*
Sharpsburg silty clay loam, taxadjunct	S56IA-1-11	Hapludoll 21/	153*
Sharpsburg silt loam	S51IA-77-7 (1-9)	Argiudoll 25/	155*
Shelby clay loam, taxadjunct	S56IA-1-5	Hapludoll 26/	157*
Shelby clay loam	S56IA-1-6	Argiudoll	159*
Shelby clay loam, taxadjunct	S56IA-1-7	Hapludoll 26/	161*
Shelby clay loam, taxadjunct	S56IA-1-8	Hapludoll 27/	163*
Shelby clay loam, variant	S56IA-1-9	Hapludoll 28/	165*
Shelby loam, taxadjunct	S55IA-83-3	Hapludoll 2/	169*
Taintor silty clay loam, taxadjunct	S61IA-54-3	Haplaquoll 29/	173*
Taintor silty clay loam	S61IA-92-3	Argiaquoll 30/	175*
Tama silty clay loam	S59IA-86-1	Argiudoll	177*
Vesser silt loam	S71IA-93-3	Argialboll	69
Wadena loam	S59IA-21-1	Hapludoll	71
Wadena loam	S59IA-21-2	Hapludoll	73
Weller silt loam	S69IA-68-1	Hapludalf	75
Weller silt loam	S69IA-59-1	Hapludalf	77
Winterset silty clay loam	S61IA-61-2	Argiaquoll	179*
Winterset silty clay loam	S61IA-61-3	Argiaquoll	181*
Zook silty clay loam	S71IA-93-1	Haplaquoll	79

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SOIL SERIES INDEX

1/ County numbers (the number following "IA" in the Soil Survey No.) are as follows:

1.	Adair	45.	Howard
4.	Appanoose	54.	Keokuk
6.	Benton	61.	Madison
7.	Black Hawk	67.	Monona
9.	Bremer	68.	Monroe
15.	Cass	71.	O'Brien
21.	Clay	77.	Polk
22.	Clayton	83.	Shelby
36.	Fremont	86.	Tama
38.	Grundy	92.	Washington
40.	Hamilton	93.	Wayne
43.	Harrison	94.	Webster

2/ This pedon lacks an argillic horizon and for this reason is considered to be a taxadjunct to the series.

3/ As described, this pedon has a thinner solum than defined for the series and the B2 and B3 horizons are less gleyed. This appears to be an intergrade to the Lamoni series.

4/ This pedon is considered to be a taxadjunct to the Ida series because it is in a coarse-silty family. Ida soils are fine-silty but border the coarse-silty family.

5/ This pedon is considered to be a taxadjunct to the Marcus series because it is in a fine, montmorillonitic family. Marcus soils are fine-silty but commonly occur near the border of the fine family.

6/ This pedon has a mollic epipedon a few inches thicker than allowed in Typic Haplaquolls, and is in a fine family. For these reasons it is considered to be a taxadjunct to the Marcus series. Marcus soils are fine-silty but commonly occur near the border of the fine family. Many Marcus pedons have epipedons that border the thickness limit for the Typic subgroup of Haplaquolls.

7/ This pedon is considered to be a variant of the Monona series because it is shallower to carbonates and has a thinner solum than allowed in the ranges of the series. It was sampled as part of a gully genesis study not as a pedon representative of the series.

8/ Carbonates are essentially leached from the top four horizons of this profile. Since this is a borderline profile it is classified with Typic Hapludolls.

9/ This pedon is considered to be a variant of the Monona series because it is shallower to free carbonates than the defined range for the series. It was sampled as part of a gully genesis study, not as a pedon representative of the series.

10/ Data indicate that this pedon is more acid in the B horizon than the defined range for the series and is leached more deeply. For these reasons it is considered to be an acid variant of the Monona series. The morphology and pH values indicate the influence of forest vegetation. This pedon was sampled as part of a gully genesis study, not as a pedon representative of the series.

11/ This pedon was sampled as part of a gully genesis study, not as a pedon representative of the series.

12/ This pedon has a thicker mollic epipedon than is allowed in the range of the Napier series and is considered as a taxadjunct to the Napier series. It was sampled as a part of a gully genesis study, not as a pedon representative of the series.

13/ Data indicate that this pedon is more acid and has a thicker mollic epipedon than is allowed in the range of the series. For this reason, it is considered to be a variant of the Napier series. It was sampled as part of a gully genesis study, not as a pedon representative of the series. It appears to have been influenced by forest vegetation.

14/ This pedon is considered to be a taxadjunct to the Olmitz series because it is deeper to colors of 4 value and 3 chroma than allowed in the ranges of the series. It was sampled as part of a landscape study, not as a pedon representative of the series.

15/ This pedon lacks a mollic epipedon. The clay content and distribution are within the range of the series. The pH values are higher than typical and are outside the series ranges. This is a common problem in paleosols. See Ruhe, Soil Science, Vol. 82, No. 6, pages 441-455.

16/ The Bonair series was never established. Pedons were selected to represent the fully timbered member of the Cresco-Lourdes biosequence.

17/ This pedon lacks an argillic horizon; it is severely eroded and for this reason lacks a mollic epipedon and is outside the range of the Clarinda series.

18/ This pedon is a slightly eroded member of a gully genesis study which has a mollic epipedon. For this reason it is outside the range of the Ida series. The data show <1 percent $CaCO_3$ in the A1, but no carbonate was recorded in the description; this was not considered sufficient to make the subgroup Entic.

19/ This pedon is shallower to free carbonates than allowed in the ranges of the Shelby series. In addition it is less acid and lacks an argillic horizon and a mollic epipedon. It was sampled as part of a landscape study, not as a pedon representative of the series.

20/ This pedon lacks a mollic epipedon and is in a fine family. For these reasons it is a taxadjunct to the Shelby series.

21/ This pedon is considered to be a taxadjunct to the Sharpsburg series because it lacks an argillic horizon and is in a fine-silty family. It was sampled as part of a landscape study, not as a pedcn representative of the series.

22/ This pedon is considered to be a taxadjunct to the Sharpsburg series because it lacks an argillic horizon and has common low chroma mottles higher in the B horizon than allowed in the series ranges. It was sampled as part of a landscape study, not as a pedon representative of the series.

23/ This pedon has colors of 3 value a few inches deeper than allowed in the series ranges. It was sampled as part of a landscape study, not as a pedon representative of the series.

24/ In addition to having grayer colors in the B horizon than allowed in the ranges of the series, this pedon lacks an argillic horizon and is in a fine-silty family.

25/ As described, this pedon has a solum a few inches thinner than that defined for the Sharpsburg series.

26/ This pedon lacks an argillic horizon and is in a fine family. For these reasons it is considered to be a taxadjunct to the Shelby series. It was sampled as part of a landscape study, not as a pedon representative of the series.

27/ This pedon is considered to be a taxadjunct to the Shelby series because it lacks an argillic horizon and the B horizon is lower in clay than the defined ranges for the series. It was sampled as part of a landscape study, not as a pedon representative of the series.

28/ This pedon is shallower to free carbonates than allowed in the range of the Shelby series.

29/ This pedon has slightly less increase in clay in the B horizon than is required for an argillic horizon

30/ This pedon has colors of 3 value extending a few inches deeper than is presently allowed in the ranges of the series.

SOIL CLASSIFICATION-

SERIES - - - - - - -

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE, MRTSC
SOIL SURVEY INVESTIGATIONS UNIT
LINCOLN, NEBRASKA

SOIL NO- - - - - - - COUNTY - - -

GENERAL METHODS- - - SAMPLE NOS.-

DEPTH IN	HORIZON	PARTICLE SIZE ANALYSIS, LT 2MM, 3A1, 3A1A, 3A1B (PCT LT 2MM) SAND 2-.05	SILT .05-.002	CLAY LT .002	FINE CLAY LT .0002	SAND VCOS 2-1	CORS 1-.5	MEDS .5-.25	FNES .25-.10	VFNS .10-.05	SILT COSI .05-.02	FNSI .02-.002	VFSI .005-.002	FAML TEXT SAND 2-.1	INTR II .2-.02	FINE CLAY TO CLAY	NON-CO3- CLAY PCT	RATIO 8D1 15-BAR TO CLAY
COLUMN 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19

Depth (in.)	Horizon	Size class and particle diameter (mm) — Total: Sand (2-0.05)	Silt (0.05-0.002)	Clay (<0.002)	Fine clay (<0.0002)	Sand: Very coarse (2-1)	Coarse (1-0.5)	Medium (0.5-0.25)	Fine (0.25-0.1)	Very fine (0.1-0.05)	Silt: (0.05-0.02)	Int. III (0.02-0.002)	(0.005-0.002)	Family texture sand (2-0.1	International II (0.2-0.02)	Ratio fine clay to clay	Non-carbonate clay pct	Ratio 15-bar to clay
		Pct of < 2mm																

DEPTH IN	PARTICLE SIZE ANALYSIS, MM, 3B, 3B1, 3B2 VOL. GT 2 PCT	WEIGHT GT 75 PCT	75-20	20-5	5-2	LT .074 PCT (PCT LT 75)	20-2 LT20	BULK DENSITY 4A1D 1/3-BAR G/CC	4A1H OVEN DRY G/CC	4D1 COLE	WATER CONTENT 4B1C 1/10 BAR PCT	4B1C 1/3-BAR PCT	4B2 15-BAR PCT	4C1 WRD CM/CM	CARBONATE 6E1B LT 2 PCT	3A1A LT .002 PCT	PH 8C1A 1/1 H2O	8C1E 1/2 CACL
COLUMN 1	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38

Depth (in.)	Size class and particle diameter (mm) — Volume > 2 pct	Weight > 75 pct	75-20	20-5	5-2	<0.074 Pass 200 mesh	20-2 pct < 20	Bulk density 1/3-bar g/cc	Oven-dry g/cc	COLE	Water content 1/10-bar pct	1/3-bar pct	15-bar pct	1/3-to 15-bar cm/cm (in./in.)	Carbonate as $CaCO_3$ < 2mm pct	<0.002 mm pct	pH (1:1) H_2O	(1:2) $CaCl_2$
		Pct < 75mm																

DEPTH IN	ORGANIC MATTER 6A1A ORGN CARB PCT	6B1A NITG PCT	C/N	IRON 6C2A EXT FE PCT	PHOS 6S1A TOTL PCT	EXTRACTABLE BASES 5B4A (MEQ / 100 G) 6N2E CA	6O2D MG	6P2A NA	6Q2A K	SUM EXTB	ACTY 6H1A BACL TEA	AL 6G1D KCL EXT	CAT EXCH 5A3A EXTB ACTY	5A6A NHAC	RATIO 8D1 NHAC TO CLAY	RATIO 8D3 CA TO MG	CA 5F SAT NHAC PCT	BASE SAT 5C3 EXTB ACTY PCT	5C1 NHAC PCT
COLUMN 1	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57

Depth (in.)	Organic matter: Organic carbon pct	Nitrogen pct	C/N	Ext. iron as Fe pct	Total phosphorus pct	Extractable bases 5B (meq/100g): Ca	Mg	Na	K	Sum extractable bases	Ext. acidity	KCl ext. Al	Cat. exch. cap.: Sum of bases plus acidity	NH_4OAc	Ratio NH_4OAc to clay	Ratio Ca to Mg	Ca saturation NH_4OAc pct	Base saturation: Extractable acidity pct	NH_4OAc CEC pct

DEPTH IN	(SATURATED PASTE) 8E1 REST OHM-CM	8C1B PH	8A H2O PCT	NA 5D2 ESP PCT	NA 5E SAR	SALT 8D5 TOTL SOLU PPM	GYP 6F1A PCT	SATURATION EXTRACT 8A1 (MEQ / LITER) 8A1A EC MMHOS/CM	6N1B CA	6O1B MG	6P1A NA	6Q1A K	6I1A CO3	6J1A HCO3	6K1A CL	6L1A SO4	6M1A NO3	ATTERBERG 4F1 LQID LMIT PCT	4F2 PLST INDX
COLUMN 1	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76

Depth (in.)	Saturated paste: Resistivity ohm-cm	pH	Water at sat. pct	Exch. Na pct	Sodium adsorption ratio	Total soluble salt ppm	Gypsum pct	Saturation extract: Electrical conductivity mmhos/cm	Ca (meq/liter)	Mg	Na	K	CO_3	HCO_3	Cl	SO_4	NO_3	Atterberg: Liquid limit pct	Plastic index

Remarks: EXAMPLE DATA SHEET HEADINGS--This page alternates computer data sheet headings with printed data sheet headings and column numbers. Column numbers refer to more complete column headings on an adjoining page.

COLUMN HEADINGS FOR COMPUTER
PRINTED DATA SHEETS

Column	
1	Depth in centimeters
2	Horizon
	Columns 3 through 16 display numbers which are percents of the total weight of particles 2 millimeters or less in size.
3	Total sand (particles range from .05 to 2 millimeters)
4	Total silt (particles range from .002 to .05 millimeter)
5	Total clay (particles are smaller than .002 millimeter)
6	Total fine clay (particles are smaller than .0002 millimeter)
7	Very coarse sand (particles range from 1 to 2 millimeters)
8	Coarse sand (particles range from 0.5 to 1 millimeter)
9	Medium sand (particles range from 0.25 to 0.5 millimeter)
10	Fine sand (particles range from 0.1 to 0.25 millimeter)
11	Very fine sand (particles range from .05 to 0.1 millimeter)
12	Coarse silt (particles range from .02 to .05 millimeter)
13	Fine silt (particles range from .002 to .02 millimeter; these limits also define the range of total silt on the International Soil Science Society Scale.)
14	Very fine silt (particles range from .002 to .005 millimeter)
15	Family texture sand (particles range from 0.1 to 2 millimeters)
16	International II (particles range from .02 to 0.2 millimeter; these limits define the range of the fine sand on the International Soil Science Society Scale.)
17	Fine clay to clay (this is the ratio of fine clay to total clay expressed as percent.)
18	Noncarbonate clay (this is the percentage of total clay, column 5, minus the percentage of carbonate clay, column 36.)
19	Ratio of 15-bar water percentage to total clay percentage
20	Volume of material greater than 2 millimeters given as a percent of total (sample volume)
21	Greater than 75 millimeter material given as a percent of total sample weight
22	Particle size range from 20 to 75 millimeters given as a weight percent of all material 75 millimeters or less in the sample
23	Particle size range from 5 to 20 millimeters given as a weight percent of all material 75 millimeters or less in the sample
24	Particle size range from 2 to 5 millimeters given as a weight percent of all material 75 millimeters or less in the sample
25	Particle size range less than .074 millimeter given as a weight percent of all material 75 millimeters or less
26	Particle size range from 2 to 20 millimeters given as a weight percent of all material 20 millimeters or less
27	Bulk density of soil desorbed to 1/3-bar given in grams per cubic centimeter
28	Bulk density of oven dry soil given in grams per cubic centimeter
29	Coefficient of linear extensibility
30	Water content of soil desorbed to 1/10-bar given as a percent of oven dry weight
31	Water content of soil desorbed to 1/3-bar given as a percent of oven dry weight
32	Water content of soil fragments desorbed to 15 bars given as a percent of oven dry weight
33	Water retention difference given in centimeter per centimeter
34	Column used for any water content measurement different from those given in columns 30 through 33
35	Carbonate content of the material 2 millimeters or less given as a percent
36	Carbonate content of the material .002 millimeter or less given as a percent
37	pH of a 1:1 suspension of soil in distilled water
38	pH of a 1:2 suspension of soil in .01 M $CaCl_2$
39	Organic carbon given as a percent
40	Nitrogen given as a percent
41	Organic carbon to nitrogen ratio
42	Extractable iron given as a percent
43	Total phosphorus given as a percent
44	Extractable calcium given in milliequivalents per 100 grams of soil
45	Extractable magnesium given in milliequivalents per 100 grams of soil
46	Extractable sodium given in milliequivalents per 100 grams of soil
47	Extractable potassium given in milliequivalents per 100 grams of soil
48	Sum of the extractable bases given in milliequivalents per 100 grams of soil
49	Acidity - barium chloride with triethanolamine measurement - given in milliequivalents per 100 grams or soil
50	Aluminum - potassium chloride extraction - given in milliequivalents per 100 grams of soil
51	Cation exchange capacity by sum of the extractable bases plus the acidity given in milliequivalents per 100 grams of soil
52	Cation exchange capacity as measured by ammonium acetate given in milliequivalents per 100 grams of soil
53	Ratio of ammonium acetate cation exchange capacity to total clay
54	Ratio of extractable calcium to extractable magnesium
55	Calcium saturation of the ammonium acetate cation exchange capacity given as a percent
56	Base saturation - sum of the extractable bases divided by the acidity plus the sum of the extractable bases - given as a percent
57	Base saturation - sum of the extractable bases divided by the ammonium acetate cation exchange capacity - given as a percent
58	Saturated paste (soil plus water) resistivity given in ohm-cm
59	Saturated paste (soil plus water) pH
60	Saturated paste (soil plus water) water content given as a percent
61	Exchangeable sodium percentage
62	Sodium adsorption ratio

Continued

COLUMN HEADINGS FOR COMPUTER
PRINTED DATA SHEETS

Column	
63	Total soluble salt given in parts per million
64	Gypsum given in percent
65	Electrical conductivity of the saturation extract given in mmhos per centimeter
66	Calcium content of the saturation extract given in milliequivalents per liter
67	Magnesium content of the saturation extract given in milliequivalents per liter
68	Sodium content of the saturation extract given in milliequivalents per liter
69	Potassium content of the saturation extract given in milliequivalents per liter
70	Carbonate (CO_3) content of the saturation extract given in milliequivalents per liter
71	Bicarbonate (HCO_3) content of the saturation extract given in milliequivalents per liter
72	Chloride content of the saturation extract given in milliequivalents per liter
73	Sulfate (SO_4) content of the saturation extract given in milliequivalents per liter
74	Nitrate (NO_3) content of the saturation extract given in milliequivalents per liter
75	Liquid limit given as percent water - percentage basis is soil material less than 0.4 millimeter
76	Plastic index

ATTERBERG LIMITS DATA FOR SOME PEDONS IN SSIR NO. 3

Soil No.	Depth in.	Horizon	LL[1]	PI[1]	Page No. of SSIR No. 3
S56IA-1-2	6-12	A12	28	9	8
	23-30	IIB23	33	12	
S59IA-21-3	0-7	A1p	60	30	78
	17-24	B21	55	31	
	41-55	IIC	48	28	
S59IA-21-4	0-7	A1p	54	21	124
	21-30	B22	49	26	
	47-60	IIC3	37	19	
S59IA-21-5	0-7	A1p	48	18	140
	11-18	B1	48	21	
	44-57	IIC	43	23	
S59IA-21-7	0-7	A1p	40	15	36
	16-22	B21	44	20	
	40-50	IIC1	40	20	
S60IA-6-1	0-7	A1	46	20	108
	22-29	B21	51	26	
	46-52	C1	41	22	
S60IA-9-1	0-5	A1p	31	12	54
	25-33	B22	33	16	
	54-62	C1	31	17	
S60IA-9-2	0-8	A1p	39	15	132
	30-37	IIB23	35	20	
	44-50	IIC1	29	15	
S60IA-9-4	0-9	A1p	38	16	134
	23-32	IIB22/IIB23	37	21	
	43-58	IIC1/C2	30	16	
S60IA-9-3	0-5	A1p1	29	11	56
	24-30	B22	33	19	
	45-55	B32	32	18	
S60IA-9-5	0-9	A1	44	17	58
	19-26	B21	43	23	
	31-40	IIB31/IIB32	32	17	
S60IA-9-6	0-7	A1p	44	17	60
	23-28	B21	40	21	
	40-50	IIC1	28	14	
S60IA-38-1	0-7	A1p	49	21	110
	23-30	B21	50	28	
	53-60	C2	36	17	
S60IA-38-2	0-6	A1p	29	16	32
	16-21	B21	46	25	
	37-44	IIB32	34	20	
	48-58	IIC1	27	14	
S61IA-36-1	2-10	C1	31	7	46
	24-54	C3/C4	30	6	
S61IA-54-1	0-7	A1p	43	18	74
	24-30	B21	60	34	
	51-61	B32	46	26	
S61IA-54-2	0-12	A1p/A12	43	19	120
	17-32	B21/B22/B23	52	26	
	46-73	B32/B33/C1	44	23	
S61IA-54-3	0-6	A1p	56	29	172
	22-28	B21	62	39	
	40-50	B32	49	29	
S61IA-61-1	0-6	A1p	44	18	72
	24-30	B21	57	31	
	42-62	B31	49	28	
S61IA-61-2	0-7	A1p	41	18	178
	24-28	B22	58	35	
	56-75	C1/C2/C3	48	27	

[1] Iowa State Highway Commission data.

SOIL CLASSIFICATION-VERTIC FLUVAQUENT
VERY FINE, MONTMORILLONITIC (CALCAREOUS), MESIC
SERIES - - - - - - -ALBATON

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE, MTSC
NATIONAL SOIL SURVEY LABORATORY
LINCOLN, NEBRASKA

SOIL NO - - - - - - S70IA-67-5 COUNTY - - - MONONA

GENERAL METHODS- - -1A,1B1B,2A1,2B SAMPLE NOS. 70L1159-70L1166

NOVEMBER 1975

DEPTH CM	HORIZON	SAND 2-.05	SILT .05-.002	CLAY LT .002	FINE CLAY LT .0002	VCOS 2-1	CORS 1-.5	MEDS .5-.25	FNES .25-.10	VFNS .10-.05	COSI .05-.02	FNSI .02-.002	VFSI .005-.002	FAML TEXT SAND 2-.1	INTR II .2-.02	FINE CLAY TO CLAY PCT	NON-CO3-CLAY PCT	RATIO 8D1 15-BAR TO CLAY
		(- - - PARTICLE SIZE ANALYSIS, LT 2MM, 3A1, 3A1A, 3A1B - - -)																
		(- - - PCT LT 2MM - - -)																
000-23	AP	.9	40.5	58.6	27.2	TR	TR	TR	.1	.8	8.2	32.3	12.5	.1	9.0	46		.38
023-48	C1G	.4	36.1	63.5	24.0	.0	.0	.0	TR	.4	3.1	33.0	14.7	.0	3.5	38		.37
048-74	C2G	.5	30.9	68.6	26.0	.0	.0	.0	TR	.5	1.8	29.1	14.6	.0	2.3	38		.36
074-100	C3G1	.4	37.2	62.4	23.6	.0	.0	TR	TR	.4	3.9	33.3	14.5	.0	4.3	38		.38
100-142	C3G2	.2	43.8	56.0	19.0	.0	.0	.0	TR	.2	2.1	41.7	14.7	.0	2.3	34		.41
142-175	C4G	.2	27.7	72.1	25.9	.0	TR	.0	TR	.2	2.0	25.7	14.7	.0	2.2	36		.37
048-60	C2G(A)	.5	26.8	72.7	28.4	.0	.0	.0	TR	.5	2.5	24.3	15.1	.0	3.0	39		.34
060-74	C2G(A)	.5	33.4	66.1	25.9	.0	TR	.0	TR	.5	2.4	31.0	14.7	.0	2.9	39		.36

DEPTH CM	VOL. GT 2 PCT	GT 75 PCT	75-20	20-5	5-2	LT .074	20-2 PCT LT20	4A1D 1/3-BAR G/CC	4A1H OVEN DRY G/CC	4D1 COLE	4B1C 1/10 BAR PCT	4B1C 1/3-BAR PCT	4B2 15-BAR PCT	4C1 WRD CM/CM		CARBONATE 6E1B LT 2 PCT	3A1A LT .002 PCT	PH 8C1A 1/1 H2O	PH 8C1E 1/2 CACL
	(PARTICLE SIZE ANALYSIS, MM, 3B, 3B1-3B2)	(- WEIGHT -)	(- - PCT LT 75 - - -)					(BULK DENSITY)			(- - - WATER CONTENT - - -)								
000-23	0	0	0	0	0	100	0	1.20B					22.1			TR	0	7.5	7.2
023-48	0	0	0	0	0	100	0	1.26	1.72	.109	37.3	36.1	23.5	.16	1.8C	TR	0	7.6	7.4
048-74	0	0	0	0	0	100	0	1.30B					24.5			TR	0	7.5	7.4
074-100	0	0	0	0	0	100	0	1.26	1.75	.116	38.1	35.9	23.7	.15	2.1C	2	0	7.6	7.5
100-142	0	0	0	0	0	100	0	1.25	1.77	.123	37.8	36.5	22.8	.17	1.6C	3	0	7.7	7.6
142-175	0	0	0	0	0	100	0	1.21	1.79	.140	41.5	40.6	26.5	.17	2.3C	2	0	7.6	7.6
048-60	0	0	0	0	0	100	0						25.0			TR	0	7.4	7.4
060-74	0	0	0	0	0	100	0						23.5			1	0	7.4	7.3

DEPTH CM	(ORGANIC MATTER) 6A1A ORGN CARB PCT	6B1A NITG PCT	C/N	IRON 6C2A EXT FE PCT	PHOS 6S1A TOTL PCT	6N2E CA	6O2D MG	6P2A NA	6Q2A K	SUM EXTB	ACTY 6H1A BACL TEA	AL 6G1D KCL EXT	(CAT EXCH) 5A3A EXTB ACTY	5A6A NHAC	RATIO 8D1 NHAC TO CLAY	RATIO 8D3 CA TO MG	CA 5F SAT NHAC PCT	(BASE-SAT) 5C3 EXTB ACTY PCT	5C1 NHAC PCT
						(- -EXTRACTABLE BASES 5B4A- -)				(- - - MEQ / 100 G- - -)									
000-23	2.07D	.210	10	1.3		34.2E	7.8E	.2	1.8	44.0				40.4	.69				
023-48	.96	.113	8	1.4		32.4E	6.0E	.2	1.6	40.2				38.7	.61				
048-74	.66	.086	8	1.3		35.8E	8.1E	.3	1.7	45.9				43.1	.63				
074-100	.59	.075	8	1.3		33.4E	7.6E	.3	1.6	42.9				39.7	.64				
100-142	.57			1.3		31.5E	7.3E	.3	1.5	40.6				36.0	.64				
142-175	.48			1.3		34.7E	10.0E	.4	1.7	46.8				42.8	.59				
048-60	.71			1.4		36.6E	7.8E	.2	1.7	46.3				45.8	.63				
060-74	.61			1.3		34.9E	7.6E	.3	1.6	44.4				41.2	.62				

DEPTH CM	(SATURATED PASTE) 8E1 REST OHM-CM	8C1B PH	8A H2O PCT	NA 5D2 ESP PCT	NA 5E SAR	SALT 8D5 TOTL SOLU PPM	GYP 6F1A PCT	8A1A EC MMHOS/CM	6N1B CA	6O1B MG	6P1A NA	6Q1A K	6I1A CO3	6J1A HCO3	6K1A CL	6L1A SO4	6M1A NO3	ATTERBERG 4F1 LQID LMIT PCT	4F2 PLST INDX
									(- - SATURATION EXTRACT 8A1- - MEQ / LITER - -)										
000-23																		75F	49
023-48																			
048-74																			
074-100	1200	7.3	81.8	1		250		.48	3.1	.9	.3	.4						78F	52
100-142																		80F	55
142-175																			
048-60																			
060-74																			

MICROMORPHOLOGY (4E1).
74-100 CM C3G1 CLAY EXHIBITS WEAK ORIENTATION. PRESSURE ORIENTATION LIMITED TO THIN ZONES ALONG CRACKS. DUSKY BLACK PLASMA THAT STRONGLY MASKS CLAY INTERFERENCE COLOR IS COMMON. PERPENDICULAR TO THE BEDDING HAVE BANDS RELATIVELY FREE OF THESE DUSKY BLACK CONCENTRATIONS INTERSPERSED WITH BANDS WHERE THE MAJORITY OF THE FABRIC SHOWS THIS CONDITION. DISCRETE CARBONATE GRAINS ARE UNIFORMLY DISTRIBUTED. BLACK OPAQUE GR AINS, .02-.05 MM, ARE COMMON.
142-175 CM C4G INTERFERENCE COLOR MASKED OVER MOST OF THIN SECTION BY DUSKY BLACK PLASMA.

CLAY MINERALOGY (7A2C).
048-74 MT3 KK2 MI2.
142-175 MT3 KK2 MI1 MC1.
COMMENTS - MONTMORILLONITE BORDERS ON ABUNDANT, IS WELL-ORDERED. PLACEMENT IS MONTMORILLONITIC.
RELATIVE AMOUNTS - (X-RAY) 5 = DOMINANT 4 = ABUNDANT 3 = MODERATE 2 = SMALL 1 = TRACE.
MINERAL CODE - MT = MONTMORILLONITE MI = MICA KK = KAOLINITE MC = MONTMORILLONITE-CHLORITE.

(A) UPPER AND LOWER PORTIONS OF C2G HORIZON ANALYZED SEPARATELY.
(B) ESTIMATED.
(C) MICRO-PENETRATION RESISTANCE - A ROD 0.6 CM DIA IS SLOWLY PUSHED INTO BULK DENSITY CLOD, EQUILIBRATED AT 1/10 BAR, A DISTANCE OF 0.6 CM USING A POCKET PENETROMETER. UNITS ARE FORCE (KG) AND NOT ESTIMATES OF UNCONFINED COMPRESSIVE STRENGTH.
(D) ORGANIC CARBON IS 13 KG/M SQ TO A DEPTH OF 1 M (6A).
(E) METHODS 6N4C FOR CA AND 6O4C FOR MG.
(F) BY IOWA STATE HWY COMM, AMES, IA.
(G) BY SOIL TESTING LAB, IOWA STATE UNIV, AMES, IA.

DEPTH CM	AVAILABLE P LBS PER ACRE (G)	AVAILABLE K LBS PER ACRE (G)
000-23	83	681
023-36	10	442
036-48	9	469
048-64	16	481
064-79	11	491
079-99	10	449
099-114	9	359
114-130	10	359
130-142	9	384

Pedon classification: Vertic Fluvaquent; very fine, montmorillonitic (calcareous), mesic.
Series classification: Vertic Fluvaquent; fine, montmorillonitic, mesic1/.
Soil: Albaton silty clay.
Soil no.: S70-Iowa-67-5 (LSL Nos. 70L1159 - 70L1164).
Location: Monona County, Iowa; about 5 miles west of Onawa, Iowa, 400 feet north and 40 feet east of the southwest corner of sec. 3, T. 83 N., R. 46 W.
Vegetation and Alfalfa; cropland.
Parent material: Recent, calcareous, clayey, alluvial sediments.
Physiography: Nearly level bottomland in Missouri River bottom. Site about 1½ miles east and 1 mile north of Missouri River and about 12 miles west of uplands.
Relief: Nearly level.
Slope: Less than 0.5 percent.
Drainage: Poorly drained.
Erosion: None.
Ground water: None at time of sampling, area seldom flooded, area was subject to flooding prior to construction of large dams on the Missouri River.
Permeability: Very slow.
Described by: J. R. Culver, C. S. Fisher, J. R. Worster, and F. F. Riecken; October 28, 1970.

(Colors are for moist conditions unless otherwise stated)

Ap 70L1159 0 to 23 cm (0 to 9 inches). Very dark grayish brown (10YR to 2.5Y 3/2) silty clay, grayish brown (10YR 2.5Y 5/2) dry; moderate very fine angular and subangular blocky structure; firm; few spots of black to very dark gray decayed organic matter; slightly effervescent; mildly alkaline; clear smooth boundary.

C1g 70L1160 23 to 48 cm (9 to 19 inches). Dark grayish brown (2.5Y 4/2) silty clay, faces of peds very dark grayish brown (2.5Y 3/2), few fine faint olive brown (2.5Y 4/4) mottles; strong fine and very fine blocky structure, appears to be recent deposition as structure is approaching rock structure; firm; slightly effervescent; mildly alkaline; clear smooth boundary.

C2g 70L1161 48 to 74 cm (19 to 29 inches). Mottled gray (5Y 5/1) and dark yellowish brown (10YR 4/4) silty clay, few very pale brown (10YR 7/3) coatings on horizontal plates; massive to weak very fine blocky and subangular blocky structure; firm; few thin bands or strata of dark yellowish brown (10YR 4/4); few snail shells and fragments of snail shells; slightly effervescent; moderately alkaline; gradual smooth boundary.

C3g 70L1162 70L1163 74 to 142 cm (29 to 56 inches). Grayish brown (2.5Y 5/2) silty clay, common fine and medium distinct gray (5Y 5/1) and common fine and medium prominent yellowish brown (10YR 5/4) mottles; strong very fine blocky structure; firm; slightly to strongly effervescent; moderately alkaline; gradual smooth boundary.

C4g 70L1164 142 to 175 cm (56 to 70 inches). Grayish brown (5Y 5/2) silty clay, few fine distinct gray (5Y 5/1) mottles; massive; firm; dark grayish brown (5Y 4/2) shiny surfaces of slickensides, few very pale brown (10YR 7/3) coatings on slickenside surfaces that are strongly effervescent; few fine dark reddish brown stains along old root channels; slightly effervescent; mildly alkaline.

1/The data indicate that this type location is very fine rather than fine because its clay content averages more than 60 percent in the 10 to 40 inch control section.

SOIL CLASSIFICATION-MOLLIC ALBAQUALF
FINE, MONTMORILLONITIC, MESIC
SERIES - - - - - - -APPANOOSE

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE NRTSC
SOIL SURVEY INVESTIGATIONS UNIT
LINCOLN, NEBRASKA

SOIL NO - - - - - - S691OWA-4-1 COUNTY - - - APPANOOSE

GENERAL METHODS- - -1A2A,1B1B,1B2,1B SAMPLE NOS. 69L971-69L980

DEPTH CM	HORIZON	PARTICLE SIZE ANALYSIS, LT 2MM, 3A1, 3A1A, 3A1B (PCT LT 2MM) SAND 2-.05	SILT .05-.002	CLAY LT .002	FINE CLAY LT .0002	VCOS 2-1	CORS 1-.5	MEDS .5-.25	FNES .25-.10	VFNS .10-.05	COSI .05-.02	FNSI .02-.002	VFSI .005-.002	FAML TEXT SAND 2-.1	INTR II .2-.02	RATIO FINE CLAY TO CLAY PCT	RATIO NON-CO3-CLAY PCT	RATIO 8D1 15-BAR TO CLAY
000-020	AP	2.6A	77.7	19.7		.3	1.0	.6	.4	.3	35.4	42.3		2.3	35.8			.44
020-030	A21	2.8A	74.1	23.1		.4	1.2	.6	.3	.3	30.8	43.3		2.5	31.2			.39
030-041	A22	3.3A	71.3	25.4		.5	1.7	.6	.3	.2	29.3	42.0		3.1	29.7			.39
041-043	B1	3.9A	68.2	27.9		1.1	1.7	.5	.3	.3	27.2	41.0		3.6	27.6			.39
043-053	B21TG	1.5A	46.0	52.5		.2	.5	.3	.3	.2	17.5	28.5		1.3	17.8			.41
053-069	B22TG	.8A	42.1	57.1		.1	.2	.2	.1	.2	15.7	26.4		.6	15.9			.44
069-084	B23TG	1.2A	46.6	52.2		.1	.3	.2	.3	.3	17.5	29.1		.9	18.0			.45
084-107	B31TG	.9A	54.2	44.9		.1	.2	.2	.2	.2	20.0	34.2		.7	20.2			.47
107-142	B32TG	.9A	61.1	38.0		.1	.2	.1	.2	.3	23.1	38.0		.6	23.5			.51
142-165	C	.8	64.8	34.4		TR	.2	.1	.2	.3	24.4	40.4		.5	24.8			.50

DEPTH CM	(PARTICLE SIZE ANALYSIS, MM, 3B, 3B1, 3B2) VOL. WEIGHT GT 2 PCT	GT 75 PCT	75-20	20-5	5-2 (PCT LT 75)	LT .074	20-2 PCT LT20	BULK DENSITY 4A1D 1/3-BAR G/CC	4A1H OVEN DRY G/CC	4D1 COLE	4B1C 1/10 BAR PCT	4B1C 1/3-BAR PCT	4B2 15-BAR PCT	WATER CONTENT 4C1 WRD CM/CM		AVAIL P 2/ LBS/ACRE	PH 8C1A 1/1 H2O	PH 8C1E 1/2 CACL
000-020	0	0	0	0	0	98	0	1.53	1.43	.019	30.8	29.1	8.7	.28	0.6C	9.5	6.1	5.6
020-030	0	0	0	0	0	97	0	1.37	1.45	.019	29.0	27.4	9.1	.25	0.6C	8.5	5.2	4.6
030-041	0	0	0	0	0	97	0	1.39	1.47	.019	28.8	26.6	9.9	.23	0.6C	9.0	5.2	4.4
041-043	0	0	0	0	0	96	0	1.40B					10.8			9.2	5.1	4.4
043-053	0	0	0	0	0	99	0	1.26	1.86	.139	39.7	37.8	21.7	.20	1.6C	4.0	5.1	4.6
053-069	0	0	0	0	0	99	0	1.25	1.96	.162	41.8	40.4	25.2	.19	1.5C	11.5	5.1	4.8
069-084	0	0	0	0	0	99	0	1.30B					23.7			37.5	5.2	5.1
084-107	0	0	0	0	0	99	0	1.37	1.93	.121	34.8	33.8	21.2	.17	1.8C	65.5	5.6	5.4
107-142	0	0	0	0	0	99	0	1.41	1.83	.091	34.3	30.8	19.2	.16	0.9C	65.5	6.1	5.8
142-165	0	0	0	0	0	99	0	1.38	1.67	.066	35.7	33.0	17.2	.22	1.0C	26.5	6.1	5.8

DEPTH CM	(ORGANIC MATTER) 6A1A ORGN CARB PCT	6B1A NITG PCT	C/N	IRON 6C2A EXT FE PCT	PHOS 6S1A TOTL PCT	(EXTRACTABLE BASES 5B4A) 6N2E CA (MEQ)	6O2D MG	6P2A NA	6Q2A K	SUM EXTB / 100	ACTY 6H1A BACL TEA G	AL 6G1D KCL EXT	(CAT EXCH) 5A3A EXTB ACTY	5A6A NHAC	RATIO 8D1 NHAC TO CLAY	RATIO 8D3 CA TO MG	CA 5E SAT NHAC PCT	(BASE SAT) 5C3 EXTB ACTY PCT	5C1 NHAC PCT
000-020	1.71D	.154	11			12.7	1.9	0.2	0.2	15.0	6.5		21.5	17.8	0.90	6.7	71	70	84
020-030	0.97	.092	11			7.3	2.2	0.3	0.2	10.0	9.4	0.6	19.4	15.9	0.69	3.3	46	52	63
030-041	0.68	.072	9			6.9	2.8	0.4	0.3	10.4	9.6	1.1	20.0	16.6	0.65	2.5	42	52	63
041-043	0.60	.068	9			7.7	3.6	0.6	0.3	12.2	9.5	1.1	21.7	18.3	0.66	2.1	42	56	67
043-053	0.88	.104	8			17.5	8.7	1.6	0.8	28.6	13.8	1.3	42.4	37.5	0.71	2.0	47	67	76
053-069	0.73	.095	8			21.6	10.3	2.2	0.9	35.0	12.4	0.8	47.4	41.0	0.72	2.1	53	74	85
069-084	0.57					21.7	10.3	2.4	0.8	35.2	9.9	0.3	45.1	38.8	0.74	2.1	56	78	91
084-107	0.32					19.5	9.9	2.2	0.6	32.2	6.7		38.9	33.9	0.76	2.0	58	83	95
107-142	0.12					17.9	9.0	2.0	0.6	29.5	5.1		34.6	29.9	0.79	2.0	60	85	99
142-165	0.08					16.3	7.9	1.8	0.6	26.6	4.5		31.1	26.9	0.78	2.1	61	86	99

(A) FE/MN NODULES COMPRISE MORE THAN 75 PCT OF THE SAND.
(B) BULK DENSITY ESTIMATED FOR HORIZONS FROM 43-53 AND 69-84 CM.
(C) MICRO-PENETRATION RESISTANCE - A ROD 0.6 CM DIA IS SLOWLY PUSHED INTO BULK DENSITY CLOD, EQUILIBRATED AT 1/10- BAR, A DISTANCE OF 0.6 CM USING A POCKET PENETROMETER. UNITS ARE FORCE (KG) AND NOT ESTIMATES OF UNCONFINED COMPRESSIVE STRENGTH.
(D) ORGANIC CARBON IS 12 KG PER SQ M TO A DEPTH OF 1 METER (METHOD 6A).
(E) IOWA STATE UNIVERSITY DATA.

Pedon classification: Mollic Albaqualf; fine, montmorillonitic, mesic.
Series classification: (Same as pedon).
Soil: Appanoose silt loam.
Soil no.: S69-Iowa-4-1 (LSL Nos. 69L971 - 69L980).
Location: Appanoose County, Iowa; 50 feet east and 1,008 feet north of the southeast corner of the SW¼ SW¼ Sec. 35, T. 68 N., R. 19 W.
Vegetation and land use: Orchardgrass and bluegrass meadow; cropland.
Parent material: Partly from deoxidized and leached and partly from oxidized and leached Wisconsin loess.
Physiography: Stable, nearly level upland divide between the drainage of two small streams--divide less than 1/4 mile in width.
Relief: Plane to slightly concave.
Slope: Less than 1 percent.
Drainage: Poorly drained.
Ground water: None within 65 inches.
Erosion: Slight.
Permeability: Very slow.
Described by: J. R. Culver, J. D. Highland, T. E. Fenton; November 3, 1969.

(Colors are for moist conditions unless otherwise stated)

Ap 69L971 0 to 20 cm (0 to 8 inches). Very dark gray (10YR 3/1) silt loam, very dark grayish brown (10YR 3/2) kneaded, grayish brown (10YR 5/2) dry; cloddy breaking to moderate fine and medium platy structure; friable; common fine roots; slightly acid; clear smooth boundary.

A21 69L972 20 to 30 cm (8 to 12 inches). Dark gray (10YR 4/1) and very dark gray (10YR 3/1) silt loam, grayish brown (10YR 4/2) kneaded, light gray (10YR 7/2) dry; few fine distinct dark yellowish brown (10YR 4/4) mottles and few fine faint light olive brown (2.5Y 5/4) mottles; moderate medium platy structure; friable; thin discontinuous light gray (10YR 7/1 dry) silt coatings on plates; few fine soft dark brown (7.5YR 4/4) accumulations of oxides; few fine roots; strongly acid; clear smooth boundary.

A22 69L973 30 to 41 cm (12 to 16 inches). Grayish brown (10YR 5/2) heavy silt loam, few very dark gray (10YR 3/1) coats on faces of peds, few fine distinct yellowish brown (10YR 5/6) mottles, light gray (10YR 7/1 dry) silt coats on faces of peds; weak coarse prismatic structure parting to weak fine subangular blocky; friable; few fine soft dark reddish brown (5YR 2/2) accumulations of oxides; few fine roots; few small wormcasts; strongly acid; clear smooth boundary.

B1 69L974 41 to 43 cm (16 to 17 inches). Grayish brown (2.5Y 5/2) silty clay loam; continuous white (10YR 8/1) dry silt coatings on faces of peds; few to common fine faint yellowish brown (10YR 5/6) mottles and few fine distinct strong brown (7.5YR 5/6) mottles; moderate fine subangular and angular blocky structure; firm; thin discontinuous dark gray (10YR 4/1) clay films; few fine black (10YR 2/1) Fe-Mn coatings on faces of peds; few fine soft reddish brown (5YR 2/2) accumulations of oxides; strongly acid; abrupt smooth boundary.

B21tg 69L975 43 to 53 cm (17 to 21 inches). Dark gray (10YR 4/1) with streaks of very dark gray (10YR 3/1) silty clay; common fine distinct yellowish brown (10YR 5/6) mottles and few fine faint light olive brown (2.5Y 5/4) mottles; moderate fine and very fine angular and subangular blocky structure; very firm; continuous thick clay films on faces of peds; few fine soft dark reddish brown (5YR 3/2) accumulations of oxides; strongly acid; gradual smooth boundary.

B22tg 69L976 53 to 69 cm (21 to 27 inches). Dark grayish brown (2.5Y 4/2) silty clay; dark gray (10YR 4/1) coatings; common fine prominent yellowish brown (10YR 5/6) mottles; moderate fine angular and subangular blocky structure; very firm; moderately thick continuous clay films on faces of peds; few fine soft dark reddish brown (5YR 3/2) accumulations of oxides; strongly acid; gradual smooth boundary.

B23tg 69L977 69 to 84 cm (27 to 33 inches). Grayish brown (2.5Y 5/2) silty clay; few dark gray (10YR 4/1) coatings on faces of peds, common fine faint light olive brown (2.5Y 5/4) mottles, common medium prominent yellowish brown (10YR 5/6) and strong brown (7.5YR 5/6) mottles; moderate medium and fine subangular blocky structure; firm; discontinuous dark gray (10YR 4/1) clay films; few fine soft dark reddish brown (5YR 3/2) oxide and Fe-Mn accumulations; medium acid; gradual smooth boundary.

B31tg 69L978 84 to 107 cm (33 to 42 inches). Light brownish gray (2.5Y 6/2) light silty clay; few fine distinct yellowish brown (10YR 5/6) mottles; common medium prominent strong brown (7.5YR 5/6) mottles; weak coarse prismatic structure parting to weak fine to medium subangular blocky structure; firm; deoxidized and leached weathering zone; thin discontinuous dark gray (10YR 4/1) clay films; few fine soft dark reddish brown (5YR 3/2) and brown (7.5YR 4/4) accumulations of oxides; few light gray (10YR 7/1) silt coats on prism faces; common soft Fe-Mn accumulations; very few roots; medium acid; gradual smooth boundary.

B32tg 69L979 107 to 142 cm (42 to 56 inches). Olive gray (5Y 5/2) heavy silty clay loam, common fine to medium prominent strong brown (7.5YR 5/6) mottles, few medium prominent yellowish red (5YR 4/6) mottles; weak medium to coarse angular and subangular blocky structure; firm; deoxidized and leached weathering zone; thin discontinuous very dark gray (10YR 3/1) clay films on faces of peds and dark gray (10YR 4/1) clay-filled root channels; few fine soft dark reddish brown (5YR 3/2) accumulations of oxides; common Fe-Mn stains and concretions; slightly acid; gradual smooth boundary.

C 69L980 142 to 165 cm (56 to 67 inches). Light gray (2.5Y 7/2) light silty clay loam, many medium prominent strong brown (7.5YR 5/6) mottles; weak coarse prismatic structure to massive; deoxidized and leached weathering zone; few grayish brown (2.5Y 5/2) colloid stains on ped faces; few fine soft dark reddish brown (5YR 3/2) accumulations of oxides; numerous very fine voids; slightly acid.

SOIL CLASSIFICATION-MOLLIC ALBAQUALF
FINE, MONTMORILLONITIC, MESIC
SERIES - - - - - - -APPANOOSE

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE NRTSC
SOIL SURVEY INVESTIGATIONS UNIT
LINCOLN, NEBRASKA

SOIL NO - - - - - - S69IOWA-4-3 COUNTY - - - APPANOOSE

GENERAL METHODS- - -1A2A,1B1B,1B2,1B SAMPLE NOS. 69L981-69L989

DEPTH CM	HORIZON	PARTICLE SIZE ANALYSIS, LT 2MM, 3A1, 3A1A, 3A1B (PCT LT 2MM) SAND 2-.05	SILT .05-.002	CLAY LT .002	FINE CLAY LT .0002	VCOS 2-1	CORS 1-.5	MEDS .5-.25	FNES .25-.10	VFNS .10-.05	COSI .05-.02	FNSI .02-.002	VFSI .005-.002	FAML TEXT SAND 2-.1	INTR II .2-.02	FINE CLAY TO CLAY PCT	NON-CO3-CLAY PCT	RATIO 8D1 15-BAR TO CLAY
000-020	AP	2.9A	75.6	21.5	11.2	.3	1.2	.7	.4	.3	29.1	46.5		2.6	29.5	52		.43
020-036	A2	4.2A	69.6	26.2	14.3	.9	2.1	.7	.3	.2	27.1	42.5		4.0	27.1	55		.39
036-038	B1	6.0A	61.3	32.7	19.3	2.0	2.5	.8	.4	.3	21.9	39.4		5.7	22.3	59		.42
038-051	B21TG	1.5A	38.9	59.6	45.1	.1	.5	.3	.3	.3	13.1	25.8		1.2	13.5	76		.43
051-066	B22TG	.6A	44.5	54.9	38.8	TR	.2	.1	.1	.2	15.8	28.7		.4	16.1	71		.45
066-084	B23TG	.5A	54.0	45.5	29.7	.0	.1	.1	.1	.2	21.1	32.9		.3	21.3	65		.47
084-104	B31TG	.8A	60.7	38.5	22.0	.0	.1	.1	.3	.3	23.1	37.6		.5	23.5	57		.50
104-150	B32TG	1.0A	66.8	32.2	17.5	.1	.2	.2	.2	.3	26.5	40.3		.7	26.9	54		.52
150-173	C	2.9	68.1	29.0		.1	.4	.7	1.1	.6	22.9	45.2		2.3	24.0			.48

DEPTH CM	(PARTICLE SIZE ANALYSIS, MM, 3B, 3B1, 3B2) VOL. (WEIGHT) GT 2 PCT	GT 75 PCT	75-20	20-5	5-2	LT .074	20-2 PCT LT20	(BULK DENSITY) 4A1D 1/3-BAR G/CC	4A1H OVEN DRY G/CC	4D1 COLE	(WATER CONTENT) 4B1C 1/10 BAR PCT	4B1C 1/3-BAR PCT	4B2 15-BAR PCT	4C1 WRD CM/CM	AVAIL. P F/ LBS/ACRE	(PH) 8C1A 1/1 H2O	8C1E 1/2 CACL
000-020	0	0	0	0	0	97	0	1.41	1.49	.019	30.7	27.9	9.2	.26	0.9C	18.0	6.6	6.2
020-036	0	0	0	0	0	96	0	1.41	1.51	.023	31.0	28.5	10.2	.26	1.9C	7.5	5.1	4.4
036-038	0	0	0	0	0	94	0	1.30B					13.6			4.0	4.8	4.3
038-051	0	0	0	0	0	99	0	1.24	1.76	.124	42.0	40.3	25.9	.18	1.0C	2.5	4.8	4.5
051-066	0	0	0	0	0	100	0	1.30B					24.6			3.0	5.2	4.7
066-084	0	0	0	0	0	100	0	1.39	1.86	.102	32.8	30.7	21.3	.13	1.3C	20.0	5.5	5.0
084-104	0	0	0	0	0	99	0	1.46	1.90	.092	31.3	30.2	19.1	.16	1.8C	67.0	6.0	5.5
104-150	0	0	0	0	0	99	0	1.42	1.74	.070	32.1	29.0	16.7	.17	1.5C	24.0	6.4	5.9
150-173	0	0	0	0	0	97	0	1.46	1.69	.050	33.0	30.4	13.8	.24	0.9C	12.0	6.6	6.0

DEPTH CM	(ORGANIC MATTER) 6A1A ORGN CARB PCT	6B1A NITG PCT	C/N	IRON 6C2A EXT FE PCT	PHOS 6S1A TOTL PCT	(EXTRACTABLE BASES 5B4A) 6N2E CA MEQ / 100	6O2D MG	6P2A NA	6Q2A K	SUM EXTB	ACTY 6H1A BACL TEA G	AL 6G1D KCL EXT	(CAT EXCH) 5A3A EXTB ACTY	5A6A NHAC	RATIO 8D1 NHAC TO CLAY	RATIO 8D3 CA TO MG	CA 5F SAT NHAC PCT	(BASE SAT) 5C3 EXTB ACTY PCT	5C1 NHAC PCT
000-020	1.48D	.159	9	1.0		14.2	1.8	0.2	0.3	16.5	7.9		24.4	18.0	0.84	7.9	79	68	92
020-036	0.68	.083	8	1.4		7.6	2.3	0.3	0.3	10.5	9.8	0.9	20.3	16.7	0.64	3.3	46	52	63
036-038	0.64	.085	8	2.0		8.8	3.6	0.6	0.4	13.4	11.3	1.5	24.7	20.6	0.63	2.4	43	54	65
038-051	1.00	.127	8	1.5		19.7	9.0	1.7	0.9	31.3	17.3	2.2	48.6	40.5	0.68	2.2	49	64	77
051-066	0.84	.092	9	1.4		20.6	9.5	2.0	0.9	33.0	13.4	1.3	46.4	39.3	0.72	2.2	52	71	84
066-084	0.34			1.5		19.0	9.0	2.1	0.6	30.7	8.4		39.1	32.7	0.72	2.1	58	79	94
084-104	0.18			1.2		18.9	8.8	2.1	0.6	30.4	7.2		37.6	30.8	0.80	2.1	61	81	99
104-150	0.18			1.3		17.3	8.0	1.9	0.7	27.9	5.9		33.8	28.1	0.87	2.2	62	83	99
150-173	0.11			1.2		14.8	6.5	1.6	0.5	23.4	3.5		26.9	23.4	0.81	2.3	63	87	100

DEPTH CM	(SATURATED PASTE) 8E1 REST OHM-CM	8C1B PH	8A H2O PCT	NA 5D2 ESP PCT	NA 5E SAR	SALT 8D5 TOTL SOLU PPM	GYP 6F1A PCT	(SATURATION EXTRACT 8A1) 8A1A EC MMHOS/CM	6N1B CA	6O1B MG	6P1A NA	6Q1A K	6I1A CO3	6J1A HCO3	6K1A CL	6L1A SO4	6M1A NO3	ATTERBERG 4F1 LQID LMIT PCT	4F2 PLST INDX
000-020																		34E	9
020-036																		37E	12
036-038																			
038-051																		56E	31
051-066																		63E	32
066-084																			
084-104	1600	5.4	57.8			120		0.32											
104-150																		66E	32
150-173																		39E	16

CLAY MINERALOGY (7A2C) PLACEMENT (S69IA-4-3) MONTMORILLONITIC.
038-51 MT4 KK2 MI1.
051-66 MT3 KK2 MI1.
150-173 MT3 KK2 MI2 VM1.
COMMENTS-- CLAYS WELL-ORDERED. MONTMORILLONITE IN B21TG (38-51CM) HAS INTERLAYER COMPONENT.
RELATIVE AMOUNTS-- (X-RAY) 5 = DOMINANT 4 = ABUNDANT 3 = MODERATE 2 = SMALL 1 = TRACE. (DTA) AS PERCENT.
MINERAL CODE-- MT = MONTMORILLONITE MI = MICA KK = KAOLINITE VM = VERMICULITE
(A) FE/MN NODULES COMPRISE MORE THAN 75 PCT OF THE SAND (0-150 CM)
(B) BULK DENSITY ESTIMATED FOR HORIZONS FROM 36-38 AND 51-66 CM.
(C) MICRO-PENETRATION RESISTANCE - A ROD 0.6 CM DIA IS SLOWLY PUSHED INTO BULK DENSITY CLOD, EQUILIBRATED AT 1/10- BAR, A DISTANCE OF 0.6 CM USING A POCKET PENETROMETER. UNITS ARE FORCE (KG) AND NOT ESTIMATES OF UNCONFINED COMPRESSIVE STRENGTH.
(D) ORGANIC CARBON IS 10 KG PER SQ M TO A DEPTH OF 1 METER (METHOD 6A).
(E) ATTERBERG LIMITS DETERMINED BY SOIL MECHANICS LAB, SCS, LINCOLN, NEBR EXCEPTFOR HORIZONS FROM 20-36, 38-51, AND 104-105 CM WHICH WERE DETERMINED BY THE IOWA HWY DEPT, AMES, IOWA.
(F) IOWA STATE UNIVERSITY DATA.

Pedon classification: Mollic Albaqualf; fine, montmorillonitic, mesic.
Series classification: (Same as pedon).
Soil: Appanoose silt loam.
Soil no.: S-69-Iowa-4-3 (LSL Nos. 69L981 - 69L989).
Location: Appanoose County, Iowa, 460 feet east and 300 feet south of the northwest corner of the NW¼ SW¼ sec. 25, T. 68 N., R. 19 W.
Vegetation and land use: Orchardgrass; rotation pasture.
Parent material: Partly from deoxidized and leached and partly from oxidized and leached Wisconsin loess.
Physiography: Nearly level stable narrow divide in the loess-covered Kansan and Nebraskan till plain. Divide has a general north-south axis.
Slope: Less than 1 percent.
Drainage: Poorly drained.
Permeability: Very slow.
Erosion: None.
Ground water: None.
Relief: Plane.
Described by: J. D. Highland, J. R. Culver and T. E. Fenton; November 4, 1969.

(Colors are for moist conditions unless otherwise stated)

Ap 69L981 0 to 20 cm (0 to 8 inches). Very dark gray (10YR 3/1) silt loam, very dark grayish brown (10YR 3/2) kneaded, grayish brown (10YR 5/2) dry; weak coarse platy structure parting to weak thin platy; friable; few fine soft dark reddish brown (5YR 3/2) oxides; common fine roots; slightly acid; clear smooth boundary.

A2 69L982 20 to 36 cm (8 to 14 inches). Grayish brown (10YR 5/2) silt loam, few fine faint dark yellowish brown (10YR 4/4) mottles, light gray (10YR 7/1 and 7/2) dry; moderate medium platy structure parting to weak thin platy structure; friable; thin discontinuous light gray (10YR 7/1) dry silt coatings on plates; common fine dark reddish brown (5YR 3/2) oxides; very strongly acid; abrupt smooth boundary.

B1 69L983 36 to 38 cm (14 to 15 inches). Grayish brown (2.5Y 5/2) silty clay loam; common fine faint light olive brown (2.5Y 5/4) mottles; moderate fine subangular blocky structure; firm; continuous white (10YR 8/1) dry silt coatings on ped surfaces; strongly acid; abrupt smooth boundary.

B21tg 69L984 38 to 51 cm (15 to 20 inches). Dark gray (10YR 4/1) with streaks of very dark gray (10YR 3/1) and dark grayish brown (2.5Y 4/2) silty clay; common fine distinct yellowish brown (10YR 5/6) and light olive brown (2.5Y 5/4) mottles; strong very fine angular and subangular blocky structure; very firm, very hard; common fine hard dark reddish brown (5YR 3/2) oxides; continuous clay films; strongly acid; gradual smooth boundary.

B22tg 69L985 51 to 66 cm (20 to 26 inches). Dark grayish brown (2.5Y 4/2) silty clay; some dark gray (10YR 4/1) on faces of peds; many olive brown (2.5Y 4/4) and yellowish brown (10YR 5/6) mottles: strong fine and very fine angular and subangular blocky structure; very firm, very hard, thick continuous clay films; few fine hard dark reddish brown (5YR 3/2) oxides; strongly acid; gradual smooth boundary.

B23tg 69L986 66 to 84 cm (26 to 33 inches). Light brownish gray (2.5Y 6/2) silty clay; many fine prominent yellowish brown (10YR 5/6) and strong brown (7.5YR 5/6) mottles; moderate coarse subangular blocky structure; firm, very hard, discontinuous dark gray (10YR 4/1) clay films; few fine soft dark reddish brown (5YR 3/2) and brown (7.5YR 4/4) oxides; medium acid; gradual smooth boundary.

B31tg 69L987 84 to 104 cm (33 to 41 inches). Light brownish gray (2.5Y 6/2) heavy silty clay loam, many fine prominent yellowish brown (10YR 5/6) and strong brown (7.5YR 5/6) mottles; weak coarse subangular blocky structure; firm, very hard, few dark gray (10YR 4/1) clay-filled root channels and streaks on peds; few fine hard dark reddish brown (5YR 3/2) and brown (7.5YR 4/4) oxides; medium acid; gradual smooth boundary.

B32tg 69L988 104 to 150 cm (41 to 59 inches). Colors as above; slight decrease in clay but still silty clay loam; weak coarse subangular blocky structure; firm, hard when dry; increase in oxides but colors as above; slightly acid; gradual smooth boundary.

C 69L989 150 to 173 cm (59 to 68 inches). Light olive gray (5Y 6/2) light silty clay loam; common medium prominent strong brown (7.5YR 5/6) and reddish yellow (7.5YR 6/8) mottles; deoxidized and leached weathering zone; massive, vertical cleavage; few fine soft dark reddish brown (5YR 3/2) oxides; slightly acid.

Remarks: Lower A2 and B1 were saturated above the silty clay B21tg.

SOIL CLASSIFICATION-TYPIC HAPLAQUOLL
FINE, MONTMORILLONITIC, MESIC
SERIES - - - - - - -CHEQUEST

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE MRTSC
SOIL SURVEY INVESTIGATIONS UNIT
LINCOLN, NEBRASKA

SOIL NO - - - - - - S71IOWA-4-2 COUNTY - - - APPANOOSE

GENERAL METHODS- - -1A,1B1B,2A1,2B SAMPLE NOS. 71L1128-71L1135 OCTOBER 1974

DEPTH CM	HORIZON	SAND 2-.05	SILT .05-.002	CLAY LT .002	FINE CLAY LT .0002	VCOS 2-1	CORS 1-.5	MEOS .5-.25	FNES .25-.10	VFNS .10-.05	COSI .05-.02	FNSI .02-.002	VFSI .005-.002	FAML TEXT SAND 2-.1	INTR TEXT II .2-.02	FINE CLAY TO CLAY PCT	NON-CO3-CLAY PCT	RATIO 8D1 15-BAR TO CLAY
		PARTICLE SIZE ANALYSIS, LT 2MM, 3A1, 3A1A, 3A1B (PCT LT 2MM)																
000-18	AP	4.7A	55.4	39.9	21.9	.1	.5	.7	1.4	2.0	15.2	40.2	12.1	2.7	18.0	55		.43
018-30	A12	4.2A	54.9	40.9	21.5	.1	.5	.6	1.1	1.9	12.9	42.0	12.2	2.3	15.4	53		.43
030-46	B&A	5.5A	55.8	38.7	20.3	.1	.8	.9	1.5	2.2	12.6	43.2	11.5	3.3	15.7	52		.44
046-69	B21G	5.3A	58.3	36.4	19.0	.1	1.1	.8	1.2	2.1	15.5	42.8	10.4	3.2	18.3	52		.45
069-89	B22G	3.7A	56.2	40.1	22.5	.3	.6	.5	.8	1.5	15.5	40.7	10.4	2.2	17.5	56		.44
089-109	B23G	5.4A	54.0	40.6	25.6	.5	.8	.5	1.2	2.4	13.9	40.1	11.1	3.0	17.1	63		.46
109-135	B31G	5.9A	58.2	35.9	24.3	.2	.6	.4	1.3	3.4	18.9	39.3	9.1	2.5	23.2	68		.47
135-165	B32G	7.5A	56.7	35.8	23.6	.4	.7	.6	1.9	3.9	17.7	39.0	10.2	3.6	22.8	66		.47

DEPTH CM	VOL. GT 2 PCT	WEIGHT GT 75 PCT	75-20 PCT	20-5 PCT	5-2 PCT	LT .074 PCT LT20	4A1D BULK DENSITY 1/3-BAR G/CC	4A1H OVEN DRY G/CC	4D1 COLE	4B1C WATER CONTENT 1/10 BAR PCT	4B1C 1/3-BAR PCT	4B2 15-BAR PCT	4C1 WRD CM/CM	AVAIL. P E/ LBS/ACRE	pH 8C1A 1/1 H2O	8C1E 1/2 CACL
000-18	0	0	0	0	0	97	0	1.37	1.61	.055	29.9	28.7	17.3	.16	3.1C	50	5.0	4.7
018-30	0	0	0	0	0	97	0	1.42	1.66	.054	27.8	27.3	17.6	.14	4.3C	37	4.8	4.4
030-46	0	0	0	0	0	96	0	1.40B					17.2			32	4.9	4.3
046-69	0	0	0	0	0	96	0	1.35	1.53	.043	28.1	27.0	16.4	.14	5.3C	28	4.8	4.3
069-89	0	0	0	0	0	97	0	1.40B					17.8			32	4.9	4.3
089-109	0	0	0	0	0	96	0	1.43	1.71	.062	28.7	27.6	18.6	.13	4.5C	53	5.1	4.3
109-135	0	0	0	0	0	97	0	1.40B					16.9			53	5.1	4.0
135-165	0	0	0	0	0	95	0	1.49	1.78	.061	26.5	25.7	16.7	.13	2.6C	51	5.4	4.7

DEPTH CM	6A1A ORGN CARB PCT	6B1A NITG PCT	C/N	6C2A EXT FE PCT	6S1A TOTL PCT	6N2E CA	6O2D MG	6P2A NA	6Q2A K	SUM EXTB / 100	6H1A BACL TEA	6G1D KCL EXT	5A3A EXTB ACTY	5A6A NHAC	8D1 NHAC TO CLAY	8D3 CA TO MG	5F SAT NHAC PCT	5C3 EXTB ACTY PCT	5C1 NHAC PCT
	(ORGANIC MATTER)			IRON	PHOS	(EXTRACTABLE BASES 5B4A)					ACTY	AL	(CAT EXCH)		RATIO	RATIO	CA	(BASE SAT)	
						(MEQ / 100 G)													
000-18	1.91D	.175	11	1.3		19.8	5.5	.4	.4	26.1	13.5	.1	39.6	33.9	.85	3.6	58	66	77
018-30	1.76	.157	11	1.2		17.5	5.4	.4	.4	23.7	14.7	.2	38.4	32.3	.79	3.2	54	62	73
030-46	1.35	.125	11	1.2		15.2	5.1	.4	.3	21.0	14.2	.5	35.2	30.3	.78	3.0	50	60	69
046-69	1.10	.099	11	1.4		13.4	4.8	.4	.3	18.9	13.5	.8	32.4	28.2	.77	2.8	48	58	67
069-89	.90			1.4		14.0	5.9	.5	.4	20.8	13.9	.8	34.7	29.6	.74	2.4	47	60	70
089-109	.73			1.3		14.9	6.6	.6	.4	22.5	13.0	.7	35.5	29.9	.74	2.3	50	63	75
109-135	.52			1.1		13.2	6.1	.5	.4	20.2	9.9	.5	30.1	26.3	.73	2.2	50	67	77
135-165	.44			1.2		14.2	6.7	.5	.4	21.8	7.9	.1	29.7	26.0	.73	2.1	55	73	84

DEPTH CM	8E1 REST OHM-CM	8C1B PH	8A H2O PCT	NA 5D2 ESP PCT	NA 5E SAR	SALT 8D5 TOTL SOLU PPM	GYP 6F1A PCT	8A1A EC MMHOS/CM	6N1B CA	6O1B MG	6P1A NA	6Q1A K	6I1A CO3	6J1A HCO3	6K1A CL	6L1A SO4	6M1A NO3	ATTERBERG F/ 4F1 LQID LMIT PCT	4F2 PLST INDX
								SATURATION EXTRACT 8A1 (MEQ / LITER)											
000-18																		44	17
018-30																			
030-46																			
046-69																		44	20
069-89																			
089-109	3400	4.7	58.2					.17										44	22
109-135																			
135-165																			

(A) FE-MN NODULES GT 50 PCT.
(B) ESTIMATED.
(C) MICRO-PENETRATION RESISTANCE - A ROD 0.6 CM DIA IS SLOWLY PUSHED INTO BULK DENSITY CLOD, EQUILIBRATED AT 1/10-BAR, A DISTANCE OF 0.6 CM USING A POCKET PENETROMETER. UNITS ARE FORCE (KG) AND NOT ESTIMATES OF UNCONFINED COMPRESSIVE STRENGTH.
(D) ORGANIC CARBON IS 18 KG/M SQ TO A DEPTH OF 1 M (6A).
(E) IOWA STATE UNIVERSITY DATA.
(F) IOWA STATE HIGHWAY COMMISSION DATA.

Pedon classification: Typic Haplaquoll; fine, montmorillonitic, mesic.
Series classification: (Same as pedon).
Soil: Chequest silty clay loam.
Soil no.: S71-Iowa-4-2 (LSL Nos. 71L1128 - 35).
Location: Appanoose County, Iowa; 100 feet west and 50 feet north of the southeast corner of the NE¼ NE¼ sec. 13, T. 68 N., R. 17 W.
Vegetation and land use: Soybeans, cropland.
Parent material: Acid, moderately fine textured alluvium that contains about 5 to 15 percent sand.
Physiography: On the nearly level bottom land of the Chariton River.
Relief: Flat.
Slope: Less than 1 percent.
Drainage: Poorly drained.
Erosion: None.
Ground water: None to 6 feet (seasonal rainfall below normal).
Permeability: Moderately slow.
Described by: J. D. Highland and L. D. Lockridge; October 1971.

(Colors are for moist soil unless otherwise stated)

Ap 71L1128 0 to 18 cm (0 to 7 inches). Very dark gray (10YR 3/1) silty clay loam, gray (10YR 5/1) dry, kneaded very dark grayish brown (10YR 3/2); weak fine granular structure; firm; common roots; many pores; slightly acid (pH 6.3); abrupt smooth boundary.

A12 71L1129 18 to 30 cm (7 to 12 inches). Very dark gray (10YR 3/1) silty clay loam, dark gray (10YR 4/1) dry, kneaded very dark gray (10YR 3/1); moderate very fine subangular blocky structure; firm; many roots; many pores; few very fine dark reddish brown soft oxides and a few fine reddish brown hard oxides; slightly acid (pH 6.1); clear wavy boundary.

B&A 71L1130 30 to 46 cm (12 to 18 inches). Dark gray (10YR 4/1) silty clay loam, gray (10YR 6/1) dry, kneaded very dark gray (10YR 3/1); common fine distinct dark brown (7.5YR 3/2) mottles; moderate fine subangular blocky structure; firm; common fine roots; common fine pores; nearly continuous light gray (10YR 7/1 dry) silt coatings on peds; medium acid (pH 5.8); gradual wavy boundary.

B21g 71L1131 46 to 69 cm (18 to 27 inches). Dark gray (10YR 4/1) heavy silty clay loam, gray (10YR 6/1) dry; many medium distinct dark brown and few fine brown (7.5YR 4/2) mottles; moderate fine and medium subangular blocky structure; firm; common gray (10YR 6/1 dry) silt coatings on peds; few thin discontinuous black (10YR 2/1) clay films; few fine reddish brown soft oxides; common fine roots; common fine pores; few old channels 1 to 2 mm in diameter filled with light gray (10YR 7/1) silty material; medium acid (pH 5.6); gradual smooth boundary.

B22g 71L1132 69 to 89 cm (27 to 35 inches). Dark gray (10YR 4/1) heavy silty clay loam, very dark gray (10YR 3/1) coatings on peds; many fine distinct dark yellowish brown (10YR 4/4) and common fine distinct dark brown (7.5YR 3/2) and brown (7.5YR 4/2) mottles; moderate fine prismatic parting to moderate fine and medium subangular blocky structure; firm; thin discontinuous very dark gray (10YR 3/1) clay films; common fine black soft oxides; common discontinuous gray (10YR 6/1 dry) silt coatings on peds; common fine roots; strongly acid (pH 5.3); gradual smooth boundary.

B23g 71L1133 89 to 109 cm (35 to 43 inches). Dark gray (10YR 4/1) medium silty clay loam, very dark gray (10YR 3/1) coatings on peds; many medium distinct dark yellowish brown (10YR 4/4) mottles; moderate fine prismatic parting to moderate fine angular and subangular blocky structure; firm; common fine black and few fine reddish brown soft oxides; thick black discontinuous clay coats on walls of root channels and pores and on prisms; few thin discontinuous gray (10YR 6/1) silt coatings dominantly on prism faces; common fine roots; strongly acid (pH 5.3); gradual smooth boundary.

B31g 71L1134 109 to 135 cm (43 to 53 inches). Dark gray (10YR 4/1) medium silty clay loam, very dark gray (10YR 3/1) coatings on peds; common fine distinct brown (7.5YR 4/4) and dark brown brown (7.5YR 4/2) mottles; weak medium prismatic parting to weak fine angular and subangular blocky structure; firm; thick black discontinuous clay coats on walls of root channels and in pores and on prisms; few thin discontinuous gray (10YR 6/1 dry) silt coats on some prisms; few fine reddish brown soft oxides; medium acid (pH 5.8); gradual smooth boundary.

B32g 71L1135 135 to 165 cm (53 to 65 inches). Dark gray (10YR 4/1) medium silty clay loam; common fine distinct reddish brown (5YR 4/4) mottles; weak medium prismatic parting to weak medium subangular blocky structure; firm; thick black discontinuous clay coats on walls of root channels and in pores and on prisms; few thin discontinuous gray (10YR 6/1 dry) silt coatings on prisms; medium acid; pH 5.8.

SOIL CLASSIFICATION-MOLLIC OCHRAQUALF
FINE-SILTY, MIXED, MESIC
SERIES - - - - - - -COPPOCK

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE MRTSC
SOIL SURVEY INVESTIGATIONS UNIT
LINCOLN, NEBRASKA

SOIL NO - - - - - - S71IOWA-4-1   COUNTY - - - APPANOOSE

GENERAL METHODS- - -1A,1B1B,2A1,2B   SAMPLE NOS. 71L1136-71L1145   OCTOBER 1974

DEPTH	HORIZON	(- - PARTICLE SIZE ANALYSIS, LT 2MM, 3A1, 3A1A, 3A1B - -)			FINE	(- - SAND - -)					(- - SILT - -)		FAML	INTR	FINE	NON-	RATIO 8D1
		SAND 2-.05	SILT .05-.002	CLAY LT .002	CLAY LT .0002	VCOS 2-1	CORS 1-.5	MEDS .5-.25	FNES .25-.10	VFNS .10-.05	COSI .05-.02	FNSI .02-.002	VFSI .005-.002	TEXT SAND 2-.1	II .2-.02	CLAY TO CLAY	CO3-CLAY	15-BAR TO CLAY
CM		(- - PCT LT 2MM - -)														PCT	PCT	
000-20	AP	8.2A	68.3	23.5	13.9	.1	.5	.5	1.4	5.7	30.2	38.1	8.6	2.5	36.9	59		.46
020-36	A21	6.7A	68.4	24.9	14.3	.2	1.2	.7	1.1	3.5	24.6	43.8	9.9	3.2	28.8	57		.45
036-51	A22	7.4A	67.9	24.7	13.7	.4	1.3	.8	1.2	3.7	24.0	43.9	10.7	3.7	28.5	55		.43
051-64	A23	8.0A	67.9	24.1	13.1	.6	1.4	.6	1.2	4.2	25.3	42.6	9.9	3.8	30.3	54		.43
064-81	B1G	8.5A	66.5	25.0	14.7	.4	1.2	.5	1.2	5.2	27.6	38.9	8.5	3.3	33.8	59		.43
081-94	B21TG	10.4A	64.1	25.5	15.5	TR	.2	.2	1.8	8.2	30.5	33.6	6.6	2.2	40.3	61		.45
094-109	B22TG	12.7A	59.5	27.8	18.6	.1	.2	.2	2.9	9.3	26.2	33.3	5.9	3.4	38.1	67		.47
109-135	B31G	8.7A	61.4	29.9	19.9	.1	.2	.2	1.8	6.4	26.7	34.7	6.8	2.3	34.6	67		.47
135-160	B32G	5.0A	61.0	34.0	20.4	.1	.4	.3	1.1	3.1	20.3	40.7	10.4	1.9	24.1	60		.46
160-191	B33G	4.5A	61.3	34.2	20.3	.1	.6	.5	.9	2.4	22.8	38.5	10.2	2.1	25.7	59		.47

DEPTH	(PARTICLE SIZE ANALYSIS, MM, 3B, 3B1, 3B2) VOL. GT 2	(- - WEIGHT - -) GT 75	75-20	20-5	5-2	LT .074	20-2 PCT LT20	(BULK DENSITY) 4A1D 1/3-BAR G/CC	4A1H OVEN DRY G/CC	4D1 COLE	(- - WATER CONTENT - -) 4B1C 1/10 BAR PCT	4B1C 1/3-BAR PCT	4B2 15-BAR PCT	4C1 WRD CM/CM		AVAIL P F/ LBS/ACRE	(- -PH - -) 8C1A 1/1 H2O	8C1E 1/2 CACL
CM	PCT	PCT	(- - PCT LT 75 - -)															
000-20	0	0	0	0	0	96	0	1.51	1.63	.026	24.1	22.9	10.9	.18	4.6C	93	5.6	5.3
020-36	0	0	0	0	0	96	0	1.53	1.63	.021	24.9	23.5	11.1	.19	4.1C	81	5.1	4.8
036-51	0	0	0	0	0	95	0	1.50B					10.7			62	4.5	3.9
051-64	0	0	0	0	0	95	0	1.49	1.55	.013	25.2	24.1	10.3	.21	2.8C	49	4.3	3.7
064-81	0	0	0	0	0	95	0	1.50B					10.7			46	4.3	3.7
081-94	0	0	0	0	0	96	0	1.46	1.59	.029	26.3	24.3	11.5	.19	3.1C	51	4.4	3.7
094-109	0	0	0	0	0	94	0	1.50	1.63	.028	24.5	23.6	13.0	.16	3.8C	63	4.4	3.7
109-135	0	0	0	0	0	96	0	1.50B					14.0			57	4.6	3.7
135-160	0	0	0	0	0	97	0	1.53	1.67	.030	23.5	23.2	15.7	.11	6.2C	84	4.8	3.9
160-191	0	0	0	0	0	97	0	1.50	1.66	.034	24.4	23.7	15.9	.12	4.8C	91	5.2	4.4

DEPTH	(ORGANIC MATTER) 6A1A ORGN CARB	6B1A NITG	C/N	IRON 6C2A EXT FE	PHOS 6S1A TOTL	(- -EXTRACTABLE BASES 5B4A- -) 6N2E CA	6O2D MG	6P2A NA	6Q2A K	SUM EXTB	ACTY 6H1A BACL TEA	AL 6G1D KCL EXT	(CAT EXCH) 5A3A EXTB ACTY	5A6A NHAC	RATIO 8D1 NHAC TO CLAY	RATIO 8D3 CA TO MG	CA 5F SAT NHAC	(BASE SAT) 5C3 EXTB ACTY	5C1 NHAC
CM	PCT	PCT		PCT	PCT	(- - MEQ / 100 G - -)											PCT	PCT	PCT
000-20	1.23D	.116	11	1.0		15.1	2.7	.1	.3	18.2	6.0		24.2	20.9	.89	5.6	72	75	87
020-36	.46	.068		1.0		11.8	2.7	.2	.2	14.9	7.2	.1	22.1	18.7	.75	4.4	63	67	80
036-51	.32	.041		1.1		6.5	1.9	.2	.2	8.8	11.8	2.8	20.6	16.8	.68	3.4	39	43	52
051-64	.26	.038		1.0		5.2	1.8	.2	.2	7.4	11.4	3.3	18.8	16.0	.66	2.9	33	39	46
064-81	.20	.033		.8		4.9	2.0	.2	.2	7.3	11.9	4.0	19.2	15.9	.64	2.5	31	38	46
081-94	.16	.036		.9		5.5	2.6	.2	.3	8.6	12.3	4.3	20.9	17.2	.67	2.1	32	41	50
094-109	.19			1.0		6.6	3.4	.3	.3	10.6	12.6	4.1	23.2	19.9	.72	1.9	33	46	53
109-135	.15			1.0		7.7	4.0	.5	.3	12.5	12.3	3.6	24.8	21.1	.71	1.9	36	50	59
135-160	.24			1.1		9.8	5.0	.7	.4	15.9	12.5	2.2	28.4	23.5	.69	2.0	42	56	68
160-191	.52			1.0		11.9	5.5	1.0	.4	18.8	9.7	.3	28.5	24.2	.71	2.2	49	66	78

DEPTH	(SATURATED PASTE) 8E1 REST OHM-CM	8C1B PH	8A H2O PCT	NA 5D2 ESP PCT	NA 5E SAR	SALT 8D5 TOTL SOLU PPM	GYP 6F1A PCT	(- - SATURATION EXTRACT 8A1- -) 8A1A EC MMHOS/CM	6N1B CA	6O1B MG	6P1A NA	6Q1A K	6I1A CO3	6J1A HCO3	6K1A CL	6L1A SO4	6M1A NO3	ATTERBERG 4F1 LQID LMIT PCT	4F2 PLST INDX
CM									(- - MEQ / LITER - -)										
000-20																		38E	14
020-36																			
036-51																		35E	12
051-64																			
064-81																			
081-94																		36E	14
094-109	4600	4.2	46.4					.22											
109-135																		40E	18
135-160																			
160-191																			

CLAY MINERALOGY (7A2C)   PLACEMENT (S71IA-4-1) - MONTMORILLONITIC.
COMMENTS - CRYSTALLINITY OF SMECTITE DECREASES TOWARD SURFACE. GENERALLY WELL CRYSTALIZED. KAOLINITE AND MICA CONTENT ABOUT SAME WITH DEPTH - SMALL TO MODERATE AMOUNTS (EST 10-15 PCT).

000-20	MT3	KK2	MI2	QZ1
036-51	MT4	KK3	MI2	
081-94	MT5	KK3	MI2	QZ1
135-160	MT5	KK3	MI2	
160-191	MT5	KK3	MI2	QZ1

MINERAL CODE* MT-MONTMORILLONITE KK-KAOLINITE MI-MICA QZ-QUARTZ.
RELATIVE ABUNDANCE* 5-DOMINANT 4-ABUNDANT 3-MODERATE 2-SMALL 1-TRACE.

(A) FE-MN NODULES GT 50 PCT, 15-25 PCT 81-135 CM.
(B) ESTIMATED.
(C) MICRO-PENETRATION RESISTANCE - A ROD 0.6 CM DIA IS SLOWLY PUSHED INTO BULK DENSITY CLOD, EQUILIBRATED AT 1/10-BAR, A DISTANCE OF 0.6 CM USING A POCKET PENETROMETER. UNITS ARE FORCE (KG) AND NOT ESTIMATES OF UNCONFINED COMPRESSIVE STRENGTH.
(D) ORGANIC CARBON IS 7 KG/M SQ TO A DEPTH OF 1 M (6A).
(E) BY USDA-SCS, SOIL MECHANICS LAB, LINCOLN, NE.
(F) IOWA STATE UNIVERSITY DATA.

Pedon classification: Mollic Ochraqualf; fine-silty, mixed, mesic.
Series classification: (Same as pedon).
Soil: Coppock silt loam.
Soil no.: S71-Iowa-4-1, (LSL Nos. 71L1136 - 71L1145).
Location: Appanoose County, Iowa, 600 feet east and 910 feet north of the southwest corner of sec. 25, T. 68 N., R. 17 W.
Vegetation and land use: Grain sorghum; cropland.
Parent material: Silty alluvium.
Physiography: On a natural levee of an abandoned stream channel on the Chariton bottom land.
Relief: Plane to slightly convex.
Slope: Less than 1 percent.
Drainage: Somewhat poorly to poorly drained.
Erosion: None.
Ground water: None to 7 feet (seasonal rainfall below normal).
Permeability: Moderate.
Described by: J. D. Highland and L. D. Lockridge; October 1971.

(Colors are for moist soil unless otherwise stated)

Ap 71L1136 0 to 20 cm (0 to 8 inches). Very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; weak fine granular structure; friable; neutral; abrupt smooth boundary.

A21 71L1137 20 to 36 cm (8 to 14 inches). Dark grayish brown (10YR 4/2) silt loam with some very dark grayish brown (10YR 3/2) coatings on peds; light brownish gray (10YR 6/2) dry, dark grayish brown (10YR 4/2) kneaded; weak thin platy structure parting to weak fine granular; friable; few fine dark brown soft oxides; neutral; clear smooth boundary.

A22 71L1138 36 to 51 cm (14 to 20 inches). Dark grayish brown (10YR 4/2) silt loam, some very dark grayish brown (10YR 3/2) coatings on peds; light brownish gray (10YR 6/2) dry, dark grayish brown (10YR 4/2) kneaded; weak thin platy parting to weak fine granular structure; friable; few dark reddish brown soft oxides; thin discontinuous light gray (10YR 7/2 dry) silt and fine sand coatings on plates; slightly acid; clear smooth boundary.

A23 71L1139 51 to 64 cm (20 to 25 inches). Grayish brown (10YR 5/2) heavy silt loam, dark grayish brown (10YR 4/2) coatings on peds; weak medium platy parting to weak fine subangular blocky structure; friable; few fine dark reddish brown soft oxides; thin discontinuous light gray (10YR 7/2 dry) silt and fine sand on blocky peds; medium acid; clear wavy boundary.

B1g 71L1140 64 to 81 cm (25 to 32 inches). Grayish brown (10YR 5/2) light silty clay loam, patchy dark grayish brown (10YR 4/2) coatings, light gray (10YR 7/2) dry; few fine distinct brown (7.5YR 4/4) mottles; moderate medium subangular blocky structure; common fine dark reddish brown soft oxides; common discontinuous light gray (10YR 7/2 dry) silt and fine sand coatings on peds; strongly acid; gradual smooth boundary.

B21tg 71L1141 81 to 94 cm (32 to 37 inches). Grayish brown (10YR 5/2) and light brownish gray (10YR 6/2) light silty clay loam; common fine distinct brown (7.5YR 4/4) mottles; weak medium prismatic structure parting to moderate medium subangular blocky; friable; few thin discontinuous dark brown clay films; common fine dark reddish brown soft oxides; common discontinuous light gray (10YR 7/2) silt and fine sand on prism faces; strongly acid; gradual smooth boundary.

B21 tg 71L1142 94 to 109 cm (37 to 43 inches). Grayish brown (10YR 5/2) and light brownish gray (10YR 6/2) light to medium silty clay loam; common fine medium distinct reddish brown (5YR 4/4) to yellowish red (5YR 4/6) mottles; weak medium prismatic structure parting to weak medium subangular blocky; friable; thin discontinuous dark brown (10YR 3/3) clay films and dark gray (10YR 4/1) clay lines pores; common fine dark reddish brown soft oxides; nearly continuous light gray (10YR 7/1 dry) silt coatings on prisms and some light gray (10YR 7/1 dry) silt filled channels 1 to 2 mm in diameter; strongly acid; gradual smooth boundary.

B31g 71L1143 109 to 135 cm (43 to 53 inches). Grayish brown (10YR 5/2) light to medium silty clay loam; many fine and medium distinct reddish brown (5YR 4/4) and strong brown (7.5YR 5/6) mottles; weak medium prismatic structure; friable; many fine dark reddish brown soft oxides; few discontinuous dark gray clay films and clay lines pores; discontinuous light gray (10YR 7/1 dry) silt coats on prism faces; strongly acid; clear smooth boundary.

B32 71L1144 135 to 160 cm (53 to 63 inches). Dark brown (7.5YR 3/2) medium silty clay loam, grayish brown (10YR 5/2) coatings on peds; few fine faint dark yellowish brown (7.5YR 4/4) mottles; weak medium prismatic parting to moderate fine subangular blocky structure; friable; few fine dark reddish brown (5YR 3/2) soft oxides; few thin discontinuous dark gray clay films and clay lined channels; medium acid; gradual smooth boundary.

B33 71L1145 160 to 191 cm (63 to 75 inches). Very dark grayish brown (10YR 3/2) medium silty clay loam, very dark gray (10YR 3/1) coatings on peds; few fine distinct dark yellowish brown (10YR 4/4) and grayish brown (10YR 6/2) mottles; weak fine and medium subangular blocky structure; friable; thin discontinuous light gray (10YR 7/1 dry) silt and fine sand coatings on some peds; medium acid.

Remarks: At 53 inches was what appeared to be the surface of an older buried soil.

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SOIL Guckeen clay loam SOIL Nos. S64Iowa-40-3 LOCATION Hamilton County, Iowa

SOIL SURVEY LABORATORY Lincoln, Nebraska LAB. Nos. 19910-19919 April 1968

General Methods: 1A, 1B1b, 2A1, 2B

Depth (in)	Horizon	Total Sand (2-0.05) a	Total Silt (0.05-0.002)	Total Clay (<0.002)	Sand: Very coarse (2-1)	Sand: Coarse (1-0.5)	Sand: Medium (0.5-0.25)	Sand: Fine (0.25-0.1)	Sand: Very fine (0.1-0.05)	Silt: 0.05-0.02	Silt: Int. III (0.02-0.002)	Int. II (0.2-0.02)	(2-0.1)	<0.074		Coarse fragments 2A2: 3B2 2-19 (vol.)	Coarse fragments 2A2: 3B1 2-19 (wt.)	
		Pct. of < 2 mm														Pct of < 19mm		
0-8	Ap	26.2	39.3	34.5	1.0	3.8	5.0	10.1	6.3	16.1	23.2	28.0	19.9	77.2			tr	
8-14	A12	25.6	37.4	37.0	2.1	4.2	4.8	8.8	5.7	15.0	22.4	25.6	19.9	77.5			tr	
14-19	B1	26.8	35.1	38.1	2.2	4.2	4.6	9.4	6.4	13.0	22.1	24.6	20.4	76.7			4	
19-24	B21	28.5	33.2	38.3	2.0	4.8	4.9	9.9	6.9	12.3	20.9	24.7	21.6	75.4			tr	
24-31	B22	33.3	28.2	38.5	2.5	5.0	5.7	12.2	7.9	10.8	17.4	25.4	25.4	71.1			tr	
31-37	IIB23	34.4	36.3	29.3	4.3	5.6	5.3	11.0	8.2	13.5	22.8	27.8	26.2	70.4		4	9	
37-42	IIB32	33.4	39.3	27.3	5.0	4.8	4.9	10.7	8.0	13.5	25.8	27.5	25.4	71.3		5	9	
42-52	IIB33	35.5	37.9	26.6	5.5	6.3	5.5	10.5	7.7	13.5	24.4	27.0	27.8	69.0		5	9	
52-65	IIB34	35.1	38.5	26.4	3.4	5.5	5.7	11.7	8.8	14.1	24.4	29.5	26.3	70.1		5	9	
65-72	IIC	34.5	38.8	26.7	2.8	5.6	5.9	11.6	8.6	14.0	24.8	29.1	25.9	70.5		7	12	

Depth (in)	6A1a Organic carbon b Pct	Nitrogen Pct.	C/N	Ext. Iron as Fe Pct.	Carbonate as $CaCO_3$: 6E1b 6E2a <2mm Pct.	Carbonate: 3A1a <0.002 mm Pct.	Bulk density: 1/3-Bar c g/cc	Bulk density: 4A1d 1/3-Bar g/cc	Bulk density: 4A1b Air-Dry g/cc	4D1 COLE	Water content: 4B1c 1/3-Bar Pct	Water content: 4B2 15-Bar Pct.	Water content: 4C1 1/3-to 15-Bar in/in.			pH		8C1a (1:1)
0-8	3.55							1.29	1.45	0.040	27.8	13.9	0.18					5.5
8-14	2.63							1.31	1.51	0.047	26.0	14.7	0.15					5.6
14-19	2.06							1.32	1.56	0.056	26.3	14.6	0.15					5.7
19-24	1.41							1.37	1.66	0.064	27.0	14.7	0.17					5.8
24-31	0.72				tr(s)	-		1.36	1.71	0.078	27.3	14.5	0.17					6.5
31-37	0.30				19	1	1.31	1.36	1.60	0.054	25.7	12.0	0.18					7.7
37-42	0.21				24	1	1.41	1.48	1.64	0.034	21.3	10.8	0.15					7.7
42-52	0.09				24	2	1.48	1.56	1.72	0.030	20.5	11.0	0.14					8.0
52-65	0.13				23	1	1.46	1.54	1.70	0.030	20.5	10.8	0.14					8.0
65-72	0.13				22	1	1.48	1.59	1.76	0.030	20.3	12.0	0.12					8.2

Depth (in)	Extractable bases 5B1a: 6N2a Ca	6O2a Mg	6P2a Na	6Q2a K	Sum	6H1a Ext. Acidity	Cat. Exch. Cap.: 5A3a Sum Cations	5A1a NH_4OAc						8D3 Ca/Mg		Base saturation: 5C3 Sum Cations	5C1 NH_4OAc
	meq/100 g															Pct.	Pct
0-8	21.0	5.7	0.1	0.6	27.4	12.9	40.3	30.1						3.7		68	91
8-14	20.3	6.3	0.1	0.5	27.2	11.5	38.7	29.3						3.2		70	93
14-19	18.9	6.5	0.1	0.6	26.1	11.1	37.2	27.5						2.9		70	95
19-24	19.2	7.2	0.1	0.6	27.1	8.7	35.8	27.7						2.7		76	98
24-31	18.0d	7.6e	0.1	0.6	26.3	4.9	31.2	27.6						2.4		84	95
31-37	14.8d	5.7e	0.1	0.5	21.1			19.2						2.6			
37-42	13.9d	4.8e	0.1	0.4	19.2			17.3						2.9			
42-52	14.5d	3.5e	0.1	0.4	18.5			16.1						4.1			
52-65	13.9d	3.1e	0.1	0.4	17.5			15.6						4.5			
65-72	13.8d	3.7e	0.2	0.5	18.2			15.5						3.7			

Depth (in)	Ratios to Clay 8D1: NH_4OAc CEC		15-Bar Water	
0-8	0.87		0.40	
8-14	0.79		0.40	
14-19	0.72		0.38	
19-24	0.72		0.38	
24-31	0.72		0.38	
31-37	0.66		0.41	
37-42	0.63		0.40	
42-52	0.61		0.41	
52-65	0.59		0.41	
65-72	0.58		0.45	

a. Carbonate comprises 10 to 20 percent of the sand below 31 inches.
b. 24 kg/m^2 to 60 inches (Method 6A).
c. Calculated to include volume but not weight of 2-19 mm material (Method 3B2).
d. KCl-TEA extract (Method 6N4b).
e. KCl-TEA extract (Method 6O4b).

Pedon classification: Aquic Hapludoll; fine, montmorillonitic, mesic.
Series classification: (Same as pedon).
Soil: Cuckeen clay loam.
Soil no: S64-Iowa-40-3 (LSL Nos. 19910 - 19919).
Location: Hamilton County, Iowa; 432 feet north and 856 feet west of the SE corner of Sec. 18, T. 87 N., R. 25 W.
Vegetation and land use: Clover; cropland.
Parent material: About 3 feet of moderately fine to fine textured glacial sediments over glacial till.
Slope: On the crest of a slightly undulating high extending in a NW-SE direction. The slope is about 1 percent at the site with the drainage to the northeast. Undulating Late Wisconsin till plain.
Drainage: Somewhat poorly drained.
Permeability: Slow.
Root distribution: Roots were many to 24 inches, common from 24 to 34 inches, and very few from 34 to 50 inches.
Described by: R. I. Dideriksen, C. S. Fisher, and M. P. Koppen; September 16, 1964.

(Colors are for moist soil unless otherwise stated)

Ap 19910 0 to 20 cm (0 to 8 inches). Black (N 2/0) medium clay loam, black (N 2/0 to 10YR 2/1) when kneaded, very dark gray (10YR 3/1) when dry; cloddy and weak coarse angular blocky structure; friable to firm when moist, hard when dry; many clean fine sand grains; medium acid (pH 6.0); abrupt smooth boundary.

A12 19911 20 to 35 cm (8 to 14 inches). Black (10YR 2/1) heavy clay loam, kneaded color the same, very dark gray (10YR 3/1) when dry; moderate very fine subangular blocky structure and some fine granular; friable; many clean sand grains; very few pebbles; slightly acid (pH 6.2); clear smooth boundary.

B1 19912 35 to 48 cm (14 to 19 inches). Black (10YR 2/1) heavy clay loam; some very dark grayish brown (10YR 3/2) peds in the lower part; very dark gray (10YR 3/1) when kneaded; dark gray (10YR 4/1) when dry; moderate very fine subangular blocky structure; friable to firm; sand grains are evident; more fine pebbles than in the horizon above; a few yellowish brown soft oxides; slightly acid (pH 6.3); clear smooth boundary.

B21 19913 48 to 60 cm (19 to 24 inches). Very dark grayish brown (10YR 3/2) light clay; faces of peds very dark gray (10YR 3/1) with 20 percent black (10YR 2/1); moderate very fine subangular blocky structure; friable to firm; very few thin discontinuous clay films; few fine and medium tubular pores; very few strong brown soft oxides; pebbles and sand grains are dull and coated; neutral (pH 6.6); clear smooth boundary.

B22 19914 60 to 78 cm (24 to 31 inches). Olive brown (2.5Y 4/4) and dark grayish brown (2.5Y 4/2) light clay; faces of peds dark grayish brown (2.5Y 4/2) and 30 percent very dark gray (10YR 3/1); weak fine prismatic structure parting to moderate to strong fine subangular blocky; firm; thin continuous clay films on fine structure; common fine tubular pores; a few fine strong brown soft oxides; few pebbles; neutral (pH 6.6); clear wavy boundary.

I&IIB23 19915 (Sampled 31-37 inches) 78 to 85 cm (31 to 34 inches). Grayish brown (2.5Y 5/2) to dark grayish brown (2.5Y 4/2) heavy clay loam; faces of peds dark grayish brown (2.5Y 4/2) with 10 percent very dark grayish brown (10YR 3/2) few very fine faint olive gray (5Y 5/2) mottles; weak medium prismatic structure parting to moderate fine and medium subangular blocky; firm; thin discontinuous clay films on vertical faces; many fine tubular pores; many yellowish brown soft oxides; many fine black soft oxides; this horizon has some ½- to 1-inch diameter lime rock but the matrix is noncalcareous; neutral (pH 6.6); clear wavy boundary.

IIB31 85 to 93 cm (34 to 37 inches). Grayish brown (2.5Y 5/2) medium clay loam; common yellowish brown (10YR 5/6) and few fine light olive gray (5Y 6/2) mottles; very weak medium prismatic structure parting to weak medium and fine subangular blocky; firm; few thin discontinuous dark grayish brown (2.5Y 4/2) clay films on peds; common fine black and strong brown soft oxides; some stones about 2 inches in diameter; neutral (pH 6.8); some calcium carbonate on vertical faces but the matrix is not calcareous; clear smooth boundary.

IIB32 19916 93 to 108 cm (37 to 42 inches). Mottled light olive brown (2.5Y 5/4) and olive gray (5Y 5/2) with some yellowish brown (10YR 5/6) medium clay loam; weak medium subangular blocky structure with some vertical cleavage; firm; ped exteriors are coated with lime and are gray to light gray (5Y 6/1) in color; many fine black oxides; this is a horizon of lime accumulation with lime in pores and some nodules in old voids; a few stones; moderately alkaline (pH 8.2+); strongly effervescent; diffuse smooth boundary.

IIB33 19917(42 to 52 inches)19918(52 to 65 inches)108 to 165 cm. Mottled yellowish brown (10YR 5/6) and light olive gray (5Y 6/2)light clay loam; very weak medium subangular blocky structure with some vertical cleavage; firm; many yellowish red and black fine soft oxides; a few stones and some shale fragments; moderately alkaline (pH 8.2+); some lime in pores and vertical faces and some distinct secondary lime concretions in the 42- to 52-inch layer; strongly effervescent; diffuse smooth boundary.

IIC 19919 165 to 183 cm (65 to 72 inches). Mottled yellowish brown (10YR 5/6) and light olive gray (5Y 6/2) light clay loam; massive; firm; many yellowish red and black fine soft oxides; a few small stones and one 6-inch diameter stone; a few secondary lime concretions about ½-inch in diameter; moderately alkaline (pH 8.2+); strongly effervescent.

Remarks: Conversation with the farm owner revealed that the field in which this soil was sampled was first plowed in the year 1895.

Penetrometer readings were made by using a Soiltest penetrometer with a 5/16-inch head. The penetrometer was pushed horizontally into the freshly exposed wall of the sampling pit to a depth of 5 inches. Three readings were obtained at each vertical depth as follows: (all measurements in pounds): at 10 inches-55, 53; at 16 inches-74, 60, 63; at 21 inches-90, 87, 95; at 27 inches-81, 100, 104; at 39 inches-93, 91, 88 (¼-inch head); and at 60 inches-99, 80, 91 (¼-inch head).

Soil temperatures were taken by inserting a Weston dial thermometer into the wall of the samplint pit. The depths and temperatures are as follows: 20 inches, 15.5° C; 30 inches, 14.0° C.; 40 inches, 16.6° C.; 80 inches, 14.1° C.

Micromorphology (Method 4E1). Thin discontinuous clay films are apparent under a stereoscopic microscope on about one-third of macrostructural surfaces in the B22 horizon. The clay films contain significant amounts of dark material, probably organic matter. In thin section, oriented clay occurs as birefringence zones on macrostructural surfaces, as elongated zones in the soil matrix, and around individual grains. Much of the oriented clay is brown and has low birefringence, suggesting significant amounts of occluded organic matter.

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SOIL Guckeen clay loam SOIL Nos. S64Iowa-94-2 LOCATION Webster County, Iowa

SOIL SURVEY LABORATORY Lincoln, Nebraska LAB. Nos. 19900-19909 April 1968

General Methods: 1A, 1B1b, 2A1, 2B

Depth (In)	Horizon	Size class and particle diameter (mm) 3A1 — Total: Sand (2-0.05) a	Total: Silt (0.05-0.002)	Total: Clay (< 0.002)	Sand: Very coarse (2-1)	Sand: Coarse (1-0.5)	Sand: Medium (0.5-0.25)	Sand: Fine (0.25-0.1)	Sand: Very fine (0.1-0.05)	Silt: (0.05-0.02)	Silt: Int. III (0.02-0.002)	Int. II (0.2-0.02)	(2-0.1)	<0.074		Coarse fragments 2A2: 3B2 2-19 (vol.) d	3B1 2-19 (wt.)	
		Pct of < 2 mm														Pct of < 19mm		
0-5	Ap1	20.7	42.0	37.3	1.0	3.1	3.7	7.9	5.0	15.2	26.8	24.5	15.7	82.1			tr	
5-9	Ap2	20.6	41.5	37.9	1.1	3.0	3.6	7.8	5.1	15.2	26.3	24.5	15.5	82.3			tr	
9-16	A12	18.4	41.2	40.4	1.5	2.7	3.0	6.6	4.6	14.3	26.9	22.6	13.8	84.2			tr	
16-21	B1	21.3	39.6	39.1	1.2	2.8	3.7	8.0	5.6	14.7	24.9	24.8	15.7	81.9			tr	
21-28	B21	21.9	33.9	44.2	1.5	3.2	3.7	8.0	5.5	9.5	24.4	19.5	16.4	81.2			tr	
28-36	B22	23.5	36.3	40.2	1.2	3.0	3.6	8.9	6.8	11.0	25.3	22.8	16.7	80.6			tr	
36-40	I&IIB31	33.0	32.0	35.0	2.8	5.4	5.8	11.6	7.4	9.4	22.6	23.2	25.6	71.0			tr	
40-48	IIB32	33.4b	39.2b	27.4b	3.4	9.1	4.8	13.7	2.4	12.1	27.1	19.4	31.0	68.0		2	5	
48-60	IIB33	28.7	42.4	28.9	4.4	4.2	4.2	8.9	7.0	11.7	30.7	23.8	21.7	75.3		1	4	
60-72	IIC	26.1	42.8	31.1	2.4	3.7	3.7	8.9	7.4	12.1	30.7	24.5	18.7	78.4		3	7	

Depth (In)	6A1a Organic carbon c Pct.	6B1a Nitrogen Pct.	C/N	6C2a Ext. Iron as Fe Pct.	Carbonate as $CaCO_3$: 6E1b 6E2a <2mm Pct.	3A1a <0.002 mm Pct.	Bulk density: 1/3-Bar d g/cc	4A1d 1/3-Bar g/cc	4A1b Air-Dry g/cc	4D1 COLE	Water content: 4B1c 1/3-Bar Pct	4B2 15-Bar Pct	4C1 1/3- to 15-Bar in./in.			pH: 8C1b Sat. Paste		8C1a (1:1)
0-5	3.25	0.268	12	0.7				1.37	1.60	0.052	26.6	15.1	0.16					5.7
5-9	3.17	0.262	12	0.7				1.32	1.52	0.047	26.9	15.7	0.15					5.6
9-16	2.44	0.217	11	0.7				1.25	1.47	0.056	28.6	16.6	0.15					5.6
16-21	1.64	0.164	10	0.8				1.25	1.51	0.064	29.6	17.0	0.15					5.7
21-28	0.74	0.084	9	0.8				1.31	1.60	0.068	30.5	18.0	0.16					5.9
28-36	0.39	0.060	7	0.8				1.28	1.59	0.073	32.3	18.6	0.18					6.3
36-40	0.27			0.8	tr(s)			1.26	1.46	0.052	30.6	15.5	0.19			7.0		7.1
40-48	0.09			0.6	17	-	1.32	1.35	1.47	0.027	29.7	14.0	0.21					7.7
48-60	0.09			0.7	18	1	1.45	1.46	1.57	0.024	24.9	12.4	0.18					7.7
60-72	0.10			0.7	17	1	1.37	1.41	1.53	0.027	27.5	13.8	0.19			7.6		7.7

Depth (In)	Extractable bases 6N2a Ca	6O2a Mg	6P2a Na	5B1a 6Q2a K	Sum	6H1a Ext. Acidity	Cat. Exch. Cap. 5A3a Sum Cations	5A1a NH_4OAc			8E1 Resistivity g ohms-cm	8B1a Elec. Cond. mmhos/cm	8B1 Water at Sat. Pct.	8D5 Total sol. salts in soil ppm.	8D3 Ca/Mg		Base saturation: 5C3 Sum Cations Pct	5C1 NH_4OAc Pct.
	meq/100 g																	
0-5	22.4	5.8	0.1	0.6	28.9	11.3	40.2	30.7							3.9		72	94
5-9	22.4	6.3	tr	0.6	29.3	11.7	41.0	30.6							3.6		71	96
9-16	22.5	6.5	0.1	0.6	29.7	10.0	39.7	31.3							3.5		75	95
16-21	22.1	7.1	0.1	0.6	29.9	9.0	38.9	31.7							3.1		77	94
21-28	22.3	8.1	0.2	0.7	31.3	6.4	37.7	31.0							2.8		83	101
28-36	22.3	8.1	0.2	0.7	31.3	4.2	35.5	29.3							2.8		88	107
36-40	17.3e	6.4f	0.2	0.6	24.5			19.9			1600	0.64	51.1	410	2.7			
40-48	14.5e	4.8f	0.2	0.5	20.0			18.6							3.0			
48-60	14.0e	4.6f	0.2	0.5	19.3			17.2							3.0			
60-72	15.1e	4.7f	0.2	0.6	20.6			18.2			1800	0.61	47.1	390	3.2			

Depth (In.)	Ratios to Clay 8D1: NH_4OAc CEC	Ext. Iron	15-Bar Water	ATTERBERG h/ 4F1 LQID LMIT PCT	4F2 PLST INDX
0-5	0.82	0.02	0.40	48	21
5-9	0.81	0.02	0.41		
9-16	0.77	0.02	0.41		
16-21	0.81	0.02	0.43		
21-28	0.70	0.02	0.41	58	33
28-36	0.73	0.02	0.46		
36-40	0.57	0.02	0.44		
40-48	0.68	0.02	0.51		
48-60	0.60	0.02	0.43		
60-72	0.59	0.02	0.44	45	24

a. Carbonate comprises 10 to 20 percent of the sand below 40 inches.
b. Duplicate: 32.0 percent sand, 40.8 percent silt, and 27.2 percent clay.
c. 22 kg/m^2 to 60 inches (Method 6A).
d. Calculated to include volume but not weight of 2-19 mm material (Method 3B2).
e. KCl-TEA extract (Method 6N4b).
f. KCl-TEA extract (Method 6O4b).
g. Resistivity of fine-and medium-textured soils measured at saturation is similar to that measured at moisture equivalent. Resistivity at saturation for coarse-textured soils is generally lower than that obtained at moisture equivalent.
h. Iowa State Highway Commission data.

Pedon classification: Aquic Hapludoll; fine, montmorillonitic, mesic.
Series classification: (Same as pedon).
Soil: Guckeen clay loam.
Soil no.: S64-Iowa-94-2 (LSL Nos. 19900 - 19909).
Location: Webster County, Iowa; 857 feet south and 1,120 feet east of the NW corner of Sec. 26, T.86 N., R. 28 W.
Vegetation and land use: Red clover; cropland.
Parent material: About 3 feet of moderately fine to fine textured glacial sediments over glacial till.
Slope: 2 percent convex slope to the NW. Gently undulating Late Wisconsin till plain.
Permeability: Slow.
Root distribution: Roots were abundant to 16 inches, common from 16 to 36 inches, and very few to no roots were observed below 36 inches.
Described by: R. I. Dideriksen, C. S. Fisher, and M. P. Koppen; September 14, 1964.

(Colors are for moist soil unless otherwise stated)

Ap1 19900 0 to 13 cm (0 to 5 inches). Black (10YR 2/1) clay loam, the same color when crushed, very dark gray (10YR 3/1) when dry; cloddy parting to weak fine granular structure; friable; distinct sand grains evident; neutral (pH 6.6); abrupt smooth boundary.

Ap2 19901 13 to 23 cm (5 to 9 inches). Black (10YR 2/1) clay loam, the same color when crushed, very dark gray (10YR 3/1) when dry; moderate fine and medium angular blocky and fine subangular blocky structure; friable; distinct sand grains; neutral (pH 6.6); clear smooth boundary.

A12 19902 23 to 40 cm (9 to 16 inches). Black (10YR 2/1) clay loam; moderate fine subangular blocky and very fine granular structure; dark gray (10YR 4/1) when dry; friable; a few peds in the lower part are very dark grayish brown (2.5Y 3/2); a few 1/8-inch pebbles; sand grains are distinct; slightly acid (pH 6.4); gradual smooth boundary.

B1 19903 40 to 53 cm (16 to 21 inches). Very dark gray (10YR 3/1) and about 25 percent very dark grayish brown (2.5Y 3/2) heavy clay loam; black (10YR 2/1) and about 20 percent very dark gray (10YR 3/1) moderate fine and very fine subangular blocky structure; friable to firm; a few pebbles; slightly acid (pH 6.4); clear smooth boundary.

B21 19904 53 to 70 cm (21 to 28 inches). Dark grayish brown (2.5Y 4/2) light clay; faces of peds very dark grayish brown (2.5Y 3/2) and very dark gray (10YR 3/1); some peds are very dark gray (10YR 3/1) throughout; weak medium prismatic and moderate fine and medium subangular blocky structure; firm; thin distinct clay films; many fine inped tubular pores; a few very fine soft dark yellowish brown oxides; some root hole fills are black (10YR 2/1); a few small shale and quartz pebbles and a few pebbles up to about 1 inch in diameter; sand grains are not clean; slightly acid (pH 6.2); clear smooth boundary.

B22 19905 70 to 90 cm (28 to 36 inches). Dark grayish brown (2.5Y 4/2) light clay; faces of peds dark gray (10YR 4/1) and dark grayish brown (2.5Y 4/2); few fine yellowish brown (10YR 5/6) mottles; moderate fine prismatic structure parting to strong medium subangular blocky; firm; thin discontinuous clay films on the smaller peds; common fine tubular pores; a few black (10YR 2/1) fills in root channels and pores; few stones and shale fragments; common dark brown oxide concretions; slightly acid (pH 6.2); clear smooth boundary.

I&IIB31 19906 90 to 103 cm (36 to 40 inches). Light olive brown (2.5Y 5/4) and about 20 percent olive gray (5Y 5/2) clay loam; weak fine prismatic structure parting to weak medium subangular blocky structure; friable to firm; some peds have dark gray (10YR 4/1) on the vertical faces; distinct clay flows and pore fills of very dark gray (10YR 3/1) to dark gray (10YR 4/1); many fine inped tubular pores; common very fine yellowish brown (10YR 5/8) soft oxides; mildly alkaline (pH 7.6); clear wavy boundary.

IIB32 19907 103 to 123 cm (40 to 48 inches). Mottled light olive brown (2.5Y 5/4) and gray to light gray (5Y 6/1) light clay loam; weak medium subangular blocky structure with some vertical cleavage; friable to firm; some dark gray (10YR 4/1) coats or fills in pores; some gray (10YR 6/1) lime coatings on vertical faces and some lime segregated in pores; common ½-to 1-inch diameter lime rock pebbles and other pebbles; few fine red and strong brown oxides; few shale fragments; moderately alkaline (pH 8.2+); strongly effervescent; gradual smooth boundary.

IIB33 19908 123 to 153 cm (48 to 60 inches). Mottled yellowish brown (10YR 5/4) and gray to light gray (5Y 6/1) loam; very weak subangular blocky structure with some vertical faces; friable; many fine pores; lime is segregated in the pores; many fine strong brown and red oxides; common pebbles and stones; moderately alkaline (pH 8.2+); strongly effervescent; diffuse smooth boundary.

IIC 19909 153 to 183 cm (60 to 72 inches). This hroizon is like the one above except the lime is not segregated; there is an increase in stones and pebbles, and there are a few pockets and seams of coarse sandy loam.

Penetrometer readings were made by using a Soiltest Penetrometer with a 5/16-inch head. The penetrometer was pushed horizontally into the freshly exposed wall of the sampling pit to a depth of 5 inches. Three readings were obtained at each vertical depth as follows (all measurements in pounds): at 5 inches-70, 67, 74; at 12 inches-75, 74, 78; at 18 inches-86, 85, 96; at 25 inches-77, 82, 74; at 31 inches-90, 92, 85; at 38 inches-66, 67, 67; at 44 inches-55, 60, 66; and at 55 inches-70, 65 (hit pebbles).

SOIL CLASSIFICATION-MOLLIC UDIFLUVENT
COARSE-SILTY, MIXED (CALCAREOUS), MESIC
SERIES - - - - - - -HAYNIE

SOIL NO - - - - - - S70IA-67-3 COUNTY - - - MONONA

GENERAL METHODS- - -1A,1B1B,2A1,2B SAMPLE NOS. 70L1143-70L1151

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE, MTSC
NATIONAL SOIL SURVEY LABORATORY
LINCOLN, NEBRASKA

NOVEMBER 1975

DEPTH	HORIZON	(- - PARTICLE SIZE ANALYSIS, LT 2MM, 3A1, 3A1A, 3A1B - -)																RATIO
					FINE	(- - SAND - -)					(- -SILT- -)			FAML	INTR	FINE	NON-	8D1
		SAND 2-.05	SILT .05-.002	CLAY LT .002	CLAY LT .0002	VCOS 2-1	CORS 1-.5	MEDS .5-.25	FNES .25-.10	VFNS .10-.05	COSI .05-.02	FNSI .02-.002	VFSI .005-.002	TEXT SAND 2-.1	II .2-.02	CLAY TO CLAY	CO3-CLAY	15-BAR TO CLAY
CM		(- - PCT LT 2MM - -)														PCT	PCT	
000-14	AP	5.1	78.4	16.5	9.9	.0	TR	.1	.5	4.5	47.9	30.5	2.6	.6	52.7	60	17	.51
014-31	C1	6.9	78.6	14.5	6.0	.0	.0	TR	.3	6.6	41.9	36.7	3.2	.3	48.7	41	15	.50
031-42	C2	4.1	81.0	14.9	6.9	.0	TR	.1	.4	3.6	40.2	40.8	3.5	.5	44.1	46	15	.51
042-56	C3	16.5	73.0	10.5		.0	.0	.2	.8	15.5	56.7	16.3	1.6	1.0	72.7		11	.53
056-66	C4	8.2	75.3	16.5		.0	.0	.1	1.1	7.0	35.8	39.5	4.1	1.2	43.8		17	.48
066-98	C5	34.1	55.3	10.6		.0	TR	.3	2.1	31.7	43.8	11.5	1.2	2.4	77.3		11	.52
098-124	C6	13.0	71.6	15.4		TR	.1	.2	.8	11.9	49.8	21.8	2.5	1.1	62.2		15	.49
124-135	C7	1.3	65.4	33.3		.0	TR	.1	.3	.9	25.9	39.5	8.1	.4	26.9		33	.44
135-185	C8	1.9	76.5	21.6		.0	.1	TR	.3	1.5	34.6	41.9	5.6	.4	36.3		22	.48

DEPTH	(PARTICLE SIZE ANALYSIS, MM, 3B, 3B1, 3B2)							(BULK DENSITY		)	(- - -WATER CONTENT- - -)					CARBONATE		(- -PH - -)	
	VOL.	(- - WEIGHT - -)						4A1D	4A1H	4D1	4B1C	4B1C	4B2	4C1		6E1B	3A1A	8C1A	8C1E
	GT 2	GT 75	75-20	20-5	5-2	LT .074	20-2 PCT	1/3-BAR	OVEN DRY	COLE	1/10 BAR	1/3-BAR	15-BAR	WRD CM/		LT 2	LT .002	1/1 H2O	1/2 CACL
CM	PCT	PCT	(- - - PCT LT 75 - - -)				LT20	G/CC	G/CC		PCT	PCT	PCT	CM		PCT	PCT		
000-14	0	0	0	0	0	99	0	1.48	1.52	.009	28.4	24.5	8.4	.24	3.6B	5	0	7.6	7.4
014-31	0	0	0	0	0	99	0	1.40	1.45	.012	33.1	27.7	7.3	.29	2.8B	7	0	8.0	7.4
031-42	0	0	0	0	0	99	0	1.30	1.36	.015	36.1	32.6	7.6	.33	1.7B	7	0	8.0	7.6
042-56	TR	0	0	0	TR	98	TR	1.40A					5.6			7	0	8.0	7.6
056-66	0	0	0	0	0	97	0	1.30A					7.9			7	0	7.9	7.6
066-98	0	0	0	0	0	91	0	1.37	1.40	.007	36.2	20.0	5.5	.20	1.1B	6	0	8.1	7.7
098-124	0	0	0	0	0	98	0	1.32	1.35	.008	37.4	33.5	7.6	.34	1.9B	6	0	7.9	7.6
124-135	0	0	0	0	0	99	0						14.5			5	0	7.8	7.7
135-185	0	0	0	0	0	99	0						10.4			6	0	7.8	7.7

DEPTH	(ORGANIC MATTER		)	IRON	PHOS	(- -EXTRACTABLE BASES 5B4A- -)					ACTY	AL	(CAT EXCH)		RATIO	RATIO	CA	(BASE SAT)	
	6A1A	6B1A	C/N	6C2A	6S1A	6N2E	6O2D	6P2A	6Q2A		6H1A	6G1D	5A3A	5A6A	8D1	8D3	5F	5C3	5C1
	ORGN CARB	NITG		EXT FE	TOTL	CA	MG	NA	K	SUM EXTB	BACL TEA	KCL EXT	EXTB ACTY	NHAC	NHAC TO CLAY	CA TO MG	SAT NHAC	EXTB ACTY	NHAC
CM	PCT	PCT		PCT	PCT	(- - -MEQ / 100 G- - -)											PCT	PCT	PCT
000-14	1.28C	.118	11	.8		16.5D	1.9D	.1	1.4	19.9				16.2	.98				
014-31	.57	.052	11																
031-42	.60	.048	13	.9		17.0D	2.5D	.2	.5	20.2				14.7	.99				
042-56	.45	.029	16																
056-66	.57			1.0		17.1D	3.3D	.2	.6	21.2				15.6	.95				
066-98	.42																		
098-124	.52			.9		15.2D	4.3D	.9	.7	21.1				14.7	.95				
124-135	.65																		
135-185	.58			1.0		20.1D	6.6D	1.6	.9	29.2				18.5	.86				

DEPTH	(SATURATED PASTE)			NA	NA	SALT	GYP	(- - SATURATION EXTRACT 8A1- -)										ATTERBERG	
	8E1	8C1B	8A	5D2	5E	8D5	6F1A	8A1A	6N1B	6O1B	6P1A	6Q1A	6I1A	6J1A	6K1A	6L1A	6M1A	4F1	4F2
	REST OHM-CM	PH	H2O	ESP	SAR	TOTL SOLU		EC MMHOS/CM	CA	MG	NA	K	CO3	HCO3	CL	SO4	NO3	LQID LMIT	PLST INDX
CM			PCT	PCT		PPM	PCT		(- - MEQ / LITER - -)									PCT	
000-14																		34E	7
014-31																			
031-42																			
042-56																			
056-66																		32E	6
066-98																		32E	4
098-124	1300	7.6	42.2	5	2	490		1.58	8.5	4.	4.8	.7						39E	16
124-135																			
135-185																			

MICROMORPHOLOGY (4E1).

66-98 CM C5 VIEWED NORMAL TO STRATIFICATION HAVE BANDS .5 TO 4 MM WIDE THAT CONTAIN A CONCENTRATION OF GRAINS .02-.1 MM. MANY OF THESE GRAINS ARE SUBROUNDED MICRO-CRYSTALLINE AGGREGATES HIGH IN CLAY. SOME ARE ALTERED MICACEOUS GRAINS, OTHERS FRAGMENTS OF SEDIMENTARY ROCK. BETWEEN THE BANDS THE FABRIC IS VERY UNIFORM WITH WEAK CLAY ORIENTATION. CARBONATE GRAINS .02-.05 MM OCCUR UNIFORMLY. BLACK AND DARK REDDISH- BROWN IRREGULAR GRAINS .02-.05 MM ARE VERY COMMON. THEY ARE LARGER IN THE SANDY BANDS.

DEPTH	AVAILABLE P	AVAILABLE K
CM	LBS PER ACRE (F)	
000-15	70	1187
015-30	2	610
030-41	2	312
041-56	1	149
056-66	3	145
066-81	3	180
081-99	1	215
099-112	1	305
112-124	1	338
124-135	3	400
135-152	2	439

(A) ESTIMATED.
(B) MICRO-PENETRATION RESISTANCE - A ROD 0.6 CM DIA IS SLOWLY PUSHED INTO BULK DENSITY CLOD, EQUILIBRATED AT 1/10-BAR, A DISTANCE OF 0.6 CM USING A POCKET PENETROMETER. UNITS ARE FORCE (KG) AND NOT ESTIMATES OF UNCONFINED COMPRESSIVE STRENGTH.
(C) ORGANIC CARBON IS 8 KG/M SQ TO A DEPTH OF 1 M (6A).
(D) METHODS 6N4C FOR CA AND 6O4C FOR MG.
(E) BY IOWA STATE HWY COMM, AMES, IA. HORIZONS 56-66 AND 66-98 CM WERE COMBINED FOR TESTING.
(F) BY SOIL TESTING LAB, IOWA STATE UNIV, AMES, IA.

Pedon classification: Mollic Udifluvent; coarse-silty, mixed, calcareous, mesic.
Series classification: (Same as pedon).
Soil: Haynie silt loam.
Soil no.: S70-Iowa-67-3 (LSL Nos. 70L1143 - 70L1151).
Location: Monona County, Iowa; about 2 miles northwest of Whiting, Iowa; 660 feet east and 201 feet north of the southwest corner of the NE¼ NW¼ sec. 34, T. 85N., R. 46 W.
Vegetation and land use: Soybeans, harvested; cropland.
Parent material: Recently deposited calcareous alluvium, dominantly coarse silt loam or very fine sandy loam.
Physiography: Nearly level bottom land east of old stream channel, about 5½ miles east of Missouri River and about 11½ miles west of uplands.
Relief: Nearly level.
Slope: Less than .5 percent; area currently being land-graded.
Drainage: Well drained and moderately well drained.
Ground water: None; seldom flooded.
Permeability: Moderate.
Described by: J. R. Culver, C. S. Fisher, J. Worster, and F. F. Riecken; October 28, 1970.

(Colors are for moist soil unless otherwise stated)

Ap 70L1143 0 to 14 cm (0 to 6 inches). Very dark grayish brown (10YR 3/2) silt loam, grayish brown (2.5Y 5/2) dry; cloddy parting to weak fine granular structure; some evidence of horizontal cleavage and stratification of lighter colors in the lower part; friable; few very dark brown (10YR 2/2) and dark brown (10YR 3/3) spots of decomposed organic material; slightly effervescent; mildly alkaline; clear smooth boundary.

C1 70L1144 14 to 31 cm (6 to 12 inches). Stratified grayish brown (10YR 5/2) and dark grayish brown (10YR 4/2) tending to 2.5Y hue; light silt loam; few fine prominent strong brown (7.5YR 5/6) and yellowish red (5YR 4/6) mottles, few fine distinct light brownish gray (10YR 6/2) mottles on faces of horizontal lenses; massive; horizontal cleavage; friable to very friable; strongly effervescent; mildly alkaline; clear smooth boundary.

C2 70L1145 31 to 42 cm (12 to 16 inches). Stratified grayish brown (2.5Y 5/2) and dark grayish brown (2.5Y 4/2) silt loam; thin darker strata less than 2 mm in thickness; few fine prominent strong brown (7.5YR 5/6) and few fine distinct light brownish gray (10YR 6/2) mottles on faces of horizontal lenses; massive; horizontal cleavage; common ¼- to 1/8-inch lenses of very fine sandy loam; very friable; strongly effervescent; mildly alkaline; clear smooth boundary.

C3 70L1146 42 to 56 cm (16 to 22 inches). Grayish brown (2.5Y 5/2) coarse silt loam stratified with thin ¼- to 1/8-inch lenses of very fine sandy loam; few fine prominent strong brown (7.5YR 5/6) and few fine distinct light brownish gray (2.5Y 6/2) mottles on faces of horizontal lenses; massive; horizontal cleavage; very friable; strongly effervescent; mildly alkaline; clear smooth boundary.

C4 70L1147 56 to 66 cm (22 to 26 inches). Dark grayish brown (2.5Y 4/2) and grayish brown (2.5Y 5/2) silt loam, few fine prominent strong brown (7.5YR 5/6) and gray (5Y 5/1) mottles on faces of lenses; massive; some horizontal cleavage; friable; strongly effervescent; mildly alkaline; clear smooth boundary.

C5 70L1148 66 to 98 cm (26 to 39 inches). Grayish brown (2.5Y 5/2) to brown (10YR 5/3) very fine sandy loam, few fine prominent strong brown (7.5YR 5/6) and gray (5Y 5/1) mottles on faces of horizontal lenses; massive; some horizontal cleavage; very friable; strongly effervescent; mildly alkaline; gradual smooth boundary.

C6 70L1149 98 to 124 cm (39 to 49 inches). Dark grayish brown (2.5Y 4/2) and grayish brown (2.5Y 5/2) very fine sandy loam with thin strata of silt loam; few fine prominent strong brown (7.5YR 5/6) and common fine distinct gray (5Y 5/1) mottles on faces of horizontal lenses; massive; some horizontal cleavage; very friable to friable; strongly effervescent; mildly alkaline; clear smooth boundary.

C7 70L1150 124 to 135 cm (49 to 53 inches). Stratified gray (5Y 5/1), dark gray (5Y 4/1), and dark grayish brown (2.5Y 4/2) silty clay loam and silty clay; common fine distinct dark yellowish brown (10YR 3/4), strong brown (7.5YR 5/6) and dark red (2.5Y 3/6) mottles; massive; some horizontal cleavage; firm; strongly effervescent; mildly alkaline; clear smooth boundary.

C8 70L1151 135 to 185 cm (53 to 70 inches). Mixed gray (5Y 5/1) to dark grayish brown (2.5Y 4/2) silt loam with thin strata of silty clay loam, few fine prominent strong brown (7.5YR 5/6) to dark reddish brown (2.5YR 3/4) mottles; strongly effervescent; mildly alkaline.

SOIL CLASSIFICATION-ARGIAQUIC ARGIALBOLL
FINE, MONTMORILLONITIC, MESIC
SERIES - - - - - - -HUMESTON

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE MRTSC
SOIL SURVEY INVESTIGATIONS UNIT
LINCOLN, NEBRASKA

SOIL NO - - - - - - S71IOWA-93-2 COUNTY - - - WAYNE

GENERAL METHODS- - -1A,1B1B,2A1,28 SAMPLE NOS. 71L1146-71L1155 OCTOBER 1974

DEPTH CM	HORIZON	PARTICLE SIZE ANALYSIS, LT 2MM, 3A1, 3A1A, 3A1B (PCT LT 2MM) SAND 2-.05	SILT .05-.002	CLAY LT .002	FINE CLAY LT .0002	VCOS 1	CORS 1-.5	MEDS .5-.25	FNES .25-.10	VFNS .10-.05	COSI .05-.02	FNSI .02-.002	VFSI .005-.002	TEXT SAND 2-.1	INTR II .2-.02	FINE CLAY TO .02	RATIO NON-CO3-CLAY PCT	BD1 15-BAR TO CLAY
000-18	A11	2.4A	67.7	29.9	18.6	.1	.2	.2	.7	1.2	21.7	46.0	9.1	1.2	23.3	62		.54
018-33	A12	5.2A	72.4	22.4	13.4	.1	.3	.3	1.5	3.0	30.2	42.2	8.0	2.2	34.2	60		.52
033-46	A21	6.9A	74.5	18.6	9.7	.2	.7	.5	1.8	3.7	29.5	45.0	5.0	3.2	34.4	52		.45
046-66	A22	8.6A	73.4	18.0	9.5	.4	1.3	.7	2.2	4.0	28.9	44.5	5.8	4.6	34.3	53		.47
066-79	B6A	8.1A	67.9	24.0	15.1	.2	.8	.7	2.3	4.1	26.5	41.4	4.9	4.0	32.1	63		.47
079-91	B21T	6.7A	59.9	33.4	23.4	.1	.5	.5	2.1	3.5	23.5	36.4	4.1	3.2	28.4	70		.48
091-114	B22T	6.5A	56.6	36.9	26.6	.3	.5	.6	2.2	2.9	19.8	36.8	4.3	3.6	24.1	72		.48
114-152	B23T	9.6A	54.4	36.0	25.1	.3	1.1	1.5	3.6	3.1	18.2	36.2	3.8	6.5	23.4	70		.50
152-178	B31GT	11.4A	55.8	32.8	21.8	.4	1.1	1.9	4.5	3.5	19.0	36.8	4.5	7.9	25.0	66		.50
178-203	B32GT	21.4A	49.6	29.0	19.1	.7	2.3	3.6	8.3	6.5	20.5	29.1	3.4	14.9	31.7	66		.48

DEPTH CM	(PARTICLE SIZE ANALYSIS, MM, 3B, 3B1, 3B2) VOL. GT 2 PCT	GT 75 PCT	75-20	20-5	5-2	LT .074	20-2 LT20	BULK DENSITY 4A1D 1/3-BAR G/CC	4A1H DRY OVEN G/CC	4D1 COLE	4B1C 1/10 BAR PCT	4B1C 1/3-BAR PCT	WATER CONTENT 4B2 15-BAR PCT	4C1 WRD CM/CM	AVAIL. P E/ LBS/ACRE	PH 8C1A 1/1 H2O	8C1E 1/2 CACL
000-18	TR	0	0	0	TR	98	TR	1.25	1.43	.047	34.1	31.6	16.0	.20	3.6C	14	6.3	6.1
018-33	0	0	0	0	0	97	0	1.28	1.37	.023	30.1	27.6	11.6	.20	3.1C	23	5.4	5.0
033-46	0	0	0	0	0	96	0	1.36	1.41	.012	28.1	25.4	8.3	.23	4.6C	23	5.3	4.6
046-66	0	0	0	0	0	94	0	1.46	1.53	.016	26.5	24.5	8.4	.24	3.3C	15	5.3	4.5
066-79	0	0	0	0	0	95	0	1.46	1.61	.033	27.3	25.6	11.2	.21	2.3C	34	5.2	4.5
079-91	TR	0	0	0	TR	96	TR	1.44	1.68	.054	28.8	27.4	16.1	.17	4.6C	63	4.9	4.4
091-114	0	0	0	0	0	95	0	1.40B					17.8			101	5.0	4.6
114-152	TR	0	0	0	TR	92	TR	1.52	1.80	.059	25.4	24.4	17.9	.10	4.8C	78	5.6	4.9
152-178	TR	0	0	0	TR	91	TR	1.50B					16.3				5.8	5.3
178-203	TR	0	0	0	TR	82	TR	1.56	1.80	.050	24.1	22.8	14.0	.14	3.3C		5.5	5.4

DEPTH CM	(ORGANIC MATTER) 6A1A ORGN CARB PCT	6B1A NITG PCT	C/N	IRON 6C2A EXT FE PCT	PHOS 6S1A TOTL PCT	(EXTRACTABLE BASES 5B4A) 6N2E CA	6O2D MG	6P2A NA	6Q2A K	SUM EXTB MEQ / 100 G	ACTY 6H1A BACL TEA	AL 6G1D KCL EXT	(CAT EXCH) 5A3A EXTB ACTY	5A6A NHAC	RATIO 8D1 NHAC TO CLAY	RATIO 8D3 CA TO MG	CA 5F SAT NHAC PCT	(BASE SAT) 5C3 EXTB ACTY PCT	5C1 NHAC PCT
000-18	2.98D	.272	11	.8		23.4	4.6	.1	.4	28.5	6.1		34.6	30.2	1.01	5.1	77	82	94
018-33	1.95	.168	12	.6		13.7	3.3	.1	.2	17.3	9.4	TR	26.7	22.5	1.00	4.2	61	65	77
033-46	1.01	.079	13	.6		8.7	2.2	.1	.1	11.1	7.8	TR	18.9	15.5	.83	4.0	56	59	72
046-66	.60	.042	14	.5		7.7	2.4	.2	.2	10.5	7.4	.1	17.9	14.8	.82	3.2	52	59	71
066-79	.53	.042	13	.6		10.2	3.6	.2	.2	14.2	8.3	.2	22.5	19.3	.80	2.8	53	63	74
079-91	.72	.057	13	.7		14.4	5.5	.4	.3	20.6	10.7	TR	31.3	28.0	.84	2.6	51	66	74
091-114	.89			.7		17.7	6.6	.4	.5	25.2	11.5	.1	36.7	32.1	.87	2.7	55	69	79
114-152	.81			.7		19.4	7.1	.4	.5	27.4	9.8		37.2	31.8	.88	2.7	61	74	86
152-178	.65			.7		18.7	6.7	.4	.5	26.3	5.4		31.7	28.1	.86	2.8	67	83	94
178-203	.36			.9		18.7	6.7	.4	.5	26.3	4.4	.0	30.7	28.2	.97	2.8	66	86	93

DEPTH CM	(SATURATED PASTE) 8E1 REST OHM-CM	8C1B PH	8A H2O PCT	NA 5D2 ESP PCT	NA 5E SAR	SALT 8D5 TOTL SOLU PPM	GYP 6F1A PCT	(SATURATION EXTRACT 8A1) 8A1A EC MMHOS/CM	6N1B CA	6O1B MG	6P1A NA	6Q1A K	6I1A CO3	6J1A HCO3	6K1A CL	6L1A SO4	6M1A NO3	ATTERBERG F/ 4F1 LQID LIMIT PCT	4F2 PLST INDX
000-18																		32	9
018-33																			
033-46																		48	18
046-66																			
066-79																			
079-91																			
091-114	2600	4.6	53.8					.18										49	28
114-152																			
152-178																		43	24
178-203																			

CLAY MINERALOGY (7A2C). PLACEMENT (S71IA-93-2) - MONTMORILLONITIC.

000-18	MT3	MI2	KK2	QZ1
033-46	MT4	KK3	MI2	QZ1
079-91	MT5	KK3	MI2	QZ1
178-203	MT5	KK3	MI1	

COMMENTS - SMECTITE BECOMES POORLY ORDERED TOWARD SURFACE. KAOLINITE SMALL TO MODERATE AMOUNTS (EST 10-15 PCT). FINE FRACTION OF SURFACE HORIZON, ASSOCIATED WITH CALGON DISPERSED ORGANIC MATTER, HAS STRONG 14A PEAK THAT FAILED TO SOLVATE WITH GLYCEROL - PROBABLY ORGANO-CLAY COMPLEX.

MINERAL CODE* MT-MONTMORILLONITE KK-KAOLINITE MI-MICA QZ-QUARTZ.
RELATIVE ABUNDANCE* 5-DOMINANT 4-ABUNDANT 3-MODERATE 2-SMALL 1-TRACE.
(A) FE-MN NODULES 15-25 PCT.
(B) ESTIMATED.
(C) MICRO-PENETRATION RESISTANCE - A ROD 0.6 CM DIA IS SLOWLY PUSHED INTO BULK DENSITY CLOD, EQUILIBRATED AT 1/10-BAR, A DISTANCE OF 0.6 CM USING A POCKET PENETROMETER. UNITS ARE FORCE (KG) AND NOT ESTIMATES OF UNCONFINED COMPRESSIVE STRENGTH.
(D) ORGANIC CARBON IS 17 KG/M SQ TO A DEPTH OF 1 M (6A).
(E) IOWA STATE UNIVERSITY DATA.
(F) IOWA STATE HIGHWAY COMMISSION DATA.

Pedon classification: Argiaquic Argialboll; fine, montmorillonitic, mesic.
Series classification: (Same as pedon).
Soil: Humeston silty clay loam.
Soil no.: S71-Iowa-93-2 (LSL Nos. 71L1146 - 71L1155).
Location: Wayne County, Iowa, 250 feet north and 100 feet west of the southeast corner of the NE¼ sec. 31, T. 70 N., R. 22 W., on a nearly level bottom land.
Vegetation and land use: Bluegrass; pasture.
Parent material: Alluvium.
Physiography: On a nearly level, slightly concave slackwater area of first bottom or low second bottom land of Nine-Mile Creek.
Relief: Plane to slightly concave.
Slope: Less than 1 percent.
Drainage: Poorly to very poorly drained.
Erosion: None
Ground water: None within 6 feet (seasonal rainfall below normal).
Permeability: Moderate to moderately slow in the upper part, very slow in the lower part.
Described by: J. D. Highland, L. D. Lockridge, and J. R. Worster; October 1971.

(Colors are for moist soil unless otherwise stated)

A11 71L1146 0 to 18 cm (0 to 7 inches). Very dark gray (10YR 3/1) light silty clay loam; weak fine subangular blocky structure parting to weak fine granular; friable; medium acid (pH 5.6); clear smooth boundary.

A12 71L1147 18 to 33 cm (7 to 13 inches). Very dark gray (10YR 3/1) light silty clay loam; common fine distinct dark brown (7.5YR 3/2) mottles; moderate thin platy structure parting to moderate fine granular; friable; discontinuous gray (10YR 6/1) and light gray (10YR 7/1 dry) silt and fine sand coatings on peds; medium acid; (pH 5.6); clear wavy boundary.

A21 71L1148 33 to 46 cm (13 to 18 inches). Dark gray (10YR 4/1) silt loam; common fine distinct dark brown (7.5YR 3/2) mottles; moderate thin platy structure; friable; discontinuous light gray (10YR 7/1 dry) silt and fine sand coatings on peds; few fine pores; strongly acid (pH 5.4); clear smooth boundary.

A22 71L1149 46 to 66 cm (18 to 26 inches). Dark gray (10YR 4/1) silt loam; few fine distinct dark brown (7.5YR 3/2) mottles; weak medium subangular blocky structure; some horizontal cleavage; friable; nearly continuous light gray (10YR 7/1 dry) silt and fine sand coatings on peds; very strongly acid (pH 5.0); clear wavy boundary.

B&A 71L1150 66 to 79 cm (26 to 31 inches). Very dark gray (10YR 3/1) light silty clay loam; weak medium subangular blocky structure; friable; common nearly continuous light gray (10YR 7/1 dry) silt and fine sand coatings on peds and accumulations in root channels; few dark brown oxides; very strongly acid (pH 4.8); clear wavy boundary.

B21t 71L1151 79 to 91 cm (31 to 36 inches). Very dark gray (10YR 3/1) silty clay loam; weak medium prismatic structure parting to weak fine subangular blocky; firm; thin patchy light gray (10YR 7/1 dry) silt and fine sand coatings on peds which are thicker and more pronounced on the prism faces; common fine dark brown oxide concretions; very strongly acid (pH 4.8); clear smooth boundary.

B22t 71L1152 91 to 114 cm (36 to 45 inches). Black (10YR 2/1) heavy silty clay loam; weak medium prismatic structure parting to moderate fine subangular blocky; firm; thin discontinuous clay films; few thin discontinuous light gray (10YR 7/1 dry) silt and fine sand coatings on peds; very strongly acid; gradual smooth boundary.

B23t 71L1153 114 to 152 cm (45 to 60 inches). Black (N 2/) heavy silty clay loam; moderate medium prismatic structure; firm; few thin discontinuous clay films; strongly acid (pH 5.4); gradual smooth boundary.

B31gt 71L1154 152 to 178 cm (60 to 70 inches). Very dark gray (10YR 3/1) silty clay loam; few fine distinct dark grayish brown (2.5Y 4/2) mottles; weak coarse prismatic structure parting to weak coarse subangular blocky; firm; few thin discontinuous clay films; few black (10YR 2/1) coats and filled root channels; medium acid (pH 5.6) gradual smooth boundary.

B32gt 71L1155 178 to 203 cm (70 to 80 inches). Dark gray (10YR 4/1) silty clay loam high in sand; few fine distinct olive brown (2.5Y 4/4) mottles; weak coarse prismatic structure parting to weak medium subangular blocky; firm; discontinuous black (10YR 2/1) to very dark gray (10YR 3/1) coatings on prisms and fillings in root channels; medium acid (pH 5.6)

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SOIL Kamrar clay loam SOIL Nos. S64Iowa-40-1 LOCATION Hamilton County, Iowa

SOIL SURVEY LABORATORY Lincoln, Nebraska LAB. Nos. 19881-19890 April 1968

General Methods: 1A, 1B1b, 2A1, 2B

Depth (in)	Horizon	Size class and particle diameter (mm) 3A1 — Total: Sand (2-0.05) a	Total: Silt (0.05-0.002)	Total: Clay (< 0.002)	Sand: Very coarse (2-1)	Sand: Coarse (1-0.5)	Sand: Medium (0.5-0.25)	Sand: Fine (0.25-0.1)	Sand: Very fine (0.1-0.05)	Silt: 0.05-0.02	Silt: Int III (0.02-0.002)	Int II (0.2-0.02)	(2-0.1)	<0.074		Coarse fragments 2A2: 3B2 2-19 (vol.)	3B1 2-19 (wt.)	
		Pct. of < 2 mm														Pct of < 19 mm		
0-8	Ap	28.1	37.6	34.3	1.4	4.9	5.4	10.2	6.2	14.2	23.4	26.0	21.9	75.2			tr	
8-11	A12	26.4	37.0	36.6	1.0	3.8	4.1	9.7	7.8	15.4	21.6	28.7	18.6	78.2			tr	
11-16	B1	28.4	35.2	36.4	1.5	4.7	4.9	10.2	7.1	14.9	20.3	27.7	21.3	75.5			tr	
16-23	B21	30.7	33.5	35.8	1.3	4.3	5.7	11.5	7.9	13.3	20.2	27.5	22.8	73.6			tr	
23-29	B22	34.1	31.1	34.8	2.1	4.3	5.2	12.7	9.8	13.1	18.0	30.4	24.3	71.5			tr	
29-36	B23	34.3	31.1	34.6	2.3	4.7	5.1	12.7	9.5	12.9	18.2	29.8	24.8	70.9		2	5	
36-41	I&IIB31	34.5	33.7	31.8	2.2	4.5	5.0	13.0	9.8	12.8	20.9	30.5	24.7	70.9		4	9	
41-50	IIB32	33.0	39.5	27.5	2.3	4.5	4.7	11.8	9.7	13.9	25.6	30.8	23.3	72.6		12	21	
50-63	IIB33	32.3	39.3	28.4	2.4	4.6	4.6	11.2	9.5	14.8	24.5	31.0	22.8	73.3		16	26	
63-72	IIC	32.4	40.8	26.8	2.1	4.1	4.7	11.4	10.1	16.7	24.1	33.5	22.3	73.4		4	7	

Depth (in)	6A1a Organic carbon b Pct	6B1a Nitrogen Pct	C/N	6C2a Ext. Iron as Fe Pct.	Carbonate as $CaCO_3$: 6E1b 6F2a <2mm Pct	3A1a <0.002 mm Pct.	Bulk density: 1/3-Bar c g/cc	4A1d 1/3-Bar g/cc	4A1b Air-Dry g/cc	4D1 COLE	Water content: 4B1c 1/3-Bar Pct	4B2 15-Bar Pct	4C1 1/3- to 15-Bar in./in.			pH: 8C1b Sat. Paste		8C1a (1:1)
0-8	2.88	0.262	11	0.9				1.40	1.61	0.047	26.0	13.8	0.17					6.2
8-11	2.72	0.230	12	0.9				1.30	1.48	0.044	27.6	14.3	0.17					5.7
11-16	2.30	0.195	12	1.0				1.31	1.49	0.044	25.6	14.1	0.15					5.7
16-23	1.70	0.151	11	1.0				1.37	1.61	0.056	26.4	14.0	0.17					5.7
23-29	0.98	0.100	10	1.0				1.40	1.68	0.064	27.8	13.9	0.19					6.0
29-36	0.52			1.0	-(s)		1.43	1.46	1.68	0.046	22.1	13.8	0.12					6.1
36-41	0.37			0.9	2	-	1.31	1.36	1.57	0.045	25.7	13.8	0.16			7.1		7.2
41-50	0.20			0.8	16	tr	1.26	1.43	1.61	0.035	24.6	11.7	0.16					7.6
50-63	0.13			0.6	19	1	1.27	1.51	1.66	0.027	23.0	12.2	0.14					7.8
63-72	0.09			0.7	18	1	1.59	1.66	1.79	0.023	18.9	11.9	0.11					7.7

Depth (in)	Extractable bases 5B1a: 6N2a Ca	6O2a Mg	6P2a Na	6Q2a K	Sum	6H1a Ext. Acidity	Cat. Exch. Cap.: 5A3a Sum Cations	5A1a NH_4OAc			8E1 Resistivity f ohms-cm	8B1a Elec. Cond. mmhos/cm	8B1 Water at Sat. Pct.	8D5 Total sol. salts in soil ppm.	8D3 Ca/Mg		Base saturation: 5C3 Sum Cations Pct	5C1 NH_4OAc Pct.
	meq/100 g																	
0-8	21.1	6.0	0.1	0.5	27.7	8.7	36.4	28.3							3.5		76	98
8-11	19.2	5.5	0.1	0.5	25.3	9.9	35.2	28.2							3.5		72	90
11-16	18.2	5.9	0.1	0.5	24.7	9.7	34.4	28.1							3.1		72	88
16-23	17.2	6.4	0.1	0.5	24.2	8.9	33.1	26.2							2.7		73	92
23-29	16.6	6.9	0.1	0.6	24.2	5.1	29.3	24.2							2.4		83	100
29-36	16.3	7.2	0.1	0.6	24.2	4.1	28.3	23.1							2.3		86	105
36-41	14.6d	6.5e	0.1	0.5	21.7			21.5			1700	0.64	43.7	410	2.2			
41-50	13.5d	5.2e	0.1	0.5	19.3			17.4							2.6			
50-63	13.3d	4.7e	0.1	0.5	18.6			16.5							2.8			
63-72	13.1d	4.6e	0.1	0.5	18.3			16.2							2.8			

Depth (in)	Ratios to Clay 8D1: NH_4OAc CEC	Ext. Iron	15-Bar Water
0-8	0.83	0.03	0.40
8-11	0.77	0.02	0.39
11-16	0.77	0.03	0.39
16-23	0.73	0.03	0.39
23-29	0.70	0.03	0.40
29-36	0.67	0.03	0.40
36-41	0.68	0.03	0.43
41-50	0.63	0.03	0.43
50-63	0.58	0.02	0.43
63-72	0.60	0.03	0.44

a. Carbonate comprises approximately 2 percent of the sand between 36 and 41 inches, and 10 to 20 percent of the sand below 41 inches.
b. 24 kg/m² to 60 inches (Method 6A).
c. Calculated to include volume but not weight of 2-19 mm material (Method 3B2).
d. KCl-TEA extract (Method 6N4b).
e. KCl-TEA extract (Method 6O4b).
f. Resistivity of fine-and medium-textured soils measured at saturation is similar to that measured at moisture equivalent. Resistivity at saturation for coarse-textured soils is generally lower than that obtained at moisture equivalent.

Pedon classification: Typic Hapludoll; fine, montmorillonitic, mesic.
Series classification: (Same as pedon).
Soil: Kamrar clay loam.
Soil no.: 864-Iowa-40-1 (LSL Nos. 19881 - 19890).
Location: Hamilton County, Iowa; 335 feet east and 260 feet south of the NW corner of the SE¼ Sec. 27, T. 88 N., R. 25 W.
Vegetation and land use: Plowed red clover sod; cropland.
Parent material: About 3 feet of moderately fine to fine textured glacial sediments over glacial till.
Slope: About 1 percent slope at the actual site but the site is on a high that has a gradient of 3 percent to the south. Late Wisconsin glacial till plain.
Drainage: Moderate well drained.
Permeability: Moderately slow.
Root distribution: Roots were abundant from 0 to 16 inches, few from 16 to 41 inches with very few below 41 inches.
Described by: R. I. Dideriksen, C. S. Fisher, and M. P. Koppen; September 15, 1964.

(Colors are for moist soil unless otherwise stated)

Ap 19881 0 to 20 cm (0 to 8 inches). Black (10YR 2/1) medium clay loam; black (10YR 2/1) to very dark gray (10YR 3/1) when kneaded; very dark gray (10YR 3/1) to dark gray (10YR 4/1) when dry; cloddy parting to weak fine granular structure; friable; sand grains are distinctly evident; neutral (pH 6.6); abrupt smooth boundary.

A12 19882 20 to 28 cm (8 to 11 inches). Black (10YR 2/1) medium clay loam; very dark gray (10YR 3/1) when kneaded; very dark gray (10YR 3/1) to dark gray (10YR 4/1) when dry; weak fine subangular blocky and fine granular structure; friable; sand grains are evident; slightly acid (pH 6.2); clear smooth boundary.

B1 19883 28 to 40 cm (11 to 16 inches). Very dark gray (10YR 3/1) heavy clay loam; the same color when kneaded; moderate very fine subangular blocky structure; friable; distinct clean sand grains are evident; slightly acid (pH 6.4); gradual smooth boundary.

B21 19884 40 to 68 cm (16 to 23 inches). Very dark grayish brown (10YR 3/2) faces of peds are about 70 percent very dark gray (10YR 3/1) and about 30 percent very dark grayish brown (10YR 3/2); heavy clay loam; moderate fine and very fine subangular blocky structure; friable to firm; a few brown (10YR 4/3) peds in the lower part; the sand grains are coated; a few fine pores and many root channels; few small pebbles about ¼ inch in diameter; slightly acid (pH 6.4); clear smooth boundary.

B22 19885 68 to 73 cm (23 to 29 inches). Brown (10YR 4/3) heavy clay loam; faces of peds very dark grayish brown (10YR 3/2) with about 20 percent very dark gray (10YR 3/1); moderate fine and very fine subangular blocky structure; friable to firm; few fine pores and many root channels; very few very fine strong brown soft oxides; a rotten stone is present; slightly acid (pH 6.2); clear smooth boundary.

B23 19886 73 to 90 cm (29 to 36 inches). Brown (10YR 4/3) with some dark yellowish brown (10YR 4/4) medium clay loam; faces of peds dark grayish brown (10YR 4/2) and brown (10YR 4/3); very few very fine strong brown (7.5YR 5/6) mottles; weak fine prismatic structure parting to moderately fine subangular blocky; firm; thin discontinuous dark grayish brown (10YR 4/2) clay films on vertical faces; very few yellowish red oxides; some 1-inch diameter pebbles; slightly acid (pH 6.2); clear smooth boundary.

I&IIB31 19887 90 to 105 cm (36 to 41 inches). Yellowish brown (10YR 5/4) and brown (10YR 4/3) medium clay loam; faces of peds brown (10YR 4/3) with some dark grayish brown (10YR 4/2); few fine gray (5Y 5/1) mottles and very few strong brown (7.5YR 5/6 and 5/8) mottles; very weak fine prismatic structure parting to weak fine and medium subangular blocky; thin discontinuous dark grayish brown (10YR 4/2) clay films on some vertical faces; very few soft red oxides; a few ½- to 1-inch diameter pebbles; mildly alkaline (pH 8.6); noncalcareous; clear wavy boundary.

IIB32 19888 105 to 128 cm (41 to 50 inches). Yellowish brown (10YR 5/4) clay loam; common fine gray (5Y 5/1) mottles; weak medium subangular blocky structure with some vertical cleavage; friable; a few lime-coated vertical faces are grayish brown (2.5Y 5/2); many very fine black oxides; few strong brown and yellowish red soft oxides; common pebbles and few stones; a few wormholes; moderately alkaline (pH 8.0); clear wavy boundary.

IIB33 19889 128 to 160 cm (50 to 63 inches). Mottled yellowish brown (10YR 5/4) and gray (5Y 5/1) clay loam; very weak medium subangular blocky structure; friable; distinct lime-coated vertical faces of gray to light gray (5Y 6/1) and many soft concretions and coats in pores; a few ½-inch clay balls; common very fine black oxides; many fine pores; moderately alkaline (pH 8.2+); calcareous; clear wavy boundary.

IIC 19890 160 to 183 cm (63 to 72 inches). Mottles yellowish brown (10YR 5/4) and 30 percent gray (5Y 5/1) heavy loam; massive; friable; many black oxides; less segregated lime than in the horizon above; some stones and pebbles; moderately alkaline (pH 8.2+); calcareous.

Remarks: From 41 to 72 inches there were common vertical rootholes and voids up to ¼ inch in diameter. The site appears to have a transitional horizon at 36 to 41 inches between materials I and II.

Penetrometer readings were made by using a Soiltest penetrometer with a 5/16-inch head. The penetrometer was pushed horizontally into the freshly exposed wall of the sampling pit to a depth of 5 inches. Three readings were obtained at each vertical depth as follows (all measurements in pounds): at 13 inches--53, 58, 57; at 20 inches--80, 80, 79; at 25 inches--98, 115, 116; at 31 inches--101, 103; and at 46 inches--72, 74, 65.

Soil temperatures were taken by inserting a Weston dial thermometer into the wall of the sampling pit. The depths and temperatures are as follows: 20 inches--16.7° C., 30 inches--16.5° C., 40 inches--16.2° C., 80 inches--14.2° C.

2-Kamrar clay loam

Micromorphology (Method 4E1) and Mineralogy (Method 7B). Clay films are not apparent on peds from the B22 horizon examined under a stereoscopic microscope. In thin section, a few, thin, oriented clay bodies that might be interpreted as clay films occur on the macrostructural surfaces. The very fine sand consists of 63 percent quartz, 21 percent feldspar, and 8 percent ferromagnesian minerals. Orthoclase is the principal feldspar. Microcline and sodic plagioclase were identified. Accessory minerals include hornblende, weathered biotite(?), hypersthene, tourmaline, epidote (clinozoisite), compound grains, zircon, kaolinite, and opaques. The very fine sands of the IIC horizon contain 10 to 15 percent carbonate; otherwise they are similar to very fine sands of the B22 in composition and in degree of weathering.

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SOIL Kamrar clay loam SOIL Nos. 864Iowa-40-2 LOCATION Hamilton County, Iowa

SOIL SURVEY LABORATORY Lincoln, Nebraska LAB. Nos. 19891-19899 April 1968

General Methods: 1A, 1B1b, 2A1, 2B

Depth (in.)	Horizon	Size class and particle diameter (mm) 3A1 — Total: Sand (2-0.05) a	Total: Silt (0.05-0.002)	Total: Clay (< 0.002)	Sand: Very coarse (2-1)	Sand: Coarse (1-0.5)	Sand: Medium (0.5-0.25)	Sand: Fine (0.25-0.1)	Sand: Very fine (0.1-0.05)	Silt: (0.05-0.02)	Silt: Int. III (0.02-0.002)	Silt: Int. II (0.2-0.02)	(2-0.1)	<0.074		Coarse fragments 2A2: 3B2 2-19 (Vol.)	3B1 2-19 (Wt.)	
		Pct of < 2 mm														Pct of < 19mm		
0-7	A11	30.4	36.4	33.2	1.4	5.4	5.9	11.0	6.7	15.2	21.2	27.9	23.7	73.3			-	
7-14	A12	28.6	34.8	36.6	2.9	5.3	5.1	9.3	6.0	13.8	21.0	24.8	22.6	74.8			4	
14-22	B1	31.0	32.3	36.7	3.9	5.5	5.2	10.1	6.3	13.4	18.9	25.2	24.7	72.5			tr	
22-27	B21	34.2	30.3	35.5	5.0	5.8	5.5	10.8	7.1	12.6	17.7	25.7	27.1	69.9		9	17	
27-32	B22	34.1	30.8	35.1	2.9	5.4	5.6	12.1	8.1	11.8	19.0	26.6	26.0	70.4		1	3	
32-39	B23	35.5	29.1	35.4	3.1	5.9	5.9	12.2	8.4	10.6	18.5	25.8	27.1	69.2		8	15	
39-50	IIB31	34.6	36.6	28.8	3.4	5.2	5.4	11.5	9.1	12.9	23.7	28.5	25.5	70.8		9	15	
50-62	IIB32	35.4	36.3	28.3	3.6	5.3	5.5	11.9	9.1	13.6	22.7	29.4	26.3	69.9		9	14	
62-72	IIC	36.1	35.8	28.1	2.5	5.4	5.9	12.7	9.6	13.0	22.8	29.8	26.5	69.5		9	14	

Depth (in.)	6A1a Organic carbon b	Nitrogen	C/N	Ext. Iron as Fe	Carbonate as $CaCO_3$: 6E1b 6M2a < 2mm	3A1a <0.002 mm	Bulk density: 1/3-Bar c	4A1d 1/3-Bar	4A1b Air-Dry	4D1 COLE	Water content: 4B1c 1/3-Bar	4B2 15-Bar	4C1 1/3- to 15-Bar			pH	8C1a (1:1)
	Pct	Pct		Pct.	Pct	Pct.	g/cc	g/cc	g/cc		Pct	Pct.	in/in.				
0-7	2.90							1.25	1.40	0.040	26.6	13.9	0.16				5.6
7-14	2.09							1.31	1.49	0.044	27.8	14.4	0.18				5.7
14-22	1.46							1.36	1.61	0.059	26.5	13.6	0.18				5.8
22-27	0.70						1.22	1.34	1.61	0.058	26.6	13.6	0.16				6.1
27-32	0.55						1.37	1.38	1.67	0.064	25.4	13.3	0.17				6.4
32-39	0.38				-(s)		1.24	1.35	1.64	0.063	26.7	14.0	0.16				6.9
39-50	0.14				18	-	1.37	1.50	1.68	0.036	21.5	12.2	0.13				7.7
50-62	0.11				18	-	1.47	1.62	1.77	0.025	19.4	11.9	0.11				7.9
62-72	0.08				18	1	1.47	1.62	1.81	0.033	19.8	11.9	0.12				7.7

Depth (in.)	Extractable bases 5B1a: 6N2a Ca	6O2a Mg	6P2a Na	6Q2a K	Sum	6H1a Ext. Acidity	Cat. Exch. Cap: 5A3a Sum Cations	5A1a NH4OAc						8D3 Ca/Mg		Base saturation: 5C3 Sum Cations	5C1 NH4OAc
	meq/100 g															Pct	Pct
0-7	15.7	5.6	tr	0.8	22.1	10.7	32.8	27.1						2.8		67	82
7-14	16.2	6.5	0.1	0.5	23.3	10.2	33.5	26.5						2.5		70	88
14-22	16.1	7.2	0.1	0.6	24.0	8.7	32.7	25.9						2.2		73	93
22-27	15.9	8.0	0.1	0.6	24.6	5.4	30.0	24.6						2.0		82	100
27-32	16.3	8.1	0.1	0.6	25.1	4.3	29.4	24.7						2.0		85	102
32-39	16.5	8.0	0.1	0.6	25.2	2.8	28.0	23.0						2.1		90	110
39-50	13.4d	5.2e	0.1	0.5	19.2			17.4						2.6			
50-62	12.7d	5.1e	0.1	0.5	18.4			16.7						2.5			
62-72	12.5d	4.9e	0.1	0.5	18.0			16.1						2.6			

Depth (in.)	Ratios to Clay 8D1: NH_4OAc CEC		15-Bar Water	Atterberg f/: 4F1 Lqid Lmit Pct	4F2 Plst Indx
0-7	0.82		0.42	48	21
7-14	0.72		0.39		
14-22	0.71		0.37		
22-27	0.69		0.38	47	25
27-32	0.70		0.38		
32-39	0.65		0.40		
39-50	0.60		0.42		
50-62	0.59		0.42		
62-72	0.57		0.42	39	23

a. Carbonate comprises 10 to 20 percent of the sand below 39 inches.
b. 19 kg/m² to 60 inches (Method 6A).
c. Calculated to include volume but not weight of 2-19 mm material (Method 3B2).
d. KCl-TEA extract (Method 6N4b).
e. KCl-TEA extract (Method 6O4b).
f. Iowa State Highway Commission data.

Pedon classification: Typic Hapludoll; fine, montmorillonitic, mesic.
Series classification: (Same as pedon).
Soil: Kamrar clay loam.
Soil no.: S64-Iowa-40-2 (LSL Nos. 19891 - 19899).
Location: Hamilton County, Iowa; 523 feet east and 1,022 feet north of the SW corner of Sec. 25, T. 88 N., R. 25 W.
Vegetation and land use: Bluegrass; pasture.
Parent material: About 3 feet of moderately fine to fine textured glacial sediments over glacial till.
Slope: 2 percent SE facing slope; the site is near a 12 percent sideslope above a drainageway. Undulating Late Wisconsin till plain.
Drainage: Moderately well drained.
Permeability: Moderately slow.
Root distribution: Not determined.
Described by: R. I. Dideriksen, C. S. Fisher and M. P. Koppen, September 16, 1964.

(Colors are for moist soil unless otherwise stated)

A11 19891 0 to 18 cm (0 to 7 inches). Black (10YR 2/1) medium clay loam; the color is the same when kneaded; dark gray (10YR 4/1) when dry; moderate very fine subangular blocky and fine granular structure; friable; evident clean sand grains; medium acid (pH 5.9); gradual smooth boundary.

A12 19892 18 to 35 cm (7 to 14 inches). Black (10YR 2/1) medium clay loam; the color is the same when kneaded; dark gray (10YR 4/1) to dark grayish brown (10YR 4/2) when dry; moderate very fine and fine subangular blocky with very little fine granular structure; friable; clean sand grains on the peds and some 1/8-inch pebbles; medium acid (pH 6.0); gradual smooth boundary.

B1 19893 35 to 55 cm (14 to 22 inches). Very dark grayish brown (10YR 3/2) medium clay loam; faces of peds very dark gray (10YR 3/1) and very dark grayish brown (10YR 3/2); a few brown (10YR 4/3) peds in the lower part; very dark grayish brown (10YR 3/2) when kneaded; moderate very fine and fine subangular blocky structure; some very thin discontinuous clay films on a few peds; very few very fine soft yellowish brown oxides; a weak, wavy pebble band in the lower part with pebbles ½-to-1 inch in diameter; medium acid (pH 6.0); clear smooth boundary.

B21 19894 55 to 78 cm (22 to 27 inches). Brown (10YR 4/3) heavy clay loam; faces of peds dark grayish brown (10YR 4/2)with about 20 percent very dark gray (10YR 3/1) moderate very fine and fine subangular blocky structure; friable when moist; slightly sticky when wet; a few thin discontinuous clay films; a few very dark gray (10YR 3/1) fills in pores; many fine and a few medium inped tubular pores; a few strong brown and yellowish brown oxides; slightly acid (pH 6.1); clear smooth boundary.

B22 19895 78 to 80 cm (27 to 32 inches). Dark yellowish brown (10YR 4/4) to yellowish brown (10YR 5/4) heavy clay loam; faces of peds brown (10YR 4/3) and dark grayish brown (10YR 4/2); weak fine and moderate very fine subangular blocky structure; friable when moist; slightly sticky when wet; thin discontinuous clay films on the very fine peds; some very dark gray (10YR 3/1) fills in pores and voids; common very fine soft strong brown oxides; slightly acid (pH 6.1); clear smooth boundary.

B23 19896 80 to 100 cm (32 to 39 inches). Yellowish brown (10YR 5/4) to light olive brown (2.5Y 5/4) medium clay loam; faces of peds brown (10YR 4/3); few fine olive gray (5Y 5/2) mottles; thin discontinuous clay films on a few peds; a few small gray (5Y 4/1) clay accumulations; common fine tubular pores; common fine yellowish brown and yellowish red soft oxides; few pebbles. This horizon is the contact to a layer with accumulations of lime rocks and increased number of pebbles; mildly alkaline (pH 7.8); clear wavy boundary.

IIB31 19897 100 to 128 cm (39 to 50 inches). Yellowish brown (10YR 5/4) with about 20 percent yellowish brown (10YR 5/6) and 30 percent light olive gray (5Y 6/2); light clay loam; weak medium subangular blocky structure; friable; common fine strong brown soft oxides; a few fine black soft oxides; common fine inped tubular pores; some pebbles and lime rocks; some vertical faces coated with lime; moderately alkaline (pH 8.4+); strongly effervescent; gradual smooth boundary.

IIB32 19898 128 to 158 cm (50 to 62 inches). Mottled yellowish brown (10YR 5/4 and 5/6) and light olive gray (5Y 6/2) light clay loam; very weak medium subangular blocky structure; friable; common very fine inped tubular pores; few fine strong brown and yellowish red soft oxides; few very fine black soft oxides; one large stone in the pit and common pebbles; a few shale fragments; some lime oriented on ped faces and in pores; moderately alkaline (pH 8.4); strongly effervescent; gradual smooth boundary.

IIC 19899 158 to 183 cm (62 to 72 inches). Yellowish brown (10YR 5/6) light clay loam; common to many light olive gray (5Y 6/2) mottles oriented around cleavage faces; massive; oxides are the same as in the horizon above; moderately alkaline (pH 8.4); strongly effervescent.

Remarks: There were no krotovinas in the pit. There is some evidence for a discontinuity at 22 inches. There is a weak stone line at this depth and the material below is noticeably higher in clay.

Penetrometer readings were made by using a Soiltest penetrometer with a 5/16-inch head. The penetrometer was pushed horizontally into the freshly exposed wall of the sampling pit to a depth of 5 inches. Three readings were obtained at each vertical depth as follows (all measurements in pounds): at 5 inches-73, 65, 65; at 10 inches-55, 59, 58; at 18 inches-64, 65, 85; at 24 inches-64, 74, 76; at 29 inches-57, 55, 58; at 34 inches-40, 50, 48; at 42 inches-62, 58, 65; and at 57 inches-63, 61, 58.

Soil temperatures were taken by inserting a Weston dial thermometer into the wall of the sampling pit. The depths and temperatures are as follows: 20 inches--15.1° C., 30 inches--14.9° C., 40 inches--14.5° C., 80 inches--12.3° C.

SOIL CLASSIFICATION-TYPIC HAPLUDOLL
COARSE-SILTY, MIXED, MESIC
SERIES - - - - - - -KEG

SOIL NO - - - - - - S70IA-67-2 COUNTY - - - MONONA

GENERAL METHODS- - -1A,1B1B,2A1,2B SAMPLE NOS. 70L1135-70L1142

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE, MTSC
NATIONAL SOIL SURVEY LABORATORY
LINCOLN, NEBRASKA

NOVEMBER 1975

DEPTH CM	HORIZON	SAND 2-.05	SILT .05-.002	CLAY LT .002	FINE CLAY LT .0002	VCDS 2-1	CORS 1-.5	MEDS .5-.25	FNES .25-.10	VFNS .10-.05	COSI .05-.02	FNSI .02-.002	VFSI .002-.002	FAML TEXT SAND 2-.1	INTR SILT .2-.02	FINE CLAY TO CLAY PCT	NON-CO3 CLAY PCT	BD1 15-BAR TO CLAY
		PARTICLE SIZE ANALYSIS, LT 2MM, 3A1, 3A1A, 3A1B (PCT LT 2MM)																RATIO
000-19	AP	22.5	57.9	19.6	12.3	.0	.1	.1	1.9	20.4	38.8	19.1	3.0	2.1	60.9	63	20	.49
019-36	A12	24.8	56.0	19.2	12.4	TR	.1	.2	2.2	22.3	38.2	17.8	2.5	2.5	62.4	65	19	.50
036-55	B2	28.2	54.8	17.0	10.5	TR	.1	.3	2.4	25.4	37.6	17.2	1.8	2.8	65.0	62	17	.51
055-80	B3	31.4	54.2	14.4	7.1	.1	.1	.2	2.0	29.0	37.3	16.9	2.4	2.4	68.0	49	13	.54
080-112	C1	25.0	61.8	13.2	4.9	.0	.1	.3	1.6	23.0	40.6	21.2	3.1	2.0	64.9	37	11	.54
112-139	C2	14.7	71.1	14.2	5.0	.1	.1	.2	.8	13.5	42.5	28.6	3.5	1.2	56.6	35	12	.56
139-160	C3	10.2	75.2	14.6	4.9	.1	.1	.2	.7	9.1	49.4	25.8	2.9	1.1	59.0	34	15	.51
160-190	C4	4.0	78.4	17.6	5.9	.1	.1	.2	.4	3.2	40.3	38.1	3.7	.8	43.8	34	18	.53

DEPTH CM	(PARTICLE SIZE ANALYSIS, MM, 3B, 3B1, 3B2) VOL. GT 2 PCT	WEIGHT GT 75 PCT	75-20	20-5	5-2	LT .074	20-2 PCT LT20	(BULK DENSITY) 4A1D 1/3-BAR G/CC	4A1H OVEN DRY G/CC	4D1 COLE	(WATER CONTENT) 4B1C 1/10 BAR PCT	4B1C 1/3-BAR PCT	4B2 15-BAR PCT	4C1 WRD CM/CM	CARBONATE 6E1B LT 2 PCT	3A1A LT .002 PCT	(PH) 8C1A 1/1 H2O	8C1E 1/2 CACL
000-19	0	0	0	0	0	93	0	1.31	1.41	.025	29.4	26.0	9.6	.22	1.98		5.2	5.0
019-36	0	0	0	0	0	93	0	1.29	1.35	.015	31.6	24.9	9.6	.20	1.68	0	5.8	5.5
036-55	0	0	0	0	0	91	0	1.23	1.31	.021	29.1	26.3	8.7	.22	1.98	TR	7.5	7.3
055-80	0	0	0	0	0	91	0	1.20A					7.8			6	1	7.9	7.7
080-112	TR	0	0	TR	TR	93	TR	1.23	1.31	.022	30.4	23.4	7.1	.20	0.98	10	2	8.0	7.8
112-139	TR	0	0	TR	TR	97	TR	1.30A					7.9			9	2	8.2	7.9
139-160	TR	0	0	TR	TR	97	TR	1.32	1.37	.013	35.2	28.8	7.4	.29	1.48	10	0	8.4	8.0
160-190	TR	0	0	TR	TR	98	TR	1.30	1.36	.016	35.4	31.6	9.4	.29	1.68	7	0	8.4	8.0

DEPTH CM	(ORGANIC MATTER) 6A1A ORGN CARB PCT	6B1A NITG PCT	C/N	IRON 6C2A EXT FE PCT	PHOS 6S1A TOTL PCT	(EXTRACTABLE BASES 5B4A) 6N2E CA	6O2D MG	6P2A NA	6Q2A K	SUM EXTB	ACTY 6H1A BACL TEA	AL 6G1D KCL EXT	(CAT EXCH) 5A3A EXTB ACTY	5A6A NHAC	RATIO 8D1 NHAC TO CLAY	RATIO 8D3 CA TO MG	CA 5F SAT NHAC PCT	(BASE SAT) 5C3 EXTB ACTY PCT	5C1 NHAC PCT
						(MEQ / 100 G)													
000-19	1.81C	.168	11	.8		13.2	3.0	.2	.9	17.3	7.6	.1	24.9	20.2	1.03	4.4	65	69	86
019-36	1.48	.144	10	.8		14.8	3.3	.2	.5	18.8	5.1		23.9	19.8	1.03	4.5	75	79	95
036-55	1.01	.097	10	.8		15.0D	3.0D	.2	.4	18.6				18.2	1.07				
055-80	.60	.065	9	.8		18.0D	2.7D	.2	.4	21.3				12.7	.88				
080-112	.29			.7		15.7D	4.0D	.2	.4	20.3				10.5	.80				
112-139	.23			.8		14.2D	7.4D	.4	.6	22.6				12.0	.85				
139-160	.18			.8		12.4D	8.9D	.6	.7	22.6				12.2	.84				
160-190	.19			.8		11.7D	11.D	1.0	1.1	25.2				15.6	.89				

DEPTH CM	(SATURATED PASTE) 8E1 REST OHM-CM	8C1B PH	8A H2O PCT	NA 5D2 ESP PCT	NA 5E SAR	SALT 8D5 TOTL SOLU PPM	GYP 6F1A PCT	(SATURATION EXTRACT 8A1) 8A1A EC MMHOS/CM	6N1B CA (MEQ / LITER)	6O1B MG	6P1A NA	6Q1A K	6I1A CO3	6J1A HCO3	6K1A CL	6L1A SO4	6M1A NO3	ATTERBERG 4F1 LQID LMIT PCT	4F2 PLST INDX
000-19																		32E	9
019-36																			
036-55																		31E	7
055-80																		30E	6
080-112	1700	7.6	39.2	2		380		1.41	8.8	5.3	.7	.4							
112-139																		30E	4
139-160																			
160-190																			

MICROMORPHOLOGY (4E1).
36-55 CM B2 UNIFORM FABRIC WITH WEAK ORIENTATION OF CLAY AND NO CLAY FILMS. PATCHY, THIN ORIENTED CLAY COATINGS ON LARGER SKELETAL GRAINS. DARK REDDISH-BROWN POORLY DEFINED LINEAR BODIES OF PLASMA UP TO A MILLIMETER LONG AS FILLINGS BETWEEN SKELETAL GRAINS AND AS PATCHY COATINGS ON LARGER GRAINS. MICA-LIKE GRAINS .05-.1 MM ARE COMMON THAT RANGE WIDELY IN ALTERATION. EARTHY BLACK TO DARK REDDISH-BROWN BODIES .02-.1 MM ACROSS ARE VERY COMMON.
55-80 CM B3 MAJOR DIFFERENCE FROM B2 IS PRESENCE OF FINE-GRAIN CARBONATE WHICH IS UNIFORMLY DISTRIBUTED IN LOW CONCENTRATION AND ALSO OCCURS AS IRREGULAR MASSES .1-1 MM ACROSS.
160-190 CM C4 VERY SIMILAR TO B3 BUT WITH LESS AUTHIGENIC CARBONATE.

DEPTH CM	AVAIL-ABLE P LBS PER ACRE (F)	AVAIL-ABLE K LBS PER ACRE (F)
000-18	56	479
018-36	5	92
036-46	3	94
046-56	3	93
056-69	1	98
069-81	2	81
081-97	2	85
097-114	2	125
114-127	3	194
127-140	2	165
140-152	2	480

(A) ESTIMATED.
(B) MICRO-PENETRATION RESISTANCE - A ROD 0.6 CM DIA IS SLOWLY PUSHED INTO BULK DENSITY CLOD, EQUILIBRATED AT 1/10-BAR, A DISTANCE OF 0.6 CM USING A POCKET PENETROMETER. UNITS ARE FORCE (KG) AND NOT ESTIMATES OF UNCONFINED COMPRESSIVE STRENGTH.
(C) ORGANIC CARBON IS 13 KG/M SQ TO A DEPTH OF 1 M (6A).
(D) METHODS 6N4C FOR CA AND 6O4C FOR MG.
(E) BY SOIL MECHANICS LAB, USDA-SCS, LINCOLN, NE. HORIZON 55-80 CM BY IOWA STATE HWY COMM, AMES, IA.
(F) BY SOIL TESTING LAB, IOWA STATE UNIV, AMES, IA.

Pedon classification: Typic Hapludoll; coarse-silty, mixed, mesic.
Series classification: Typic Hapludoll; fine-silty, mixed, mesic.1/
Soil: Keg silt loam.
Soil no.: S70-Iowa-67-2 (LSL Nos. 70L1135 - 70L1142).
Location: Monona County, Iowa; about ½ mile east and 2 miles north of east edge of Whiting, Iowa; 265 feet south and 145 feet west of the northeast corner of the SE¼ sec. 24, T. 85 N., R. 46 W.
Vegetation and land use: Corn, harvested; cropland.
Parent material: Loamy alluvial sediments deposited by the Missouri River.
Physiography: This site is among the highest elevations in the bottoms and between the slackwater areas to the east and the river channel to the west. Area is high enough that it has not been subject to overflow or deposition in recent times. Site is about 10½ miles east of the Missouri River and 6½ miles west of the uplands.
Relief: Nearly level.
Slope: Less than 1 percent.
Drainage: Well drained to moderately well drained.
Erosion: None.
Ground water: None.
Permeability: Moderate.
Described by: J. R. Culver, C. S. Fisher, J. R. Worster, and F. F. Riecken; October 27, 1970.

(Colors are for moist soil unless otherwise stated)

Ap 70L1135 0 to 19 cm (0 to 7 inches). Very dark brown (10YR 2/2) silt loam, very dark brown (10YR 2/2) to very dark grayish brown (10YR 3/2) crushed; weak very fine subangular blocky and weak fine granular structure; friable; neutral; clear smooth boundary.

A12 70L1136 19 to 36 cm (7 to 14 inches). Very dark brown (10YR 2/2) silt loam, very dark grayish brown (10YR 3/2) crushed; weak fine subangular blocky and weak fine granular structure; friable; neutral; clear smooth boundary.

B2 70L1137 36 to 55 cm (14 to 22 inches). Dark grayish brown (10YR 4/2) to very dark grayish brown (10YR 3/2) silt loam, faces of peds very dark brown (10YR 2/2) and very dark grayish brown (10YR 3/2), dark grayish brown (2.5Y 4/2) crushed; weak fine and very fine subangular blocky structure; very friable; common very fine tubular pores; few circular krotovinas about 7 mm in diameter of grayish brown (2.5Y 5/2) material; mildly alkaline; clear smooth boundary.

B3 70L1138 55 to 80 cm (22 to 32 inches). Brown (10YR 5/3) to dark grayish brown (2.5Y 4/2) and light olive brown (2.5Y 5/4) coarse silt loam; few fine faint dark yellowish brown (10YR 4/4) mottles; weak fine and moderate subangular blocky structure; very friable; common very fine tubular pores; few ped coats and common wormcasts of very dark grayish brown (10YR 3/2); brown (7.5YR 4/4) coatings in old root channels; strongly effervescent; moderately alkaline; gradual smooth boundary.

C1 70L1139 80 to 112 cm (32 to 45 inches). Brown (10YR 5/3) to dark grayish brown (2.5Y 4/2) grayish brown (2.5Y 5/2), and light olive brown (2.5Y 5/4) coarse silt loam, few fine distinct yellowish brown (10YR 5/4) mottles; massive; very friable; common very fine tubular pores; a few wormcasts are dark grayish brown (2.5Y 4/2); brown (7.5YR 4/4) coatings in old root channels; few soft secondary carbonates; strongly effervescent; moderately alkaline; gradual smooth boundary.

C2 70L1140 112 to 139 cm (45 to 55 inches). Grayish brown (2.5Y 5/2) to light olive brown (2.5Y 5/4) coarse silt loam, brown (10YR 5/3) crushed; massive; very friable; common very fine tubular pores; brown (7.5YR 4/4) coats along old root channels; small dark krotovina about 3 inches in diameter; few to common secondary carbonate concretions; strongly effervescent; moderately alkaline; gradual smooth boundary.

C3 70L1141 139 to 160 cm (55 to 63 inches). Grayish brown (2.5Y 5/2) with mixing of light brownish gray (2.5Y 6/2) coarse silt loam, few fine faint light olive brown (2.5Y 5/4) mottles; massive; very friable; very fine tubular pores; brown (7.5YR 4/4) coats along old root channels; small dark krotovina about 2 inches in diameter; few secondary carbonate concretions; strongly effervescent; moderately alkaline; gradual smooth boundary.

C4 70L1142 160 to 190 cm (63 to 72 inches). Mixed grayish brown (2.5Y 5/2) and light brownish gray (2.5Y 6/2) coarse silt loam; common fine and medium distinct yellowish brown (10YR 5/6) mottles; massive; distinct evidence of stratification; very friable; strongly effervescent; moderately alkaline.

1/This type location averages slightly less clay in the control section than is permitted in a fine-silty family.

SOIL CLASSIFICATION-UDOLLIC OCHRAQUALF
FINE, MONTMORILLONITIC, MESIC
SERIES - - - - - - - -KNIFFIN

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE MRTSC
SOIL SURVEY INVESTIGATIONS UNIT
LINCOLN, NEBRASKA

SOIL NO - - - - - - - S69IOWA-4-2 COUNTY - - - APPANOOSE

GENERAL METHODS- - -1A2A,1B1B,1B2,1B SAMPLE NOS. 69L990-69L998

DEPTH CM	HORIZON	(- - - PARTICLE SIZE ANALYSIS, LT 2MM, 3A1, 3A1A, 3A1B - - - PCT LT 2MM - - -) SAND 2-.05	SILT .05-.002	CLAY LT .002	FINE CLAY LT .0002	(- - SAND - -) VCOS 2-1	CORS 1-.5	MEDS .5-.25	FNES .25-.10	VFNS .10-.05	(- -SILT- -) COSI .05-.02	FNSI .02-.002	VFSI .005-.002	FAML TEXT SAND 2-.1	INTR II .2-.02	FINE CLAY TO CLAY PCT	NON-CO3-CLAY PCT	)RATIO 8D1 15-BAR TO CLAY
000-018	AP	2.9A	68.7	28.4	15.7	.4	.8	.7	.6	.4	30.6	38.1		2.5	31.2	55		.44
018-028	A2	2.9A	67.3	29.8	16.4	.4	1.1	.7	.4	.3	29.1	38.2		2.6	29.5	55		.42
028-038	B1	1.9A	57.5	40.6		.5	.7	.3	.2	.2	23.3	34.2		1.7	23.6			.41
038-053	B21T	.7A	45.9	53.4		.1	.2	.1	.1	.2	17.8	28.1		.5	18.0			.43
053-064	B22T	.6A	52.4	47.0		.1	.1	.1	.1	.2	20.2	32.2		.4	20.5			.45
064-079	B23T	1.0A	57.6	41.4		.0	.2	.1	.3	.4	23.6	34.0		.6	24.1			.48
079-122	B31T	1.5A	63.6	34.9		.1	.4	.2	.4	.4	26.3	37.3		1.1	26.9			.50
122-145	B32T	3.5A	63.3	33.2	19.3	.1	.5	.7	1.3	.9	20.5	42.8		2.6	22.1	58		.46
145-168	2C1	7.0	62.1	30.9		.2	1.0	1.5	2.7	1.6	24.0	38.1		5.4	27.0			.42

DEPTH CM	(PARTICLE SIZE ANALYSIS, MM, 3B, 3B1, 3B2) VOL. GT 2 PCT	(- - WEIGHT - -) GT 75 PCT	75-20 (- - PCT LT 75	20-5	5-2 - - -)	LT .074	20-2 PCT LT20	(BULK DENSITY 4A1D 1/3-BAR G/CC	4A1H OVEN DRY G/CC	) 4D1 COLE	(- - -WATER CONTENT- - -) 4B1C 1/10 BAR PCT	4B1C 1/3-BAR PCT	4B2 15-BAR PCT	4C1 WRD CM/CM		AVAIL P E/ LBS/ACRE	(- -PH - -) 8C1A 1/1 H2O	8C1E 1/2 CACL
000-018	0	0	0	0	0	97	0	1.30B					12.4			14	5.5	5.1
018-028	0	0	0	0	0	97	0	1.34	1.47	.031	31.0	29.0	12.5	.22	0.9C	10	4.7	4.3
028-038	0	0	0	0	0	98	0	1.28	1.53	.061	32.8	31.1	16.8	.18	1.9C	8.5	5.0	4.2
038-053	0	0	0	0	0	99	0	1.26	1.89	.145	40.1	38.3	23.0	.19	1.7C	6.5	5.0	4.3
053-064	0	0	0	0	0	100	0	1.36	1.92	.122	34.7	34.6	21.3	.18	1.5C	8.5	5.1	4.5
064-079	0	0	0	0	0	99	0	1.41	1.91	.107	32.8	30.8	19.8	.16	1.6C	11.5	5.2	4.7
079-122	0	0	0	0	0	99	0	1.41	1.86	.097	33.8	31.2	17.6	.19	1.1C	20	5.9	5.4
122-145	0	0	0	0	0	97	0	1.40B					15.2			43	6.1	5.6
145-168	0	0	0	0	0	94	0	1.52	1.76	.050	30.3	27.8	12.9	.23	0.6C	40	6.0	5.4

DEPTH CM	(ORGANIC MATTER 6A1A ORGN CARB PCT	) 6B1A NITG PCT	C/N	IRON 6C2A EXT FE PCT	PHOS 6S1A TOTL PCT	(- -EXTRACTABLE BASES 5B4A- -) 6N2E CA (- - MEQ / 100 G- - -)	6O2D MG	6P2A NA	6Q2A K	SUM EXTB	ACTY 6H1A BACL TEA	AL 6G1D KCL EXT	(CAT EXCH) 5A3A EXTB ACTY	5A6A NHAC	RATIO 8D1 NHAC TO CLAY	RATIO 8D3 CA TO MG	CA 5F SAT NHAC PCT	(BASE SAT) 5C3 EXTB ACTY PCT	5C1 NHAC PCT
000-018	2.07D	.199	10			13.7	3.3	0.2	0.4	17.6	11.3	0.1	28.9	24.0	0.85	4.2	57	61	73
018-028	1.24	.123	10			8.5	3.4	0.2	0.3	12.4	16.3	1.9	28.7	21.9	0.73	2.5	39	43	57
028-038	0.79	.088	9			11.8	6.0	0.7	0.5	19.0	16.0	2.6	35.0	27.4	0.67	2.0	43	54	69
038-053	0.76	.085	9			18.0	9.4	1.3	0.9	29.6	17.7	2.5	47.3	38.7	0.72	1.9	47	63	76
053-064	0.49	.059	8			18.5	9.5	1.6	0.8	30.4	13.5	1.5	43.9	34.8	0.74	1.9	53	69	87
064-079	0.30					17.9	9.0	1.6	0.7	29.2	11.2	0.8	40.4	31.5	0.76	2.0	57	72	93
079-122	0.14					16.8	8.3	1.6	0.7	27.4	8.0		35.4	28.4	0.81	2.0	59	77	96
122-145	0.15					13.8	6.5	1.3	0.6	22.2	7.4		29.6	22.9	0.69	2.1	60	75	97
145-168	0.12					11.7	5.4	1.0	0.5	18.6	7.8		26.4	19.7	0.64	2.2	59	70	94

(A) FE/MN NODULES COMPRISE MORE THAN 75 PCT OF THE SAND (0-145 CM).
(B) BULK DENSITY ESTIMATED FOR HORIZONS FROM 0-18 AND 122-145 CM.
(C) MICRO-PENETRATION RESISTANCE - A ROD 0.6 CM DIA IS SLOWLY PUSHED INTO BULK DENSITY CLOD, EQUILIBRATED AT 1/10- BAR, A DISTANCE OF 0.6 CM USING A POCKET PENETROMETER. UNITS ARE FORCE (KG) AND NOT ESTIMATES OF UNCONFINED COMPRESSIVE STRENGTH.
(D) ORGANIC CARBON IS 11 KG PER SQ M TO A DEPTH OF 1 METER (METHOD 6A).
(E) IOWA STATE UNIVERSITY DATA.

Pedon classification: Udollic Ochraqualf; fine, montmorillonitic, mesic.
Series classification: (Same as pedon).
Soil: Kniffin silt loam.
Soil no.: S69-Iowa-4-2 (LSL Nos. 69L990 - 69L998).
Location: Appanoose County, Iowa, 2,588 feet north and 45 feet east of the southeast corner of the SW¼ SW¼ Sec. 35, T. 68 N., R. 19 W.
Vegetation and land use: Oats stubble; cropland.
Parent material: Partly from deoxidized and leached and partly from oxidized and leached Wisconsin loess; pedisediment at 57 inches.
Physiography: Nose of a nearly level extended interfluve. Breaks rather sharply to D slope (9 to 14 percent) to the northeast.
Relief: Gently sloping narrow convex upland ridge.
Slope: 2 percent.
Drainage: Somewhat poorly drained.
Ground water: None.
Permeability: Very slow.
Described by: J. D. Highland, J. R. Culver and T. E. Fenton, November 3, 1969.

(Colors are for moist conditions unless otherwise stated)

Ap 69L990 0 to 18 cm (0 to 7 inches). Very dark gray (10YR 3/1) silt loam; very dark grayish brown (10YR 3/2) crushed, gray (10YR 5/1) dry; cloddy breaking to moderate fine granular structure; friable; medium acid; abrupt smooth boundary.

A2 69L991 18 to 28 cm (7 to 11 inches). Dark grayish brown (10YR 4/2) silt loam, discontinuous very dark grayish brown (10YR 3/2) coatings in upper 2 inches, light brownish gray (10YR 6/2) dry; weak coarse platy structure parting to moderate fine subangular blocky and granular structure; friable; few fine soft black (5YR 2/1) oxides; very strongly acid; clear smooth boundary.

B1 69L992 28 to 38 cm (11 to 15 inches). Brown (10YR 5/3) heavy silty clay loam, grayish brown (10YR 5/2) coatings on peds, few fine distinct yellowish brown (10YR 5/4) mottles; moderate very fine subangular blocky structure; firm; few thin discontinuous dark grayish brown (10YR 4/2) clay films; few soft brown (7.5YR 4/4) and black (5YR 2/1) oxides; strongly acid; clear smooth boundary.

B21t 69L993 38 to 53 cm (15 to 21 inches). Dark grayish brown (10YR 4/2) medium silty clay; many fine prominent yellowish brown (10YR 5/6) mottles and few fine prominent strong brown (7.5YR 5/6) mottles; moderate fine and very fine angular and subangular blocky structure; very firm; thick continuous dark grayish brown (10YR 4/2) and moderately thick discontinuous dark gray (10YR 4/1) clay films on peds; few soft dark reddish brown (5YR 2/2) oxides; strongly acid; gradual smooth boundary.

B22t 69L994 53 to 64 cm (21 to 25 inches). Dark grayish brown (10YR 4/2) silty clay, many fine prominent strong brown (7.5YR 5/6) and yellowish brown (10YR 5/6) mottles; moderate medium prismatic structure parting to moderate fine subangular blocky structure; very firm; thick continuous dark gray (10YR 4/1) clay films; few fine hard dark reddish brown (5YR 2/2) and dark brown (7.5YR 3/2) oxides; strongly acid; gradual smooth boundary.

B23t 69L995 64 to 79 cm (25 to 31 inches). Grayish brown (2.5Y 5/2) silty clay; common medium prominent strong brown (7.5YR 5/6) mottles; moderate medium prismatic structure parting to moderate fine and medium subangular blocky structure; very firm; few thin discontinuous dark grayish brown (2.5Y 4/2) clay films on faces of peds; few fine hard dark reddish brown (5YR 2/2) and dark brown (7.5YR 3/2) oxides; medium acid; gradual smooth boundary.

B31t 69L996 79 to 122 cm (31 to 48 inches). Grayish brown (5Y 5/2) medium to heavy silty clay loam; many coarse prominent strong brown (7.5YR 5/8) mottles; deoxidized and leached weathering zone; moderate medium prismatic structure; very firm; few thin discontinuous clay films on prisms and in root channels; common medium hard dark reddish brown (5YR 2/2) oxides; medium acid; gradual smooth boundary.

B32t 69L997 122 to 145 cm (48 to 57 inches). Gray (5Y 6/1) light silty clay loam, faces of peds grayish brown (2.5Y 5/2), common coarse prominent strong brown (7.5YR 5/8) mottles; deoxidized and leached weathering zone; moderate coarse prismatic structure; firm; common fine hard dark reddish brown (5YR 2/2) oxides; neutral; clear smooth boundary.

IIC1 69L998 145 to 168 cm (57 to 66 inches). Mottled gray (5Y 5/1) and strong brown (7.5YR 5/8) gritty heavy silt loam to light silty clay loam pedisediment; massive; vertical cleavage; firm; few dark gray (10YR 4/1) colloidal coats on vertical faces; common fine hard dark reddish brown (5YR 2/2) oxides; neutral.

Remarks: Loamy pedisediment occurs at a depth of 57 inches. Gumbotil (Yarmouth-Sangamon paleosol) is at a depth of 70 inches.

SOIL CLASSIFICATION-UDOLLIC OCHRAQUALF
FINE, MONTMORILLONITIC, MESIC
SERIES - - - - - - - -KNIFFIN

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE MRTSC
SOIL SURVEY INVESTIGATIONS UNIT
LINCOLN, NEBRASKA

SOIL NO - - - - - - S69IOWA-93-1 COUNTY - - - WAYNE

GENERAL METHODS- - -1A2A,1B1B,1B2,1B SAMPLE NOS. 69L999-69L1011

DEPTH CM	HORIZON	SAND 2-.05	SILT .05-.002	CLAY LT .002	FINE CLAY LT .0002	VCOS 2-1	CORS 1-.5	MEDS .5-.25	FNES .25-.10	VFNS .10-.05	COSI .05-.02	FNSI .02-.002	VFSI .005-.002	FAML TEXT SAND 2-.1	INTR II .2-.02	FINE CLAY TO CLAY PCT	NON-CO3-CLAY PCT	RATIO 8D1 15-BAR TO CLAY
		(- - - PARTICLE SIZE ANALYSIS, LT 2MM, 3A1, 3A1A, 3A1B - - -)																
		(- - - PCT LT 2MM - - -)																
000-015	A1	3.5B	62.7	33.8		.1	.6	.7	1.2	.9	27.9	34.8		2.6	29.4			.48
015-023	A2	2.3B	60.4	37.3	24.5	TR	.4	.5	.8	.6	26.3	34.1		1.7	27.3	66		.43
023-036	B1	1.5B	56.3	42.2		.0	.2	.3	.5	.5	23.0	33.3		1.0	23.7			.42
036-046	B21T	.8B	48.8	50.4	36.7	.1	.1	.1	.2	.3	19.2	29.6		.5	19.6	73		.43
046-058	B22T	.7B	56.0	43.3	29.9	.0	.1	.1	.2	.3	20.0	36.0		.4	20.5	69		.46
058-071	B23T	.9B	63.1	36.0		TR	.1	.1	.3	.4	21.0	42.1		.5	21.6			.50
071-089	B31T	.7B	66.7	32.6	18.7	.0	.1	.1	.2	.3	26.6	40.1		.4	27.0	57		.51
089-114	B32T	.6B	67.4	32.0	18.1	.0	.1	.1	.1	.3	26.0	41.4		.3	26.4	57		.51
114-132	B33	4.0	65.7	30.3		.1	.7	.9	1.5	.8	21.4	44.3		3.2	23.0			.51
132-160	B34	14.6	60.9	24.5		.3	2.2	3.4	6.0	2.7	19.7	41.2		11.9	25.4			.49
160-180	C	30.2	49.9	19.9		1.8	4.8	6.8	11.6	5.2	19.6	30.3		25.0	30.3			.41
018-028	A2 (A)	2.9	73.4	23.7		.1	.3	.5	1.2	.8	28.3	45.1		2.1	29.8			.42
041-051	B21T(A)	1.7	51.8	46.5		.0	.2	.3	.6	.6	18.2	33.6		1.1	19.1			.47

DEPTH CM	VOL. GT 2 PCT	GT 75 PCT	75-20	20-5	5-2	LT .074	20-2 PCT LT20	4A1D 1/3-BAR G/CC	4A1H OVEN DRY G/CC	4D1 COLE	4B1C 1/10 BAR PCT	4B1C 1/3-BAR PCT	4B2 15-BAR PCT	4C1 WRD CM/CM		CARBONATE 6E1B LT 2 PCT	3A1A LT .002 PCT	PH 8C1A 1/1 H2O	PH 8C1E 1/2 CACL
	(PARTICLE SIZE ANALYSIS, MM, 3B, 3B1, 3B2)	(- - WEIGHT - -)	(- - - PCT LT 75 - - -)					(BULK DENSITY	)		(- - - -WATER CONTENT- - - -)								
000-015	0	0	0	0	0	97	0	1.09	1.37	.079	44.6	42.0	16.1	.28	2.1D			4.9	4.6
015-023	0	0	0	0	0	98	0	1.20C					15.9					4.6	4.2
023-036	0	0	0	0	0	99	0	1.19	1.51	.083	39.7	35.2	17.9	.21	1.9D			4.7	4.2
036-046	0	0	0	0	0	99	0	1.24	1.84	.141	37.8	35.1	21.7	.17	2.1D			4.8	4.3
046-058	0	0	0	0	0	100	0	1.33	1.85	.116	35.1	33.8	20.0	.18	1.9D			5.4	4.8
058-071	0	0	0	0	0	99	0	1.38	1.76	.085	33.7	32.0	18.0	.19	1.0D			6.0	5.5
071-089	0	.0	0	0	0	100	0	1.37	1.69	.073	34.8	32.4	16.5	.22	1.0D			6.3	5.7
089-114	0	0	0	0	0	100	0	1.40C					16.4					6.3	5.7
114-132	0	0	0	0	0	97	0	1.40	1.59	.043	33.5	31.0	15.4	.22	1.0D				
132-160	0	0	0	0	0	87	0	1.48	1.61	.029	29.8	28.0	12.0	.24	1.4D			6.3	5.6
160-180	TR	0	0	TR	TR	72	TR	1.73	1.84	.021	19.5	17.1	8.2	.16	2.0D			6.3	5.6
018-028		0	0	0	TR	97	TR						9.9					4.9	4.3
041-051	0	0	0	0	0	99	0						21.8					4.5	4.2

DEPTH CM	6A1A ORGN CARB PCT	6B1A NITG PCT	C/N	IRON 6C2A EXT FE PCT	PHOS 6S1A TOTL PCT	6N2E CA	6O2D MG	6P2A NA	6Q2A K	SUM EXTB	ACTY 6H1A BACL TEA	AL 6G1D KCL EXT	(CAT EXCH) 5A3A EXTB ACTY	5A6A NHAC	RATIO 8D1 NHAC TO CLAY	RATIO 8D3 CA TO MG	CA 5E SAT NHAC PCT	(BASE SAT) 5C3 EXTB ACTY PCT	5C1 NHAC PCT
	(ORGANIC MATTER	)				(- -EXTRACTABLE BASES 5B4A- -)													
						(- - - MEQ / 100 G- - - -)													
000-015	3.34E	.311	11	1.3		14.3	4.9	0.2	0.9	20.3	20.2	0.3	40.5	31.2	0.92	2.9	46	50	65
015-023	2.07	.191	11	1.4		12.3	4.7	0.2	0.7	17.9	21.4	2.0	39.3	29.4	0.79	2.6	42	46	61
023-036	1.52	.147	10	1.4		12.3	5.9	0.3	0.7	19.2	19.6	3.2	38.8	31.4	0.74	2.1	39	49	61
036-046	0.95	.106	9	1.7		16.0	8.9	0.6	0.9	26.4	18.6	2.7	45.0	36.4	0.72	1.8	44	59	73
046-058	0.53	.069	8	1.4		18.0	9.8	1.1	0.8	29.7	9.3	0.4	39.0	33.6	0.78	1.8	54	76	88
058-071	0.22			1.3		16.9	8.9	1.3	0.7	27.8	4.5		32.3	29.0	0.81	1.9	58	86	96
071-089	0.14			1.1		15.3	8.1	1.4	0.6	25.4	5.7		31.1	26.3	0.81	1.9	58	82	97
089-114	0.11			1.1		15.3	7.9	1.4	0.6	25.2	5.1		30.3	25.7	0.80	1.9	60	83	98
114-132	0.15			1.3		14.8	7.3	1.4	0.5	24.0	6.6		30.6	24.2	0.80	2.0	61	78	99
132-160	0.15			1.3		11.2	5.3	1.1	0.4	18.0	5.0		23.0	19.1	0.78	2.1	59	78	94
160-180	0.11			1.1		8.4	3.6	0.8	0.3	13.1	4.1		17.2	13.5	0.68	2.3	62	76	97
018-028																			
041-051																			

DEPTH CM	(SATURATED PASTE) 8E1 REST OHM-CM	8C1B PH	8A H2O PCT	NA 5D2 ESP PCT	NA 5E SAR	SALT 8D5 TOTL SOLU PPM	GYP 6F1A PCT	8A1A EC MMHOS/CM	6N1B CA	6O1B MG	6P1A NA	6Q1A K	6I1A CO3	6J1A HCO3	6K1A CL	6L1A SO4	6M1A NO3	ATTERBERG 4F1 LQID LMIT PCT	4F2 PLST INDX
									(- - - SATURATION EXTRACT 8A1- - - MEQ / LITER - - -)										
000-015																		47F	14
015-023																			
023-036																			
036-046																		66F	35
046-058																		56F	27
058-071																			
071-089																			
089-114	2000	5.6	50.0			74		0.23											
114-132																		41F	23
132-160																			
160-180																		24F	8
018-028																			
041-051																			

CLAY MINERALOGY (7A2C). PLACEMENT (S69IA-93-1) MONTMORILLONITIC.
046-58 MT3 MI2 KK2.
018-28(SATELLITE) MI2 KK2 MT1.
COMMENTS-- CLAYS FAIRLY WELL-ORDERED.
RELATIVE AMOUNTS-- (X-RAY) 5 = DOMINANT 4 = ABUNDANT 3 = MODERATE 2 = SMALL 1 = TRACE. (DTA) AS PERCENT.
MINERAL CODE-- MT = MONTMORILLONITE MI = MICA KK = KAOLINITE
(A) SAMPLED 100 M NNE OF 93-1.
(B) FE/MN NODULES COMPRISE 50 TO 75 PCT OF THE SAND (0-114 CM).
(C) BULK DENSITY ESTIMATED FOR HORIZONS FROM 15-23 AND 89-114 CM.
(D) MICRO-PENETRATION RESISTANCE - A ROD 0.6 CM DIA IS SLOWLY PUSHED INTO BULK DENSITY CLOD, EQUILIBRATED AT 1/10- BAR, A DISTANCE OF 0.6 CM USING A POCKET PENETROMETER. UNITS ARE FORCE (KG) AND NOT ESTIMATES OF UNCONFINED COMPRESSIVE STRENGTH.
(E) ORGANIC CARBON IS 13 KG PER SQ M TO A DEPTH OF 1 METER (METHOD 6A).
(F) ATTERBERG LIMITS DETERMINED BY SOIL MECHANICS LAB., SCS, LINCOLN, NEBR., EXCEPT FOR HORIZONS FROM 36-46 AND 114-132 CM WHICH WERE DETERMINED BY THE IOWA HWY. DEPT., AMES, IA.

Pedon classification: Udollic Ochraqualf; fine, montmorillonitic, mesic.
Series classification: (Same as pedon).
Soil: Kniffin silt loam.
Soil no.: S69-Iowa-93-1 (LSL Nos. 69L999 - 69L1011).
Location: Wayne County, Iowa; 60 feet north and 750 feet east of the southwest corner of the SE¼ SW¼ Sec. 16, T 67 N., R 22 W.
Vegetation and land use: Bluegrass; pasture.
Parent material: Partly from oxidized and leached and partly from deoxidized and leached Wisconsin loess low in sand (less than 5 percent).
Physiography: Convex ridgecrest on a north by northeast axis which adjoins the nearly level stable upland divide to the southwest. Near the nose of a well-defined extended interfluve. Breaks sharply to D and E slopes (9 to 18 percent) to east and west.
Relief: Gently sloping convex ridge.
Slope: 2 percent.
Drainage: Somewhat poorly drained.
Ground water: None observed.
Erosion: Slight.
Permeability: Very slow.
Described by: J. D. Highland, J. R. Culver and T. E. Fenton; November 3, 1969.

(Colors are for moist conditions unless otherwise stated)

A1 69L999 0 to 15 cm (0 to 6 inches). Very dark gray (10YR 3/1) silt loam, gray (10YR 5/1) dry; moderate fine subangular blocky parting to moderate fine granular structure; friable; strongly acid; clear smooth boundary.

A2 69L1000 15 to 23 cm (6 to 9 inches). Very dark grayish brown (10YR 3/2) light silty clay loam; dark grayish brown (10YR 4/2) coatings on peds; kneaded very dark grayish brown (10YR 3/2); weak fine subangular blocky and granular structure; friable; light gray (10YR 6/1 dry) patches of thin silt coats on plates; few fine dark brown (7.5YR 3/2) oxides; few very dark gray (10YR 3/1) wormcasts; very strongly acid; clear smooth boundary.

B1 69L1001 23 to 36 cm (9 to 14 inches). Dark grayish brown (10YR 4/2) light silty clay; discontinuous very dark grayish brown (10YR 3/2) on coatings of peds; few fine faint dark yellowish brown (10YR 4/4) mottles; kneaded dark grayish brown (2.5Y 4/2); moderate very fine subangular blocky structure; firm; horizontal band of light gray (10YR 6/1 dry) silt coats on peds; few fine dark brown (7.5YR 3/2) oxides; few very dark gray (10YR 3/1) wormcasts; very strongly acid; clear smooth boundary.

B21t 69L1002 36 to 46 cm (14 to 18 inches). Dark grayish brown (10YR 4/2) heavy silty clay; many fine prominent yellowish brown (10YR 5/6) and few fine distinct strong brown (7.5YR 5/6) mottles; few very dark gray (10YR 3/1) wormcasts; moderate fine angular blocky and subangular blocky structure; very firm; thick discontinuous very dark gray (10YR 3/1) clay films; few fine dark brown (7.5YR 3/2) oxides; strongly acid; gradual smooth boundary.

B22t 69L1003 46 to 58 cm (18 to 23 inches). Dark grayish brown (10YR 4/2) medium silty clay; many fine prominent yellowish brown (10YR 5/6) and common fine distinct strong brown (7.5YR 5/6) mottles; moderate fine angular blocky and subangular blocky structure; very firm; thick discontinuous dark gray (10YR 4/1) clay films; few fine dark reddish brown (5YR 3/2) oxides; strongly acid; gradual smooth boundary.

B23t 69L1004 58 to 71 cm (23 to 28 inches). Grayish brown (2.5Y 5/2) light silty clay; many fine prominent yellowish brown (10YR 5/4 and 5/8) and strong brown (7.5YR 5/6) mottles; weak coarse prismatic structure parting to moderate medium subangular blocky; very firm; thin discontinuous clay films mostly on faces of prisms; deoxidized and leached weathering zone; few fine dark reddish brown (5YR 3/2) oxides; medium acid; gradual smooth boundary.

B31t 69L1005 71 to 89 cm (28 to 35 inches). Mottled olive gray (5Y 5/2) and yellowish brown (10YR 5/6) heavy silty clay loam; weak coarse prismatic structure parting to weak medium and coarse angular blocky structure; firm; few discontinuous clay films; some dark grayish brown (10YR 4/2) on faces of prisms; deoxidized and leached weathering zone; many fine dark reddish brown (5YR 3/2) soft oxides; few dark reddish brown (5YR 2/2) stains on ped surfaces; slightly acid; gradual smooth boundary.

B32t 69L1006 89 to 114 cm (35 to 45 inches). Mottled olive gray (5Y 5/2) and yellowish brown and strong brown (10YR 5/6 and 7.5YR 5/6); medium silty clay loam; kneaded yellowish brown (10YR 5/4); weak coarse prismatic structure; firm; few discontinuous clay films on faces of prisms; deoxidized and leached weathering zone; many fine soft dark reddish brown (5YR 3/2) oxides; slightly acid; gradual wavy boundary.

B33 69L1007 114 to 132 cm (45 to 52 inches). Gray (5Y 6/1) light silty clay loam; many fine prominent strong brown (7.5YR 5/8) and few fine prominent reddish brown (5YR 4/4) mottles; kneaded yellowish brown (10YR 5/4); weak coarse prismatic structure; friable; deoxidized and leached weathering zone; many fine soft dark reddish brown (5YR 3/2) oxides and stains; neutral; gradual smooth boundary.

B34 69L1008 132 to 160 cm (52 to 63 inches). Mottled dark grayish brown (2.5Y 4/2), light brownish gray (2.5Y 6/2), and dark yellowish brown (10YR 4/4) silt loam; weak fine and medium platy structure; friable; few very dark gray (10YR 3/1) stains on surface of plates; occasional charcoal flecks; neutral; gradual smooth boundary.

C 69L1009 160 to 180 cm (63 to 71 inches). Yellowish brown (10YR 4/4) silt loam high in sand; common fine prominent light brownish gray (2.5Y 6/2) mottles; massive; occasional charcoal flecks.

Remarks: A2 horizon not well expressed in pit. A satellite sample of the A2 (7-11 in.) and B21t (16-20 in.) was collected 330 feet north northeast of the principal site and is considered to be more representative of the A2 horizon for the Kniffin soils.

2-Kniffin silt loam

Satellite Kniffin Site - 330 feet north, northeast of prime site.

A1 69L1010 18 to 28 cm (7 to 11 inches). Dark grayish brown (10YR 4/2) silt loam, weak coarse platy structure parting to weak very fine subangular blocky; friable; some very dark gray (10YR 3/1) coatings on surfaces of plates; few fine soft dark reddish brown (5YR 2/2) oxides; strongly acid; clear smooth boundary.

B21t 69L1011 41 to 51 cm (16 to 20 inches). Dark grayish brown (10YR 4/2) medium silty clay; common fine distinct yellowish brown (10YR 5/6) mottles; moderate very fine subangular blocky structure; very firm; thick continuous very dark gray (10YR 3/1) clay films on faces of peds; few fine dark brown (7.5YR 3/2) oxides; strongly acid, gradual smooth boundary.

SOIL CLASSIFICATION-VERTIC HAPLAQUOLL
VERY FINE, MONTMORILLONITIC, MESIC
SERIES - - - - - - -LUTON

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE, MTSC
NATIONAL SOIL SURVEY LABORATORY
LINCOLN, NEBRASKA

SOIL NO - - - - - - S70IA-67-1 COUNTY - - - MONONA

GENERAL METHODS- - -1A,1B1B,2A1,2B SAMPLE NOS. 70L1125-70L1134

NOVEMBER 1975

DEPTH CM	HORIZON	SAND 2-.05	SILT .05-.002	CLAY LT .002	FINE CLAY LT .0002	VCOS 2-1	CORS 1-.5	MEDS .5-.25	FNES .25-.10	VFNS .10-.05	COSI .05-.02	FNSI .02-.002	VFSI .005-.002	FAML TEXT SAND 2-.1	INTR II .2-.02	FINE CLAY TO CLAY PCT	NON-CO3-CLAY PCT	RATIO 8D1 15-BAR TO CLAY
		PARTICLE SIZE ANALYSIS, LT 2MM, 3A1, 3A1A, 3A1B - - - - - - - - - -																
		PCT LT 2MM																
000-18	AP	2.9	51.1	46.0	26.5	TR	TR	.1	.2	2.6	24.2	26.9	8.9	.3	27.0	58		.52
018-46	A1	2.9	46.9	50.2	32.2	TR	.1	.2	.4	2.2	19.4	27.5	9.1	.7	21.9	64		.50
046-61	A3	1.9	38.1	60.0	37.4	TR	.1	.1	.3	1.4	14.5	23.6	9.4	.5	16.1	62		.43
061-81	B21G	1.6	29.4	69.0	37.8	.1	.2	.2	.3	.8	6.3	23.1	11.1	.8	7.4	55		.40
081-102	B22G	2.0	32.6	65.4	31.4	.2	.2	.2	.3	1.1	8.2	24.4	11.0	.9	9.5	48		.41
102-128	B3G	2.8	42.9	54.3	28.8	.2	.2	.2	.4	1.8	15.0	27.9	8.7	1.0	17.1	53		.48
128-152	C1G	2.2	40.2	57.6	27.2	.2	.2	.2	.5	1.1	8.5	31.7	10.3	1.1	10.0	47		.40
152-178	C2G	4.3	53.9	41.8	21.8	.1	.1	.1	.9	3.1	20.6	33.3	7.0	1.2	24.4	52		.45
178-205	C3G	6.2	51.0	42.8	17.2	.6	.3	.3	1.9	3.1	12.1	38.9	9.6	3.1	16.6	40		.46
000-18	AP (A)																	

DEPTH CM	(PARTICLE SIZE ANALYSIS, MM, 3B, 3B1, 3B2) VOL. GT 2 PCT	WEIGHT GT 75 PCT	75-20	20-5	5-2	LT .074	20-2 PCT LT20	(BULK DENSITY) 4A1D 1/3-BAR G/CC	4A1H OVEN DRY G/CC	4D1 COLE	4B1C 1/10 BAR PCT	4B1C 1/3-BAR PCT	4B2 15-BAR PCT	(WATER CONTENT) 4C1 WRD CM/CM		CARBONATE 6E1B LT 2 PCT	3A1A LT .002 PCT	(PH) 8C1A 1/1 H2O	8C1E 1/2 CACL
		PCT LT 75																	
000-18	0	0	0	0	0	99	0	1.18	1.69	.127	38.3	36.7	24.1	.15	2.3C			6.7	6.5
018-46	0	0	0	0	0	99	0	1.28	1.85	.131	35.8	34.0	25.0	.12	2.5C			6.5	6.5
046-61	0	0	0	0	0	99	0	1.26	1.90	.147	39.6	38.2	25.9	.16	2.0C			6.9	6.8
061-81	0	0	0	0	0	99	0	1.23	1.88	.152	42.3	41.0	27.8	.16	2.3C	TR		7.3	7.2
081-102	0	0	0	0	0	99	0	1.26	1.87	.141	40.2	38.9	26.6	.16	1.7C	TR		7.5	7.4
102-128	0	0	0	0	0	99	0	1.36	1.88	.114	34.5	33.3	25.9	.10	2.1C	TR		7.4	7.5
128-152	0	0	0	0	0	99	0	1.40B					23.2			TR	0	7.6	7.4
152-178	0	0	0	0	0	98	0	1.45	1.84	.083	27.7	26.9	18.7	.12	3.6C	TR	0	7.7	7.4
178-205	0	0	0	0	0	96	0	1.50B					19.5			4	0	7.9	7.6
000-18								1.40	1.89	.106	32.0	31.4	24.1	.10	4.0C				

DEPTH CM	(ORGANIC MATTER) 6A1A ORGN CARB PCT	6B1A NITG PCT	C/N	IRON 6C2A EXT FE PCT	PHOS 6S1A TOTL PCT	(EXTRACTABLE BASES 5B4A) 6N2E CA	6O2D MG	6P2A NA	6Q2A K	SUM EXTB / 100	ACTY 6H1A BACL TEA G	AL 6G1D KCL EXT	(CAT EXCH) 5A3A EXTB ACTY	5A6A NHAC	RATIO 8D1 NHAC TO CLAY	RATIO 8D3 CA TO MG	CA 5F SAT NHAC PCT	(BASE SAT) 5C3 EXTB ACTY PCT	5C1 NHAC PCT
						(MEQ / 100 G)													
000-18	2.36D	.201	12	.7		29.6	8.9	.2	1.3	40.0	4.9		44.9	39.8	.87	3.3	74	89	
018-46	1.63	.151	11	.7		30.2	9.7	.4	1.0	41.3	4.6		45.9	41.2	.82	3.1	73	90	
046-61	1.20	.117	10	.8		34.1	12.6	.5	1.2	48.4	3.4		51.8	43.6	.73	2.7	78	93	
061-81	.75	.097	8	1.1		33.2E	14.8E	.8	1.3	50.1				47.0	.68				
081-102	.59			1.0		30.5E	13.3E	1.0	1.3	46.1				44.5	.68				
102-128	.51			.9		26.1E	11.5E	1.0	1.2	39.8				36.8	.68				
128-152	.39			1.1		28.4E	11.8E	1.1	1.1	42.4				37.3	.65				
152-178	.38			.8		21.1E	8.9E	.8	1.0	31.8				30.2	.72				
178-205	.35			1.0		25.8E	8.5E	.7	1.0	36.0				28.2	.66				
000-18																			

DEPTH CM	(SATURATED PASTE) 8E1 REST OHM-CM	8C1B PH	8A H2O PCT	NA 5D2 ESP PCT	NA 5E SAR	SALT 8D5 TOTL SOLU PPM	GYP 6F1A PCT	(SATURATION EXTRACT 8A1) 8A1A EC MMHOS/CM	6N1B CA	6O1B MG	6P1A NA	6Q1A K	6I1A CO3	6J1A HCO3	6K1A CL	6L1A SO4	6M1A NO3	ATTERBERG 4F1 LQID LMIT PCT	4F2 PLST INDX
								(MEQ / LITER)											
000-18																			
018-46																			
046-61																			
061-81																			
081-102	1200	7.2	89.5	2	1	290		.51	2.2	1.2	1.5	.1							
102-128																			
128-152																			
152-178																			
178-205																			
000-18																			

CLAY MINERALOGY (7A2C).
061-81 MT3 MI2 KK2.
152-178 MT4 MI2 KK2.
COMMENTS - MONTMORILLONITE IS WELL-ORDERED. PLACEMENT IS MONTMORILLONITIC.
RELATIVE AMOUNTS - (X-RAY) 5 = DOMINANT 4 = ABUNDANT 3 = MODERATE 2 = SMALL 1 = TRACE.
MINERAL CODE - MT = MONTMORILLONITE MI = MICA KK = KAOLINITE.

DEPTH CM	AVAILABLE P LBS PER ACRE (F)	AVAILABLE K LBS PER ACRE (F)
000-18	13	321
018-33	9	119
033-46	8	116
046-61	7	109
061-71	5	96
071-81	6	117
081-91	6	152
091-102	6	144
102-114	6	140
114-127	6	164
127-152	8	183

(A) TWO SETS OF CLOD SAMPLES WERE COLLECTED FROM THE AP HORIZON. 70L1125 - BENEATH THE CORN ROW. 70L1134 - BENEATH THE WHEEL TRACK BETWEEN THE CORN ROWS.
(B) ESTIMATED.
(C) MICRO-PENETRATION RESISTANCE. A ROD 0.6 CM DIA IS SLOWLY PUSHED INTO A BULK DENSITY CLOD, EQUILIBRATED AT 1/10-BAR, A DISTANCE OF 0.6 CM USING A POCKET PENETROMETER. UNITS ARE FORCE (KG) AND NOT ESTIMATES OF UNCONFINED COMPRESSIVE STRENGTH.
(D) ORGANIC CARBON IS 26 KG/M SQ TO A DEPTH OF 1 M (6A).
(E) METHODS 6N4C FOR CA AND 6O4C FOR MG.
(F) BY SOIL TESTING LAB, IOWA STATE UNIV, AMES, IA.

Pedon classification: Vertic Haplaquoll; very fine, montmorillonitic, mesic.
Series classification: Vertic Haplaquoll; fine, montmorillonitic, mesic.1/
Soil: Luton silty clay.
Sample no.: S70-Iowa-67-1 (LSL Nos. 70L1125 - 70L1134).
Location: Monona County, Iowa; about 3 miles north of Onawa; 485 feet north and 130 feet east of road center from the southwest corner of sec. 16, T. 84 N., R. 45 W.
Vegetation and land use: Corn, harvested; cropland.
Parent material: Clayey alluvial sediments.
Physiography: Level to slightly concave backswamp area of second bottomland in Missouri River bottom. Site is about 4½ miles west of uplands and 9 miles east of Missouri River.
Relief: Level.
Slope: Less and 0.5 percent.
Drainage: Poorly to very poorly drained.
Ground water: 70 inches or 178 cm.
Permeability: Very slow.
Erosion: None.
Described by: J. R. Culver, C. S. Fisher, J. R. Worster, and F. F. Riecken; October 27, 1970.

(Colors are for moist soil unless otherwise stated)

Ap 70L1125 0 to 18 cm (0 to 7 inches). Black (N 2 or 10YR 2/1) silty clay; cloddy breaks to weak fine granular structure; friable; neutral; clear smooth boundary.

A1 70L1126 18 to 46 cm (7 to 18 inches). Black (N 2) silty clay, few small circular areas about 5 mm in diameter of dark grayish brown (2.5Y 5/2); moderate very fine subangular blocky structure; firm; few fine soft dark brown accumulations of oxides; neutral; gradual smooth boundary.

A3 70L1127 46 to 61 cm (18 to 24 inches). Very dark gray (5Y 3/1) silty clay; few fine distinct olive brown (2.5Y 4/4) mottles; strong very fine subangular blocky and angular blocky structure; firm; some thin discontinuous very dark brown (10YR 2/2) coatings on peds; few fine soft dark brown accumulations of oxides; mildly alkaline; clear smooth boundary.

B21g 70L1128 61 to 81 cm (24 to 32 inches). Dark gray (5Y 4/1) silty clay, common fine faint light olive brown (2.5Y 5/4) mottles; moderate very fine subangular blocky and angular blocky structure; very firm; thin continuous films on peds; few fine soft dark brown accumulations of oxides; a few ¼-inch wide vertical cracks are filled with black (N 2) silty clay; mildly alkaline; clear smooth boundary.

B22g 70L1129 81 to 102 cm (32 to 40 inches). Dark gray (5Y 4/1) silty clay; common fine distinct olive brown (2.5Y 5/4) and dark yellowish brown (10YR 4/4) mottles; moderate medium subangular blocky structure; very firm; some thin discontinuous organic films on peds, a few fine dark concretions; distinct slickensides with continuous thick dark gray (5Y 4/1) and very dark gray (5Y 3/1) films on 60° ped faces; a few ¼-inch wide vertical cracks are filled with black (N 2) silty clay; moderately alkaline; clear smooth boundary.

B3g 70L1130 102 to 128 cm (40 to 50 inches). Dark gray (5Y 4/1) silty clay; few to common fine distinct olive brown (2.5Y 4/4) and yellowish brown (10YR 5/6) mottles; moderate medium subangular blocky structure; very firm; distinct slickensides with many thick dark gray (5Y 4/1) films on 60° ped faces; few 1/8-inch carbonate concretions; slightly effervescent; moderately alkaline; clear smooth boundary.

C1g 70L1131 128 to 152 cm (50 to 60 inches). Dark gray (5Y 4/1) silty clay; many medium distinct light olive brown (2.5Y 5/4) or yellowish brown (10YR 5/6) mottles; weak coarse subangular blocky structure; very firm; distinct slickensides with many thick gray (5Y 5/1) films on 60° ped faces; slightly effervescent; moderately alkaline; gradual smooth boundary.

C2g 70L1132 152 to 178 cm (60 to 70 inches). Dark gray (5Y 4/1) silty clay; many medium distinct yellowish brown (10YR 5/4 and 5/6) mottles; weak coarse subangular blocky structure; very firm; slightly effervescent; moderately alkaline; gradual boundary.

C3g 70L1133 178 to 205 cm (70 to 80 inches). Dark gray (5Y 4/1) silty clay; many medium distinct dark yellowish brown (10YR 4/4) and olive brown (2.5Y 4/4) mottles; weak medium subangular blocky structure to massive; firm; few secondary carbonates; slightly effervescent; moderately alkaline.

1/The data indicate that this type location pedon averages more than 60 percent clay in the 10 to 40 inch control section.

U S DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SOIL Marna silty clay loam SOIL Nos. S64Iowa-94-1 LOCATION Webster County, Iowa

SOIL SURVEY LABORATORY Lincoln, Nebraska LAB. Nos. 19920-19930 April 1968

General Methods: 1A, 1B1b, 2A1, 2B

Depth (In)	Horizon	Size class and particle diameter (mm) 2A1 — Total: Sand (2-0.05) a	Silt (0.05-0.002)	Clay (< 0.002)	Sand: Very coarse (2-1)	Coarse (1-0.5)	Medium (0.5-0.25)	Fine (0.25-0.1)	Very fine (0.1-0.05)	Silt: 0.05-0.02	Int III (0.02-0.002)	Int II (0.2-0.02)	(2-0.1)	<0.074		Coarse fragments 2A2: 3B2 2-19 (vol.)	3B1 2-19 (wt.)	
		Pct of < 2 mm														Pct of < 19mm		
0-6	Ap1	20.1	43.8	36.1	0.7	3.0	3.9	7.8	4.7	17.1	26.7	26.0	15.4	82.6			tr	
6-10	Ap2	19.4	44.0	36.6	0.8	2.8	3.5	7.5	4.8	16.5	27.5	25.4	14.6	83.4			tr	
10-14	A12	18.8	43.8	37.4	0.7	2.6	3.2	7.1	5.2	16.5	27.3	25.7	13.6	84.2			tr	
14-20	B1	19.8	41.2	39.0	1.2	3.2	3.4	7.0	5.0	15.0	26.2	23.9	14.8	83.2			1	
20-26	B21	21.3	35.9	42.8	1.6	2.9	3.4	7.9	5.5	12.3	23.6	22.2	15.8	81.9			4	
26-32	B22g	22.4	32.7	44.9	1.9	3.0	3.3	8.0	6.2	11.4	21.3	22.2	16.2	81.2			2	
32-40	B23g	29.3	34.5	36.2	2.1	3.8	4.5	10.4	8.5	11.8	22.7	26.3	20.8	75.7		2	5	
40-45	IIB31g	32.8	37.1	30.1	2.8	4.8	5.0	11.2	9.0	13.6	23.5	29.0	23.8	72.5		2	6	
45-49	IIB32g	36.4	38.8	24.8	3.0	5.1	6.1	12.8	9.4	14.9	23.9	31.4	27.0	69.1		7	12	
49-61	IIB33&B34	28.5b	42.1b	29.4b	2.3	4.2	4.6	9.9	7.5	12.7	29.4	25.7	21.0	76.0		4	7	
61-72	IIC1&C2	32.1	42.1	25.8	2.5	4.9	5.1	11.1	8.5	14.1	28.0	28.8	23.6	73.0		4	8	

Depth (In)	6A1a Organic carbon c Pct	6B1a Nitrogen Pct	C/N	6C2a Ext. Iron as Fe Pct.	Carbonate as $CaCO_3$: 6E1b 6E2a <2mm Pct.	3A1a <0.002 mm Pct.	Bulk density: 1/3-Bar d g/cc	4A1d 1/3-Bar g/cc	4A1b Air-Dry g/cc	4D1 COLE	Water content: 4B1c 1/3-Bar Pct	4B2 15-Bar Pct.	4C1 1/3- to 15-Bar in/in.			pH: 8C1b Sat. Paste		8C1a (1:1)
0-6	3.86	0.299	13	0.5				1.28	1.55	0.064	30.6	16.0	0.19					5.8
6-10	3.49	0.277	13	0.4				1.35	1.63	0.064	27.5	16.1	0.16					5.9
10-14	2.69	0.218	12	0.5				1.4e				16.9						6.0
14-20	1.86	0.159	12	0.5				1.32	1.61	0.068	27.3	16.9	0.14					6.2
20-26	1.00	0.095	11	0.5				1.37	1.84	0.11	29.0	18.1	0.15					6.4
26-32	0.49	0.054	9	0.5	-			1.35	1.86	0.11	30.5	18.4	0.16					6.8
32-40	0.32			0.7	tr(s)		1.32	1.35	1.67	0.072	29.0	15.9	0.17			6.9		7.4
40-45	0.25			0.7	5	-	1.38	1.41	1.63	0.046	25.2	14.1	0.15					8.0
45-49	0.14			0.7	16	-	1.37	1.47	1.65	0.037	24.1	12.1	0.16					8.0
49-61	0.14			0.7	17	tr	1.48	1.54	1.67	0.027	23.6	13.8	0.15					8.0
61-72	0.13			0.7	17	tr	1.48	1.54	1.66	0.023	23.2	13.1	0.15			7.4		7.9

Depth (In.)	Extractable bases 5B1a: 6N2a Ca	6O2a Mg	6P2a Na	6Q2a K	Sum	6H1a Ext. Acidity	Cat.Exch.Cap.: 5A3a Sum Cations	5A1a NH_4OAc			8F1 Resistivity h ohms-cm	8B1a Elec. Cond. mmhos/cm	8B1 Water at Sat. Pct.	8D5 Total sol. salts in soil ppm.	8D3 Ca/Mg		Base saturation: 5C3 Sum Cations Pct	5C1 NH_4OAc Pct
	meq/100 g																	
0-6	27.3	7.6	0.1	0.7	35.7	10.7	46.4	34.5							3.6		77	103
6-10	27.5	7.8	0.1	0.6	36.0	10.5	46.5	34.1							3.5		77	106
10-14	24.6	8.1	0.1	0.6	33.4	9.7	43.1	32.7							3.0		77	102
14-20	24.3	8.9	0.1	0.6	33.9	8.8	42.7	32.7							2.7		79	104
20-26	26.4	11.1	0.2	0.7	38.4	5.6	44.0	33.9							2.4		87	113
26-32	25.6	11.3	0.2	0.6	37.7	3.7	41.4	32.2							2.3		91	117
32-40	19.4f	8.7g	0.3	0.6	29.0	2.4	31.4	26.8			1300	0.86	55.5	550	2.2		92	108
40-45	16.7f	7.0g	0.3	0.5	24.5			22.8							2.4			
45-49	14.4f	5.5g	0.3	0.4	20.6			18.2							2.6			
49-61	14.7f	5.9g	0.3	0.5	21.4			17.4							2.5			
61-72	13.1f	5.1g	0.3	0.5	19.0			16.5			1700	0.76	43.6	490	2.6			

Depth (In)	Ratios to Clay 8D1: NH_4OAc CEC	Ext. Iron	15-Bar Water	Atterberg[i]: 4F1 Lqid Lmit Pct	4F2 Plst Indx
0-6	0.96	0.01	0.44	49	23
6-10	0.93	0.01	0.44		
10-14	0.87	0.01	0.45		
14-20	0.84	0.01	0.43		
20-26	0.79	0.01	0.42	59	35
26-32	0.72	0.01	0.41		
32-40	0.74	0.02	0.44		
40-45	0.76	0.02	0.47		
45-49	0.73	0.03	0.49		
49-61	0.59	0.02	0.47		
61-72	0.64	0.03	0.51	40	21

a. Carbonate comprises 1 to 5 percent of the sand between 40 and 45 inches, and 10 to 20 percent of the sand below 45 inches.
b. Duplicate: 27.3 percent sand, 42.7 percent silt, and 30.0 percent clay.
c. 25 kg/m^2 to 60 inches (Method 6A).
d. Calculated to include volume but not weight of 2-19 mm material (Method 3B2).
e. Estimated.
f. KCl-TEA extract (Method 6N4b).
g. KCl-TEA extract (Method 6O4b).
h. Resistivity of fine-and medium-textured soils measured at saturation is similar to that measured at moisture equivalent. Resistivity at saturation for coarse-textured soils is generally lower than that obtained at moisture equivalent.
i. Iowa State Highway Commission data.

Pedon classification: Typic Haplaquoll; fine, montmorillonitic, mesic.
Series classification: (Same as pedon).
Soil: Marna silty clay loam.
Soil no.: S64-Iowa-94-1 (LSL Nos. 19920 - 19930).
Location: Webster County, Iowa; 1,041 feet south and 790 feet east of the NW corner of Sec. 25, T. 86 N., R. 28 W.
Vegetation and land use: Alfalfa; cropland.
Parent material: About 40 inches of fine textured glacial sediments over glacial till.
Slope: Nearly level area in a nearly level to gently undulating till plain.
Drainage: Poor.
Permeability: Slow.
Root distribution: Roots are abundant to 20 inches, common to 32 inches, and few below.

Described by: R. I. Dideriksen, C. S. Fisher, M. P. Koppen, G. T. Carlson, L. I. Harmon; September 14, 1964.

(Colors are for moist soil unless otherwise stated)

Ap1 19920 0 to 15 cm (0 to 6 inches). Black (N 2/0) heavy silty clay loam; black (10YR 2/1) crushed; black (10YR 2/1) to very dark gray (10YR 3/1) dry; strong medium angular blocky structure parting to moderate fine subangular blocky; firm; clean sand grains are evident; the structure has some vertical orientation probably due to drying; slightly acid (pH 6.2); clear smooth boundary.

Ap2 19921 15 to 25 cm (6 to 10 inches). Color, texture, and structure similar to Ap1 horizon; firm; clean sand grains are evident; the structure is due to plow layer compaction and drying; slightly acid (pH 6.2); abrupt smooth boundary.

A12 19922 25 to 35 cm (10 to 14 inches). Color as above; moderate very fine granular and some very fine subangular blocky structure; friable; a few 1/8-inch or smaller pebbles; slightly acid (pH 6.2); clear smooth boundary.

B1 19923 35 to 50 cm (14 to 20 inches). Color and texture as above except dark gray (10YR 4/1) dry; moderate fine and very fine subangular blocky structure; firm; very few very fine soft brown (7.5YR 4/4) oxides; a few very dark gray (5Y 3/1) peds in the lower part of horizon; a few 1/8-inch and smaller pebbles; sand grains are evident; common inped tubular pores; neutral (pH 6.6); clear smooth boundary.

B21 19924 50 to 65 cm (20 to 26 inches). Olive gray (5Y 5/2) and dark gray (5Y 4/1) silty clay to clay; faces of peds very dark gray (10YR 3/1) to black (10YR 2/1); strong coarse prismatic structure parts to medium prismatic, then to strong fine and very fine subangular blocky; very firm; distinct continuous clay films; a few inped tubular pores; very few very fine soft dark brown (7.5YR 3/2) oxides; very few ¼-inch pebbles and some sand grains; neutral (pH 7.2); gradual smooth boundary.

B22g 19925 65 to 80 cm (26 to 32 inches). Colors as above except faces of peds are very dark gray (5Y 3/1) (about 70 percent) and black (10YR 2/1) (about 30 percent); silty clay; structure and consistence similar to B21 horizon; thick continuous clay films on the prisms and the subangular blocks; pores as above; very few very fine light olive brown (2.5Y 5/4) to dark yellowish brown soft oxides; a few fine black soft oxides; a few fragments of shale and rotted stones; a few sand grains; prism faces are about 30° from the horizontal and appear to have fewer pores than vertical faces; neutral (pH 7.2); gradual smooth boundary.

B23g 19926 80 to 103 cm (32 to 40 inches). Colors similar to B22g horizon except faces of peds are about 50 percent olive gray (5Y 5/2), about 30 percent very dark gray (5Y 3/1), and about 20 percent black (10YR 2/1); heavy silty clay loam; common fine light olive brown (2.5Y 5/4) grading to yellowish brown (10YR 5/6) mottles; structure as above; firm; prisms have faces 30° from horizontal with thick continuous clay films; vertical faces have thin clay films and a somwhat grainy appearance; some of the larger prism faces have colors that are very dark gray (5Y 3/1) and black (10YR 2/1); smaller faces are olive gray (5Y 5/2) and very dark gray (10YR 3/1); many fine tubular pores; few fine black oxide concretions; a few ½-inch pebbles; mildly alkaline (pH 7.8); clear wavy boundary.

IIB31g 19927 103 to 115 cm (40 to 45 inches). Color similar to B23g horizon except some dark gray (5Y 4/1); light clay loam; mottles as above; weak coarse prismatic structure parting to weak medium to coarse subangular blocky structure; firm; a few pores coated with very dark gray (10YR 3/1) clay; many distinct tubular pores; some 1- to 1½-inch lime rocks; a few pebbles; a few shale rocks; common black oxides; glacial till; the vertical faces are high in lime; moderately alkaline (pH 7.9); weakly effervescent; gradual wavy boundary.

IIB32g 19928 115 to 125 cm (45 to 49 inches). Colors similar to IIB31g horizon; heavy loam; mottles and structure as above; friable; a few dark gray (10YR 4/1) coatings on prism faces and few very dark gray (10YR 3/1) coats in pores; tubular pores as above; few fine black oxide concretions; some pebbles; some lime segregated along pores, roots, and large prism faces; several old krotovinas in the pit at this depth and below; moderately alkaline (pH 8.2+); strongly effervescent; gradual wavy boundary.

IIB33 19929 (sampled 49-61 inches) 125 to 140 cm (49 to 55 inches). Mottled olive gray (5Y 5/2) and yellowish brown (10YR 5/6) heavy loam; weak very coarse prismatic structure or vertical faces; friable; many medium and fine inped tubular pores; a few very dark gray (10YR 3/1) coats in some pores; distinct lime on large vertical faces; also prominent filament lime along pores; some pebbles; moderately alkaline (pH 8.2+); strongly effervescent; and higher in lime than the horizon above; gradual smooth boundary.

IIB34 140 to 155 cm (55 to 61 inches). Color, texture, mottles, structure, and consistence similar to IIB33 horizon; some pores are coated with dark gray (10YR 3/1); lime on the vertical faces decreases but ¼-inch lime concretions are common; prominent filament lime along pores; krotovinas are as in the horizon above; moderately alkaline (pH 8.2+); strongly effervescent; gradual smooth boundary.

2-Marna silty clay loam

IIC1 19930 155 to 170 cm (61 to 67 inches). Yellowish brown (10YR 5/6) about 70 percent and gray (5Y 5/1) about 30 percent; heavy loam; massive but with some vertical faces with thin coats of gray (5Y 5/1); friable; dark coats on a few vertical pores like above; a few lime nodules; a few yellowish red (5Y 4/6) soft oxides; moderately alkaline (pH 8.2+); strongly effervescent; gradual smooth boundary.

IIC2 170 to 183 cm (67 to 72 inches). This horizon is the same as that above but the vertical faces are less distinct.

Remarks: Parent material I consisted of glacial sediments with few pebbles. A lime-enriched zone was prominent from 49 to 61 inches. Large vertical cleavage planes or prisms are evident below about 45 inches.

Micromorphology (Method 4E1). Clay films are not apparent in the B22g horizon when examined under a stereoscopic microscope. However, the smooth irregular clayey surfaces resemble clay films, particularly when the surfaces are moist. In thin section, oriented clay occurs primarily as elongated zones in the soil matrix. These stringers or ribbons of clay have probably formed from stress, resulting from the shrinking and swelling of the clayey fabric. A few isolated patches of oriented clay, interpreted as clay films, occur on macrostructural surfaces. No oriented clay was observed in thin section in the IIC1 horizon. Clay occurs as birefringent flecks.

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SOIL Marna silty clay loam SOIL Nos. S64Iowa-40-4 LOCATION Hamilton County, Iowa

SOIL SURVEY LABORATORY Lincoln, Nebraska LAB. Nos. 19931-19941 April 1968

General Methods: 1A, 1B1b, 2A1, 2B

Depth (in.)	Horizon	Total: Sand (2-0.05) a	Total: Silt (0.05-0.002)	Total: Clay (< 0.002)	Sand: Very coarse (2-1)	Sand: Coarse (1-0.5)	Sand: Medium (0.5-0.25)	Sand: Fine (0.25-0.1)	Sand: Very fine (0.1-0.05)	Silt: 0.05-0.02	Silt: Int. III (0.02-0.002)	Int. II (0.2-0.02)	(2-0.1)	<0.074	0.005-0.002	Coarse fragments 2A2: 3B2 2-19 (vol.)	Coarse fragments 2A2: 3B1 2-19 (wt.)	
		Pct of < 2 mm														Pct. of < 19mm		
0-6	Ap1	15.5	46.7	37.8	1.1	2.1	2.6	5.2	4.5	17.4	29.3	24.9	11.0	87.3			tr	
6-9	Ap2	15.0	45.7	39.3	0.5	2.0	2.4	5.6	4.5	15.3	30.4	23.1	10.5	87.7			tr	
9-16	A12	10.5	47.3	42.2	0.4	1.3	1.6	3.8	3.4	15.4	31.9	21.0	7.1	91.6			tr	
16-21	B1	10.5	46.0	43.5	0.4	1.3	1.5	3.7	3.6	15.6	30.4	21.4	6.9	91.9			tr	
21-29	B21g	9.4	44.7	45.9	0.4	1.1	1.3	3.3	3.3	13.5	31.2	18.7	6.1	92.7			tr	
29-34	B22g	13.4	40.2	46.4	0.7	1.7	2.0	4.8	4.2	11.1	29.1	18.0	9.2	89.2	10.1		tr	
34-38	B23g	21.1	38.9	40.0	1.2	2.8	3.3	7.8	6.0	10.2	28.7	20.6	15.1	82.4			3	
38-49	IIB31g&B32g	23.7	42.5	33.8	1.8	3.6	3.7	8.1	6.5	11.4	31.1	22.4	17.2	80.1		2	5	
49-56	IIB33	23.2	42.6	34.2	2.0	3.4	3.7	8.0	6.1	10.2	32.4	20.9	17.1	80.3	12.2	2	5	
56-68	IIB34	27.2	45.8	27.0	2.1	4.1	4.3	9.3	7.4	13.0	32.8	25.7	19.8	77.2		2	5	
68-80	IIC	26.4	46.0	27.6	1.6	3.9	4.4	9.3	7.2	12.3	33.7	24.7	19.2	77.8		4	7	

Depth (in.)	6A1a Organic carbon b Pct	Nitrogen Pct	C/N	Ext. Iron as Fe Pct.	Carbonate as $CaCO_3$: 6E1b 6E2a <2mm Pct	Carbonate: 3A1a <0.002 mm Pct.	Bulk density: 1/3-Bar c g/cc	Bulk density: 4A1d 1/3-Bar g/cc	Bulk density: 4A1b Air-Dry g/cc	4D1 COLE	Water content: 4B1c 1/3-Bar Pct.	Water content: 4B2 15-Bar Pct	Water content: 4C1 1/3- to 15-Bar in./in.		3A2b Fine clay <0.0002 mm Pct.	pH		8C1a (1:1)
0-6	4.03							1.26	1.56	0.073	30.5	16.9	0.17					5.7
6-9	3.77							1.29	1.58	0.068	29.5	16.7	0.17					5.7
9-16	2.60							1.28	1.58	0.073	28.0	18.0	0.13					5.9
16-21	1.92							1.32	1.70	0.087	30.1	18.7	0.15		31.3			6.2
21-29	1.07							1.35	1.87	0.12	30.2	17.9	0.17					6.4
29-34	0.57				-(s)			1.39	1.87	0.11	27.5	17.6	0.14		28.2			6.7
34-38	0.37				-(s)			1.46	1.86	0.087	25.2	15.4	0.14					7.2
38-49	0.23				10	-	1.44	1.47	1.74	0.058	24.1	14.3	0.14					7.8
49-56	0.16				17	1	1.57	1.60	1.75	0.031	20.4	13.4	0.11		17.5			8.1
56-68	0.16				18	tr	1.56	1.59	1.74	0.031	20.9	11.9	0.14					8.0
68-80	0.18				19	tr	1.59	1.66	1.78	0.023	20.0	12.0	0.13					8.1

Depth (in.)	Extractable bases 5B1a: 6N2a Ca	6O2a Mg	6P2a Na	6Q2a K	Sum	6H1a Ext. Acidity	Cat. Exch. Cap.: 5A3a Sum Cations	5A1a NH_4OAc						8D3 Ca/Mg		Base saturation: 5C3 Sum Cations	5C1 NH_4OAc
	meq/100 g															Pct	Pct
0-6	28.0	8.6	0.1	0.6	37.3	12.1	49.4	38.0						3.3		76	98
6-9	27.1	8.8	0.1	0.6	36.6	12.1	48.7	38.0						3.1		75	96
9-16	26.5	10.4	0.1	0.6	37.6	9.6	47.2	35.6						2.5		80	106
16-21	26.4	11.5	0.1	0.6	38.6	8.4	47.0	36.8						2.3		82	105
21-29	25.7	12.6	0.1	0.6	39.0	5.7	44.7	35.3						2.0		87	110
29-34	23.4	12.3	0.2	0.6	36.5	4.8	41.3	31.3						1.9		88	117
34-38	21.4	11.3	0.2	0.6	33.5	2.9	36.4	29.2						1.9		92	115
38-49	16.6d	9.0e	0.2	0.5	26.3			23.5						1.8			
49-56	15.1d	6.8e	0.2	0.5	22.6			19.5						2.2			
56-68	12.8d	5.8e	0.2	0.5	19.3			16.3						2.2			
68-80	11.4d	5.6e	0.2	0.5	17.7			16.5						2.0			

Depth (in.)	Ratios to Clay 8D1: NH_4OAc CEC		15-Bar Water	
0-6	1.01		0.45	
6-9	0.97		0.42	
9-16	0.84		0.43	
16-21	0.85		0.43	
21-29	0.77		0.39	
29-34	0.67		0.38	
34-38	0.73		0.39	
38-49	0.70		0.42	
49-56	0.57		0.39	
56-68	0.60		0.44	
68-80	0.60		0.43	

a. Carbonate comprises 10 to 20 percent of the sand below 38 inches.
b. 27 kg/m^2 to 60 inches (Method 6A).
c. Calculated to include volume but not weight of 2-19 mm material (Method 3B2).
d. KCl-TEA extract (Method 6N4b).
e. KCl-TEA extract (Method 6O4b).

Pedon classification: Typic Haplaquoll; fine, montmorillonitic, mesic.
Series classification: (Same as pedon).
Soil: Marna silty clay loam.
Soil no.: S64-Iowa-40-4 (LSL Nos. 19931 - 19941).
Location: Hamilton County, Iowa; 297 feet east and 1,397 feet north of the SW Corner of Sec. 33, T. 87 N., R. 25 W.
Vegetation and land use: Clover; cropland.
Parent material: About 40 inches of fine textured glacial sediments over glacial till.
Slope: A slope of less than 1 percent on the slightly undulating Late Wisconsin till plain.
Permeability: Slow.
Root distribution: Roots were abundant to 16 inches, common from 16 to 34 inches, and very few below 34 inches.
Described by: R. I. Dideriksen, C. S. Fisher, and M. P. Koppen.

(Colors are for moist soil unless otherwise stated)

Ap1 19931 0 to 15 cm (0 to 6 inches). Black (N 2/0) heavy silty clay loam; black (10YR 2/1) when kneaded; black (10YR 2/1) to very dark gray (10YR 3/1) dry; cloddy with medium angular blocky structure in the lower part and some granular structure in the upper part; friable when moist, hard when dry; a few evident sand grains; slightly acid (pH 6.3); abrupt smooth boundary.

Ap2 19932 15 to 28 cm (6 to 9 inches). Color and texture like above; moderate medium angular blocky structure with a few fine subangular blocks and some weak fine granular structure; friable when moist, hard when dry; a few clean sand grains are evident; slightly acid (pH 6.3); clear smooth boundary.

A12 19933 23 to 40 cm (9 to 16 inches). Color and texture like above; moderate very fine subangular blocky structure; firm; low in sand (less than 20 percent) but grains are evident; root channels present but inped pores are few; slightly acid (pH 6.4); clear smooth boundary.

B1 19934 40 to 53 cm (16 to 21 inches). Black (N 2/0) light silty clay; a few peds are very dark gray (10YR 3/1); black (10YR 2/1) to very dark gray (10YR 3/1) when kneaded; very dark gray (10YR 3/1) to dark gray (10YR 4/1) when dry; strong very fine subangular blocky structure with some vertical cleavage; firm; thin discontinuous clay films; all peds have a sheen; few medium root channels and fine pores; common very fine dark brown soft oxides; low sand content (less than 20 percent); slightly acid (pH 6.4); clear smooth boundary.

B21t 19935 53 to 73 cm (21 to 29 inches). Dark gray (5Y 4/1) with about 20 percent olive gray (5Y 5/2) silty clay faces of peds very dark gray (10YR 3/1) with about 30 percent dark gray (5Y 4/1); very dark gray (10YR to 5Y 3/1) when kneaded; strong medium prismatic structure parting to moderate medium subangular blocky; very firm; a few black (10YR 2/1) coats on the prisms; the olive gray color increases with depth; thin continuous clay films and a few clay flows on the prisms; common very fine dark brown and a few black soft oxides; a few 30° cleavage faces; slightly acid (pH 6.5); clear smooth boundary.

B22g 19936 73 to 85 cm (29 to 34 inches). Olive gray (5Y 5/2) silty clay; faces of peds dark gray (5Y 4/1) with 30 percent olive gray (5Y 5/2); structure, and consistence like B21g horizon; clay films as above; distinct clay flows and fills along vertical faces; a few very dark gray (10YR 3/1) coats; common fine yellowish brown and strong brown soft oxides; some 30° cleavage faces across the prisms; some increase in sand from above but probably less than 20 percent; neutral (pH 6.6); clear smooth boundary.

B23g 19937 85 to 98 cm (34 to 38 inches). Color similar to B22g Horizon; light clay; weak medium prismatic structure parting to medium subangular blocky structure; firm; thin discontinuous clay films on vertical faces; common fine black and strong brown soft oxides; more pebbles than the horizon above; neutral (pH 6.7); clear smooth boundary.

IIB31g 19938 (sampled 38-49 inches) 98 to 110 cm (38 to 43 inches). Color similar to B23g horizon except faces are olive gray (5Y 5/2) with 40 percent dark gray (5Y 4/1); heavy clay loam; weak coarse prismatic structure parting to weak medium subangular blocky structure; firm; clay films less distinct than above; common fine yellowish brown and black soft oxides; distinct increase in pebbles and sand and contact with lime rock pebbles in the lower part; neutral (pH 7.2); gradual wavy boundary.

IIB32g 110 to 125 cm (43 to 49 inches). Mottled yellowish brown (10YR 5/6) and olive gray (5Y 5/2) medium clay loam; olive gray (5Y 5/2) with many fine yellowish brown (10YR 5/6) mottles on faces; structure like IIB31g horizon; friable to firm; many fine tubular pores; some dark gray (5Y 4/1) fills in pores and along some vertical faces; some pebbles; some ½-inch hard lime nodules; moderately alakline (pH 8.2+); strongly effervescent; gradual wavy boundary.

IIB33 19939 125 to 138 cm (49 to 56 inches). Color similar to IIB32g horizon but structure weaker; friable to firm; many fine tubular pores; some dark gray (5Y 4/1) coats in vertical pores; few black and strong brown soft oxides; maximum zone of lime segregation with lime oriented in pores and on vertical cleavage faces; fewer lime nodules than in the horizon above; common pebbles; old krotovina from horizon below extends into this horizon; moderately alkaline (pH 8.2+); strongly effervescent; diffuse smooth boundary.

IIB34 19940 138 to 168 cm (56 to 68 inches). Color and structure similar to IIB33 horizon; heavy loam; friable; very few fine black soft oxides; some lime in vertical cleavage faces but less segregated lime than above; an old krotovina in this horizon, moderately alkaline (pH 8.2+); strongly effervescent; diffuse wavy boundary.

IIC 19941 168 to 203 cm (68 to 80 inches). Color similar to IIB33 horizon except less olive gray; heavy loam; massive; friable; the lime is not segregated; moderately alkaline (pH 8.2+); strongly effervescent.

Penetrometer readings were made by using a Soiltest penetrometer with a 5/16-inch head. The penetrometer was pushed horizontally into the freshly exposed wall of the sampling pit to a depth of 5 inches. Three readings were obtained at each vertical depth as follows: at 8 inches--67, 67, 61 pounds; at 13 inches--50, 52 pounds; at 18 inches--60, 67, 71 pounds; at 24 inches--62, 64 pounds; at 32 inches--65, 53, 64 pounds; at 46 inches--64, 59, 70 pounds; at 63 inches--54, 62, 52 pounds.

2-Marna silty clay loam

Soil temperatures were taken by inserting a Weston dial thermometer into the wall of the sampling pit. The depths of temperatures are as follows: 20 inches--16.9°; 30 inches--16.1°; 40 inches--15.9°; 80 inches--13.6° C.

Mineralogy (Method 7A2). The clay mineralogy is similar for the B1, B22g and IIB33 horizons. A fairly well crystallized montmorillonite dominates; small amounts of mica (or illite) and kaolinite are present. The montmorillonite is somewhat higher while the mica and kaolinite are somewhat lower in the B1 horizon. Mineralogy is montmorillonitic.

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SOIL Marshall silty clay loam SOIL Nos S63Iowa-15-1 LOCATION Cass County, Iowa

SOIL SURVEY LABORATORY Lincoln, Nebraska LAB. Nos 18322-18330 May 1967

General Methods: 1A, 1B1b, 2A1, 2B

Depth (In)	Horizon	Size class and particle diameter (mm) 3A1 — Total: Sand (2-0.05)	Total: Silt (0.05-0.002)	Total: Clay (< 0.002)	Sand: Very coarse (2-1)	Sand: Coarse (1-0.5)	Sand: Medium (0.5-0.25)	Sand: Fine (0.25-0.1)	Sand: Very fine (0.1-0.05)	Silt: (0.05-0.02)	Silt: Int. III (0.02-0.002)	Int. II (0.2-0.02)	(2-0.1)			Coarse fragments: 2A2 > 2 Pct	2-19 (Pct of < 76mm)	19-76 (Pct of < 76mm)
		Pct. of < 2 mm																
0-7	A1p	2.3a	69.1	28.6	tr	0.1	0.1	0.2	1.9	37.9	31.2	39.9	0.4			-		
7-16	A12	2.0a	65.0	33.0	tr	0.1	0.1	0.2	1.6	33.9	31.1	35.6	0.4			-		
16-23	A3	2.2a	64.4	33.4	tr	0.1	0.1	0.2	1.8	33.2	31.2	35.1	0.4			-		
23-28	B21	2.7a	63.3	34.0	0.1	0.2	0.2	0.3	1.9	33.0	30.3	35.1	0.8			-		
28-36	B22	3.2a	64.3	32.5	tr	0.2	0.2	0.4	2.4	36.4	27.9	39.0	0.8			-		
36-44	B23	3.6a	66.3	30.1	-	0.1	0.2	0.3	3.0	38.2	28.1	41.3	0.6			-		
44-52	B31	3.7a	67.8	28.5	-	0.1	0.1	0.2	3.3	39.5	28.3	42.9	0.4			-		
52-60	B32	3.4b	67.4	29.2	tr	0.1	0.1	0.2	3.0	39.1	28.3	42.2	0.4			-		
60-72	C1	3.6b	68.9	27.5	-	tr	0.1	0.2	3.3	40.0	28.9	43.4	0.3			-		

Depth (In)	6A1a Organic carbon (Pct.)	6B1a Nitrogen (Pct)	C/N		6E2a Carbonate as $CaCO_3$ (Pct)	6C2a Ext. Iron as Fe (Pct.)	Bulk density: 4A1a Field-State (g/cc)	4A1d 1/3-Bar (g/cc)	4A1b Air-Dry (g/cc)	4D1 COLE	Water content: 4B4 Field-State (Pct.)	4B1c 1/3-Bar (Pct)	4B2 15-Bar (Pct)	4C1 1/3-to 15-Bar (In./in.)		pH		8C1a (1:1)
0-7	2.46	0.189	13			1.0	1.34	1.34	1.44	0.024	25.3	25.2	12.5	0.17				5.5
7-16	2.14	0.172	12			1.1	1.19	1.16	1.28	0.032	29.0	32.7	14.0	0.22				5.7
16-23	1.61	0.142	11			1.2	1.22	1.19	1.34	0.040	28.5	32.4	14.6	0.21				5.9
23-28	1.00	0.093	11			1.3	1.26	1.24	1.42	0.047	28.2	28.5	15.7	0.16				5.9
28-36	0.58	0.062	9			1.4	1.28	1.28	1.45	0.044	26.9	28.1	15.2	0.16				6.0
36-44	0.33					1.2	1.38	1.33	1.48	0.036	20.6	27.1	14.6	0.17				6.1
44-52	0.22					1.3	1.38	1.32	1.46	0.036	22.5	26.3	14.0	0.16				6.2
52-60	0.15					1.2	1.36	1.32	1.46	0.036	25.1	27.4	14.1	0.18				6.4
60-72	0.13				-(s)	1.1	1.34	1.30	1.42	0.028	26.7	28.3	13.7	0.19				6.5

Depth (In)	Extractable bases 5B1a: 6N2a Ca (meq/100 g)	6Q2a Mg	6P2a Na	6Q2a K	Sum	6H1a Ext. Acidity	Cat. Exch. Cap.: 5A3a Sum Cations	5A1a NH_4OAc		Resistivity d (ohms)	8B1a Elec. Cond. (mmhos)	6F1a Sol. Na (me/l.)	5D2 Exch. Na (Pct.)	8B Water at Sat. (Pct.)	8D3 Ca/Mg		Base saturation: 5C3 Sum Cations (Pct)	5C1 NH_4OAc (Pct)
0-7	12.4	4.0	tr	0.8	17.2	12.7	29.9	21.2							3.1		58	81
7-16	15.4	5.5	0.1	0.5	21.5	11.9	33.4	24.0							2.8		64	90
16-23	14.8	6.1	0.1	0.7	21.7	10.3	32.0	23.8							2.4		68	91
23-28	15.5	7.1	0.1	0.7	23.4	8.6	32.0	24.4							2.2		73	96
28-36	15.7	7.6	0.1	0.8	24.2	7.5	31.7	23.3							2.1		76	104
36-44	15.0	7.5	0.1	0.7	23.3	6.2	29.5	22.1		2800	0.29	0.8	0.3	55.5	2.0		79	105
44-52	14.6	7.4	0.1	0.6	22.7	5.5	28.2	21.4							2.0		80	106
52-60	15.4	7.7	0.2	0.6	23.9	4.8	28.7	22.0							2.0		83	109
60-72	15.0	7.5	0.2	0.7	23.4	4.0	27.4	20.8							2.0		85	113

Depth (In)	Ratios to Clay 8D1: NH_4OAc CEC	Ext. Iron	15-Bar Water		
0-7	0.74	0.035	0.44		
7-16	0.73	0.033	0.42		
16-23	0.71	0.036	0.44		
23-28	0.72	0.038	0.46		
28-36	0.72	0.043	0.47		
36-44	0.73	0.040	0.49		
44-52	0.75	0.046	0.49		
52-60	0.75	0.041	0.48		
60-72	0.76	0.040	0.50		

a. Fe-Mn nodules: > 50 percent (2-0.1 mm).
b. Fe-Mn nodules: 25-50 percent (2-0.1 mm).
c. 20 kg/m^2 to 60 inches (Method 6A).
d. Saturated paste.

Pedon classification: Typic Hapludoll; fine-silty, mixed, mesic.
Series classification: (Same as pedon).
Soil: Marshall silty clay loam.
Soil no.: S63-Iowa-15-1 (LSL Nos. 18322 - 18330).
Location: Cass County, Iowa, 642 feet south of road center and 719 feet east of the NW corner of the NW¼ SE¼ sec. 34, T. 77 N., R. 37 W., (approximately 3 miles northwest of Atlantic, Iowa).
Vegetation and land use: Clover; cropland.
Parent material: Wisconsin loess.
Physiography: Moderately broad (about ¼ mile wide) upland divide. Appears to be ½-to 1 foot lower than the highest elevation within the watershed.
Slope: Less than 1 percent towards the west or southwest.
Drainage: Well drained.
Moisture: Moist at 0 to 36 inches and below 48 inches but somewhat dry at about 36 to 48 inches.
Permeability: Moderate.
Ground water: Below 72 inches.
Root distribution: Roots common from 0 to 23 inches, few from 23 to 52 inches, nearly absent below 57 inches.
Described by: R. I. Dideriksen and W. M. Jury.

(Colors are for moist soil unless otherwise stated)

Ap 18322 0 to 18 cm (0 to 7 inches). Black (10YR 2/1) light silty clay loam, dark gray (10YR 4/1) when dry; black (10YR 2/1) to very dark brown (10YR 2/2) when kneaded; weak medium subangular blocky structure parting to weak fine granular structure; friable; common fine and medium root channels; weak plow sole at 6 to 7 inches; medium acid (pH 5.6); abrupt smooth boundary.

A12 18323 18 to 40 cm (7 to 16 inches). Black (10YR 2/1) light silty clay loam, dark gray (10YR 4/1) when dry; black (10YR 2/1) to very dark brown (10YR 2/2) when kneaded; very weak fine subangular blocky and moderate fine granular structure; friable; common fine and medium root channels; medium acid (pH 5.8) gradual smooth boundary.

A3 18324 40 to 58 cm (16 to 23 inches). Very dark brown (10YR 2/2) with some very dark grayish brown (10YR 3/2) light to medium silty clay loam, dark gray (10YR 4/1) and dark grayish brown (10YR 4/2) when dry; very dark grayish brown (10YR 3/2) when kneaded; weak fine subangular blocky structure; friable; few fine and medium root channels; few moisture films on some peds; medium acid (pH 5.8) clear smooth boundary.

B21 18325 58 to 70 cm (23 to 28 inches). Brown (10YR 4/3) medium silty clay loam; pale brown (10YR 6/3) and light brownish gray (10YR 6/2) when dry; weak to moderate fine subangular blocky structure; faces of peds are brown (10YR 4/3) and very dark grayish brown (10YR 3/2) brown (10YR 4/3) when kneaded; friable; common fine and medium inped tubular pores; very few thin discontinuous clay films on some peds; very few, very fine soft dark brown accumulations of oxides; common 1/8-inch root fills of black material from above; medium acid (pH 6.0); clear smooth boundary.

B22 18326 70 to 90 cm (28 to 36 inches). Brown (10YR 4/3) medium silty clay loam; yellowish brown (10YR 5/4) when kneaded; weak medium prismatic structure parting to moderate fine subangular blocky; friable; few fine and medium inped tubular pores; very few, very fine soft dark brown accumulations of oxides; few thin discontinuous clay films on some peds; few black (10YR 2/1) root fills from above horizons; medium acid (pH 6.0); gradual smooth boundary.

B23 18327 90 to 113 cm (36 to 44 inches). Yellowish brown (10YR 5/4) light silty clay loam; common (5 percent) fine grayish brown (2.5Y 5/2) mottles; weak medium prismatic structure parting to moderate to weak medium subangular blocky; friable to firm; common fine inped tubular pores; very few thin discontinuous clay films on some vertical faces; few fine dark brown and yellowish brown soft accumulations of oxides; slightly acid (pH 6.2); gradual smooth boundary.

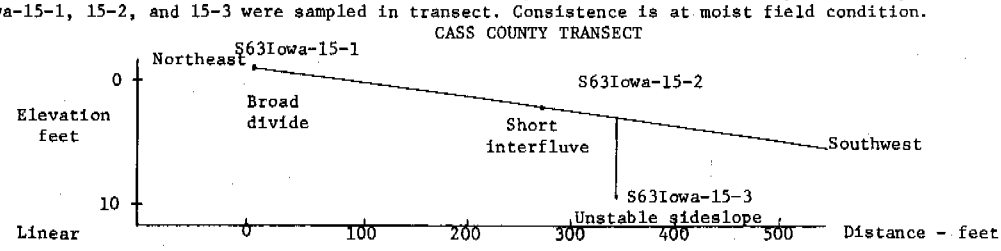
B31 18328 113 to 133 cm (44 to 52 inches). Mottled yellowish brown (10YR 5/4) and grayish brown (2.5Y 5/2) to olive gray (5Y 5/2) light silty clay loam to heavy silt loam; weak medium prismatic structure parting to weak medium and coarse subangular blocky; many fine brown (7.5YR 4/4) and yellowish brown (10YR 5/6) mottles; friable to firm; pores same as above; few thin indistinct silt coats and very few thin discontinuous clay films on some vertical faces; common very fine soft dark brown accumulations of oxides; slightly acid (pH 6.4); diffuse smooth boundary.

B32 18329 133 to 153 cm (52 to 60 inches). Colors same as above but with a slight decrease in the brown (7.5YR 4/4) mottles; heavy silt loam; some vertical cleavage; friable; pores as above; few indistinct silt coats on cleavage faces; oxides same as above horizon; neutral (pH 6.8) diffuse smooth boundary.

C1 18330 153 to 183 cm (60 to 72 inches). Mottled dark yellowish brown (10YR 4/4) to yellowish brown (10YR 5/6) and grayish brown (2.5Y 5/2) to olive gray (5Y 5/2) medium silt loam; massive; pores same as above; oxides same; neutral (pH 6.8).

Remarks: One 2x4 inch oval fill of black material at 30 inches in pit; some mixing of 10YR 3/2 material at 13 to 23 inches by rodents; few distinct ½ inch spherical voids at 44 to 72 inches. The grayish brown (2.5Y 5/2) to olive gray (5Y 5/2) mottles below 36 inches appear to be a relict feature. The depth to a deoxidized olive gray zone decreased with increasing slope (see Marshall description S63-Iowa-15-3 on 7 percent slope). Marshall soils S63-Iowa-15-1, 15-2, and 15-3 were sampled in transect. Consistence is at moist field condition.

CASS COUNTY TRANSECT



U S DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SOIL Marshall silty clay loam SOIL Nos. S63Iowa-15-2 LOCATION Cass County, Iowa

SOIL SURVEY LABORATORY Lincoln, Nebraska LAB. Nos. 18331-18341 May 1967

General Methods: 1A, 1B1b, 2A1, 2B

Depth (In.)	Horizon	Size class and particle diameter (mm) 3A1 — Total: Sand (2-0.05) a	Total: Silt (0.05-0.002)	Total: Clay (< 0.002)	Sand: Very coarse (2-1)	Sand: Coarse (1-0.5)	Sand: Medium (0.5-0.25)	Sand: Fine (0.25-0.1)	Sand: Very fine (0.1-0.05)	Silt: (0.05-0.02)	Silt: Int III (0.02-0.002)	Silt: Int II (0.2-0.02)	(2-0.1)			Coarse fragments 2A2 > 2 Pct	2-19 (Pct of < 76mm)	19-76 (Pct of < 76mm)
		Pct of < 2 mm																
0-7	A1p	2.8	66.3	30.9	0.1	0.1	0.1	0.2	2.3	38.4	27.9	40.8	0.5			-		
7-13	A12	2.5	64.5	33.0	-	0.1	0.1	0.2	2.1	36.1	28.4	38.3	0.4			-		
13-18	A3	2.7	64.1	33.2	tr	0.2	0.1	0.2	2.2	35.5	28.6	37.8	0.5			-		
18-26	B21	3.7	64.5	31.8	tr	0.2	0.2	0.4	2.9	36.7	27.8	39.8	0.8			-		
26-34	B22	3.7	68.5	27.8	-	0.1	0.1	0.3	3.2	38.1	30.4	41.4	0.5			-		
34-41	B31	4.1	67.7	28.2	-	0.1	0.1	0.3	3.6	39.4	28.3	43.1	0.5			-		
41-47	B32	3.6	67.3	29.1	-	0.1	0.1	0.4	3.0	38.2	29.1	41.4	0.6			-		
47-58	B33	4.0	68.3	27.7	-	0.1	0.1	0.3	3.5	40.6	27.7	44.3	0.5			-		
58-68	C1	3.9	69.2	26.9	-	tr	0.1	0.3	3.5	39.3	29.9	43.0	0.4			-		
68-72	C2	3.2	68.8	28.0	-	0.1	0.1	0.2	2.8	40.4	28.4	43.3	0.4			-		
72-76	C3	3.4	68.3	28.3	-	tr	tr	0.2	3.2	39.6	28.7	42.9	0.2			-		

Depth (In.)	6A1a Organic carbon b Pct.	6B1a Nitrogen Pct.	C/N		Carbonate as $CaCO_3$ Pct	6C2a Ext. Iron as Fe Pct.	Bulk density: 4A1a Field-State g/cc	4A1d 1/3-Bar g/cc	4A1b Air-Dry g/cc	4D1 COLE	Water content: 4B4 Field-State Pct.	4B1c 1/3-Bar Pct	4B2 15-Bar Pct	4C1 1/3-to 15-Bar in./in.		pH		8C1a (1:1)
0-7	2.14	0.179	12			1.1	1.42	1.42	1.53	0.024	24.4	24.0	13.5	0.15				5.6
7-13	1.82	0.151	12			1.3	1.23	1.22	1.33	0.028	28.1	27.1	13.7	0.16				5.9
13-18	1.37	0.125	11			1.4	1.24	1.22	1.36	0.036	27.4	26.8	14.2	0.15				6.0
18-26	0.68	0.065	10			1.4	1.20	1.21	1.34	0.036	28.0	25.4	14.3	0.13				6.1
26-34	0.46	0.047	10			1.3	1.22	1.24	1.36	0.032	27.3	25.4	14.0	0.14				6.1
34-41	0.33					1.3	1.29	1.28	1.42	0.036	26.6	25.2	13.5	0.15				6.2
41-47	0.22					1.3		1.3 c					13.9					6.2
47-58	0.16					1.3	1.34	1.30	1.43	0.032	23.9	26.8	12.0	0.19				6.2
58-68	0.13					1.3	1.36	1.32	1.44	0.028	25.2	26.2	13.0	0.17				6.3
68-72	0.13					1.3	1.38	1.32	1.44	0.028	26.2	26.7	14.2	0.16				6.4
72-76	0.08					1.2							13.4					6.5

Depth (In.)	Extractable bases 6N2a Ca	6O2a Mg	6P2a Na	6Q2a K	Sum	6H1a Ext. Acidity	Cat. Exch. Cap: 5A3a Sum Cations	5A1a NH_4OAc		Resistivity d	8B1a Elec. Cond.	6P1a Sol. Na	5D2 Exch. Na	8B Water at Sat.	8D3 Ca/Mg		Base saturation: 5C3 Sum Cations	5C1 NH_4OAc
	meq/100 g									ohms	mmhos.	me./l.	Pct.	Pct.			Pct	Pct
0-7	13.0	4.8	0.1	0.7	18.6	12.6	31.2	21.9							2.7		60	85
7-13	14.3	6.0	0.1	0.6	21.0	9.8	30.8	22.7							2.4		68	93
13-18	14.4	6.4	0.1	0.6	21.5	9.8	31.3	22.5							2.3		69	96
18-26	14.8	7.4	0.1	0.6	22.9	7.2	30.1	22.9							2.0		76	100
26-34	15.0	7.9	0.1	0.6	23.6	5.8	29.4	22.9							1.9		80	103
34-41	14.7	7.5	0.2	0.6	23.0	4.9	27.9	22.3		2500	0.30	0.6	0.8	52.8	2.0		82	103
41-47	15.1	7.8	0.2	0.6	23.7	5.1	28.8	22.3							1.9		82	106
47-58	14.9	7.5	0.2	0.6	23.2	5.0	28.2	21.6							2.0		82	107
58-68	14.4	7.5	0.2	0.6	22.7	4.3	27.0	20.8							1.9		84	109
68-72	14.6	7.8	0.2	0.7	23.3	3.9	27.2	21.6							1.9		86	108
72-76	14.8	8.1	0.2	0.7	23.8	3.2	27.0	21.8							1.8		88	109

Depth (In.)	Ratios to Clay 8I1: NH_4OAc CEC	Ext. Iron	15-Bar Water		
0-7	0.71	0.036	0.44		
7-13	0.69	0.039	0.42		
13-18	0.68	0.042	0.43		
18-26	0.72	0.044	0.45		
26-34	0.82	0.047	0.50		
34-41	0.79	0.046	0.48		
41-47	0.77	0.045	0.48		
47-58	0.78	0.047	0.43		
58-68	0.77	0.048	0.48		
68-72	0.77	0.046	0.51		
72-76	0.77	0.042	0.47		

a. Fe-Mn nodules: > 50 percent (2-0.1 mm).
b. 15 kg/m^2 to 60 inches (Method 6A).
c. Estimated.
d. Saturated paste.

Pedon classification: Typic Hapludoll; fine-silty, mixed, mesic.
Series classification: (Same as pedon).
Soil: Marshall silty clay loam.
Soil no.: S63-Iowa-15-2 (LSL Nos: 18331 - 18341).
Location: Cass County, Iowa, 829 feet south of road center and 500 feet east of the NW corner of the NW¼ SE¼ sec. 34, T. 77 N., R 37 W., (approximately 3 miles northwest of Atlantic, Iowa).
Vegatation and land use: Clover; cropland.
Parent material: Wisconsin loess.
Elevation: 3.02 feet lower in elevation than S63-Iowa-15-1 in Cass County transect.
Physiography: Somewhat stable position on the axis of a short interfluve which projects into a cove position formed by a forked hillside drainageway.
Slope: About 3 percent toward the west.
Drainage: Well drained.
Moisture: Moist at 0 to 41 inches and 58 to 76 inches but somewhat dry at 41 to 58 inches.
Permeability: Moderate.
Ground water: Below 76 inches.
Root distribution: Roots common from 0 to 26 inches, few from 26 to 58 inches, and nearly absent below.
Described by: R. I. Dideriksen and W. M. Jury.

(Colors are for moist soil unless otherwise stated)

Ap 18331 0 to 18 cm (0 to 7 inches). Black (10YR 2/1) to very dark brown (10YR 2/2) light silty clay loam, dark gray (10YR 4/1) to grayish brown (10YR 5/2) when dry; very dark brown (10YR 2/2) when kneaded; weak medium subangular blocky structure parting to weak fine granular; friable; common fine and medium root channels; few very dark grayish brown (10YR 3/2) wormcasts; medium acid (pH 5.8); clear smooth boundary.

A12 18332 18 to 33 cm (7 to 13 inches). Very dark brown (10YR 2/2) light silty clay loam, grayish brown (10YR 5/2) when dry; very dark brown (10YR 2/2) to very dark grayish brown (10YR 3/2) when kneaded; weak fine granular with some weak fine subangular blocky structure; friable; common fine and medium root channels; few wormcasts as above; medium acid (pH 5.8); gradual smooth boundary.

A3 18333 33 to 45 cm (13 to 18 inches). Very dark grayish brown (10YR 3/2) medium silty clay loam; grayish brown (10YR 5/2) with some pale brown (10YR 6/3) peds when dry; weak fine subangular blocky structure; friable; common fine inped tubular pores and some medium root channels; few peds, pore fills and wormcasts of brown (10YR 4/3); medium acid (pH 5.8); clear wavy boundary.

B21 18334 45 to 65 cm (18 to 26 inches). Brown (10YR 4/3) medium silty clay loam, same color kneaded, pale brown (10YR 6/3) when dry; weak to moderate fine subangular blocky structure; friable; pores as above; some oriented thin discontinuous very dark grayish brown (10YR 3/2) stains on a few peds; few black (10YR 2/1) fills in fine vertical channels; very few very fine soft dark brown accumulations of oxides; medium acid (pH 6.0); gradual smooth boundary.

B22 18335 65 to 85 cm (26 to 34 inches). Brown (10YR 4/3) light to medium silty clay loam; same color kneaded; weak medium prismatic structure parting to moderate fine subangular blocky; very few fine faint grayish brown (2.5Y 5/2) mottles; friable; many fine inped tubular pores; thin discontinuous clay films on some peds; few fine soft dark brown and yellowish brown accumulations of oxides; medium acid (pH 6.0); clear smooth boundary.

B31 18336 85 to 105 cm (34 to 41 inches). Yellowish brown (10YR 5/4) and brown (10YR 4/3) light silty clay loam; weak medium prismatic structure parting to moderate to weak medium subangular blocky; common fine grayish brown (2.5Y 5/2) and common fine yellowish brown (10YR 5/6) grading to brown (7.5YR 4/4) mottles; friable; pores as above; thin discontinuous clay films on vertical faces; oxides as above; slightly acid (pH 6.2); gradual smooth boundary.

B32 18337 105 to 120 cm (41 to 47 inches). Mottled yellowish brown (10YR 5/4), grayish brown (2.5Y 5/2), and some brown (10YR 4/3) light silty clay loam; weak medium prismatic structure parting to weak medium subangular blocky; common fine yellowish brown (10YR 5/6) and brown (7.5YR 4/4) mottles; friable to firm; many fine and medium inped tubular pores; few thin discontinuous films on some vertical faces (may be clay); slight increase in grayish brown color in ped interiors; pores as above; very few very fine soft black accumulations of oxides; slightly acid (pH 6.4); gradual smooth boundary.

B33 18338 120 to 148 cm (47 to 58 inches). Color same as above except the grayish brown colors grade to olive gray (5Y 5/2) light silty clay loam to heavy silt loam; weak medium to coarse prismatic structure parting to weak medium subangular blocky structure; mottles as above; friable to firm; oxides and pores as above; very few indistinct silt coats on a few vertical faces; slightly acid (pH 6.6); diffuse smooth boundary.

C1 18339 148 to 173 cm (58 to 68 inches). Mottled yellowish brown (10YR 5/4 to 5/6) and olive gray (5Y 5/2) silt loam; massive with some vertical cleavage; friable; many fine and very fine tubular pores; few indistinct grainly silt coats on vertical faces; few fine soft dark brown to black accumulations of oxides; neutral (pH 6.8); clear smooth boundary.

C2 18340 173 to 183 cm (68 to 72 inches). Mottled brown (7.5YR 4/4), strong brown (7.5YR 5/6) and some olive gray (5Y 5/2) silt loam; massive with some vertical cleavage; friable; pores and silt coats as above; common fine soft dark brown to black accumulations of oxides; neutral (pH 6.8); clear smooth boundary.

C3 18341 183 to 193 cm (72 to 76 inches). Mottled dark yellowish brown (10YR 4/4), yellowish brown (10YR 5/6), and olive gray (5Y 5/2) silt loam; massive; friable; oxides as above; neutral (pH 7.0).

Remarks; Mottled subsoil has a higher percentage of olive gray colors but doesn't appear to be a distinct deoxidized zone; mottles from 26 inches plus, however, appear to be relict and related to the more gray zone below. The 68- to 72-inch layer represents a weak iron zone. At 18 to 26 inches there is faint tonguing of very dark grayish brown stains to 24 inches and about 6 inches wide in places; one 8-inch burrow hole filled with black soil material at 34 inches in pit 5 feet in diameter. Marshall soils S63-Iowa-15-1, 15-2, and 15-3 were sampled in transect. Consistence is at moist field condition. See description for Marshall, S63-Iowa-15-1, for elevation transect.

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SOIL: Marshall silty clay loam — SOIL Nos. S63Iowa-15-3 — LOCATION: Cass County, Iowa

SOIL SURVEY LABORATORY: Lincoln, Nebraska — LAB. Nos 18342-18355 — May 1967

General Methods: 1A, 1B1b, 2A1, 2B

Depth (In)	Horizon	Size class and particle diameter (mm) 3A1: Total: Sand (2-0.05) a	Total: Silt (0.05-0.002)	Total: Clay (< 0.002)	Sand: Very coarse (2-1)	Sand: Coarse (1-0.5)	Sand: Medium (0.5-0.25)	Sand: Fine (0.25-0.1)	Sand: Very fine (0.1-0.05)	Silt: (0.05-0.002)	Silt: Int III (0.02-0.002)	Int II (0.2-0.02)	(2-0.1)			Coarse fragments: 2A2 > 2 Pct.	2-19 (Pct of < 76mm)	19-76 (Pct of < 76mm)
		Pct of < 2 mm																
0-6	A1p	3.3	65.0	31.7	-	0.1	0.1	0.2	2.9	39.5	25.5	42.5	0.4			-		
6-10	A3	3.0	63.7	33.3	-	tr	0.1	0.2	2.7	36.3	27.4	39.1	0.3			-		
10-18	B21	2.9	65.8	31.3	-	tr	0.1	0.2	2.6	36.6	29.2	39.3	0.3			-		
18-25	B22	2.8	67.2	30.0	-	tr	0.1	0.2	2.5	36.9	30.3	39.5	0.3			-		
25-32	B31	3.0	67.4	29.6	-	tr	0.1	0.2	2.7	37.8	29.6	40.6	0.3			-		
32-39	B32	2.6	68.2	29.2	-	tr	0.1	0.2	2.3	38.2	30.0	40.6	0.3			-		
39-44	B33	2.5	69.7	27.8	-	tr	0.1	0.2	2.2	40.1	29.6	42.4	0.3			-		
44-47	B34	2.5	67.0	30.5	-	tr	0.1	0.3	2.1	36.8	30.2	39.1	0.4			-		
47-53	C1	2.7	69.0	28.3	-	tr	tr	0.1	2.6	40.9	28.1	43.6	0.1			-		
53-58	C2	2.4	71.0	26.6	-	tr	tr	0.2	2.2	39.9	31.1	42.2	0.2			-		
58-60	C3	2.3	69.9	27.8	-	tr	tr	0.1	2.2	39.1	30.8	41.4	0.1			-		
60-63	C4	2.3	72.1	25.6	-	tr	tr	0.2	2.1	40.1	32.0	42.3	0.2			-		
63-69	C5	3.4	72.4	24.2	-	tr	0.1	0.5	2.8	42.0	30.4	45.2	0.6			-		
69-77	C6	2.7	71.4	25.9	-	tr	0.1	0.2	2.4	39.4	32.0	41.9	0.3			-		

Depth (In)	6A1a Organic carbon b Pct	6B1a Nitrogen Pct	C/N		6E2a Carbonate as $CaCO_3$ Pct	6C2a Ext. Iron as Fe Pct.	Bulk density: 4A1a Field-State g/cc	4A1d 1/3-Bar g/cc	4A1b Air-Dry g/cc	4D1 COLE	Water content: 4B4 Field-State Pct	4B1c 1/3-Bar Pct	4B2 15-Bar Pct	4C1 1/3-to 15-Bar in./in.		pH	8C1a (1:1)
0-6	2.05	0.170	12			1.2	1.39	1.40	1.52	0.028	26.6	25.0	13.7	0.16			5.6
6-10	1.45	0.129	11			1.4	1.23	1.23	1.34	0.028	28.3	27.3	13.0	0.18			5.6
10-18	0.86	0.085	10			1.4	1.22	1.20	1.32	0.032	28.2	27.2	13.2	0.17			6.0
18-25	0.54	0.058	9			1.4	1.20	1.20	1.32	0.032	28.4	26.1	13.6	0.15			5.9
25-32	0.33					1.3	1.22	1.25	1.39	0.036	28.8	27.2	14.6	0.16			5.9
32-39	0.24					1.3	1.30	1.27	1.41	0.036	28.3	27.6	14.3	0.17			5.9
39-44	0.17					1.4	1.34	1.31	1.44	0.032	22.0	27.6	14.0	0.18			6.0
44-47	0.19					4.2	1.23	1.22	1.34	0.032	29.0	33.2	12.8	0.25			6.1
47-53	0.10					1.0	1.36	1.32	1.46	0.036	24.4	28.1	13.8	0.19			6.4
53-58	0.13					1.0	1.36	1.32	1.43	0.028	25.3	27.9	13.1	0.20			6.4
58-60	0.08					1.7		1.3 c					13.3				6.4
60-63	0.07					1.0							14.0				6.5
63-69	0.06					1.3	1.36	1.30	1.40	0.024	28.6	29.1	13.2	0.21			6.5
69-77	0.06				-(s)	1.0	1.39	1.32	1.45	0.032	28.9	28.8	13.4	0.20			7.0

Depth (In)	Extractable bases: 6N2a Ca	6P2a Mg	6P2a Na	6Q2a K	5B1a Sum	6H1a Ext. Acidity	Cat. Exch. Cap.: 5A3a Sum Cations	5A1a NH_4OAc		Resistivity d ohms	8B1a Elec Cond. mmhos	6F1a Sol. Na me/l.	5D2 Exch. Na Pct.	8B Water at Sat. Pct.	8D3 Ca/Mg		Base saturation: 5C3 Sum Cations Pct	5C1 NH_4OAc Pct
	meq/100 g																	
0-6	13.4	5.6	0.1	0.7	19.8	11.0	30.8	22.4							2.4		64	88
6-10	14.1	6.3	0.1	0.6	21.1	10.1	31.2	22.8							2.2		68	93
10-18	14.5	7.0	0.1	0.5	22.1	7.6	29.7	22.4							2.1		74	99
18-25	14.6	7.3	0.1	0.6	22.6	6.5	29.1	22.5							2.0		78	100
25-32	14.9	7.6	0.2	0.6	23.3	5.8	29.1	23.1							2.0		80	101
32-39	15.0	7.9	0.2	0.6	23.7	5.6	29.3	23.3							1.9		81	102
39-44	14.8	7.6	0.2	0.6	23.2	5.6	28.8	22.0		1600	0.71	1.1	0.5	51.5	1.9		81	105
44-47	14.5	7.6	0.2	0.6	22.9	6.2	29.1	21.5							1.9		79	107
47-53	14.6	8.0	0.2	0.6	23.4	3.5	26.9	21.3							1.8		87	110
53-58	14.2	7.9	0.2	0.6	22.9	3.5	26.4	21.0							1.8		87	109
58-60	13.9	7.6	0.2	0.6	22.3	4.0	26.3	20.7							1.8		85	108
60-63	13.9	7.6	0.2	0.6	22.3	3.2	25.5	20.8							1.8		87	107
63-69	13.7	7.5	0.2	0.6	22.0	3.7	25.7	19.7							1.8		86	112
69-77	14.3	8.2	0.2	0.6	23.3	1.9	25.2	20.7							1.7		92	113

Depth (In)	Ratios to Clay: NH_4OAc CEC	Ext. Iron	8D1 15-Bar Water	
0-6	0.71	0.030	0.43	
6-10	0.68	0.042	0.39	
10-18	0.72	0.045	0.42	
18-25	0.75	0.047	0.45	
25-32	0.78	0.044	0.49	
32-39	0.80	0.045	0.49	
39-44	0.79	0.050	0.50	
44-47	0.70	0.14	0.49	
47-53	0.75	0.035	0.49	
53-58	0.79	0.038	0.49	
58-60	0.74	0.061	0.48	
60-63	0.81	0.039	0.55	
63-69	0.81	0.054	0.55	
69-77	0.80	0.039	0.52	

a. Fe-Mn nodules: > 50 percent (1-0.1 mm)
b. 12 kg/m^2 to 60 inches (Method 6A).
c. Estimated.
d. Saturated paste.

Pedon classification: Typic Hapludoll; fine-silty, mixed, mesic.
Series classification: (Same as pedon).
Soil: Marshall silty clay loam.
Soil no.: S63-Iowa-15-3 (LSL Nos. 18342 - 18355).
Location: Cass County, Iowa 798 feet south of road center and 379 feet east of the NW corner of the NW¼ SE¼ sec. 34, T. 77 N., R. 37 W., (approximately 3 miles northeast of Atlantic, Iowa).
Vegetation and land use: Plowed, cropland.
Parent material: Wisconsin loess.
Elevation: 9.30 feet lower in elevation than S63-Iowa-15-1 in Cass County transect.
Physiography: Unstable sideslope of a short interfluve which projects into a cove position formed by a forked hillside drainageway.
Slope: About 6 to 7 percent toward the west-northwest.
Drainage: Well drained.
Moisture: Moist 0 to 32 inches and 53 to 77 inches but somewhat dry at 32 to 53 inches.
Permeability: Moderate.
Ground water: Below 77 inches.
Root distribution: Not determined.
Described by: R. I. Dideriksen.

(Colors are for moist soil unless otherwise stated)

Ap 18342 0 to 15 cm (0 to 6 inches). Very dark brown (10YR 2/2) to very dark grayish brown (10YR 3/2) light to medium silty clay loam; kneaded color the same; grayish brown (10YR 5/2) dry; weak medium subangular blocky structure parting to weak fine granular; friable; few medium root channels; strongly acid (pH 5.4) abrupt smooth boundary.

A3 18343 15 to 25 cm (6 to 10 inches). Very dark grayish brown (10YR 3/2) and grayish brown (10YR 5/2), very dark grayish brown (10YR 3/2) to dark brown (10YR 3/3) when kneaded; medium silty clay loam; some pale brown (10YR 6/3) dry; weak fine subangular blocky structure parting to weak fine granular; friable; common fine and medium root channels; some mixing of brown (10YR 4/3) peds; few very dark brown (10YR 2/2) fills in vertical pores; medium acid (pH 5.6); clear smooth boundary.

B21 18344 25 to 45 cm (10 to 18 inches). Brown (10YR 4/3) light to medium silty clay loam; pale brown (10YR 6/3) dry; yellowish brown (10YR 5/4) when kneaded; weak to moderate fine subangular blocky structure; friable; common fine and medium inped tubular pores; few peds have thin discontinuous stains of very dark grayish brown (10YR 3/2) color; few 1/8-inch fills in pores of very dark brown to very dark grayish brown material from above; slightly acid (pH 6.4); gradual smooth boundary.

B22 18345 45 to 63 cm (18 to 25 inches). Yellowish brown (10YR 5/4) light silty clay loam; faces of peds brown (10YR 4/3); weak medium prismatic structure parting to weak fine subangular blocky; very few fine grayish brown (2.5Y 5/2) mottles; friable; pores as above; few very thin discontinuous clay films on some vertical faces; slight increase in mottles in ped interiors; distinct ½-inch spherical voids in this horizon; slightly acid (pH 6.4); clear smooth boundary.

B31 18346 63 to 80 cm (25 to 32 inches). Color, texture, and structure same as above; common fine grayish brown (2.5Y 5/2), dark yellowish brown (10YR 4/4), and yellowish brown (10YR 5/6) mottles; friable; pores as above; very few thin discontinuous clay films on some vertical faces; slightly acid (pH 6.4); gradual smooth boundary.

B32 18347 80 to 100 cm (32 to 39 inches). Mottles yellowish brown (10YR 5/4) brown (10YR 4/3), and olive gray (5Y 5/2) heavy silt loam to light silty clay loam; structure as above but medium in size; friable; tubular pores as above; common fine soft dark brown to black accumulations of oxides; few indistinct silt coats on some peds; slightly acid (pH 6.4); gradual smooth boundary.

B33 18348 100 to 113 cm (39 to 44 inches). Color, texture, and structure like B32 horizon; many fine strong brown (7.5YR 5/6) to yellowish brown (10YR 5/6) mottles; friable; pores as above; oxides as above; few ½-inch spherical voids; few indistinct silt coats on vertical ped faces; neutral (pH 6.6); abrupt smooth boundary.

B34 18349 113 to 120 cm (44 to 47 inches). Brown (7.5YR 4/4) and strong brown (7.5YR 5/8) silt loam; weak coarse prismatic structure; common fine olive gray (5Y 5/2) mottles; friable; pores as above; zone of iron accumulations; slightly acid (pH 6.4); abrupt smooth boundary.

C1 18350 120 to 135 cm (47 to 53 inches). Olive gray (5Y 5/2) silt loam; massive with some vertical cleavage; tubular pores finer than above; many ¼- to ½-inch soft to moderately hard "pipestems" of strong brown (7.5YR 5/8) and brown (7.5YR 4/4); friable; few ½-inch spherical voids; slightly acid (pH 6.4); gradual wavy boundary.

C2 18351 135 to 148 cm (53 to 58 inches). Mottled light olive brown (2.5Y 5/4) to yellowish brown (10YR 5/4) and olive gray (5Y 5/2) silt loam; massive; friable; pores as above; common very fine soft dark brown to black accumulations of oxides; slightly acid (pH 6.4); abrupt smooth boundary.

C3 18352 148 to 153 cm (58 to 60 inches). Yellowish brown (10YR 5/6) silt loam; massive; common medium olive gray (5Y 5/2) and few fine brown (7.5YR 4/4) mottles; friable; pores as above; few moderately hard "pipestems" of strong brown (7.5YR 5/8); weak zone of iron accumulations; neutral (pH 6.6); abrupt smooth boundary.

C4 18353 153 to 160 cm (60 to 63 inches). Olive gray (5Y 5/2) silt loam; massive; common fine yellowish brown (10YR 5/6) mottles; friable; pores as above; few ¼-inch soft "pipestems" as above; neutral (pH 6.6); clear smooth boundary.

C5 18354 160 to 175 cm (63 to 69 inches). Color, texture, and mottles like C2 horizon; massive; friable; pores as above; common brown (7.5YR 4/4) moderately hard "pipestems"; neutral (pH 6.6); clear irregular boundary.

C6 18355 175 to 195 cm (69 to 77 inches). Color, texture, and mottles like C4 horizon; massive; friable; pores as above; common ¼- to ½-inch moderately hard to hard "pipestems" of brown (7.5YR 4/4) color; neutral (pH 6.6).

Remarks: Zones of iron accumulation at 44 to 47 inches are distinct, 58 to 60 inches moderate, and 63 to 69 inches weak; 3-inch rodent fill at 10 inches, another at 18 inches, and one at 25 inches. Iron band at 44 to 47 inches is continuous around pit and slopes slightly to the west-northwest. Mottles at 18 inches plus are considered to be relict and related to the deoxidized zone below. Marshall soils S63-Iowa-15-1, 15-2, and 15-3 were samples in transect. Consistence is at moist field condition. See description for Marshall, S63-Iowa-15-1, for elevation transect.

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SOIL Marshall silty clay loam SOIL Nos. S63Iowa-83-1 LOCATION Shelby County, Iowa

SOIL SURVEY LABORATORY Lincoln, Nebraska LAB Nos. 18356-18364 May 1967

General Methods: 1A, 1B1b, 2A1, 2B

Depth (In.)	Horizon	Size class and particle diameter (mm) 3A1 — Total: Sand (2-0.05) a	Total: Silt (0.05-0.002)	Total: Clay (< 0.002)	Sand: Very coarse (2-1)	Sand: Coarse (1-0.5)	Sand: Medium (0.5-0.25)	Sand: Fine (0.25-0.1)	Sand: Very fine (0.1-0.05)	Silt: 0.05-0.02	Silt: Int. III (0.02-0.002)	Silt: Int. II (0.2-0.02)	(2-0.1)			Coarse fragments: 2A2 > 2 Pct.	2-19 (Pct of < 76mm)	19-76 (Pct of < 76mm)
		Pct. of < 2 mm																
0-7	A1p	2.6	68.4	29.0	-	0.1	0.1	0.2	2.2	37.6	30.8	39.9	0.4			-		
7-16	A12	2.2	65.4	32.4	-	0.1	0.1	0.2	1.8	34.7	30.7	36.6	0.4			-		
16-23	A3	2.5	64.6	32.9	-	0.1	0.1	0.2	2.1	33.3	31.3	35.4	0.4			-		
23-33	B21	3.0	64.2	32.8	-	0.1	0.1	0.3	2.5	35.0	29.2	37.7	0.5			-		
33-38	B22	3.3	67.0	29.7	-	tr	0.1	0.3	2.9	40.3	26.7	43.4	0.4			-		
38-45	B23	4.0	69.0	27.0	-	tr	0.1	0.3	3.6	40.1	28.9	43.9	0.4			-		
45-56	B31	4.3	69.5	26.2	-	0.1	0.1	0.4	3.7	40.8	28.7	44.8	0.6			-		
56-63	B32	4.3	68.9	26.8	-	0.1	0.1	0.4	3.7	40.9	28.0	44.8	0.6			-		
63-72	C1	4.4	69.6	26.0	-	tr	0.1	0.3	4.0	41.8	27.8	46.0	0.4			-		

Depth (In.)	6A1a Organic carbon b Pct	6B1a Nitrogen Pct	C/N		6E2a Carbonate as $CaCO_3$ Pct	6C2a Ext. Iron as Fe Pct.	Bulk density: 4A1a Field-State g/cc	4A1d 1/3-Bar g/cc	4A1b Air-Dry g/cc	4D1 COLE	Water content: 4B4 Field-State Pct	4B1c 1/3-Bar Pct.	4B2 15-Bar Pct	4C1 1/3-to 15-Bar in./in.		pH		8C1a (1:1)
0-7	2.61	0.204	13			1.0	1.28	1.27	1.35	0.020	24.6	24.4	13.2	0.14				6.2
7-16	2.16	0.179	12			1.1	1.30	1.28	1.39	0.028	27.6	27.3	13.1	0.18				5.7
16-23	1.45	0.133	11			1.2	1.22	1.19	1.32	0.036	28.6	26.6	14.3	0.15				5.7
23-33	0.78	0.076	10			1.3	1.22	1.24	1.37	0.036	28.6	26.7	14.0	0.16				5.8
33-38	0.38					1.3		1.3 c					14.2					5.8
38-45	0.25					1.3	1.30	1.29	1.40	0.028	26.7	25.2	14.3	0.14				5.8
45-56	0.15					1.3	1.32	1.28	1.39	0.028	22.8	25.4	13.9	0.15				5.8
56-63	0.08					1.2		1.3 c					13.5					6.0
63-72	0.09				-(s)	1.2	1.33	1.29	1.39	0.024	23.5	27.2	13.4	0.18				6.0

Depth (In.)	Extractable bases: 6N2a Ca	6O2a Mg	6P2a Na	5H1a 6Q2a K	Sum	6H1a Ext. Acidity	Cat. Exch. Cap.: 5A3a Sum Cations	5A1a NH_4 OAc						8D3 Ca/Mg		Base saturation: 5C3 Sum Cations Pct	5C1 NH_4 OAc Pct
	meq/100 g																
0-7	17.4	3.9	tr	1.0	22.3	8.3	30.6	22.6						4.5		73	99
7-16	15.3	5.1	0.1	0.6	21.1	10.6	31.7	22.9						3.0		67	92
16-23	15.5	6.0	0.1	0.6	22.2	9.7	31.9	22.7						2.6		70	98
23-33	14.9	6.9	0.1	0.6	22.5	7.5	30.0	22.1						2.2		75	102
33-38	14.6	6.9	0.1	0.5	22.1	6.4	28.5	21.1						2.1		78	105
38-45	14.7	6.9	0.2	0.5	22.3	5.1	27.4	20.9						2.1		81	107
45-56	14.6	7.0	0.2	0.6	22.4	5.2	27.6	20.3						2.1		81	110
56-63	14.7	7.3	0.2	0.6	22.8	4.7	27.5	20.8						2.0		83	110
63-72	14.2	7.5	0.2	0.6	22.5	4.2	26.7	20.1						1.9		84	112

Depth (In.)	Ratios to Clay 8D1: NH_4 OAc CEC	Ext. Iron	15-Bar Water		
0-7	0.78	0.034	0.46		
7-16	0.71	0.034	0.40		
16-23	0.69	0.036	0.43		
23-33	0.67	0.040	0.43		
33-38	0.71	0.044	0.48		
38-45	0.77	0.048	0.53		
45-56	0.77	0.050	0.53		
56-63	0.78	0.045	0.50		
63-72	0.77	0.046	0.52		

a. Fe-Mn nodules: > 50 percent (1-0.1 mm).
b. 20 kg/m^2 to 60 inches (Method 6A).
c. Estimated.

Pedon classification: Typic Hapludoll; fine-silty, mixed, mesic.
Series classification: (Same as pedon).
Soil: Marshall silty clay loam.
Soil no.: S63-Iowa-83-1 (LSL Nos. 18356 - 18364).
Location: Shelby County, Iowa, 362 feet south and 968 feet west of the center of road corner in the NE¼ NW¼ sec. 28, T. 78 N. R. 38 W., (approximately 3 miles north of Walnut, Iowa).
Vegetation and land use: Alfalfa; cropland.
Parent material: Wisconsin loess.
Elevation: 0.00 feet in respect to other sites in Shelby County transect.
Physiography: Moderately broad (about ¼-mile wide) upland divide. This divide may be slightly higher in elevation to the east where it is about ½-mile wide.
Slope: Less than 1 percent toward the west.
Drainage: Well drained.
Moisture: Moist at 0 to 38 inches and below 56 inches; somewhat dry at 38 to 56 inches.
Permeability: Moderate.
Ground water: Below 72 inches.
Root distribution: Roots are abundant at 0 to 16 inches, common at 16 to 33 inches, and few at 33 to 56 inches.
Described by: R. I. Dideriksen, C. S. Fisher.

(Colors are for moist soil unless otherwise stated)

Ap 18356 0 to 18 cm (0 to 7 inches). Black (10YR 2/1) light silty clay loam, dark gray (10YR 4/1) when dry; black (10YR 2/1) to very dark brown (10YR 2/2) when kneaded; weak medium subangular blocky structure parting to weak fine granular; friable; common fine and medium root channels; weak plow sole at 6 to 7 inches; few very dark brown wormcasts; slightly acid (pH 6.4); abrupt smooth boundary.

A12 18357 18 to 40 cm (7 to 16 inches). Black (10YR 2/1) light silty clay loam, dark gray (10YR 4/1) when dry; very dark brown (10YR 2/2) when kneaded; weak fine subangular blocky and fine granular structure; friable; root channels as above; few fine peds of brown (10YR 4/3) in lower part; common very dark brown wormcasts; slightly acid (pH 6.2); gradual smooth boundary.

A3 18358 40 to 58 cm (16 to 23 inches). Very dark grayish brown (10YR 3/2) light to medium silty clay loam, kneaded color same; dark gray (10YR 4/1) and some grayish brown (10YR 5/2) when dry; weak fine subangular blocky structure; friable; few fine and medium inped tubular pores; brown (10YR 4/3) peds are common; some 1/8-inch channel fills of very dark brown (10YR 2/2) material; slightly acid (pH 6.2); clear smooth boundary.

B21 18359 58 to 83 cm (23 to 33 inches). Brown (10YR 4/3) medium silty clay loam; few faces of peds are very dark grayish brown (10YR 3/2); pale brown (10YR 6/3) when dry; weak fine subangular blocky structure; friable; few fine inped tubular pores; few very thin discontinuous clay films; hue of horizon toward 2.5Y; few wormcasts as above; some ½-inch spherical voids; slightly acid (pH 6.4) gradual smooth boundary.

B22 18360 83 to 95 cm (33 to 38 inches). Brown (10YR 4/3) light to medium silty clay loam; yellowish brown (10YR 5/4) when kneaded; weak medium prismatic structure parting to weak medium subangular blocky structure; very few very fine grayish brown (2.5Y 5/2) and very few fine brown (7.5YR 4/4) mottles; many fine inped tubular pores; thin discontinuous clay films on vertical faces; very few very fine soft dark brown to black accumulations of oxides; neutral (pH 6.6); clear smooth boundary.

B23 18361 95 to 115 cm (38 to 45 inches). Mottles brown (10YR 4/3) and grayish brown (2.5Y 5/2) to olive gray (5Y 5/2) light silty clay loam; yellowish brown (10YR 5/4) when kneaded; weak medium prismatic structure parting to weak medium subangular blocky structure; common fine brown (7.5YR 4/4) and strong brown (7.5YR 5/6) mottles; friable to firm; pores as above; very few very thin discontinuous clay films on some vertical faces; very few ½-inch spherical voids; few fine soft dark brown to black accumulations of oxides; neutral (pH 6.6) gradual smooth boundary.

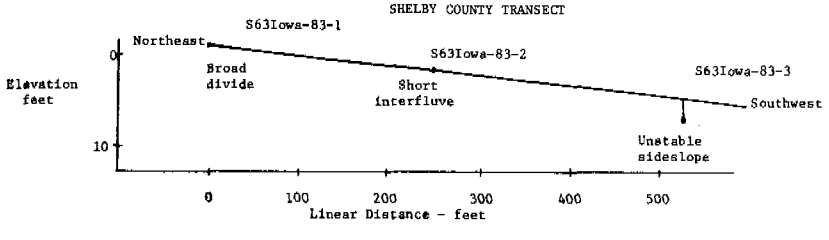
B31 18362 115 to 143 cm (45 to 56 inches). Mottles yellowish brown (10YR 5/4) and olive gray (5Y 5/2) heavy silt loam; structure as above; many medium yellowish brown (10YR 5/6 to 5/8) mottles; friable to firm; pores as above; common fine soft dark brown to black accumulations of oxides; neutral (pH 6.4); diffuse smooth boundary.

B32 18363 143 to 160 cm (56 to 63 inches). Color, texture, and mottles as above; massive with some vertical cleavage; very few indistinct grainy silt coats on some cleavage faces; pores and concretions as above; slightly acid (pH 6.4); diffuse smooth boundary.

C1 18364 160 to 183 cm (63 to 72 inches). Same as horizon above but vertical cleavage may be absent.

Remarks: Two-inch rodent burrow filled with dark materials at 40 inches. Mottles of 2.5Y to 5Y hue below 33 inches appear to be a relict feature. No distinct deoxidized zone observed in pit, but about 50 percent of the colors are olive gray below 45 inches. Marshall soils S63-Iowa-83-1, 83-2, and 83-3 were sampled in transect. Consistence is at moist field condition.

SHELBY COUNTY TRANSECT



U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SOIL Marshall silty clay loam SOIL Nos. S63Iowa-83-2 LOCATION Shelby County, Iowa

SOIL SURVEY LABORATORY Lincoln, Nebraska LAB. Nos. 18365-18374 May 1967

General Methods: 1A, 1B1b, 2A1, 2B

Depth (In)	Horizon	Total Sand (2-0.05) a	Total Silt (0.05-0.002)	Total Clay (< 0.002)	Sand: Very coarse (2-1)	Sand: Coarse (1-0.5)	Sand: Medium (0.5-0.25)	Sand: Fine (0.25-0.1)	Sand: Very fine (0.1-0.05)	Silt: 0.05-0.02	Silt: Int. III (0.02-0.002)	Int. II (0.2-0.02)	(2-0.1)			Coarse fragments 2A2 > 2 Pct	2-19	19-76
		Pct. of < 2 mm															Pct of < 76mm	
0-7	A1p	3.0	66.6	30.4	0.1	0.1	0.1	0.2	2.5	38.7	27.9	41.3	0.5			-		
7-13	A12	2.6	63.9	33.5	tr	0.1	0.1	0.2	2.2	35.7	28.2	38.0	0.4			-		
13-18	A3	2.8	64.4	32.8	tr	0.1	0.1	0.2	2.4	36.1	28.3	38.6	0.4			-		
18-27	B21	3.2	66.4	30.4	tr	0.1	0.1	0.2	2.8	38.9	27.5	41.8	0.4			-		
27-34	B22	4.1	67.7	28.2	-	tr	0.1	0.3	3.7	39.7	28.0	43.6	0.4			-		
34-44	B31	4.1	69.0	26.9	-	0.1	0.1	0.3	3.6	41.6	27.4	45.4	0.5			-		
44-50	B32	3.8	68.2	28.0	-	tr	tr	0.2	3.6	39.4	28.8	43.1	0.2			-		
50-58	C1	3.7	69.4	26.9	-	tr	tr	0.2	3.5	40.5	28.9	44.1	0.2			-		
58-68	C2	4.7	69.6	25.7	-	tr	0.1	0.2	4.4	41.9	27.7	46.4	0.3			-		
68-76	C3	4.1	70.5	25.4	-	tr	0.1	0.3	3.7	40.2	30.3	44.1	0.4			-		

Depth (In)	6A1a Organic carbon b Pct.	6B1a Nitrogen Pct.	C/N		6E2a Carbonate as $CaCO_3$ Pct	6C2a Ext. Iron as Fe Pct.	Bulk density: 4A1a Field-State g/cc	4A1d 1/3-Bar g/cc	4A1b Air-Dry g/cc	4D1 COLE	Water content: 4B4 Field-State Pct	4B1c 1/3-Bar Pct	4B2 15-Bar Pct.	4C1 1/3-to 15-Bar In./in.		pH	8C1a (1:1)
0-7	2.20	0.195	11			1.3	1.32	1.31	1.41	0.024	24.0	24.4	13.0	0.15			5.6
7-13	1.87	0.156	12			1.3	1.26	1.25	1.37	0.032	28.2	27.4	14.1	0.17			5.7
13-18	1.11	0.106	10			1.3	1.24	1.24	1.36	0.032	27.5	26.4	14.5	0.15			5.8
18-27	0.58	0.062	9			1.3	1.24	1.23	1.34	0.028	27.8	26.1	14.0	0.15			5.8
27-34	0.33					1.4	1.25	1.24	1.36	0.032	28.0	25.5	13.4	0.15			5.9
34-44	0.21					1.3		1.3 c					12.8				5.9
44-50	0.17					1.3	1.34	1.31	1.44	0.032	27.7	27.0	13.7	0.17			6.0
50-58	0.11					1.4	1.38	1.34	1.46	0.028	25.0	26.7	13.6	0.18			6.0
58-68	0.10					1.2		1.3 c					12.6				6.2
68-76	0.10				-(s)	1.5							12.6				6.3

Depth (In.)	Extractable bases 6N2a Ca	6Q2a Mg	6P2a Na	6Q2a K	5B1a Sum	6H1a Ext. Acidity	Cat. Exch. Cap. 5A3a Sum Cations	5A1a NH_4OAc					8D3 Ca/Mg		Base saturation 5C3 Sum Cations	5C1 NH_4OAc
	meq/100 g														Pct	Pct.
0-7	13.9	4.3	0.1	0.8	19.1	11.0	30.1	22.0					3.2		63	87
7-13	14.7	5.5	0.1	0.6	20.9	9.8	30.7	22.9					2.7		68	91
13-18	14.8	6.3	0.1	0.6	21.8	8.2	30.0	21.6					2.3		73	101
18-27	14.8	6.6	0.1	0.6	22.1	6.6	28.7	20.0					2.2		77	111
27-34	14.7	6.6	0.1	0.5	21.9	5.1	27.0	20.7					2.2		81	106
34-44	14.6	6.8	0.2	0.6	22.2	4.9	27.1	20.4					2.1		82	109
44-50	15.2	6.9	0.2	0.6	22.9	4.6	27.5	20.7					2.2		83	111
50-58	14.6	6.9	0.2	0.6	22.3	4.2	26.5	20.8					2.1		84	107
58-68	13.8	6.7	0.2	0.6	21.3	3.8	25.1	19.7					2.1		85	108
68-76	13.7	7.0	0.2	0.6	21.5	3.8	25.3	18.3					2.0		85	117

Depth (In.)	Ratios to Clay 8D1: NH_4OAc CEC	Ext. Iron	15-Bar Water		
0-7	0.72	0.043	0.43		
7-13	0.68	0.039	0.42		
13-18	0.66	0.040	0.44		
18-27	0.66	0.043	0.46		
27-34	0.73	0.050	0.48		
34-44	0.76	0.049	0.48		
44-50	0.74	0.046	0.49		
50-58	0.77	0.052	0.51		
58-68	0.77	0.047	0.49		
68-76	0.72	0.059	0.50		

a. Fe-Mn nodules: > 50 percent (2-0.1 mm).
b. 14 kg/m^2 to 60 inches (Method 6A).
c. Estimated.

Pedon classification: Typic Hapludoll; fine-silty, mixed, mesic.
Series classification: (Same as pedon).
Soil: Marshall silty clay loam.
Soil no.: S63-Iowa-83-2 (LSL Nos. 18365 - 18374).
Location: Shelby County, Iowa, 434 feet south and 1,224 feet west of center of road corner in the NE¼ NW¼ sec. 28, T. 78 N., R. 38 W., (approximately 3 miles north of Walnut, Iowa).
Vegetation and land use: Alfalfa, cropland.
Parent material: Wisconsin loess.
Physiography: Somewhat stable position on the axis of a poorly defined short interfluve. This interfluve extends into a cove position formed by a forked hillside drainageway.
Slope: About 3 percent toward the west.
Drainage: Well drained.
Moisture: Moist 0 to 76 inches.
Permeability: Moderately permeable.
Ground water: Below 76 inches.
Elevation: 2.71 feet lower in elevation than S63-Iowa-83-1 in Shelby County transect.
Root distribution: Roots abundant from 0 to 18 inches, common from 18 to 34 inches, few from 34 to 58 inches.
Described by: R. I. Dideriksen and C. S. Fisher.

(Colors are for moist soil unless otherwise stated)

Ap 18365 0 to 18 cm (0 to 7 inches). Very dark brown (10YR 2/2) light silty clay loam, kneaded color the same; dark gray (10YR 4/1) to grayish brown (10YR 5/2) when dry; weak medium subangular blocky structure parting to weak fine granular; friable; common fine and medium root channels; weak plow sole at 6 to 8 inches; slightly acid (pH 6.4); clear smooth boundary.

A12 18366 18 to 33 cm (7 to 13 inches). Very dark brown (10YR 2/2) light silty clay loam, very dark grayish brown (10YR 3/2) when kneaded; grayish brown (10YR 5/2) when dry; weak fine subangular blocky and fine granular structure; friable; root channels as above; common dark brown and brown peds in lower part; few dark worm-casts; slightly acid (pH 6.4); clear smooth boundary.

A3 18367 33 to 45 cm (13 to 18 inches). Brown (10YR 4/3) light to medium silty clay loam; faces of peds very dark grayish brown (10YR 3/2) with 30 percent brown (10YR 4/3); dark brown (10YR 3/3) to very dark grayish brown (10YR 3/2) when kneaded; grayish brown (10YR 5/2) and some pale brown (10YR 6/3) when dry; weak fine subangular blocky structure; friable; common fine and very fine inped tubular pores; very few thin discontinuous stains on some peds; few dark wormcasts and fills in old root channels; slightly acid (pH 6.4); clear smooth boundary.

B21 18368 45 to 68 cm (18 to 27 inches). Yellowish brown (10YR 5/4) medium silty clay loam; faces of peds are brown (10YR 4/3), pale brown (10YR 6/3) when dry; weak fine subangular blocky structure; friable; pores as above; thin discontinuous clay films on some peds; a very few dark fills in old root channels; slightly acid (pH 6.5); gradual smooth boundary.

B22 18369 68 to 85 cm (27 to 34 inches). Yellowish brown (10YR 5/4) light silty clay loam; faces of peds brown (10YR 4/3) weak medium prismatic structure parting to weak medium subangular blocky; common fine grayish brown (2.5Y 5/2) and a few fine dark yellowish brown (10YR 4/4) mottles; friable; pores as above; a few very thin discontinuous clay films on some vertical faces; few very fine soft dark brown to black accumulations of oxides, slightly acid (pH 6.5); gradual smooth boundary.

B31 18370 85 to 113 cm (34 to 44 inches). Yellowish brown (10YR 5/4) light silty clay loam to heavy silt loam; structure and consistence as above; many medium grayish brown (2.5Y 5/2) and common fine dark brown to brown (7.5YR to 10YR 4/4) mottles; many fine and very fine inped tubular pores; less clay films than above; common fine soft dark brown to black accumulations of oxides, yellowish brown (10YR 5/4) when kneaded; neutral (pH 6.6); gradual smooth boundary.

B32 18371 113 to 128 cm (44 to 50 inches). Mottled yellowish brown (10YR 5/4) and olive gray (5Y 5/2) heavy silt loam; weak medium prismatic structure parting to very weak medium subangular blocky; common fine brown (7.5YR 4/4) mottles; friable; pores as above; some darker fills in vertical channels; very few indistinct silt coats on some vertical ped faces; oxides as above; slightly acid (pH 6.5); diffuse smooth boundary.

C1 18372 128 to 148 cm (50 to 58 inches). Mottled brown (10YR to 7.5YR 4/4) and olive gray (5Y 5/2) silt loam; massive with some vertical cleavage; friable; common fine and very fine tubular pores; silt coats as above; slight increase in accumulations of oxides; neutral (pH 6.6); diffuse smooth boundary.

C2 18373 148 to 173 cm (58 to 68 inches). Mottled yellowish brown (10YR 5/6) and olive gray (5Y 5/2) silt loam; massive with some vertical cleavage; friable; pores as above; some indistinct silt coats on cleavage faces; oxides same as C1 horizon; neutral (pH 6.8); diffuse smooth boundary.

C3 18374 173 to 193 cm (68 to 76 inches). Same as above horizon but no cleavage noted.

Remarks: Rodent burrows occur at 10 inches, at 24 inches, and one at 54 inches; grayish brown mottles at 27 inches appear to be relict. Not a distinct deoxidized zone at 44 inches and below, but 50 percent of material is olive gray. Marshall soils S63-Iowa-83-1, 83-2, and 83-3 were sampled in transect. Consistence is at moist field condition. See description for Marshall, S63-Iowa-83-1, for elevation transect.

U S DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SOIL Marshall silty clay loam SOIL Nos. 863Iowa-83-3 LOCATION Shelby County, Iowa

SOIL SURVEY LABORATORY Lincoln, Nebraska LAB. Nos. 18375-18387 May 1967

General Methods: 1A, 1B1b, 2A1, 2B

Depth (In.)	Horizon	Size class and particle diameter (mm) 3A1 — Total: Sand (2-0.05) a	Total: Silt (0.05-0.002)	Total: Clay (< 0.002)	Sand: Very coarse (2-1)	Sand: Coarse (1-0.5)	Sand: Medium (0.5-0.25)	Sand: Fine (0.25-0.1)	Sand: Very fine (0.1-0.05)	Silt: 0.05-0.02	Silt: Int III (0.02-0.002)	Silt: Int II (0.2-0.02)	(2-0.1)			Coarse fragments 2A2 > 2 Pct.	2-19	19-76
		Pct. of < 2 mm															Pct of < 76mm	
0-7	A1p	3.6	65.8	30.6	-	0.1	0.1	0.2	3.2	40.4	25.4	43.7	0.4			-		
7-12	A3	3.4	64.1	32.5	-	tr	0.1	0.2	3.1	35.2	28.9	38.4	0.3			-		
12-16	B1	3.6	65.1	31.3	-	tr	0.1	0.2	3.3	37.4	27.7	40.8	0.3			-		
16-22	B21	4.0	65.9	30.1	-	tr	0.1	0.4	3.5	38.2	27.7	41.9	0.5			-		
22-27	B22	4.0	67.1	28.9	-	tr	0.1	0.3	3.6	39.2	27.9	43.0	0.4			-		
27-34	B23	4.4	68.4	27.2	-	tr	0.1	0.3	4.0	41.2	27.2	45.4	0.4			-		
34-42	B31	4.2	70.0	25.8	-	0.1	0.1	0.3	3.7	41.0	29.0	44.9	0.5			-		
42-49	B32	4.0	69.4	26.6	-	0.1	0.1	0.4	3.4	36.4	33.0	40.0	0.6			-		
49-57	C1	3.6	69.6	26.8	-	tr	0.1	0.3	3.2	38.7	30.9	42.1	0.4			-		
57-68	C2	3.9	69.5	26.6	-	tr	0.1	0.3	3.5	42.0	27.5	45.7	0.4			-		
68-74	C3	4.3	69.1	26.6	-	tr	tr	0.3	4.0	40.9	28.2	45.1	0.3			-		
79-81	C5	3.7	67.7	28.6	-	tr	0.1	0.3	3.3	40.5	27.2	44.0	0.4			-		
81-87	C6	3.0	70.0	27.0	-	0.1	tr	0.2	2.7	40.6	29.4	43.4	0.3			-		

Depth (In.)	6A1a Organic carbon b Pct.	6B1a Nitrogen Pct	C/N		6E2a Carbonate as $CaCO_3$ Pct.	6C2a Ext. Iron as Fe Pct.	Bulk density 4A1a Field-State g/cc	4A1d 1/3-Bar g/cc	4A1b Air-Dry g/cc	4D1 COLE	Water content 4B4 Field-State Pct.	4B1c 1/3-Bar Pct	4B2 15-Bar Pct.	4C1 1/3-to 15-Bar in./in.			pH 8C1a (1:1)
0-7	2.31	0.202	11			1.2	1.26	1.25	1.36	0.028	25.0	24.9	13.7	0.14			5.8
7-12	1.48	0.136	11			1.4	1.24	1.23	1.35	0.032	29.0	27.5	13.9	0.17			5.8
12-16	1.08	0.101	11			1.4		1.2 c					13.9				6.0
16-22	0.63	0.067	9			1.4	1.20	1.20	1.32	0.032	28.3	26.6	13.4	0.16			6.0
22-27	0.51	0.053	10			1.3	1.20	1.18	1.30	0.032	28.4	26.5	13.1	0.16			6.1
27-34	0.29					1.3		1.2 c					12.6				6.0
34-42	0.22					1.4		1.3 c					11.7				6.1
42-49	0.17					1.3	1.33	1.30	1.42	0.028	28.8	28.1	12.2	0.21			6.1
49-57	0.13					1.3	1.34	1.30	1.42	0.028	27.4	28.8	13.2	0.20			6.2
57-68	0.13					1.3		1.3 c					12.0				6.3
68-74	0.11					1.2	1.34	1.30	1.40	0.024	30.1	28.6	12.6	0.21			6.3
79-81	0.11				(a)	3.4							15.4				6.3
81-87	0.10					0.7							12.5				6.5

Depth (In.)	Extractable bases 6N2a Ca	6Q2a Mg	6P2a Na	6Q2a K	5B1a Sum	6H1a Ext. Acidity	Cat. Exch. Cap 5A3a Sum Cations	5A1a NH_4OAc	8D3 Ca/Mg	Base saturation 5C3 Sum Cations	5C1 NH_4OAc
	meq/100 g									Pct.	Pct.
0-7	15.5	4.8	0.1	0.8	21.2	9.1	30.3	22.2	3.2	70	95
7-12	14.9	6.1	0.1	0.6	21.7	9.0	30.7	22.2	2.4	71	98
12-16	14.8	6.5	0.1	0.6	22.0	7.1	29.1	21.7	2.3	76	101
16-22	14.7	7.0	0.1	0.7	22.5	5.9	28.4	21.3	2.1	79	106
22-27	14.3	7.0	0.1	0.6	22.0	5.0	27.0	21.9	2.0	81	100
27-34	13.9	6.8	0.2	0.6	21.5	4.9	26.4	20.7	2.0	81	104
34-42	13.6	6.6	0.2	0.6	21.0	4.9	25.9	20.0	2.1	81	105
42-49	14.1	7.0	0.2	0.6	21.9	4.0	25.9	20.6	2.0	85	106
49-57	14.4	7.3	0.3	0.6	22.6	4.1	26.7	20.9	2.0	85	108
57-68	13.9	7.5	0.3	0.6	22.3	3.8	26.1	20.6	1.9	85	108
68-74	13.9	7.9	0.3	0.6	22.7	3.5	26.2	21.1	1.8	87	108
79-81	13.6	8.2	0.2	0.6	22.6	4.3	27.8	20.4	1.7	81	111
81-87	13.4	8.5	0.2	0.7	22.8	2.4	25.2	20.1	1.6	90	113

Depth (In.)	Ratios to Clay 8D1 NH_4OAc CEC	Ext. Iron	15-Bar Water
0-7	0.73	0.039	0.45
7-12	0.68	0.043	0.43
12-16	0.69	0.045	0.44
16-22	0.71	0.047	0.45
22-27	0.76	0.045	0.45
27-34	0.76	0.048	0.46
34-42	0.78	0.054	0.45
42-49	0.77	0.049	0.46
49-57	0.78	0.049	0.49
57-68	0.77	0.049	0.45
68-74	0.79	0.045	0.47
79-81	0.71	0.12	0.54
81-87	0.74	0.026	0.46

a. Fe-Mn nodules: > 50 percent (1-0.1 mm).
b. 13 kg/m^2 to 60 inches (Method 6A).
c. Estimated.

Pedon classification: Typic Hapludoll; fine-silty, mixed, mesic.
Series classification: (Same as pedon).
Soil: Marshall silty clay loam.
Soil no.: S63-Iowa-83-3 (LSL Nos., 18375 - 18387).
Location: Shelby County, Iowa, 605 feet south and 1,432 feet west of center of road corner in the NE¼ NW¼ sec. 28, T. 78 N., R 38 W., (approximately 3 miles north of Walnut, Iowa).
Vegetation and land use: Alfalfa; cropland.
Parent material: Wisconsin loess.
Elevation: 6.94 feet lower in elevation than S63-Iowa-83-1 in Shelby County transect.
Physiography: Unstable sideslope of an interfluve near the cove position formed by a drainageway.
Slope: About 6 to 7 percent toward the west-northwest.
Drainage: Well drained.
Moisture: Moist to 87 inches.
Permeability: Moderate.
Ground water: Below 87 inches.
Root distribution: Roots are abundant from 0 to 12 inches, common from 12 to 34 inches, and few from 34 to 68 inches.
Described by: R. I. Dideriksen and C. S. Fisher.

(Colors are for moist soil unless otherwise stated)

Ap 18375 0 to 18 cm (0 to 7 inches). Very dark brown (10YR 2/2) light silty clay loam, dark gray (10YR 4/1) to grayish brown (10YR 5/2) dry; very dark grayish brown (10YR 3/2) when kneaded; weak medium subangular blocky structure parting to weak fine granular; friable; few fine and medium root channels; weak plow sole at 5 to 7 inches; slightly acid (pH 6.2); clear smooth boundary.

A3 18376 18 to 30 cm (7 to 12 inches). Very dark grayish brown (10YR 3/2) light to medium silty clay loam, grayish brown (10YR 5/2) dry; few brown (10YR 4/3) peds; very dark grayish brown (10YR 3/2) to dark brown (10YR 3/3) when kneaded; weak fine subangular blocky and fine granular structure; friable; many fine and very fine root channels; few root fills of dark material from above; slightly acid (pH 6.4); clear smooth boundary.

B1 18377 30 to 40 cm (12 to 16 inches). Dark brown (10YR 3/3) and brown (10YR 4/3) medium silty clay loam, grayish brown (10YR 5/2) and pale brown (10YR 6/3) dry; some very dark grayish brown (10YR 3/2) stains on faces of peds; kneaded color the same; weak fine subangular blocky structure; friable; few dark root fills and worm-casts; common fine and very fine inped tubular pores; slightly acid (pH 6.4); clear smooth boundary.

B21 18378 40 to 55 cm (16 to 22 inches). Brown (10YR 4/3) light to medium silty clay loam, pale brown (10YR 6/3) dry; brown (10YR 4/3) to yellowish brown (10YR 5/4) when kneaded; weak fine subangular blocky structure; friable; pores as above; few very thin discontinuous clay films of dark brown (10YR 3/3); few darker wormcasts; slightly acid (pH 6.4); gradual smooth boundary.

B22 18379 55 to 68 cm (22 to 27 inches). Brown (10YR 4/3) light silty clay loam; few fine grayish brown (2.5Y 5/2) mottles; yellowish brown (10YR 5/4) when kneaded; weak fine subangular blocky structure; friable; pores as above; few thin discontinuous clay films on some peds; slightly acid (pH 6.4); clear smooth boundary.

B23 18380 68 to 85 cm (27 to 34 inches). Color, texture and mottles like B22 horizon except few fine brown (7.5YR 4/4) mottles; weak medium prismatic structure parting to weak medium and fine subangular blocky; friable; pores as above; few thin discontinuous clay films on vertical ped faces; few very fine soft dark brown to black accumulations of oxides; few dark wormcasts; few ½-inch spherical voids; slightly acid (pH 6.4); gradual smooth boundary.

B31 18381 85 to 108 cm (34 to 42 inches). Texture, structure, and mottles like B23 horizon; color similar except more grayish brown (2.5Y 5/2); common fine brown (7.5YR 4/4) to dark yellowish brown (10YR 4/4) mottles; friable; pores as above; yellowish brown (10YR 5/4) when kneaded; slight decrease in clay films from above but more distinctly oriented on vertical ped faces; few to common fine soft dark brown to black accumulations of oxides; few ½-inch spherical voids; neutral (pH 6.6); gradual smooth boundary.

B32 18383 108 to 125 cm (42 to 49 inches). Same color and structure as above; heavy silt loam to light silty clay loam; common fine dark yellowish brown (10YR 4/4) mottles; friable; many fine and very fine inped tubular pores; oxides as above; slightly acid (pH 6.5); gradual smooth boundary.

C1 18383 125 to 145 cm (49 to 57 inches). Mottles yellowish brown (10YR 5/4) and olive gray (5Y 5/2) to gray (5Y 5/1) heavy silt loam; massive with some weak vertical cleavage; mottles similar to B32 horizon except some 7.5YR hue; friable; pores slightly larger than above; many fine and medium soft dark brown to black accumulations of oxides; slightly acid (pH 6.4); diffuse smooth boundary.

C2 18384 145 to 168 cm (57 to 68 inches). Color, texture and mottles like C1 horizon; massive with some vertical cleavage; pores and oxides as above; neutral (pH 6.6); diffuse smooth boundary.

C3 18385 168 to 188 cm (68 to 74 inches). Same as above except for a slight increase in brown (7.5YR 4/4) mottles; neutral (pH 6.6); diffuse smooth boundary.

C4 (not sampled) 188 to 200 cm (74 to 79 inches). Same as above except an increase in mottling of strong brown (7.5YR 5/6) colors; slight increase in oxides; clear smooth boundary.

C5 18386 200 to 205 cm (79 to 81 inches). Strong brown (7.5YR 5/6) to yellowish brown (10YR 5/6) silt loam; massive; common medium olive gray (5Y 5/2) around pores and on some faces; friable; pores as above; few brown (7.5YR 4/4) soft ¼-inch "pipestems"; slightly acid (pH 6.4); abrupt smooth boundary.

C6 18387 205 to 225 cm (81 to 87 inches). Gray (5Y 5/1) silt loam; massive; few fine light olive brown (2.5Y 5/4) mottles; some brown (7.5YR 4/4) to strong brown (7.5YR 5/6) moderately hard "pipestems"; friable; pores as above; neutral (pH 6.6).

Remarks: Rodent burrows at 24 and 40 inches are filled with darker material. Grayish brown mottles start at 22 inches and are considered relict; olive gray colors are present at 34 inches and below; a distinct deoxidized gray zone at 81 inches plus; distinct iron band at 79 to 81 inches. A3 and B1 horizon depths were redefined at time of sampling to determine the zone of maximum clay; the original description of this profile did not have a B1 horizon. Marshall soils S63-Iowa-83-1, 83-2 and 83-3 were sampled in transect. Consistence is at moist field condition. See description for Marshall, S63-Iowa-83-1, for elevation transect.

SOIL CLASSIFICATION-AQUIC UDIFLUVENT
FINE-SILTY OVER CLAYEY, MIXED (CALCAREOUS), MESIC
SERIES - - - - - - -MODALE

SOIL NO - - - - - - S70IA-67-4 COUNTY - - - MONONA

GENERAL METHODS- - -1A,1B1B,2A1,2B SAMPLE NOS. 70L1152-70L1158

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE, MTSC
NATIONAL SOIL SURVEY LABORATORY
LINCOLN, NEBRASKA

NOVEMBER 1975

DEPTH	HORIZON	(- - - PARTICLE SIZE ANALYSIS, LT 2MM, 3A1, 3A1A, 3A1B - - -)															RATIO
					FINE	(- - SAND - -)					(- - SILT - -)			FAML	INTR	FINE	NON-	8D1
		SAND 2-.05	SILT .05-.002	CLAY LT .002	CLAY LT .0002	VCOS 2-1	CORS 1-.5	MEDS .5-.25	FNES .25-.10	VFNS .10-.05	COSI .05-.02	FNSI .02-.002	VFSI .005-.002	TEXT SAND 2-.1	II .2-.02	CLAY TO CLAY	CO3-CLAY	15-BAR TO CLAY
CM		(- - - PCT LT 2MM - - -)														PCT	PCT	
000-20	AP	2.5	75.6	21.9	10.5	.0	.1	TR	.3	2.1	33.6	42.0	5.1	.4	35.9	48	22	.47
020-41	C1	2.8	79.1	18.1	8.2	.0	.0	.1	.3	2.4	38.8	40.3	4.3	.4	41.4	45	18	.49
041-61	C2	1.8	76.7	21.5	11.7	.0	.0	.1	.2	1.5	29.0	47.7	5.6	.3	30.6	54	22	.48
061-76	2C3G	.2	54.1	45.7		.0	.0	.0	.0	.2	7.5	46.6	12.0	.0	7.7		46	.41
076-109	2C4G	.2	39.8	60.0		.0	.0	.0	.0	.2	2.6	37.2	14.3	.0	2.8		60	.38
109-130	2C5G	.3	62.1	37.6		.0	.0	.0	.0	.3	12.4	49.7	9.7	.0	12.6		38	.42
130-160	2C6G	20.0	67.4	12.6		TR	.1	.4	4.2	15.3	43.9	23.5	2.4	4.7	62.0		13	.50

DEPTH	(PARTICLE SIZE ANALYSIS, MM, 3B, 3B1, 3B2)							(BULK DENSITY)			(- - WATER CONTENT - -)					CARBONATE		(- PH -)	
	VOL.	(- - - WEIGHT - - -)						4A1D	4A1H	4D1	4B1C	4B1C	4B2	4C1		6E1B	3A1A	8C1A	8C1E
	GT 2	GT 75	75-20	20-5	5-2	LT .074	20-2 PCT	1/3-BAR	OVEN DRY	COLE	1/10 BAR	1/3-BAR	15-BAR	WRD CM/		LT 2	LT .002	1/1 H2O	1/2 CACL
CM	PCT	PCT	(- - PCT LT 75 - -)				LT20	G/CC	G/CC		PCT	PCT	PCT	CM		PCT	PCT		
000-20	TR	0	0	TR	TR	99	TR	1.36	1.43	.017	31.7	28.3	10.3	.25	2.38	4	0	7.8	7.5
020-41	0	0	0	0	0	99	0	1.25	1.31	.016	35.3	30.1	8.8	.27	1.38	5	0	7.9	7.6
041-61	0	0	0	0	0	100	0	1.25	1.33	.021	36.7	33.7	10.3	.29	1.28	5	0	8.0	7.6
061-76	0	0	0	0	0	100	0	1.20A					18.6			4	0	7.7	7.5
076-109	0	0	0	0	0	100	0	1.18	1.65	.118	39.3	37.5	22.6	.18	1.88	3	0	7.7	7.5
109-130	0	0	0	0	0	100	0	1.35	1.57	.052	34.6	33.1	15.7	.24	2.88	5	0	7.7	7.5
130-160	0	0	0	0	0	93	0	1.40A					6.3			6	0	7.7	7.6

DEPTH	(ORGANIC MATTER)			IRON	PHOS	(- EXTRACTABLE BASES 5B4A- -)					ACTY	AL	(CAT EXCH)		RATIO	RATIO	CA	(BASE SAT)	
	6A1A ORGN CARB	6B1A NITG	C/N	6C2A EXT FE	6S1A TOTL	6N2E CA	6O2D MG	6P2A NA	6Q2A K	SUM EXTB	6H1A BACL TEA	6G1D KCL EXT	5A3A EXTB ACTY	5A6A NHAC	8D1 NHAC TO CLAY	8D3 CA TO MG	5F SAT NHAC	5C3 EXTB ACTY	5C1 NHAC
CM	PCT	PCT		PCT	PCT	(- - - MEQ / 100 G - - -)											PCT	PCT	PCT
000-20	1.39C	.133	10	.9		18.3D	2.4D	.2	1.4	22.3				20.2	.92				
020-41	.74	.065	11	1.0		19.6D	2.2D	.2	.6	22.6				17.1	.94				
041-61	.64	.055	12	1.0		20.9D	2.9D	.3	.6	24.7				19.4	.90				
061-76	.69	.073	9	1.2		29.2D	5.9D	.4	1.0	36.5				29.3	.64				
076-109	.62			1.3		32.9D	8.1D	.5	1.2	42.7				37.5	.62				
109-130	.61			1.2		26.2D	6.9D	.6	.9	34.6				25.4	.68				
130-160	.55			.8		15.0D	3.4D	.6	.6	19.6				12.7	1.01				

DEPTH	(SATURATED PASTE)			NA	NA	SALT	GYP	(- - - SATURATION EXTRACT 8A1- - -)											ATTERBERG	
	8E1 REST OHM-CM	8C1B PH	8A H2O	5D2 ESP	5E SAR	8D5 TOTL SOLU	6F1A	8A1A EC MMHOS/CM	6N1B CA	6O1B MG	6P1A NA	6Q1A K	6I1A CO3	6J1A HCO3	6K1A CL	6L1A SO4	6M1A NO3		4F1 LQID LMIT	4F2 PLST INDX
CM			PCT	PCT		PPM	PCT		(- - - MEQ / LITER - - -)										PCT	
000-20																			37E	10
020-41																				
041-61																			38E	11
061-76																				
076-109	980	7.4	79.1	1		440		.80	5.8	1.6	.8	.4							66E	33
109-130																				
130-160																				

MICROMORPHOLOGY (4E1).
20-41 CM C1 FABRIC OVERALL UNIFORM WITH WEAK CLAY ORIENTATION. UNIFORMLY DISTRIBUTED CARBONATE GRAINS .01-.05 MM. SILT-SIZE MICACEOUS GRAINS COMMON, MANY ARE STRONGLY ALTERED. BLACK AND DARK REDDISH-BROWN SILT-SIZE EARTHY GRAINS ARE VERY COMMON. DARKER ISOLATED PORTIONS .5-2 MM ACROSS ARE INTERPRETED AS WORM CASTS, THEY ARE DENSER THAN FABRIC GENERALLY AND MAY BE HIGHER IN LT .02 MM.

CLAY MINERALOGY (7A2C).
076-109 MT3 KK2 MI1 CM1.
COMMENTS - CLAYEY PORTION OF PEDON HAS MONTMORILLONITIC MINERALOGY. MONTMORILLONITE WELL-ORDERED.
RELATIVE AMOUNTS - (X-RAY) 5 = DOMINANT 4 = ABUNDANT 3 = MODERATE 2 = SMALL 1 = TRACE.
MINERAL CODE - MT = MONTMORILLONITE MI = MICA KK = KAOLINITE MC = MONTMORILLONITE-CHLORITE.

(A) ESTIMATED.
(B) MICRO-PENETRATION RESISTANCE - A ROD 0.6 CM DIA IS SLOWLY PUSHED INTO BULK DENSITY CLOD, EQUILIBRATED AT 1/10 BAR, A DISTANCE OF 0.6 CM USING A POCKET PENETROMETER. UNITS ARE FORCE (KG) AND NOT ESTIMATES OF UNCONFINED COMPRESSIVE STRENGTH.
(C) ORGANIC CARBON IS 10 KG/M SQ TO A DEPTH OF 1 M (6A).
(D) METHODS 6N4C FOR CA AND 6O4C FOR MG.
(E) BY SOIL MECHANICS LAB, USDA-SCS, LINCOLN, NE.
(F) BY SOIL TESTING LAB, IOWA STATE UNIV, AMES, IA.

DEPTH	AVAIL-ABLE P	AVAIL-ABLE K
CM	LBS PER ACRE (F)	
000-20	58	836
020-30	18	772
030-41	2	133
041-51	3	138
051-61	2	144
061-76	1	212
076-91	2	344
091-109	3	312
109-130	2	270
130-145	1	239

Pedon classification: Aquic Udifluvent; fine-silty over clayey, mixed, (calcareous) mesic.
Series classification: Aquic Unifluvent; coarse-silty over clayey, mixed, (calcareous) mesic.1/
Soil: Modale silt loam.
Soil no.: S70-Iowa-67-4 (LSL Nos. 70L1152 - 70L1158).
Location: Monona County, Iowa; about 4 miles west-southwest of Whiting, Iowa; 1,905 feet north and 135 feet east of road center from the southwest corner of sec. 8, T. 84 N., R. 46 W.
Vegatation and land use: Corn, harvested; cropland, irrigated.
Parent material: Recently deposited silty alluvium about 2 feet thick which is underlain by grayish silty clay or clay 2 to many feet thick. The sediments that make up material I are variable over short distances, tending to be near and either side of the coarse silty-fine silty line in clay content.
Physiography: Nearly level bottomlands. Site about 2 miles east of Missouri River and about 12 miles west of uplands.
Relief: Nearly level.
Slope: Less than 1 percent.
Drainage: Moderately well drained and somewhat poorly drained.
Erosion: None.
Ground water: None.
Permeability: The upper part is moderately permeable, the IIC horizon is very slowly to slowly permeable.
Described by: J. R. Culver, C. S. Fisher, J. R. Worster, and F. F. Riecken, October 28, 1970.

Ap 70L1152 0 to 20 cm (0 to 8 inches). Very dark grayish brown (10YR 3/2) light silt loam, grayish brown (10YR 5/2) dry; cloddy weak fine and very fine subangular blocky structure parting to weak fine granular structure; very friable; mildly alkaline; slightly effervescent; abrupt smooth boundary.

C1 70L1153 20 to 41 cm (8 to 16 inches). Stratified dark grayish brown (2.5Y 4/2) grayish brown (2.5Y 5/2), and very dark grayish brown (2.5Y 3/2) light silt loam, few fine prominent strong brown (7.5YR 5/6) mottles; horizontal cleavage parting to weak fine granular structure; friable; mildly alkaline; strongly effervescent; gradual smooth boundary.

C2 70L1154 41 to 61 cm (16 to 24 inches). Stratified grayish brown (2.5Y 5/2) and dark grayish brown (2.5Y 4/2) silt loam, few fine distinct yellowish brown (10YR 5/6) mottles; massive; horizontal cleavage; few light gray spots, few very dark grayish brown (10YR 3/2) wormcasts; friable; mildly alkaline; strongly effervescent; clear smooth boundary.

IIC3g 70L1155 61 to 76 cm (24 to 30 inches). Dark grayish brown (2.5Y 4/2) light silty clay; few fine prominent yellowish red (5YR 4/6) mottles; horizontal cleavage parting to moderate fine and medium angular and subangular blocky structure; very firm; slightly effervescent; mildly alkaline; gradual boundary.

IIC4g 70L1156 76 to 109 cm (30 to 43 inches). Dark grayish brown (2.5Y 4/2) silty clay, faces of peds very dark grayish brown (2.5Y 3/2), few fine prominent strong brown (7.5YR 5/6) mottles; moderate very fine angular blocky structure; structure appears to be related to recent sedimentation; very firm; slightly effervescent; mildly alkaline; abrupt boundary.

IIC5g 70L1157 109 to 130 cm (43 to 51 inches). Stratified dark grayish brown (2.5Y 4/2) light silty clay with thin lenses of silt loam, few fine prominent gray (5Y 5/1) and strong brown (7.5YR 5/6) mottles; horizontal cleavage parting to moderate very fine angular blocky structure; firm; grayish brown (2.5Y 5/2) silt coats on ped faces; strongly effervescent; mildly alkaline; clear smooth to wavy boundary.

IIC6g 70L1158 130 to 160 cm (51 to 62 inches). Stratified grayish brown (2.5Y 5/2), brown (10YR 5/3), dark grayish brown (2.5Y 4/2), and very dark grayish brown (10YR 3/2) silt loam with thin strata of very fine sandy loam to loamy fine sand; few fine prominent strong brown (7.5YR 5/6) mottles; massive with horizontal cleavage; friable; strongly effervescent; mildly alkaline.

1/This type location pedon averages slightly more clay in the upper part than allowed in a coarse-silty over clayey family.

SOIL CLASSIFICATION-UDOLLIC OCHRAQUALF
FINE, MONTMORILLONITIC, MESIC
SERIES - - - - - - -PERSHING

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE MRTSC
SOIL SURVEY INVESTIGATIONS UNIT
LINCOLN, NEBRASKA

SOIL NO - - - - - - S69IOWA-68-2 COUNTY - - - MONROE

GENERAL METHODS- - -1A2A,1B1B,1B2,1B SAMPLE NOS. 69L1012-69L1020

DEPTH CM	HORIZON	PARTICLE SIZE ANALYSIS, LT 2MM, 3A1, 3A1A, 3A1B (PCT LT 2MM) SAND 2-.05	SILT .05-.002	CLAY LT .002	FINE CLAY LT .0002	SAND VCOS 2-1	SAND CORS 1-.5	SAND MEDS .5-.25	SAND FNES .25-.10	SAND VFNS .10-.05	SILT COSI .05-.02	SILT FNSI .02-.002	SILT VFSI .005-.002	FAML TEXT SAND 2-.1	INTR II .2-.02	FINE CLAY TO CLAY PCT	NON-CO3-CLAY PCT	RATIO 8D1 15-BAR TO CLAY
000-020	AP	4.2A	74.3	21.5		.4	1.5	1.0	.8	.5	31.6	42.7		3.7	32.4			.44
020-028	A21	3.8A	73.6	22.6		.3	1.6	.8	.7	.4	29.2	44.4		3.4	29.9			.42
028-038	A22	3.6A	70.7	25.7	12.9	.3	1.3	.8	.7	.5	27.7	43.0		3.1	28.5	50		.40
038-053	B1	2.3A	62.2	35.5	19.7	.2	.7	.5	.5	.4	23.3	38.9		1.9	24.0	55		.40
053-069	B21T	1.3A	54.4	44.3	27.6	.0	.3	.2	.4	.4	20.5	33.9		.9	21.1	62		.45
069-091	B22T	1.4A	56.7	41.9	25.5	.0	.3	.2	.4	.5	22.8	33.9		.9	23.5	61		.48
091-109	B31T	1.6A	60.4	38.0	21.8	.0	.3	.3	.5	.5	25.0	35.4		1.1	25.7	57		.49
109-135	B32T	1.3A	63.4	35.3		TR	.2	.2	.4	.5	27.3	36.1		.8	28.0			.49
135-155	B33	1.0A	66.3	32.7	19.0	TR	.1	.2	.3	.4	29.4	36.9		.6	30.0	58		.50

DEPTH CM	PARTICLE SIZE ANALYSIS, MM, 3B, 3B1, 3B2 VOL. GT 2 PCT	WEIGHT GT 75 PCT	75-20 PCT LT 75	20-5	5-2	LT .074	20-2 PCT LT20	BULK DENSITY 4A1D 1/3-BAR G/CC	4A1H OVEN DRY G/CC	4D1 COLE	WATER CONTENT 4B1C 1/10 BAR PCT	4B1C 1/3-BAR PCT	4B2 15-BAR PCT	4C1 WRD CM/CM	CARBONATE 6E1B LT 2 PCT	3A1A LT .002 PCT	PH 8C1A 1/1 H2O	8C1E 1/2 CACL
000-020	0	0	0	0	0	96	0	1.39	1.47	.019	29.4	28.3	9.5	.26	2.6C		5.8	5.4
020-028	0	0	0	0	0	97	0	1.44	1.51	.016	27.6	24.7	9.4	.22	2.6C		5.3	4.8
028-038	0	0	0	0	0	97	0	1.40B					10.4				5.2	4.6
038-053	0	0	0	0	0	98	0	1.39	1.64	.057	28.2	26.7	14.3	.17	2.8C		5.0	4.6
053-069	0	0	0	0	0	99	0	1.22	1.83	.145	34.1	32.0	20.0	.15	2.0C		5.0	4.7
069-091	0	0	0	0	0	99	0	1.36	1.83	.104	34.3	33.4	20.0	.18	1.5C		5.4	4.9
091-109	0	0	0	0	0	99	0	1.38	1.80	.093	34.4	32.7	18.6	.19	1.5C		5.6	5.1
109-135	0	0	0	0	0	99	0	1.43	1.71	.062	31.7	29.9	17.3	.18	2.6C		5.7	5.3
135-155	0	0	0	0	0	99	0	1.42	1.62	.045	33.3	31.0	16.4	.21	1.9C		5.9	5.4

DEPTH CM	ORGANIC MATTER 6A1A ORGN CARB PCT	6B1A NITG PCT	C/N	IRON 6C2A EXT FE PCT	PHOS 6S1A TOTL PCT	EXTRACTABLE BASES 5B4A (MEQ) 6N2E CA	6O2D MG	6P2A NA	6Q2A K	SUM EXTB / 100	ACTY 6H1A BACL TEA	AL 6G1D KCL EXT	CAT EXCH 5A3A EXTB ACTY	5A6A NHAC	RATIO 8D1 NHAC TO CLAY	RATIO 8D3 CA TO MG	CA 5E SAT NHAC PCT	BASE SAT 5C3 EXTB ACTY PCT	5C1 NHAC PCT
000-020	1.85D	.160	12	1.0		12.2	2.7	0.1	0.4	15.4	7.4	0.1	22.8	18.4	0.86	4.5	66	68	84
020-028	1.01	.097	10	0.9		8.5	3.2	0.2	0.3	12.2	8.0	0.1	20.2	16.2	0.72	2.7	52	60	75
028-038	0.57	.062	9	1.2		7.8	4.2	0.2	0.4	12.6	7.6	0.4	20.2	16.8	0.65	1.9	46	62	75
038-053	0.42	.060	7	1.2		10.7	7.5	0.3	0.7	19.2	8.6	0.7	27.8	24.0	0.68	1.4	45	69	80
053-069	0.42	.063	7	1.3		14.9	10.8	0.5	0.9	27.1	10.0	0.8	37.1	31.3	0.71	1.4	48	73	87
069-091	0.28			1.1		15.9	11.3	0.6	0.8	28.6	8.3	0.4	36.9	31.1	0.74	1.4	51	78	92
091-109	0.19			1.1		15.4	10.8	0.7	0.7	27.6	7.1		34.7	28.9	0.76	1.4	53	80	96
109-135	0.15			1.2		15.0	10.2	0.7	0.7	26.6	5.4		32.0	27.7	0.78	1.5	54	83	96
135-155	0.12			1.1		15.1	10.0	0.7	0.7	26.5	5.2		31.7	26.6	0.81	1.5	57	84	100

DEPTH CM	SATURATED PASTE 8E1 REST OHM-CM	8C1B PH	8A H2O PCT	NA 5D2 ESP PCT	NA 5E SAR	SALT 8D5 TOTL SOLU PPM	GYP PCT	SATURATION EXTRACT 8A1 (MEQ / LITER) 8A1A EC MMHOS/CM	6N1B CA	6D1B MG	6P1A NA	6Q1A K	6I1A CO3	6J1A HCO3	6K1A CL	6L1A SO4	6M1A NO3	ATTERBERG E/ 4F1 LQID LMIT PCT	4F2 PLST INDX
000-020																		36	12
020-028																			
028-038																		35	13
038-053																			
053-069																			
069-091																			
091-109	2500	5.2	62.6			72		0.18											
109-135																			
135-155																			

CLAY MINERALOGY (7A2C). PLACEMENT (S69IA-68-2) MONTMORILLONITIC.
069-91 MT3 MI2 KK2.
COMMENTS-- CLAYS FAIRLY WELL ORDERED.
RELATIVE AMOUNTS-- (X-RAY) 5 = DOMINANT 4 = ABUNDANT 3 = MODERATE 2 = SMALL 1 = TRACE. (DIA) AS PERCENT.
MINERAL CODE-- MT = MONTMORILLONITE MI = MICA KK = KAOLINITE

(A) FE/MN NODULES COMPRISE MORE THAT 75 PCT OF THE SAND
(B) BULK DENSITY ESTIMATED FOR HORIZON FROM 28-38 CM.
(C) MICRO-PENETRATION RESISTANCE - A ROD 0.6 CM DIA IS SLOWLY PUSHED INTO BULK DENSITY CLOD, EQUILIBRATED AT 1/10- BAR, A DISTANCE OF 0.6 CM USING A POCKET PENETROMETER. UNITS ARE FORCE (KG) AND NOT ESTIMATES OF UNCONFINED COMPRESSIVE STRENGTH.
(D) ORGANIC CARBON IS 10 KG PER SQ M TO A DEPTH OF 1 METER (METHOD 6A).
(E) IOWA STATE HIGHWAY COMMISSION DATA.

Pedon classification: Udollic Ochraqualf; fine, montmorillonitic, mesic.
Series classification: (Same as pedon).
Soil: Pershing silt loam.
Soil no.: S69-Iowa-68-2 (LSL Nos. 69L1012 - 69L1020).
Location: Monroe County, Iowa, 225 feet west and 60 feet north of gate along north-south section line road in the SE¼ NE¼ Sec. 6, T. 72 N., R. 18 W.
Vegetation and land use: Soybeans; cropland.
Parent material: Deoxidized-leached and oxidized-leached loess (Wisconsin) of low sand content (less than 5 percent).
Physiography: Convex ridgecrest; slight slope to the north near head of drain. Adjoins nearly level relief of slightly higher elevation.
Relief: Gently sloping convex upland ridge.
Slope: 2 percent, north aspect.
Drainage: Somewhat poorly and moderately well drained.
Ground water: None.
Permeability: Very slow.
Described by: J. D. Highland, J. R. Culver and T. E. Fenton; November 6, 1969.

(Colors are for moist conditions unless otherwise stated)

Ap 69L1012 0 to 20 cm (0 to 8 inches). Very dark gray (10YR 3/1) silt loam, gray (10YR 5/1) dry, kneaded very dark gray (10YR 3/1); weak cloddy breaking to weak fine granular structure; friable; few fine dark brown (7.5YR 3/2) soft accumulations of oxides, slightly acid; abrupt smooth boundary.

A21 69L1013 20 to 28 cm (8 to 11 inches). Dark grayish brown (10YR 4/2) silt loam, very dark gray (10YR 3/1) and dark gray (10YR 4/1) coatings on plates, light brownish gray (10YR 6/2) dry; few fine distinct mottles of light olive brown (2.5Y 5/4); weak medium platy structure; friable; discontinuous light gray (10YR 7/1 dry) silt coats; few fine dark brown (7.5YR 3/2) soft accumulations of oxides; medium acid; clear smooth boundary.

A22 69L1014 28 to 38 cm (11 to 15 inches). Grayish brown (10YR 5/2) silt loam, dark gray (10YR 4/1) coatings on plates, few fine distinct mottles of light olive brown (2.5Y 5/4); weak medium platy structure; friable; continuous light gray (10YR 7/1 dry) silt coats; few fine dark brown (7.5YR 3/2) soft accumulations of oxides; strongly acid; clear smooth boundary.

B1 69L1015 38 to 53 cm (15 to 21 inches). Mottled grayish brown (2.5Y 5/2) and yellowish brown (10YR 5/4), grayish brown (10YR 5/2) coatings on peds; medium silty clay loam; kneaded yellowish brown (10YR 5/4); moderate fine and very fine subangular blocky structure; friable; continuous light gray (10YR 7/1 dry) grainy ped coats; few fine brown (7.5YR 4/4) and dark reddish brown (5YR 3/2) soft accumulations of oxides; strongly acid; clear smooth boundary.

B21t 69L1016 53 to 69 cm (21 to 27 inches). Mottled grayish brown (2.5Y 5/2) and yellowish brown (10YR 5/6) medium silty clay; moderate fine and very fine subangular and angular blocky structure; very firm; continuous dark grayish brown (10YR 4/2) and few discontinuous very dark gray (10YR 3/1) clay films; few very dark gray (10YR 3/1) clay-filled root pores; common fine dark brown (7.5YR 3/2) and dark reddish brown (5YR 2/2) soft accumulations of oxides; medium acid; gradual smooth boundary.

B22t 69L1017 69 to 91 cm (27 to 36 inches). Mottled brown (10YR 5/3) and yellowish brown (10YR 5/6) light silty clay in upper part, heavy silty clay loam in lower part; grayish brown (2.5Y 5/2) on faces of prisms; moderate coarse prismatic structure parting to moderate fine subangular and angular blocky structure; very firm; few discontinuous very dark gray (10YR 3/1) clay films; continuous dark gray (10YR 4/1) clay flows in old root channels; common fine dark brown (7.5YR 3/2) and dark reddish brown (5YR 2/2) soft accumulations of oxides; medium acid; gradual smooth boundary.

B31t 69L1018 91 to 109 cm (36 to 43 inches). Mottled grayish brown (2.5Y 5/2) yellowish brown (10YR 5/6), and strong brown (7.5YR 5/6) medium silty clay loam; moderate coarse prismatic structure parting to weak medium subangular blocky; firm; deoxidized and leached weathering zone; few discontinuous dark gray (10YR 4/1) clay films on prism faces; common dark gray (10YR 4/1) clay flows in pores; many fine soft dark reddish brown (5YR 2/2) accumulations of oxides; slightly acid; gradual smooth boundary.

B32t 69L1019 109 to 135 cm (43 to 53 inches). Mottled olive gray (5Y 5/2), yellowish brown (10YR 5/6), and strong brown (7.5YR 5/6) medium silty clay loam; grayish brown (2.5Y 5/2) on faces of prisms; moderate coarse prismatic structure; firm; deoxidized and leached weathering zone; few discontinuous dark gray (10YR 4/1) clay films on prism faces, few very dark gray (10YR 3/1) clay-filled pores; many fine soft and hard dark reddish brown (5YR 2/2) accumulations of oxides; slightly acid; gradual smooth boundary.

B33 69L1020 135 to 155 cm (53 to 61 inches). Mottled olive gray (5Y 5/2) and yellowish brown (10YR 5/6) light silty clay loam; weak coarse prismatic structure; deoxidized and leached weathering zone; firm; very few discontinuous very dark gray (10YR 3/1) clay films on prisms; few dark gray (10YR 4/1) and black (10YR 2/1) clay-lined pores; many fine dark reddish brown (5YR 2/2) soft accumulations of oxides, slightly acid.

SOIL CLASSIFICATION-AERIC OCHRAQUALF
FINE, MONTMORILLONITIC, MESIC
SERIES - - - - - - -RATHBUN

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE MRTSC
SOIL SURVEY INVESTIGATIONS UNIT
LINCOLN, NEBRASKA

SOIL NO - - - - - - S69IOWA-4-4 COUNTY - - - APPANOOSE

GENERAL METHODS- - -1A2A,1B1B,1B2,1B SAMPLE NOS. 69L1021-69L1030

DEPTH	HORIZON	(- - - PARTICLE SIZE ANALYSIS, LT 2MM, 3A1, 3A1A, 3A1B - - -			FINE	(- - SAND - -				)(- -SILT- - -)			FAML	INTR	FINE	NON-	)RATIO BD1
		SAND 2-.05	SILT .05-.002	CLAY LT .002	CLAY LT .0002	VCOS 2-1	CORS 1-.5	MEDS .5-.25	FNES .25-.10	VFNS .10-.05	COSI .05-.02	FNSI .02-.002	VFSI .005-.002	TEXT SAND 2-.1	II .2-.02	CLAY TO CLAY	CO3-CLAY	15-BAR TO CLAY
CM		(- - - PCT LT 2MM - - -)														PCT	PCT	
000-010	A1	4.9A	74.6	20.5		.5	1.8	1.0	1.0	.6	30.2	44.4		4.3	31.3			.48
010-033	A2	3.8A	69.8	26.4		.3	1.4	.9	.8	.4	25.8	44.0		3.4	26.6			.42
033-043	B1	2.3A	61.0	36.7		.1	.7	.5	.6	.4	21.2	39.8		1.9	21.9			.42
043-058	B21T	.8A	42.5	56.7		.1	.3	.1	.2	.1	13.6	28.9		.7	13.9			.44
058-074	B22T	.6A	50.6	48.8		.0	.1	.1	.2	.2	17.1	33.5		.4	17.4			.45
074-091	B23T	.7A	58.9	40.4		.0	.1	.1	.2	.3	18.7	40.2		.4	19.1			.48
091-109	B31T	.8A	63.3	35.9		.0	.1	.1	.2	.4	18.7	44.6		.4	19.2			.60
109-142	B32	1.1A	67.5	31.4	15.7	.0	.1	.2	.4	.4	24.3	43.2		.7	24.9	50		.49
142-165	C1	5.4	66.2	28.4		.1	.9	1.3	2.1	1.0	21.4	44.8		4.4	23.4			.48
165-178	C2	11.6	63.4	25.0		.4	1.8	2.8	4.6	2.0	19.4	44.0		9.6	23.6			.45

DEPTH	(PARTICLE SIZE ANALYSIS, MM, 3B, 3B1, 3B2)(VOL. GT 2 PCT	(- - WEIGHT GT 75 PCT	75-20	20-5	5-2	LT .074	20-2 PCT LT20	BULK DENSITY 4A1D 1/3-BAR G/CC	4A1H OVEN DRY G/CC	4D1 COLE	)(- - -WATER CONTENT 4B1C 1/10 BAR PCT	4B1C 1/3-BAR PCT	4B2 15-BAR PCT	4C1 WRD CM/CM	- - -)	AVAIL P [E] LBS/ACRE	(- -PH - -) 8C1A 1/1 H2O	8C1E 1/2 CACL
CM			(- - - PCT LT 75 - - -)															
000-010	0	0	0	0	0	96	0	1.10B					9.8			8.5	5.3	4.9
010-033	0	0	0	0	0	97	0	1.33	1.47	.034	29.8	26.9	11.0	.21	1.8C	6.0	4.5	3.7
033-043	0	0	0	0	0	98	0	1.30B					15.5			5.0	4.6	3.7
043-058	0	0	0	0	0	99	0	1.30B					24.7			6.0	4.3	3.7
058-074	0	0	0	0	0	100	0	1.40B					21.8			14.0	4.4	3.8
074-091	0	0	0	0	0	100	0	1.38	1.58	.046	33.7	32.9	19.3	.19	1.0C	64.0	4.5	4.0
091-109	0	0	0	0	0	99	0	1.40B					17.9			51.0	5.0	4.4
109-142	0	0	0	0	0	99	0	1.42	1.62	.045	32.7	30.1	15.3	.21	0.8C	29.0	5.8	5.2
142-165	0	0	0	0	0	95	0	1.34	1.52	.043	36.1	34.1	13.7	.27	0.4C	20.0	6.4	5.7
165-178	0	0	0	0	0	89	0						11.2			15.5	6.6	5.4

DEPTH	(ORGANIC MATTER 6A1A ORGN CARB PCT	6B1A NITG PCT	) C/N	IRON 6C2A EXT FE PCT	PHOS 6S1A TOTL PCT	(- -EXTRACTABLE BASES 5B4A- -) 6N2E CA	6O2D MG	6P2A NA	6Q2A K	SUM EXTB	ACTY 6H1A BACL TEA	AL 6G1D KCL EXT	(CAT EXCH) 5A3A EXTB ACTY	5A6A NHAC	RATIO 8D1 NHAC TO CLAY	RATIO 8D3 CA TO MG	CA 5F SAT NHAC PCT	(BASE SAT) 5C3 EXTB ACTY PCT	5C1 NHAC PCT
CM					(- - -	- - -	- - -	- - -	-MEQ / 100	G- - -	- - -	- - -	- - -)						
000-010	2.250	.177	13			8.4	2.3	0.1	0.5	11.3	10.4	0.1	21.7	16.9	0.82	3.7	50	52	67
010-033	0.46	.060	8			2.0	1.4	0.2	0.3	3.9	15.5	7.2	19.4	15.7	0.59	1.4	13	20	25
033-043	0.38	.054	7			4.2	3.5	0.5	0.5	8.7	19.9	9.8	28.6	23.6	0.64	1.2	18	30	37
043-058	0.47	.064	7			9.6	7.8	1.1	0.9	19.4	26.2	12.3	45.6	38.4	0.68	1.2	25	43	51
058-074	0.43	.049	9			12.0	8.5	1.3	0.8	22.6	20.0	7.4	42.6	34.4	0.70	1.4	35	53	66
074-091	0.23					12.4	8.3	1.5	0.8	23.0	13.0	3.2	36.0	30.4	0.75	1.5	41	64	76
091-109	0.15					14.5	8.5	1.7	0.8	25.5	9.3	1.0	34.8	28.2	0.79	1.7	51	73	90
109-142	0.11					14.9	8.0	1.7	0.7	25.3	5.7		31.0	25.8	0.82	1.9	58	82	98
142-165	0.11					13.9	6.8	1.7	0.6	23.0	6.1		29.1	23.4	0.82	2.0	59	79	98
165-178	0.08					12.3	5.6	1.6	0.5	20.0	4.4		24.4	19.6	0.78	2.2	53	82	102

(A) FE/MN NODULES COMPRISE MORE THAN 75 PCT OF THE SAND (0-142 CM).
(B) BULK DENSITY ESTIMATED FOR HORIZONS FROM 0-10, 33-43, 43-58, 58-74, AND 99-109 CM.
(C) MICRO-PENETRATION RESISTANCE - A ROD 0.6 CM DIA IS SLOWLY PUSHED INTO BULK DENSITY CLOD, EQUILIBRATED AT 1/10- BAR, A DISTANCE OF 0.6 CM USING A POCKET PENETROMETER. UNITS ARE FORCE (KG) AND NOT ESTIMATES OF UNCONFINED COMPRESSIVE STRENGTH.
(D) ORGANIC CARBON IS 7 KG PER SQ M TO A DEPTH OF 1 METER (METHOD 6A).
(E) IOWA STATE UNIVERSITY DATA.

Pedon classification: Aeric Ochraqualf; fine, montmorillonitic, mesic.
Series classification: (Same as pedon).
Soil: Rathbun silt loam.
Soil no.: S69-Iowa-4-4 (LSL Nos. 69L1021 - 69L1030).
Location: Appanoose County, Iowa, 200 feet south and 850 feet west of the northeast corner of the NW¼ Sec. 21, T. 67 N., R. 18 W.
Vegetation and land use: Oak and hickory trees; woods.
Parent material: Wisconsin loess.
Physiography: Convex ridgetop extending in a southeast to east direction. Breaks rather sharply to D and E slopes (9 to 18 percent) to the north and C slope (5 to 9 percent) to the south.
Relief: Gently sloping convex upland ridgetop.
Slope: 3 percent.
Drainage: Somewhat poorly drained.
Ground water: None observed.
Permeability: Very slow.
Described by: J. D. Highland, J. R. Culver, and T. E. Fenton; November 1969.

(Colors for moist conditions unless otherwise stated)

A1 69L1021 0 to 10 cm (0 to 4 inches). Very dark gray (10YR 3/1), dark grayish brown (10YR 4/2) crushed silt loam; light brownish gray (10YR 6/2) dry; weak thin platy structure; friable; strongly acid; abrupt smooth boundary.

A2 69L1022 10 to 33 cm (4 to 13 inches). Yellowish brown (10YR 5/4) silt loam, very pale brown (10YR 7/3) dry; weak to moderate thin platy structure; friable; few fine dark reddish brown (5YR 3/2) oxides; strongly acid; clear smooth boundary.

B1 69L1023 33 to 43 cm (13 to 17 inches). Yellowish brown (10YR 5/4) light silty clay; pale brown (10YR 6/3) coatings on peds; continuous light gray (10YR 7/1) coatings dry; strong very fine subangular and angular blocky structure; firm; strongly acid; abrupt smooth boundary.

B21t 69L1024 43 to 58 cm (17 to 23 inches). Brown (10YR 4/3) heavy silty clay; dark grayish brown (10YR 4/2) coatings on peds; few fine distinct grayish brown (2.5Y 5/2) mottles; moderate fine subangular blocky structure; very firm; thin continuous clay films; few very fine soft dark brown (7.5YR 3/2) oxides; strongly acid; gradual smooth boundary.

B22t 69L1025 58 to 74 cm (23 to 29 inches). Brown (10YR 4/3) medium silty clay; dark grayish brown (10YR 4/2) coatings on peds; few fine distinct grayish brown (2.5Y 5/2) mottles and few fine faint mottles of dark brown (10YR 3/3); weak coarse prismatic structure parting to moderate medium subangular blocky; very firm; thin continuous clay films; few very fine soft dark brown (7.5YR 3/2) oxides; medium acid; gradual smooth boundary.

B23t 69L1026 74 to 91 cm (29 to 36 inches). Mottled grayish brown (2.5Y 5/2) and brown (10YR 4/3) medium to light silty clay; few fine and medium faint mottles of dark brown (10YR 3/3 and 10 YR 3/4); weak coarse prismatic structure parting to weak to moderate medium subangular blocky; firm; few discontinuous clay films; few dusky red (2.5YR 3/2) oxides; very few patches of light gray (10YR 7/2) silt coats; medium acid; gradual boundary.

B31t 69L1027 91 to 109 cm (36 to 43 inches). Grayish brown (2.5Y 5/2) heavy silty clay loam to light silty clay; common fine distinct mottles of dark yellowish brown (10YR 4/4) and strong brown (7.5YR 5/6); weak coarse prismatic structure parting to weak medium subangular blocky; firm; few thin discontinuous clay films and clay fills along root channels; few soft dark reddish brown (5YR 2/2) oxides; few dusky red (2.5YR 3/2) oxides; very few light gray (10YR 7/2) silt coats; medium acid; gradual boundary.

B32 69L1028 109 to 143 cm (43 to 56 inches). Mottled grayish brown (2.5Y 5/2), yellowish brown (10YR 5/4), and strong brown (7.5YR 5/6) silty clay loam; weak medium prismatic structure; firm; thin discontinuous light gray (10YR 7/1) silt coats on faces of prisms; common dark brown (7.5YR 3/2) oxide stains; few clay flows along root channels; Fe-Mn stains on vertical prism faces and along root channels; neutral; gradual boundary.

C1 69L1029 142 to 165 cm (56 to 65 inches). Mottled light brownish gray (2.5Y 6/2), yellowish brown (10YR 5/6), and strong brown (7.5YR 5/6); light silty clay loam; massive with vertical cleavage; discontinuous light gray (10YR 7/1) silt coats on faces of prisms; many hard dark brown (7.5YR 3/2) concretions; few Fe-Mn stains of dark reddish brown (5YR 2/2) on cleavage faces; neutral; gradual boundary.

C2 69L1030 165 to 178 cm (65 to 70 inches). Mottled light brownish gray (2.5Y 6/2), yellowish brown (10YR 5/6), and strong brown (7.5YR 5/6) heavy silt loam; massive with vertical cleavage; many soft dark brown (7.5YR 3/2) and dark reddish brown (5YR 2/2) oxide concretions; few Fe-Mn stains on vertical cleavage faces; neutral.

Remarks: About ½ to 1 inch of leaf litter on surface.

SOIL CLASSIFICATION-AERIC OCHRAQUALF
FINE, MONTMORILLONITIC, MESIC
SERIES - - - - - - -RATHBUN

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE MRTSC
SOIL SURVEY INVESTIGATIONS UNIT
LINCOLN, NEBRASKA

SOIL NO - - - - - - S69IOWA-93-2 COUNTY - - - WAYNE

GENERAL METHODS- - -1A2A,1B1B,1B2,1B SAMPLE NOS. 69L1031-69L1040

DEPTH CM	HORIZON	SAND 2-.05	SILT .05-.002	CLAY LT .002	FINE CLAY LT .0002	VCOS 2-1	CORS 1-.5	MEDS .5-.25	FNES .25-.10	VFNS .10-.05	COSI .05-.02	FNSI .02-.002	VFSI .005-.002	FAML TEXT SAND 2-.1	INTR II .2-.02	FINE CLAY TO CLAY PCT	NON-CO3-CLAY PCT	RATIO 8D1 15-BAR TO CLAY
		(- - - PARTICLE SIZE ANALYSIS, LT 2MM, 3A1, 3A1A, 3A1B - - -) PCT LT 2MM																
000-010	A1	4.4A	74.9	20.7	10.4	.4	1.4	.9	1.0	.7	29.3	45.6		3.7	30.4	50		.39
010-018	A21	3.7A	74.8	21.5	11.0	.3	1.3	.8	.7	.6	28.7	46.1		3.1	29.6	51		.41
018-033	A22	3.1A	70.8	26.1	13.9	.1	1.1	.8	.7	.4	26.6	44.2		2.7	27.3	53		.39
033-043	B1	1.9A	61.1	37.0	23.9	.1	.6	.4	.4	.4	22.0	39.1		1.5	22.6	65		.39
043-064	B21T	1.0A	46.7	52.3	35.5	.0	.2	.2	.3	.3	17.3	29.4		.7	17.7	68		.44
064-079	B22T	.9A	51.9	47.2	31.5	.0	.1	.2	.3	.3	19.2	32.7		.6	19.7	67		.45
079-091	B23T	.8A	56.5	42.7	26.4	.0	.1	.1	.3	.3	21.2	35.3		.5	21.7	62		.46
091-112	B31T	.8A	61.1	38.1		.0	.1	.1	.3	.3	23.6	37.5		.5	24.1			.47
112-137	B32T	1.4A	64.9	33.7	19.6	.1	.2	.2	.5	.4	24.6	40.3		1.0	25.3	58		.48
137-160	B33T	3.0A	66.3	30.7		TR	.4	.7	1.2	.7	22.9	43.4		2.3	24.3			.46

DEPTH CM	VOL. GT 2 PCT	GT 75 PCT	75-20	20-5	5-2	LT .074	20-2 PCT LT20	BULK DENSITY 4A1D 1/3-BAR G/CC	4A1H OVEN DRY G/CC	4D1 COLE	WATER CONTENT 4B1C 1/10 BAR PCT	4B1C 1/3-BAR PCT	4B2 15-BAR PCT	4C1 WRD CM/CM		CARBONATE 6E1B LT 2 PCT	3A1A LT .002 PCT	PH 8C1A 1/1 H2O	8C1E 1/2 CACL
	(PARTICLE SIZE ANALYSIS, MM, 3B, 3B1, 3B2)	WEIGHT	(- - - PCT LT 75 - - -)																
000-010	0	0	0	0	0	96	0	1.10B					8.1					5.4	5.2
010-018	0	0	0	0	0	97	0	1.41	1.48	.016	30.6	27.6	8.9	.26	2.5C			4.7	4.1
018-033	0	0	0	0	0	97	0	1.37	1.48	.026	30.6	26.1	10.3	.22	1.8C			4.5	3.8
033-043	0	0	0	0	0	98	0	1.34	1.81	.106	32.7	30.9	14.3	.22	1.7C			4.5	3.3
043-064	0	0	0	0	0	99	0	1.32	1.94	.137	38.5	36.8	23.1	.18	1.2C			4.1	3.7
064-079	0	0	0	0	0	99	0	1.41	1.86	.097	34.3	30.3	21.0	.13	1.1C			4.3	3.8
079-091	0	0	0	0	0	99	0	1.38	1.81	.095	32.7	31.7	19.7	.17	0.8C			4.4	3.9
091-112	0	0	0	0	0	99	0	1.40B					17.9					4.9	4.4
112-137	0	0	0	0	0	99	0	1.40B					16.1					5.9	5.6
137-160	0	0	0	0	0	98	0	1.35	1.65	.069	35.5	32.7	14.2	.25	0.8C			6.5	5.8

DEPTH CM	ORGANIC MATTER 6A1A ORGN CARB PCT	6B1A NITG PCT	C/N	IRON 6C2A EXT FE PCT	PHOS 6S1A TOTL PCT	EXTRACTABLE BASES 5B4A 6N2E CA	6O2D MG	6P2A NA	6Q2A K	SUM EXTB	ACTY 6H1A BACL TEA	AL 6G1D KCL EXT	CAT EXCH 5A3A EXTB ACTY	5A6A NHAC	RATIO 8D1 NHAC TO CLAY	RATIO 8D3 CA TO MG	CA 5F SAT NHAC PCT	BASE SAT 5C3 EXTB ACTY PCT	5C1 NHAC PCT
						(- - - MEQ / 100 G - - -)													
000-010	3.24D	.283	11	0.9		13.3	2.7	0.2	0.5	16.7	11.4	0.1	28.1	21.5	1.04	4.9	52	59	78
010-018	1.18	.114	10	1.0		5.0	1.8	0.3	0.3	7.4	13.1	1.6	20.5	15.5	0.72	2.8	32	36	48
018-033	0.62	.074	8	1.1		3.3	2.0	0.3	0.4	6.0	15.2	4.8	21.2	16.1	0.62	1.7	20	28	37
033-043	0.46	.060	8	1.2		6.4	4.9	0.5	0.6	12.4	18.4	7.3	30.8	25.1	0.68	1.3	25	40	49
043-064	0.44	.058	8	1.2		11.9	8.3	0.9	0.8	21.9	22.3	7.7	44.2	36.4	0.70	1.4	33	50	60
064-079	0.39			1.2		14.0	8.7	1.1	0.9	24.7	17.8	4.5	42.5	33.8	0.72	1.6	41	58	73
079-091	0.34			1.1		13.9	8.5	1.2	0.9	24.5	14.0	3.0	38.5	31.5	0.74	1.6	44	64	78
091-112	0.15			1.1		15.0	8.8	1.3	0.8	25.9	9.1	1.2	35.0	29.5	0.77	1.7	51	74	88
112-137	0.12			1.1		15.0	8.1	1.4	0.7	25.2	6.3		31.5	26.8	0.80	1.9	56	80	94
137-160	0.15			1.1		13.9	7.1	1.2	0.8	23.0	4.7		27.7	24.1	0.79	2.0	58	83	95

DEPTH CM	SATURATED PASTE 8E1 REST OHM-CM	8C1B PH	8A H2O PCT	NA 5D2 ESP PCT	NA 5E SAR	SALT 8D5 TOTL SOLU PPM	GYP 6F1A PCT	SATURATION EXTRACT 8A1 8A1A EC MMHOS/CM	6N1B CA	6O1B MG	6P1A NA	6Q1A K	6I1A CO3	6J1A HCO3	6K1A CL	6L1A SO4	6M1A NO3	ATTERBERG 4E1 LQID LIMIT PCT	4F2 PLST INDX
									(- - - MEQ / LITER - - -)										
000-010																		40E	13
010-018																		31E	9
018-033																			
033-043																			
043-064																		62E	32
064-079																			
079-091																			
091-112	2300	4.4	54.8			74		0.21											
112-137																			
137-160																		46E	23

CLAY MINERALOGY (7A2C). PLACEMENT (S69IA-93-2) MONTMORILLONITIC.
043-64 MT5 KK2 MI1.
064-79 MT5 KK2 MI1.
COMMENTS-- CLAYS WELL-ORDERED.
RELATIVE AMOUNTS-- (X-RAY) 5 = DOMINANT 4 = ABUNDANT 3 = MODERATE 2 = SMALL 1 = TRACE. (DTA) AS PERCENT.
MINERAL CODE-- MT = MONTMORILLONITE MI = MICA KK = KAOLINITE

MICROMORPHOLOGY (4E1)--B1 (69L1034) AND B21T (69L1035) HORIZONS.
CLAY FILMS ON MACROSURFACES OCCUR IN THE B21T AND TO A LESSER EXTENT IN THE B1. THE CLAY IN THE CLAY FILMS SHOW MODERATE ORIENTATION. STRIAE OF ORIENTED CLAY IN THE MATRIX AWAY FROM MACROSURFACES ARE WELL EXPRESSED IN THE B21T. IN BREWER'S TERMINOLOGY, THE S-FABRIC OF THE B1 IS INSEPIC AND THAT OF THE B21T IS MASEPIC. FLAKES OF MICA ARE FAIRLY COMMON IN BOTH HORIZONS. A HIGH PROPORTION OF THE GRAINS OF BIOTITE( ) BUT NOT THE MUSCOVITE( ) APPEAR QUITE ALTERED. IRON-RICH SEGREGATIONS (GLAEBULES) MOSTLY CIRCULAR IN CROSS-SECTION ARE COMMON. THE DIAMETER OF MOST EXCEEDS 0.05 MM WITH AN UPPER LIMIT NEAR 2 MM. IRON CONCENTRATION APPEARS TO INCREASE TOWARD THE PERIPHERY OF THE SEGREGATION. A FEW SEGREGATIONS HAVE A CONCENTRIC RING ORGANIZATION. THE SEGREGATIONS HAVE SHARP BOUNDARIES. SEGREGATIONS IN THE B21T BUT NOT THE B1 COMMONLY ARE SURROUNDED BY ORIENTED CLAY. THE B1 CONTAINS 5 TO 8 PERCENT BY VOLUME. THE B21T HAS 11 PERCENT NEAR THE UPPER BOUNDARY AND 3 TO 5 PERCENT THROUGHOUT MOST OF THE HORIZON. THESE PERCENTAGES HAVE A LARGE UNCERTAINTY BECAUSE OF THE SMALL AREA OF THIN SECTION OBSERVED.

(A) FE/MN NODULES COMPRISE MORE THAN 75 PCT OF THE SAND.
(B) BULK DENSITY ESTIMATED FOR HORIZONS FROM 0-10, 91-112, AND 111-137 CM.
(C) MICRO-PENETRATION RESISTANCE - A ROD 0.6 CM DIA IS SLOWLY PUSHED INTO BULK DENSITY CLOD, EQUILIBRATED AT 1/10- BAR, A DISTANCE OF 0.6 CM USING A POCKET PENETROMETER. UNITS ARE FORCE (KG) AND NOT ESTIMATES OF UNCONFINED COMPRESSIVE STRENGTH.
(D) ORGANIC CARBON IS 10 KG PER SQ M TO A DEPTH OF 1 METER (METHOD 6A).
(E) ATTERBERG LIMITS DETERMINED BY IOWA HWY. DEPT., AMES, IA.

Pedon classification: Aeric Ochraqualf; fine, montmorillonitic, mesic.
Series classification: (Same as pedon).
Soil: Rathbun silt loam.
Soil no.: S69-Iowa-93-2 (LSL Nos. 69L1031 - 69L1040).
Location: Wayne County, Iowa, 680 feet south and 540 feet west of the northeast corner of the SW¼ Sec. 19, T. 67 N., R. 21 W.
Vegetation and land use: Large, deciduous trees; woods.
Parent material: Oxidized-leached and deoxidized-leached loess low in sand (less than 5 percent)(Wisconsin).
Physiography: Convex ridgetop adjoining a nearly level, narrow, stable divide in the loess-covered Kansan and Nebraskan till plain.
Relief: Gently sloping convex summit of narrow ridgetop or interfluve.
Slope: 3 percent north-facing.
Drainage: Somewhat poorly drained.
Ground water: None observed.
Permeability: Very slow.
Described by: J. D. Highland, J. R. Culver, T. E. Fenton; November 5, 1969.

(Colors for moist conditions unless otherwise stated)

A1 69L1031 0 to 10 cm (0 to 4 inches). Very dark gray (10YR 3/1) silt loam; light gray (10YR 6/1) dry; kneaded very dark grayish brown (10YR 3/2); moderate thin and very thin platy structure; friable; thin patchy light gray (10YR 7/1 dry) silt coatings; few fine brown (7.5YR 4/4) oxides; medium acid; abrupt smooth boundary.

A21 69L1032 10 to 18 cm (4 to 7 inches). Brown (10YR 5/3) silt loam, pale brown (10YR 6/3) dry; kneaded same as matrix; moderate thin platy structure; friable; few dark grayish brown (10YR 4/2) patches; thin discontinuous light gray (10YR 7/2 dry) silt coatings; few fine dark reddish brown (5YR 3/2) oxides; very strongly acid; clear smooth boundary.

A22 69L1033 18 to 33 cm (7 to 13 inches). Yellowish brown (10YR 5/4) silt loam, pale brown (10YR 6/3) dry; kneaded same as matrix; weak coarse platy structure parting to weak medium and fine subangular blocky; friable; thin discontinuous light gray (10YR 7/2 dry) silt coatings; few fine dark reddish brown (5YR 3/2) oxides; very strongly acid; clear smooth boundary.

B1 69L1034 33 to 43 cm (13 to 17 inches). Yellowish brown (10YR 5/4) light silty clay; brown (10YR 5/3) coatings on peds; kneaded yellowish brown (10YR 5/4); strong fine and very fine angular blocky and subangular blocky structure; firm; thin nearly continuous light gray (10YR 7/1 dry) silt coatings; few fine dark reddish brown (5YR 3/2) oxides; very strongly acid; abrupt smooth boundary.

B21t 69L1035 43 to 64 cm (17 to 25 inches). Dark grayish brown (10YR 4/2) medium to heavy silty clay; few fine faint dark yellowish brown (10YR 4/4) mottles; kneaded grayish brown (10YR 5/2) to brown (10YR 5/3); moderate very fine subangular blocky structure; very firm; few fine dark brown (7.5YR 3/2) oxides; thick continuous clay films; very strongly acid; clear smooth boundary.

B22t 69L1036 64 to 79 cm (25 to 31 inches). Dark grayish brown (10YR 4/2) medium silty clay; common fine faint dark yellowish brown (10YR 4/4) mottles; kneaded grayish brown (10YR 5/2) to brown (10YR 5/3); weak fine subangular blocky structure; very firm; thick discontinuous clay films; few fine dark brown (7.5YR 3/2) oxides; very strongly acid; clear smooth boundary.

B23t 69L1037 79 to 91 cm (31 to 36 inches). Mottled grayish brown (2.5Y 5/2) and yellowish brown (10YR 5/4) medium silty clay; few fine faint brown (7.5YR 4/4) mottles; kneaded yellowish brown (10YR 5/4); weak medium prismatic parting to weak fine and medium subangular blocky structure; firm; thin discontinuous clay films; deoxidized and leached weathering zone; common fine dark brown (7.5YR 3/2) oxides; strongly acid; gradual smooth boundary.

B31t 69L1038 91 to 112 cm (36 to 44 inches). Mottled grayish brown (2.5Y 5/2) and strong brown (7.5YR 5/6) medium to heavy silty clay loam; kneaded yellowish brown (10YR 5/4); weak medium prismatic parting to weak medium subangular blocky structure; firm; thin patchy dark grayish brown (10YR 4/2) clay films; deoxidized and leached weathering zone; common fine dark brown (7.5YR 3/2) oxides; strongly acid; gradual smooth boundary.

B32t 69L1039 112 to 137 cm (44 to 54 inches). Mottled light brownish gray (2.5Y 6/2) and strong brown (7.5YR 5/6) medium silty clay loam; kneaded brown (10YR 5/3); weak medium prismatic structure; firm; few thin patchy clay films on vertical prism faces; deoxidized and leached weathering zone; common fine dark brown (7.5YR 3/2) oxides; few hard black (5YR 2/1) Fe-Mn concretions and stains on faces of prisms; slightly acid; gradual smooth boundary.

B33t 69L1040 137 to 160 cm (54 to 63 inches). Light brownish gray (2.5Y 6/2) silt loam to light silty clay loam; many fine and medium prominent strong brown (7.5YR 5/6) mottles; kneaded color brown (10YR 5/3); weak medium prismatic structure parting to weak medium subangular blocky; friable; deoxidized and leached weathering zone; common fine dark brown (7.5YR 3/2) and few medium yellowish red (5YR 4/6) oxides; few clay flows in root channels; thin discontinuous light gray (10YR 7/1) silt coats on faces of prisms; slightly acid.

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SOIL Series not designated (sampled as Seymour) SOIL Nos. 862Iowa-93-1 LOCATION Wayne County, Iowa

SOIL SURVEY LABORATORY Lincoln, Nebraska LAB. Nos. 17997-18010 February 1967

General Methods: 1A, 1B1b, 2A1, 2B

Depth (In.)	Horizon	Size class and particle diameter (mm) 3A1 — Total: Sand (2-0.05)	Total: Silt (0.05-0.002)	Total: Clay (< 0.002)	Sand: Very coarse (2-1)	Sand: Coarse (1-0.5)	Sand: Medium (0.5-0.25)	Sand: Fine (0.25-0.1)	Sand: Very fine (0.1-0.05)	Silt: 0.05-0.02	Silt: Int III (0.02-0.002)	Int. II (0.2-0.02)	(2-0.1)			Coarse fragments 2A2: > 2 Pct	2 - 19	19-76
		Pct. of < 2 mm														Pct	Pct of < 76 mm	
0-6	A1p	3.3a	71.0	25.7	0.3	0.8	0.7	0.7	0.8	32.9	38.1	34.0	2.5			-		
6-9	A1A2(?)	3.2a	68.9	27.9	0.3	1.0	0.7	0.5	0.7	30.5	38.4	31.4	2.5			-		
9-13	A3	4.1b	65.8	30.1	0.8	1.3	0.7	0.6	0.7	27.4	38.4	28.4	3.4			-		
13-17	B1	4.2b	61.2	34.6	0.9	1.2	0.6	0.7	0.8	23.8	37.4	25.0	3.4			-		
17-22	B21	1.3b	45.3	53.4	tr	0.2	0.2	0.3	0.6	17.1	28.2	17.9	0.7			-		
22-29	B22	1.8b	49.1	49.1	tr	0.3	0.3	0.5	0.7	19.2	29.9	20.2	1.1			-		
29-35	B23	2.3b	52.9	44.8	0.2	0.6	0.3	0.5	0.7	21.2	31.7	22.2	1.6			-		
35-39	B31	0.9b	58.6	40.5	0.1	0.2	0.1	0.1	0.4	22.8	35.8	23.3	0.5			-		
39-45	B32	0.7b	60.0	39.3	tr	tr	tr	0.1	0.6	23.8	36.2	24.5	0.1			-		
45-50	C1	0.7a	61.0	38.3	tr	0.1	0.1	0.1	0.4	23.5	37.5	24.0	0.3			-		
50-60	C2	0.6a	63.8	35.6	-	0.1	0.1	0.1	0.3	24.9	38.9	25.3	0.3			-		
60-70	C3	0.6a	64.8	34.6	tr	tr	0.1	0.1	0.4	24.0	40.8	24.5	0.2			-		
70-77	IIA1b	2.2	60.8	37.0	tr	0.2	0.3	0.7	1.0	20.7	40.1	22.1	1.2			-		
77-90	IIA12b	3.6	55.1	41.3	0.1	0.3	0.6	1.1	1.5	21.3	33.8	23.4	2.1			-		

Depth (In.)	6A1a Organic carbon	6B1a Nitrogen	C/N		6E2a Carbonate as $CaCO_3$	6C2a Ext. Iron as Fe	Bulk density: 4A1a Field-State	4A1d 1/3-Bar	4A1b Air-Dry	4D1 COLE	Water content: 4B4 Field-State	4B1c 1/3-Bar	4B2 15-Bar	4C1 1/3-minus 15-Bar			pH 8C1a (1:1)
	c Pct.	Pct			Pct	Pct.	g/cc	g/cc	g/cc		Pct.	Pct.	Pct	in./in.			
0-6	2.41	0.196	12			1.0	1.38	1.41	1.50	0.02	30.0	26.5	11.2	0.22			5.5
6-9	1.46	0.138	11			1.0	1.32	1.32	1.40	0.02	28.3	26.0	11.4	0.19			5.4
9-13	0.98	0.090	11			1.4	1.32	1.32	1.40	0.02	26.9	24.6	12.2	0.16			5.4
13-17	0.78	0.078	10			2.0	1.37	1.36	1.45	0.02	25.0	24.3	15.1	0.12			5.4
17-22	0.73	0.072	10			1.5	1.32	1.28	1.69d	0.09	32.2	31.2	22.9	0.11			5.4
22-29	0.42	0.052	8			1.3	1.34	1.30	1.84	0.11	31.8	31.8	21.4	0.14			5.6
29-35	0.28					1.3	1.40	1.36	1.84	0.10	28.8	29.5	19.9	0.13			5.9
35-39	0.20					0.7	1.46	1.35	1.84	0.10	26.6	31.0	18.8	0.16			6.3
39-45	0.19				-(s)	1.0	1.48	1.36	1.80	0.09	26.0	29.9	18.7	0.15			6.4
45-50	0.16				-(s)	0.8	1.50	1.37	1.79	0.09	25.1	29.8	18.6	0.15			6.4
50-60	0.12					0.5	1.56	1.40	1.76	0.07	22.6	29.1	17.0	0.17			6.6
60-70	0.12					0.6							16.2				6.4
70-77	0.19					0.4							16.7				6.4
77-90	0.08					0.5							17.4				6.3

Depth (In.)	Extractable bases 6N2a Ca	6O2a Mg	6P2a Na	6Q2a K	5B1a Sum	6H1a Ext. Acidity	Cat. Exch. Cap.: 5A3a Sum Cations	5A1a NH_4OAc		Resistivity a	8B1a Elec. Cond.	6F1a Sol. Na	5E2 Exch. Na	6B Water at Sat.	8D3 Ca/Mg		Base Sat.: 5C3 Sum Cations	5C1 NH_4OAc
	meq/100 g									ohms	mmhos.	me./l.	Pct.	Pct.			Pct.	Pct.
0-6	12.7	3.3	0.1	0.3	16.4	12.7	29.1	20.0							3.8		56	82
6-9	10.7	4.1	0.1	0.3	15.2	11.3	26.5	19.0							2.6		57	80
9-13	10.8	4.9	0.2	0.3	16.2	10.1	26.3	19.8							2.2		62	82
13-17	12.5	6.4	0.4	0.4	19.7	10.6	30.3	22.9							2.0		65	86
17-22	21.1	11.4	0.9	0.8	34.2	11.6	45.8	36.6							1.9		75	93
22-29	20.4	11.1	1.1	0.9	33.5	8.7	42.2	33.5							1.8		79	100
29-35	20.1	11.0	1.2	0.8	33.1	7.3	40.4	31.2							1.8		82	106
35-39	19.1	10.3	1.2	0.7	31.3	4.3	35.6	28.7							1.9		88	109
39-45	19.3	10.5	1.2	0.7	31.7	4.0	35.7	28.6		2200	0.40	2.7	3.7	58.0	1.8		89	111
45-50	18.8	10.1	1.1	0.7	30.7	3.8	34.5	28.0							1.9		89	110
50-60	17.5	9.3	1.1	0.6	28.5	3.4	31.9	26.3							1.9		89	108
60-70	17.1	8.9	1.1	0.5	27.6	3.1	30.7	25.5							1.9		90	108
70-77	16.2	8.1	1.0	0.4	25.7	4.6	30.3	24.4							2.0		85	105
77-90	16.4	8.6	1.0	0.5	26.5	4.6	31.1	25.3							1.9		85	105

Depth (In.)	Ratios to Clay 8D1: NH_4OAc CEC	Ext. Iron	15-Bar Water				
0-6	0.78	0.039	0.44				
6-9	0.68	0.036	0.41				
9-13	0.66	0.047	0.41				
13-17	0.66	0.058	0.44				
17-22	0.69	0.028	0.43				
22-29	0.68	0.026	0.44				
29-35	0.70	0.029	0.44				
35-39	0.71	0.02	0.46				
39-45	0.73	0.03	0.48				
45-50	0.73	0.02	0.49				
50-60	0.74	0.01	0.48				
60-70	0.74	0.02	0.47				
70-77	0.66	0.01	0.45				
77-90	0.61	0.01	0.42				

a. Fe-Mn nodules: > 50 percent (2-0.1 mm); 5-25 percent (0.1-0.05 mm).
b. Fe-Mn nodules: > 50 percent (2-0.1 mm); 25-50 percent (0.1-0.05 mm).
c. 13 kg/m^2 to 60 inches (Method 6A).
d. Range in duplicate clods is 0.20 g/cc.
e. Saturated paste.

Pedon classification: Udollic Ochraqualf; fine, montmorillonitic, mesic.
Series classification: Aquic Argiudoll; fine, montmorillonitic, mesic.
Soil: Series not designated (sampled as Seymour)1/.
Soil no.: S62Iowa-93-1 (LSL Nos. 17997 - 18010).
Location: Wayne County, Iowa; 457 feet south and 152 feet west of the northeast corner SE ¼ Sec. 9, T. 68 N., R. 22 W., about 1 mile southwest of Allerton.
Vegetation and land use: Clover; cropland.
Parent material: Wisconsin loess.
Physiography: Somewhat stable interfluve summit with slope slightly convex toward the northwest.
Elevation: 0.00 in respect to other sites in Allerton transect.
Slope: About 2 percent.
Drainage: Somewhat poorly drained.
Ground water: Water table at 70 inches.
Moisture: Very moist; rained 3 inches a few days before sampling.
Permeability: Moderately slow.
Described by: A. R. Hidlebaugh and R. I. Dideriksen; October 15, 1962.

(Colors are for moist soil unless otherwise stated)

Ap 17997 0 to 15 cm (0 to 6 inches). Very dark gray (10YR 3/1) heavy silt loam, kneaded color the same; gray (10YR 5/1) when dry; moderate fine granular and some weak fine subangular blocky structure; friable; abundant fine roots; very few dark grayish brown (2.5Y 4/2) wormcasts; very few fine soft dark brown accumulations of oxides; slightly acid (pH 6.2); clear smooth boundary.

A12 17998 15 to 23 cm (6 to 9 inches). Very dark gray (10YR 3/1) to dark gray (10YR 4/1) with a few peds of dark grayish brown (10YR 4/2); heavy to medium silt loam; kneaded color very dark grayish brown (10YR 3/2); gray (10YR 5/1 to 6/1) when dry; moderate fine granular structure; friable; abundant fine roots; very few fine soft dark brown accumulations and very few fine hard black concretions of an oxide; medium acid (pH 5.6); clear smooth boundary.

A3 17999 23 to 33 cm (9 to 13 inches). Dark grayish brown (10YR 4/2 to 2.5Y 4/2) light silty clay loam, gray (10YR 6/1) when dry; kneaded color dark grayish brown (2.5Y 4/2); moderate very fine and fine subangular blocky structure; friable to firm; 10 percent very dark gray (10YR 3/1) coats on some peds; common fine roots; thin silt coats on ped exteriors; concretions of an oxide the same as above horizon; medium acid (pH 5.6); clear smooth boundary.

B1 18000 33 to 43 cm (13 to 17 inches). Dark grayish brown (2.5Y 4/2) heavy silty clay loam; kneaded color dark grayish brown (2.5Y 4/2); moderate very fine and fine subangular blocky structure; firm to friable; few fine roots; thin silt coats on many peds; common fine soft dark brown and very few hard black accumulations of oxides; about 2 percent very dark gray (10YR 3/1) coats on some vertical faces; medium acid (pH 5.7); clear smooth boundary.

B21 18001 43 to 55 cm (17 to 22 inches). Dark grayish brown (2.5Y 4/2) silty clay; faces of peds very dark gray (10YR to 2.5Y 3/1) kneaded color dark grayish brown (2.5Y 4/2); strong very fine and fine angular blocky structure; common fine yellowish brown (10YR 5/6) mottles; firm; distinct thin continuous clay films and some very dark gray (10YR 3/1) coats in fine pores; no silt coats; very few fine roots; very few very fine soft black accumulations of an oxide; slightly acid (pH 6.3); clear smooth boundary.

B22 18002 55 to 73 cm (22 to 29 inches). Olive gray (5Y 5/2) silty clay; faces of peds dark gray (5Y 4/1) strong fine subangular blocky structure; common to many fine yellowish brown (10YR 5/6) mottles; firm; distinct thin continuous clay films and a few coats of very dark gray (10YR 3/1) on vertical faces; very few very thin silt coats on some peds; common medium moderately hard black concretions of an oxide; neutral (pH 6.6) gradual smooth boundary.

B23 18003 73 to 88 cm (29 to 35 inches). Olive gray (5Y 5/2) heavy silty clay loam; moderate fine and medium subangular blocky structure; firm; common medium yellowish brown (10YR 5/6) mottles and a distinct strong brown (7.5YR 5/8) 1-inch wavy Fe band extending into this horizon; thin patchy clay films on some peds and a few clay flows of very dark gray (10YR 3/1) in some pores and a few ped faces; few fine inped tubular pores; very few thin silt coats on some peds; few medium soft strong brown and common medium hard black concretions of an oxide; neutral (pH 6.8); clear wavy boundary.

B24 18004 88 to 100 cm (35 to 39 inches). Same color, texture, and structure as B23 horizon; few fine dark grayish brown to olive brown (2.5Y 4/3) mottles; firm; clay films on peds and in pores same as above but fewer in abundance; common fine inped tubular pores; horizon lacks the oxides as above; neutral (pH 6.8); gradual smooth boundary.

B25 18005 100 to 115 cm (39 to 45 inches). Same color and texture as the B23; weak to moderate medium and coarse subangular blocky structure; distinct oblique pressure faces; few very dark gray clay flows in fine pores; common fine inped tubular pores; common fine soft dark brown and black accumulations of an oxide; weak 1- to 4-inch wavy band of mottles which are strong brown (7.5YR 5/8) in color; neutral (pH 6.8); clear wavy boundary.

B31 18006 115 to 128 cm (45 to 50 inches). Same color as the B23; medium silty clay loam; distinct vertical and oblique pressure faces; common medium strong brown (7.5YR 5/6) mottles associated with above horizon; pores same as B32; few very dark gray clay flows in pores; few to common fine black moderately hard concretions of an oxide; neutral (pH 6.8); diffuse smooth boundary.

B32 18007 128 to 153 cm (50 to 60 inches). Same color as the B23; light silty clay loam; pressure faces less than above; weak medium and coarse subangular blocky structure; vertical distribution of common fine strong brown (7.5YR 5/8) mottles which are associated with distinct hard reddish brown (5YR 4/4) pipestems ¼ inch in diameter; firm; clay flows nearly absent; pores same as B32; diffuse irregular boundary.

B33 18008 153 to 178 cm (60 to 70 inches). Same color as the B23; light silty clay loam; weak coarse prismatic structure parting to weak coarse subangular blocky structure; firm; reddish brown color lacking but vertical orientations of strong brown colors extend to this horizon; pores same as B32; few patchy dark gray clay films on some prism faces; abrupt wavy boundary.

IIA1b 18009 178 to 195 cm (70 to 77 inches). Dark gray (10YR 4/1) medium silty clay loam with noticeable sand; moderate medium angular blocky structure; firm; few fine dark brown (10YR 3/3) mottles; moisture moves along ped faces; few very fine strong brown and black soft accumulations of an oxide; horizon appears to be involuted or disturbed; gradual smooth boundary.

IIA12b 18010 195 to 225 cm (77 to 90 inches). Dark gray (10YR 4/1) heavy silty clay loam with some grit; many medium dark yellowish brown (10YR 3/4) mottles; firm; few fine soft black accumulations of an oxide.

Remarks: This site probed to 19½ feet. At about 108 inches the B2 of the Yarmouth-Sangamon paleosol was encountered. At 19½ feet the B3 was still present. Depth to unweathered Kansan till is not known. Consistence at moist field conditions. See description for Seymour, S62Iowa-93-2, for elevation transect.

1/This pedon lacks a mollic epipedon.
It was sampled as part of a transect study, not as a pedon representative of the series. Selected to be borderline to the Edina series in characteristics.

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SOIL Series not designated (sampled as Seymour) SOIL Nos. 862Iowa-93-4 LOCATION Wayne County, Iowa

SOIL SURVEY LABORATORY, Lincoln, Nebraska LAB. Nos. 18054-18062 February 1967

General Methods: 1A, 1B1b, 2A1, 2B

Depth (In.)	Horizon	Size class and particle diameter (mm) 3A1 — Total: Sand (2-0.05)	Total: Silt (0.05-0.002)	Total: Clay (< 0.002)	Sand: Very coarse (2-1)	Sand: Coarse (1-0.5)	Sand: Medium (0.5-0.25)	Sand: Fine (0.25-0.1)	Sand: Very fine (0.1-0.05)	Silt: (0.05-0.02)	Silt: Int III (0.02-0.002)	Int. II (0.2-0.02)	(2-0.1)			Coarse fragments 2A2: > 2	2-19	19-76
		Pct. of < 2 mm														Pct.	Pct of < 76mm	
0-6	Ap	3.9a	68.5	27.6	0.3	1.0	0.8	0.8	1.0	32.4	36.1	33.8	2.9			-		
6-10	B1	2.0a	58.3	39.7	0.1	0.4	0.4	0.5	0.6	24.6	33.7	25.5	1.4			tr		
10-13	B21	2.4a	54.6	43.0	0.1	0.5	0.4	0.6	0.8	23.0	31.6	24.1	1.6			tr		
13-18	B22	2.1a	52.8	45.1	tr	0.4	0.4	0.6	0.7	21.3	31.5	22.3	1.4			tr		
18-25	B23	2.2a	56.0	41.8	0.1	0.4	0.4	0.6	0.7	23.2	32.8	24.2	1.5			tr		
25-32	B31	1.6a	61.0	37.4	tr	0.2	0.2	0.4	0.8	24.8	36.2	25.8	0.8			tr		
32-39	B32	0.7a	65.0	34.3	tr	0.1	0.1	0.2	0.3	24.7	40.3	25.1	0.4			-		
39-46	C1	1.2a	65.8	33.0	tr	0.2	0.2	0.4	0.4	21.6	44.2	22.2	0.8			-		
46-52	IIAb(?)	8.2	64.8	27.0	0.4	1.2	1.6	2.9	2.1	24.2	40.6	27.8	6.1			tr		

Depth (In.)	6A1a Organic carbon	6B1a Nitrogen	C/N		6E2a Carbonate as $CaCO_3$	6C2a Ext. Iron as Fe	Bulk density: 4A1a Field-State	4A1d 1/3-Bar	4A1b Air-Dry	4D1 COLE	Water content: 4B4 Field-State	4B1c 1/3-Bar	4B2 15-Bar	4C1 1/3-minus 15-Bar		pH		8C1 (1:1)
	b Pct.	Pct			Pct.	Pct.	g/cc	g/cc	g/cc		Pct	Pct	Pct.	in/in				H_2O
0-6	1.77	0.155	11			0.8	1.37	1.35	1.44	0.02	20.9	22.8	10.9	0.16				5.4
6-10	0.65	0.058	11			1.0	1.35	1.33	1.50	0.04	23.5	25.8	16.6	0.12				5.0
10-13	0.57	0.055	10			1.2	1.36	1.33	1.54	0.05	23.7	26.5	18.6	0.10				5.0
13-18	0.46	0.051	9			1.2	1.37	1.32	1.72	0.08	27.6	29.7	20.1	0.13				5.0
18-25	0.28	0.039	7			1.2		1.3c					19.3					5.2
25-32	0.21					1.0	1.44	1.36	1.79	0.09	26.5	28.8	17.8	0.15				5.7
32-39	0.15					0.6		1.4c					16.1					6.0
39-46	0.17					1.1	1.70	1.50	1.78	0.06	16.5	25.0	16.8	0.12				6.1
46-52	0.11					1.0	1.72	1.58	1.76	0.04	14.8	22.5	11.3	0.18				6.4

Depth (In.)	Extractable bases 5B1a: 6N2a Ca	6O2a Mg	6P2a Na	6Q2a K	Sum	6H1a Ext. Acidity	Cat. Exch. Cap.: 5A3a Sum Cations	5A1a NH_4OAc	8D3 Ca/Mg	Base saturation: 5C3 Sum Cations	5C1 NH_4OAc
	meq/100 g									Pct.	Pct.
0-6	12.7	4.3	0.1	0.5	17.6	10.0	27.6	19.0	3.0	64	93
6-10	14.2	8.0	0.2	0.6	23.0	13.3	36.3	24.8	1.8	63	93
10-13	15.7	9.8	0.4	0.7	26.6	14.3	40.9	29.3	1.6	65	91
13-18	16.6	10.8	0.7	0.8	28.9	14.6	43.5	30.6	1.5	66	94
18-25	17.3	10.8	1.0	0.8	29.9	10.6	40.5	30.2	1.6	74	99
25-32	16.7	10.1	1.1	0.6	28.5	7.8	36.3	28.1	1.7	79	101
32-39	15.5	9.2	1.0	0.6	26.3	5.5	31.8	25.3	1.7	83	104
39-46	15.7	9.0	1.0	0.6	26.3	6.0	32.3	24.9	1.7	81	106
46-52	10.5	5.7	0.7	0.3	17.2	5.7	22.9	16.8	1.8	75	102

Depth (In.)	Ratios to Clay 8D1: NH_4OAc CEC	Ext. Iron	15-Bar Water
0-6	0.69	0.03	0.38
6-10	0.62	0.025	0.42
10-13	0.68	0.028	0.43
13-18	0.68	0.027	0.45
18-25	0.72	0.029	0.46
25-32	0.75	0.027	0.48
32-39	0.74	0.02	0.47
39-46	0.75	0.03	0.51
46-52	0.62	0.04	0.42

a. Fe-Mn nodules: > 50 percent (2-0.1 mm); 25-50 percent (0.1-0.05 mm).
b. 8.2 kg/m² to 52 inches (Method 6A).
c. Estimated.

Pedon classification: Udollic Ochraqualf; fine, montmorillonitic, mesic.
Series classification: Aquic Argiudoll; fine, montmorillonitic, mesic.
Soil: Series not designated (sampled as Seymour)1/ .
Soil no.: S62-Iowa-93-4 (LSL Nos. 18054 - 18062)
Location: Wayne County, Iowa; 272 feet west and 449 feet south of center of road in northeast corner of the SW ¼ Sec. 3, T. 68 N., R. 20 W, about 2 miles south of Promise City.
Vegetation and land use: Oats stubble; cropland.
Parent material: Wisconsin loess.
Physiography: Unstable crest of a narrow interfluve extending to the north.
Elevation: 3.43 feet below S62-Iowa-93-6.
Slope: About 3 percent.
Drainage: Somewhat poorly drained.
Ground water: None noted.
Moisture: Slightly moist.
Permeability: Moderately slow.
Described by: A. R. Hidlebaugh and R. I. Dideriksen; October 17, 1962.

(Colors are for moist soil unless otherwist stated)

Ap 18054 0 to 15 cm (0 to 6 inches). Very dark gray (10YR 3/1) light silty clay loam; gray (10YR 5.4/1) when dry; kneaded color is very dark grayish brown (10YR 3/2); few peds of dark grayish brown (10YR 4/2) mixed in horizon; weak medium subangular blocky and some fine granular structure; friable; very few very fine soft strong brown and black accumulations of an oxide; abundant fine roots; abrupt smooth boundary.

B1 18055 15 to 25 cm (6 to 10 inches). Brown (10YR 4/3) heavy silty clay loam, pale brown (10YR 6/3) when dry; common fine yellowish brown (10YR 5/4) mottles; moderate very fine subangular blocky structure; friable; some very dark gray fills from Ap horizon; very few very fine soft strong brown and few black accumulations of an oxide; abundant fine roots; clear smooth boundary.

B21 18056 25 to 33 cm (10 to 13 inches). Dark grayish brown (10YR 4/2) light silty clay; faces of some peds grayish brown (10YR 5/2); strong very fine subangular blocky structure; common fine yellowish brown (10YR 5/4) mottles on faces of peds and many fine strong brown (7.5YR 5/6) mottles in peds; firm; very thin discontinuous clay films; thin silt coats on many peds; common very fine hard black concretions of an oxide; common fine roots; clear smooth boundary.

B22 18057 33 to 45 cm (13 to 18 inches). Grayish brown (2.5Y 5/2) silty clay; many fine strong brown (7.5YR 5/6) mottles; strong very fine angular and subangular blocky structure; firm; thin discontinuous clay films of dark grayish brown (10YR 4/2) color; common fine soft black accumulations of an oxide; few fine roots; clear smooth boundary.

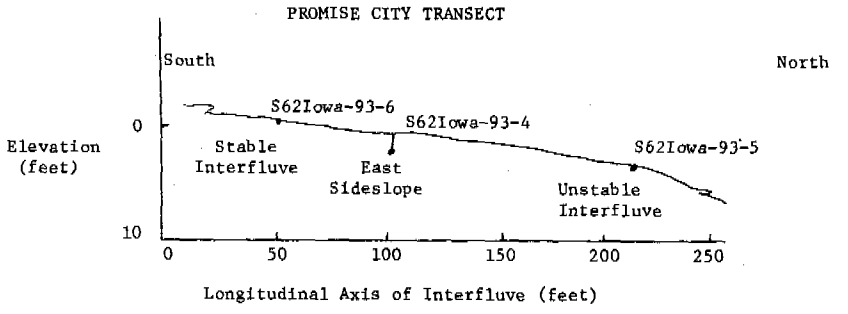
B23 18058 45 to 63 cm (18 to 25 inches). Grayish brown (2.5Y 5/2) light silty clay; faces of peds olive gray (5Y 5/2) weak medium prismatic structure parting to moderate fine angular blocky; many coarse strong brown (7.5YR 5/6) mottles; firm; thin discontinuous clay films on peds; some silt coats on many peds; few dark gray clay films on faces; very few fine soft black accumulations of an oxide; few fine inped tubular pores; very few very fine roots; clear wavy boundary.

B31 18059 63 to 80 cm (25 to 32 inches). Mixed grayish brown (2.5Y 5/2) and strong brown (7.5YR 5/6) heavy silty clay loam; weak medium prismatic structure parting to moderate medium subangular blocky; firm; few thin discontinuous clay films with some orientation on prism faces; thin silt grains on most peds; common fine soft black accumulations of an oxide; common fine inped tubular pores; gradual wavy boundary.

B32 18060 80 to 100 cm (32 to 39 inches). Gray (5Y 5/1) medium silty clay loam; faces of peds olive gray (5Y 5/2) weak medium to coarse prismatic structure parting to moderate medium subangular blocky; common medium strong brown (7.5YR 5/6) mottles; firm; few dark gray clay coats in pores and on some prism faces; thin silt coats on most peds; common fine inped tubular pores; very few very fine soft black accumulations of an oxide; diffuse smooth boundary.

C1 18061 100 to 118 cm (39 to 46 inches). Olive gray (5Y 5/2) light silty clay loam; weak coarse prismatic structure parting to weak coarse subangular blocky structure; common fine strong brown (7.5YR 5/6) and reddish brown (5YR 4/4) mottles; firm; very few dark gray clay films on prism faces and as coats in pores; very thin silt coats on some peds; common fine inped tubular pores; abrupt irregular boundary.

IIAb? 18062 118 to 133 cm (46 to 52 inches). Mixed dark gray (10YR 4/1) and dark yellowish brown (10YR 3/4) gritty silty clay loam; paleosol; clear quartz grains present.



1/This pedon lacks a mollic epipedon. As described, the solum is thinner than typical for the series and the clay maximum is a few percent less than the ranges allow. This pedon was sampled as part of a transect study, not as one representative of the series.
Remarks: Consistence at moist field conditions.

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SOIL: Series not designated (sampled as Seymour) SOIL Nos. S62Iowa-93-5 LOCATION Wayne County, Iowa

SOIL SURVEY LABORATORY, Lincoln, Nebraska LAB. Nos 18045-18053 February 1967

General Methods: 1A, 1B1b, 2A1, 2B

Depth (In.)	Horizon	Size class and particle diameter (mm) 3A1 — Total: Sand (2-0.05)	Total: Silt (0.05-0.002)	Total: Clay (< 0.002)	Sand: Very coarse (2-1)	Sand: Coarse (1-0.5)	Sand: Medium (0.5-0.25)	Sand: Fine (0.25-0.1)	Sand: Very fine (0.1-0.05)	Silt: 0.05-0.02	Silt: Int III (0.02-0.002)	Silt: Int II (0.2-0.02)	(2-0.1)			Coarse fragments 2A2: > 2	2-19	19-76
		Pct of < 2 mm														Pct.	Pct. of < 76mm	
0-6	Ap	3.6a	63.4	33.0	0.1	0.7	0.8	1.0	1.0	30.3	33.1	31.8	2.6			tr		
6-9	B21	2.8a	53.2	44.0	0.3	0.7	0.4	0.7	0.7	25.2	28.0	26.3	2.1			-		
9-14	B22	1.5a	50.4	48.1	tr	0.3	0.3	0.5	0.4	20.7	29.7	21.4	1.1			-		
14-19	B23	1.4a	53.2	45.4	0.1	0.3	0.2	0.4	0.4	22.5	30.7	23.1	1.0			tr		
19-25	B31	1.8a	58.2	40.0	0.1	0.3	0.3	0.5	0.6	27.5	30.7	28.4	1.2			-		
25-31	B32	1.0a	62.9	36.1	0.1	0.2	0.1	0.2	0.4	27.1	35.8	27.6	0.6			-		
31-36	B33	0.6a	63.9	35.5	tr	0.1	0.1	0.1	0.3	22.7	41.2	23.1	0.3			-		
36-46	B34	2.2a	64.5	33.3	tr	0.3	0.4	0.7	0.8	20.2	44.3	21.4	1.4			-		
46-52	IIAb(?)	7.9	63.1	29.0	0.3	1.0	1.6	2.8	2.2	24.3	38.8	28.0	5.7			-		

Depth (In.)	6A1a Organic carbon b Pct	6B1a Nitrogen Pct.	C/N		6E2a Carbonate as $CaCO_3$ Pct	6C2a Ext. Iron as Fe Pct.	Bulk density: 4A1a Field-State g/cc	4A1d 1/3-Bar g/cc	4A1b Air-Dry g/cc	4D1 COLE	Water content: 4B4 Field-State Pct	4B1c 1/3-Bar Pct	4B2 15-Bar Pct.	4C1 1/3-minus 15-Bar in/in.		pH		8C1a (1:1) H_2O
0-6	1.68	0.151	11			1.2	1.36	1.35	1.51	0.04	24.4	24.6	14.0	0.14				5.6
6-9	0.82	0.080	10			1.4		1.3c					18.9					5.3
9-14	0.70	0.067	10			1.4	1.32	1.29	1.76	0.10	31.8	32.2	20.9	0.14				5.3
14-19	0.44	0.050	9			1.1		1.4c					19.6					5.5
19-25	0.28	0.036	8			0.9	1.52	1.41	1.83	0.08	23.1	28.2	18.6	0.14				5.8
25-31	0.19				-(s)	0.8		1.4c					16.9					6.2
31-36	0.15				-(s)	0.9	1.60	1.43	1.75	0.06	19.8	28.4	16.7	0.17				6.4
36-46	0.13				-(s)	1.0		1.5c					15.8					6.4
46-52	0.11					0.8	1.66	1.54	1.74	0.04	18.0	24.7	12.7	0.18				6.5

Depth (In.)	Extractable bases: 6N2a Ca	6Q2a Mg	6P2a Na	6Q2a K	Sum	6H1a Ext. Acidity	Cat. Exch. Cap.: 5A3a Sum Cations	5A1a NH_4OAc						8D3 Ca/Mg		Base saturation: 5C3 Sum Cations	5C1 NH_4OAc
	meq/100 g															Pct	Pct
0-6	16.4	5.8	0.1	0.5	22.8	10.4	33.2	24.6						2.8		69	93
6-9	18.3	9.6	0.2	0.8	28.9	12.7	41.6	31.6						1.9		69	91
9-14	19.9	10.8	0.4	0.9	32.0	11.5	43.5	33.2						1.8		74	96
14-19	19.5	11.0	0.5	0.8	31.8	9.3	41.1	31.8						1.8		77	100
19-25	18.4	10.3	0.7	0.6	30.0	7.2	37.2	27.8						1.8		81	108
25-31	17.0	9.5	0.8	0.6	27.9	4.6	32.5	24.3						1.8		86	115
31-36	16.7	9.3	0.9	0.6	27.5	4.5	32.0	24.3						1.8		86	113
36-46	15.6	8.2	0.8	0.6	25.2	4.8	30.0	22.6						1.9		84	112
46-52	11.2	6.2	0.6	0.4	18.4	3.8	22.2	17.4						1.8		83	106

Depth (In.)	Ratios to Clay 8D1: NH_4OAc CEC	Ext. Iron	15-Bar Water
0-6	0.75	0.036	0.42
6-9	0.72	0.032	0.43
9-14	0.69	0.029	0.43
14-19	0.70	0.024	0.43
19-25	0.70	0.02	0.47
25-31	0.67	0.02	0.47
31-36	0.68	0.03	0.47
36-46	0.68	0.03	0.47
46-52	0.60	0.03	0.44

a. Fe-Mn nodules: > 50 percent (2-0.1 mm); 25-50 percent (0.1-0.05 mm).
b. 8.2 kg/m^2 to 52 inches (Method 6A).
c. Estimated.

Pedon classification: Udollic Ochraqualf; fine, montmorillonitic, mesic.
Series classification: Aquic Argiudoll; fine, montmorillonitic, mesic.
Soil: Series not designated (sampled as Seymour)1/.
Soil no.: S62-Iowa-93-5 (LSL Nos. 18045 - 18053).
Location: Wayne County, Iowa; 342 feet west and 342 feet south of center of road in northeast corner of SW ¼ Sec. 3, T. 68 N., R. 20 W., about 2 miles south of Promise City.
Vegetation and land use: Oats stubble; cropland.
Parent material: Wisconsin loess.
Physiography: Lower portion of an unstable sideslope position with slope convex toward the east.
Elevation: 3.30 feet below S62-Iowa-93-6.
Slope: About 5 percent.
Drainage: Somewhat poorly drained.
Ground water: None noted.
Moisture: Slightly moist.
Permeability: Moderately slow.
Described by: A. R. Hidlebaugh and R. I. Dideriksen; October 17, 1962.

(Colors are for moist soil unless otherwise stated)

Ap 18045 0 to 15 cm (0 to 6 inches). Very dark gray (10YR 3/1) light silty clay loam, gray (10YR 5/1) when dry; weak fine subangular blocky and fine granular structure; friable; few dark grayish brown (10YR 4/2) peds or wormcasts; very few fine soft dark brown concretions of an oxide; abundant fine roots; abrupt smooth boundary.

B21 18046 15 to 23 cm (6 to 9 inches). Very dark grayish brown (10YR to 2.5Y 3/2) light silty clay, grayish brown (10YR 5/2) to light brownish gray (10YR 6/2) when dry; few fine olive brown (2.5Y 4/4) mottles on faces of peds and common fine yellowish brown (10YR 5/6) mottles in ped; firm; moderate to strong very fine subangular blocky structure; few thin discontinuous clay films; few thin silt coats on some peds; some tonguing of very dark gray (10YR 3/1) silty clay loam from above horizon; few fine soft dark brown and black accumulations of an oxide; common fine roots; clear smooth boundary.

B22 18047 23 to 35 cm (9 to 14 inches). Dark grayish brown (2.5Y 4/2) silty clay; common fine yellowish brown (10YR 5/4) mottles on faces of peds to medium mottles of same color in peds; firm; strong very fine angular and subangular blocky structure; thin continuous clay films; very dark gray silty clay loam fills from above continue in this horizon; common fine inped tubular pores; common fine roots; clear smooth boundary.

B23 18048 35 to 48 cm (14 to 19 inches). Dark grayish brown (2.5Y 4/2) silty clay; common fine yellowish brown (10YR 5/6) mottles on faces of peds and many fine and medium yellowish brown to strong brown (10YR to 7.5YR 5/6) mottles in peds; structure same as B22; firm; few thin discontinuous clay films; few thin silt coats on some peds; common fine inped tubular pores; few fine roots; oxides like B22 horizon; clear smooth boundary.

B31 18049 48 to 63 cm (19 to 25 inches). Olive gray (5Y 5/2) heavy silty clay loam; many medium yellowish brown (10YR 5/4 to 5/6) mottles; weak medium prismatic structure parting to moderate fine and medium subangular blocky; firm; few thin discontinuous clay films on prism faces and few very dark gray clay coats in fine pores; distinct oblique pressure faces; few fine black hard concretions of an oxide; thin silt coats on peds; common fine inped tubular pores; clear smooth boundary.

B32 18050 63 to 78 cm (25 to 31 inches). Same color and texture as above; weak medium prismatic structure parting to moderate medium subangular blocky; common fine yellowish brown (10YR 5/4) mottles on faces of peds grading to strong brown (7.5YR 5/6) in peds; firm; gray (5Y 5/1) on ped exteriors are thin silt coats; few very dark gray clay coats in pores and a few ½-inch clay ball accumulations, no clay films on peds; distinct oblique pressure faces; common fine inped tubular pores; gradual smooth boundary.

B33 18051 78 to 90 cm (31 to 36 inches). Same color as B31 horizon; medium silty clay loam; few to common fine yellowish brown mottles; moderate medium prismatic structure parting to moderate fine blocky; firm; very few dark gray clay coats in pores and on a few prism faces; thin silt coats on peds; common fine inped tubular pores; gradual wavy boundary.

B34 18052 90 to 118 cm (36 to 46 inches). Same color as B31 horizon; medium silty clay loam; many medium yellowish brown (10YR 5/6) to strong brown (7.5YR 5/6) mottled; weak coarse to medium prismatic structure parting to moderate medium angular blocky; firm; very few very dark gray clay coats in pores or on a few prism faces; thin silt coats on peds; common fine inped tubular pores, abundant fine soft strong brown and black accumulations of an oxide; common fine inped tubular pores; abrupt wavy boundary.

IIAb? 18053 118 to 133 cm (46 to 52 inches). Dark gray (5Y 4/1) silty clay loam with noticeable sand; abundant medium dark yellowish brown (10YR 4/4) and yellowish brown (10YR 5/4) mottles; paleosol; clean quartz grains noted; few very dark gray clay coats extending into paleosol.

Remarks: Consistence at moist field conditions. See description for Seymour, S62-Iowa-93-4, for elevation transect.

1/This pedon lacks a mollic epipedon. It was sampled as part of a transect study and not as a representative pedon for the series.

U S DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SOIL Seymour silt loam SOIL Nos. S62Iowa-93-2 LOCATION Wayne County, Iowa

SOIL SURVEY LABORATORY Lincoln, Nebraska LAB. Nos. 18011-18020 February 1967

General Methods: 1A, 1B1b, 2A1, 2B

Depth (In)	Horizon	Size class and particle diameter (mm) 3A1 — Total: Sand (2-0.05)	Total: Silt (0.05-0.002)	Total: Clay (< 0.002)	Sand: Very coarse (2-1)	Sand: Coarse (1-0.5)	Sand: Medium (0.5-0.25)	Sand: Fine (0.25-0.1)	Sand: Very fine (0.1-0.05)	Silt: (0.05-0.002)	Silt: Int III (0.02-0.002)	Silt: Int II (0.2-0.02)	(2-0.1)			Coarse fragments 2A2: > 2	2-19	19-76
		Pct of < 2 mm														Pct	Pct of < 76mm	
0-6	A1p	3.2a	66.3	30.5	0.2	0.6	0.7	0.7	1.0	31.0	35.3	32.3	2.2			-		
6-11	A3	3.2a	62.0	34.8	0.4	0.8	0.6	0.6	0.8	27.5	34.5	28.6	2.4			-		
11-16	B1	2.1a	53.0	44.9	0.1	0.3	0.3	0.5	0.9	21.4	31.6	22.6	1.2			-		
16-19	B21	1.6a	46.7	51.7	tr	0.2	0.2	0.5	0.7	18.5	28.2	19.5	0.9			-		
19-23	B22	2.0a	50.0	48.0	0.1	0.3	0.3	0.7	0.6	19.6	30.4	20.6	1.4			-		
23-28	B23	1.0a	54.8	44.2	-	0.1	0.1	0.3	0.5	21.5	33.3	22.2	0.5			-		
28-32	B31	1.4a	57.7	40.9	-	0.1	0.1	0.5	0.7	22.7	35.0	23.7	0.7			-		
32-43	B32	0.7b	62.8	36.5	-	tr	tr	0.2	0.5	26.8	36.0	27.4	0.2			-		
43-51	C1	0.6b	64.3	35.1	tr	tr	tr	0.1	0.5	25.0	39.3	25.6	0.1			-		
51-60	IIAb(?)	3.2	56.4	40.4	0.1	0.2	0.5	1.1	1.3	21.0	35.4	22.9	1.9			-		

Depth (In)	6A1a Organic carbon	6B1a Nitrogen	C/N		Carbonate as $CaCO_3$	6C2a Ext. Iron as Fe	Bulk density: 4A1a Field-State	4A1d 1/3-Bar	4A1b Air-Dry	4D1 COLE	Water content: 4B4 Field-State	4B1c 1/3-Bar	4B2 15-Bar	4C1 1/3-minus 15-Bar		pH	8C1a (1:1) H_2O
	c Pct	Pct			Pct	Pct.	g/cc	g/cc	g/cc		Pct	Pct	Pct	in./in.			
0-6	2.12	0.187	11			1.2	1.33	1.36	1.46	0.02	28.7	26.4	13.2	0.18			5.3
6-11	1.29	0.118	11			1.4	1.35	1.35	1.48	0.03	27.7	26.2	14.6	0.16			5.2
11-16	0.91	0.087	10			1.6	1.28	1.28	1.50	0.05	31.6	28.4	20.5	0.10			5.3
16-19	0.76	0.075	10			1.6		1.3d					22.2				5.4
19-23	0.66	0.061	11			1.6	1.28	1.24	1.80	0.12	34.8	33.4	21.6	0.15			5.4
23-28	0.32	0.042	8			0.8	1.36	1.32	1.84	0.10	31.9	31.5	19.9	0.15			5.7
28-32	0.24					2.0		1.4d					19.7				6.1
32-43	0.16					0.7	1.54	1.42	1.80	0.08	24.8	28.1	17.4	0.15			6.3
43-51	0.11					0.6	1.58	1.44	1.76	0.06	23.1	27.9	16.8	0.16			6.4
51-60	0.15					0.5	1.54	1.40	1.81	0.08	24.1	28.1	17.4	0.15			6.3

Depth (In)	Extractable bases 6N2a Ca	6O2a Mg	6P2a Na	6Q2a K	5B1a Sum	6H1a Ext. Acidity	Cat. Exch. Cap: 5A3a Sum Cations	5A1a NH_4OAc		Resistivity e	8B1a Elec. Cond.	6F1a Sol. Na	5I2 Exch. Na	8B Water at Sat.	8D3 Ca/Mg		Base saturation: 5C3 Sum Cations	5C1 NH_4OAc
	meq/100 g									ohms	mmhos.	me./l.	Pct.	Pct.			Pct	Pct
0-6	12.6	4.2	0.9	0.5	18.2	14.8	33.0	22.9							3.0		55	79
6-11	11.9	5.8	0.2	0.5	18.4	14.0	32.4	22.9							2.1		57	80
11-16	16.2	8.6	0.6	0.8	26.2	13.6	39.8	29.4							1.9		66	89
16-19	19.7	10.7	0.9	1.1	32.4	12.0	44.4	33.6							1.8		73	96
19-23	19.8	10.7	1.0	0.8	32.3	11.3	43.6	31.9							1.9		74	101
23-28	19.1	10.5	1.1	0.7	31.4	8.2	39.6	28.9							1.8		79	109
28-32	19.0	10.2	1.2	0.6	31.0	6.4	37.4	28.7							1.9		83	108
32-43	17.9	9.3	1.1	0.6	28.9	4.1	33.0	26.7		1700	0.47	2.7	3.6	55.2	1.9		88	108
43-51	17.3	8.9	1.1	0.6	27.9	4.2	32.1	25.6							1.9		87	109
51-60	17.2	8.8	1.0	0.5	27.5	5.1	32.6	25.9							2.0		84	106

Depth (In.)	Ratios to Clay 8D1: NH_4OAc CEC	Ext. Iron	15-Bar Water		
0-6	0.75	0.039	0.43		
6-11	0.66	0.040	0.42		
11-16	0.65	0.036	0.46		
16-19	0.65	0.031	0.43		
19-23	0.66	0.033	0.45		
23-28	0.65	0.02	0.45		
28-32	0.70	0.05	0.48		
32-43	0.73	0.02	0.48		
43-51	0.73	0.02	0.48		
51-60	0.64	0.01	0.43		

a. Fe-Mn nodules: > 50 percent (2-0.1 mm); 25-50 percent (0.1-0.05 mm).
b. Fe-Mn nodules: > 50 percent (2-0.1 mm); 5-25 percent (0.1-0.05 mm).
c. 12 kg/m² to 60 inches (Method 6A).
d. Estimated.
e. Saturated paste.

Pedon classification: Aquic Argiudoll; fine, montmorillonitic, mesic.
Series classification: (Same as pedon).
Soil: Seymour silt loam.
Soil no.: S62-Iowa-93-2 (LSL Nos. 18011 - 18020).
Location: Wayne County, Iowa; 288 feet south and 223 feet west of the northeast corner of the SW ¼ Sec. 9, T. 68 N., R. 22 W., about 1 mile southwest of Allerton.
Vegetation and land use: Clover; cropland.
Parent material: Wisconsin loess.
Physiography: Lower portion of an unstable sideslope position with slope convex toward the west.
Elevation: 1.8 feet below S62-Iowa-93-1.
Slope: About 5 percent.
Drainage: Somewhat poorly drained.
Ground water: Seepage at 51 inches.
Moisture: Very moist; rained 3 inches a few days before sampling.
Permeability: Moderately slow.
Described by: A. R. Hidlebaugh and R. E. Hideriksen; October 16, 1962.

(Colors are for moist soil unless otherwise stated)

Alp 18011 0 to 15 cm (0 to 6 inches). Very dark gray (10YR 3/1) heavy silt loam, gray (10YR 5/1) when dry; weak medium subangular blocky and moderate fine granular structure; friable; abundant fine roots; very few very fine soft dark brown and black accumulations of an oxide; strongly acid (pH 5.5); abrupt smooth boundary.

A3 18012 15 to 28 cm (6 to 11 inches). Very dark gray (10YR 3/1) light to medium silty clay loam; some dark grayish brown (10YR 4/2) peds increasing in number with depth; gray (10YR 5/1 to 6/1) when dry; moderate very fine subangular blocky with some granular structure; friable; few thin silt coats on peds; abundant fine roots; very few fine soft dark brown and black accumulations of an oxide; strongly acid (pH 5.4); clear smooth boundary.

B1 18013 28 to 40 cm (11 to 16 inches). Dark grayish brown (2.5Y 4/2) light silty clay, faces of peds dark gray (10Y 4/1) gray to light gray (10YR 6/1) when dry; common fine yellowish brown (10YR 5/6 to 5/8) mottles; kneaded color is dark grayish brown (2.5Y 4/2); strong very fine subangular blocky structure; firm; some silt coats on peds; few thin discontinuous clay films at 14 inches and below; very few medium black hard concretions of an oxide; some evidence of 3/1 silty clay loam fills in cracks and crevices; medium acid (pH 5.6); clear smooth boundary.

B21 18014 40 to 48 cm (16 to 19 inches). Same color as above; silty clay; strong fine and very fine subangular blocky structure; common fine yellowish brown (10YR 5/6 to 5/8) mottles with many in interior of peds; firm; thin dontinuous clay films on peds, some very dark gray silty clay loam fills from above; few fine roots; medium acid (pH 5.8); clear smooth boundary.

B22 18015 48 to 58 cm (19 to 23 inches). Same as above horizon except a decrease in dark gray (10YR 4/1) colors; medium acid (pH 5.8); clear smooth boundary.

B23 18016 58 to 70 cm (23 to 28 inches). Olive gray (5Y 5/2) light silty clay; few fine grayish brown to light olive brown (2.5Y 5/3) and many fine strong brown (7.5YR 5/6) mottles in peds; moderate medium and fine subangular blocky structure; firm; very few thin patchy clay films and some clay flows in fine pores; some very dark gray silty clay loam fills from above horizons; some very thin silt coats on peds; few fine inped tubular pores; few to common fine black hard concretions of an oxide; neutral (pH 6.6); clear smooth boundary.

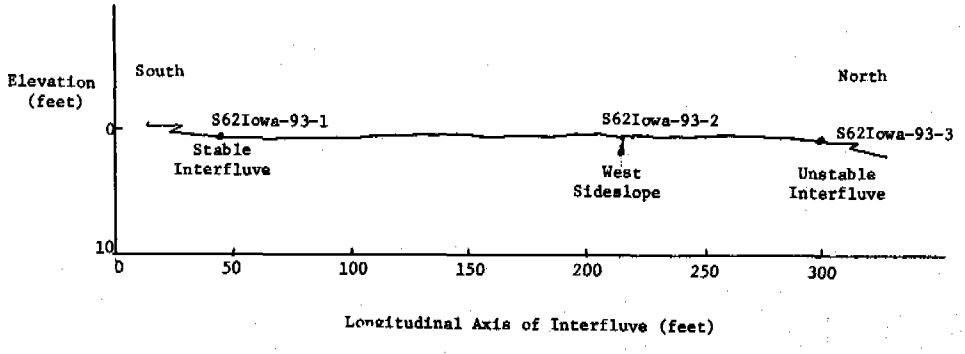
B31 18017 70 to 80 cm (28 to 32 inches). Strong brown (7.5YR 5/6) with few peds of olive gray (5Y 5/2); medium to heavy silty clay loam; moderate medium subangular blocky structure; firm; zone of iron accumulation--more diffuse pattern to the left of sampling hole; oblique pressure faces; moisture present on peds; few dark gray coats in root channels; abundant fine black hard concretions of an oxide; neutral (pH 6.6); clear wavy boundary.

B32 18018 80 to 110 cm (32 to 43 inches). Gray (5Y 5/1) and olive gray (5Y 5/2) medium silty clay loam; common fine strong brown (7.5YR 5/6) mottles with some vertical distribution; weak coarse subangular blocky structure; firm; some dark gray coats in pores and ½-inch clay balls which are very dark gray in color; distinct silt coats on peds; common fine inped tubular pores; distinct oblique pressure faces; neutral (pH 6.7); clear wavy boundary.

B33 18019 110 to 130 cm (43 to 51 inches). Same color as above; medium silty clay loam; weak coarse subangular blocky structure; weak horizontal band of common fine strong brown (7.5YR 5/6) mottles; firm; few dark gray discontinuous clay films on some peds; common fine inped tubular pores; exterior color is grainy coat of gray (5Y 5/1) and interior of ped is olive gray (5Y 5/2) in color; some oblique pressure faces; neutral (pH 6.7); abrupt wavy boundary.

IIAb? 18020 130 to 153 cm (51 to 60 inches). Dark gray (10YR 4/1) heavy silty clay loam with noticeable sand; involuted Ab with tonguing of olive gray (5Y 5/2) loess into the paleosol; common medium dark yellowish brown (10YR 3/4) mottles; mottling increases at 60 to 64 inches; neutral (pH 6.7).

ALLERTON TRANSECT



U S DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SOIL Seymour silt loam SOIL Nos. S62Iowa-93-3 LOCATION Wayne County, Iowa

SOIL SURVEY LABORATORY Lincoln, Nebraska LAB. Nos. 18021-18033 February 1967

General Methods: 1A, 1B1b, 2A1, 2B

Depth (In.)	Horizon	Size class and particle diameter (mm) 3A1 — Total: Sand (2–0.05)	Total: Silt (0.05–0.002)	Total: Clay (< 0.002)	Sand: Very coarse (2–1)	Sand: Coarse (1–0.5)	Sand: Medium (0.5–0.25)	Sand: Fine (0.25–0.1)	Sand: Very fine (0.1–0.05)	Silt: 0.05–0.02	Silt: Int. III (0.02–0.002)	Int II (0.2–0.02)	(2–0.1)			Coarse fragments 2A2: > 2	2–19	19–76
		Pct of < 2 mm														Pct	Pct of < 76mm	
0-5	A1p	3.7a	68.2	28.1	0.4	0.9	0.7	0.7	1.0	31.0	37.2	32.3	2.7			-		
5-9	A12	3.1a	65.1	31.8	0.3	0.9	0.6	0.6	0.7	27.7	37.4	28.7	2.4			-		
9-13	A3	3.1a	62.1	34.8	0.6	0.8	0.5	0.6	0.6	25.5	36.6	26.4	2.5			-		
13-17	B1	2.1a	53.3	44.6	0.1	0.5	0.4	0.5	0.6	21.5	31.8	22.4	1.5			-		
17-21	B21	1.0a	49.7	49.3	tr	0.1	0.1	0.2	0.6	18.9	30.8	19.6	0.4			-		
21-28	B22	1.5a	54.5	44.0	tr	0.2	0.2	0.4	0.7	21.1	33.4	22.0	0.8			-		
28-34	B23	1.2a	60.3	38.5	-	0.2	0.2	0.3	0.5	24.0	36.3	24.7	0.7			-		
34-39	B31	1.0a	62.4	36.6	tr	0.2	0.1	0.3	0.4	24.2	38.2	24.8	0.6			-		
39-44	B32	1.1b	62.4	36.5	tr	0.1	0.1	0.3	0.6	23.8	38.6	24.6	0.5			-		
44-50	C1	1.0b	64.4	34.6	-	0.1	0.1	0.3	0.5	25.9	38.5	26.6	0.5			-		
50-57	C2	0.5b	66.7	32.8	tr	tr	tr	0.1	0.4	26.7	40.0	27.2	0.1			-		
57-65	C3	0.5b	67.5	32.0	-	tr	tr	0.1	0.4	25.9	41.6	26.4	0.1			-		
65-70	IIAb(?)	4.0	57.7	38.3	0.1	0.4	0.7	1.4	1.4	22.6	35.1	24.8	2.6			tr		

Depth (In.)	6A1a Organic carbon	6B1a Nitrogen	C/N		6E2a Carbonate as $CaCO_3$	6C2a Ext. Iron as Fe	Bulk density: 4A1a Field-State	4A1d 1/3-Bar	4A1b Air-Dry	4D1 COLE	Water content: 4B4 Field-State	4B1c 1/3-Bar	4B2 15-Bar	4C1 1/3-minus 15-Bar		pH		8C1a (1:1) H_2O
	C Pct	Pct			Pct	Pct.	g/cc	g/cc	g/cc		Pct	Pct	Pct	in./in.				
0-5	2.53	0.215	12			1.2	1.34	1.33	1.44	0.03	27.9	26.7	12.5	0.19				5.4
5-9	1.63	0.150	11			1.4	1.32	1.32	1.42	0.02	28.8	27.3	13.5	0.18				5.1
9-13	1.10	0.109	10			1.4	1.30	1.30	1.40	0.02	27.8	26.4	14.9	0.15				5.2
13-17	0.87	0.079	11			1.5		1.3 d					18.8					5.3
17-21	0.61	0.061	10			1.1	1.34	1.28	1.78	0.10	30.8	31.3	21.4	0.13				5.3
21-28	0.44	0.043	10			1.1		1.3 d					17.9					5.7
28-34	0.23					1.0	1.50	1.40	1.85	0.09	25.3	28.8	18.3	0.15				6.1
34-39	0.17					0.6		1.4 d					17.7					6.4
39-44	0.15					1.2	1.50	1.38	1.74	0.08	24.9	29.5	18.7	0.15				6.5
44-50	0.13					0.9		1.4 d					17.5					6.4
50-57	0.11				-(s)	0.4	1.47	1.38	1.65	0.06	26.1	29.4	15.7	0.19				6.5
57-65	0.15					0.3		1.4 d					15.3					6.3
65-70	0.11					0.6							16.2					6.0

Depth (In.)	Extractable bases 5B1a: 6N2a Ca	6O2a Mg	6P2a Na	6Q2a K	Sum	6H1a Ext. Acidity	Cat. Exch. Cap.: 5A3a Sum Cations	5A1a NH_4OAc		Resistivity e ohms	8B1a Elec. Cond. mmhos	6P1a Sol. Na me./l	5D2 Exch. Na Pct.	8B Water at Sat. Pct.	8D3 Ca/Mg		Base saturation: 5C3 Sum Cations Pct	5C1 NH_4OAc Pct.
	meq/100 g																	
0-5	11.9	3.7	0.1	0.4	16.1	14.7	30.8	22.2							3.2		52	73
5-9	11.4	4.6	0.2	0.4	16.6	14.2	30.8	21.9							2.5		54	76
9-13	12.2	6.1	0.3	0.5	19.1	13.2	32.3	23.7							2.0		59	80
13-17	16.5	9.1	0.6	0.7	26.9	13.0	39.9	29.7							1.8		67	91
17-21	19.6	11.0	1.0	0.8	32.4	11.3	43.7	32.9							1.8		74	98
21-28	18.9	10.5	1.1	0.8	31.3	8.4	39.7	29.9							1.8		79	105
28-34	17.8	9.9	1.2	0.7	29.6	7.4	37.0	27.7							1.8		80	107
34-39	17.0	9.6	1.3	0.6	28.5	5.4	33.9	26.5							1.8		84	108
39-44	17.8	9.4	1.3	0.6	29.1	5.4	34.5	27.3		1600	0.50	3.4	4.1	55.0	1.9		84	107
44-50	16.9	9.1	1.3	0.6	27.9	5.3	33.2	25.7							1.9		84	109
50-57	15.9	8.6	1.2	0.5	26.2	3.9	30.1	23.8							1.8		87	110
57-65	15.3	8.1	1.1	0.5	25.0	4.1	29.1	23.8							1.9		86	105
65-70	14.5	7.7	1.1	0.4	23.7	6.1	29.8	23.9							1.9		80	99

Depth (In.)	Ratios to Clay 8D1: NH_4OAc CEC	Ext. Iron	15-Bar Water		
0-5	0.79	0.043	0.44		
5-9	0.69	0.044	0.42		
9-13	0.68	0.040	0.43		
13-17	0.67	0.034	0.42		
17-21	0.67	0.022	0.43		
21-28	0.68	0.025	0.41		
28-34	0.72	0.026	0.48		
34-39	0.72	0.02	0.48		
39-44	0.75	0.03	0.51		
44-50	0.74	0.03	0.50		
50-57	0.73	0.01	0.48		
57-65	0.74	0.01	0.48		
65-70	0.62	0.02	0.42		

a. Fe-Mn nodules: > 50 percent (2-0.1 mm); 25-50 percent (0.1-0.05 mm).
b. Fe-Mn nodules: > 50 percent (2-0.1 mm); 5-25 percent (0.1-0.05 mm).
c. 13 kg/m^2 to 60 inches (Method 6A).
d. Estimated.
e. Saturated paste.

Pedon classification: Aquic Argiudoll; fine, montmorillonitic, mesic.
Series classification: (Same as pedon).
Soil: Seymour silt loam.
Soil no.: S62-Iowa-93-3 (LSL Nos. 18021 - 18033).
Location: Wayne County, Iowa; 222 feet south and 177 feet west of the northeast corner of the SE¼ Sec. 9, T. 68 N., R. 22 W., about 1 mile southwest of Allerton.
Vegetation and land use: Clover, cropland.
Parent material: Wisconsin loess.
Physiography: Unstable crest of a narrow interfluve extending to the north.
Elevation: 0.60 foot below S62Iowa-93-1.
Slope: About 3 percent.
Drainage: Somewhat poorly drained.
Ground water: Some seepage at 65 inches.
Moisture: Very moist; rained 3 inches a few days before sampling.
Permeability: Moderately slow.
Described by: A. R. Hidlebaugh and R. I. Dideriksen; October 16, 1962.

(Colors are for moist soil unless otherwise stated)

Alp 18021 0 to 13 cm (0 to 5 inches). Very dark gray (10YR 3/1) heavy silt loam, gray (10YR 5/1) when dry; cloddy parting to weak medium subangular blocky structure; friable; very few very fine soft dark brown and black accumulations of an oxide; abundant fine roots; clear smooth boundary.

A12 18022 13 to 23 cm (5 to 9 inches). Very dark gray (10YR 3/1) light silty clay loam, kneaded color is very dark grayish brown; some mixing of dark grayish brown (10YR 4/2) peds which increases with depth; gray (10YR 5/1) when dry; weak very fine subangular blocky and fine granular structure; friable; abundant fine roots; kind, color and size of oxides like horizon above; clear irregular boundary.

A3 18023 23 to 33 cm (9 to 13 inches). Very dark grayish brown (10YR 3/2) medium silty clay loam, grayish brown (10YR 5/2) when dry; about 20 percent mixing of dark grayish brown (10YR 4/2) peds; kneaded color is very dark grayish brown (10YR 3/2) to dark grayish brown (10YR 4/2); some tonguing of very dark gray (10YR 3/1) from above horizon; moderate very fine subangular blocky structure; friable; common thin silt coats on peds; common fine roots; clear smooth boundary.

B1 18024 33 to 43 cm (13 to 17 inches). Dark grayish brown (10YR 4/2) light silty clay; faces of peds dark gray (10YR 4/1) light gray (10YR 6/1 to 7/1 when dry); common fine yellowish brown (10YR 5/4) mottles on faces of peds and common to many fine strong brown (7.5YR 5/6) mottles in peds; moderate very fine subangular blocky structure; friable to firm; few fine roots; few thin silt coats on peds, few very dark gray (10YR 3/1) silty clay loam fills extending from above horizons; few very fine soft dark brown and black accumulations of an oxide; clear smooth boundary.

B21 18025 43 to 53 cm (17 to 21 inches). Dark grayish brown (10YR 4/2) silty clay; faces of peds dark gray (10YR to 2.5Y 4/1) common fine dark yellowish brown (10YR 4/4) mottle on faces of peds and many fine yellowish brown (10YR 5/6) mottles in peds; strong fine subangular blocky structure; firm; distinct thin continuous clay films on all peds, some very dark gray (10YR 3/1) clay coats in fine pores; very few fine roots; very few very fine hard black oxides; clear smooth boundary.

B22 18026 53 to 70 cm (21 to 28 inches). Olive gray (5Y 5/2) silty clay; faces of peds dark gray (5Y 3/1) common fine dark yellowish brown (10YR 4/4) and few fine dark brown (7.5YR 4/4) mottles; firm; strong fine and medium subangular blocky structure; firm; thin discontinuous clay films; common thin silt coats on some peds; few fine inped tubular pores; very few very fine dark brown and black hard concretions of an oxide; gradual smooth boundary.

B23 18027 70 to 85 cm (28 to 34 inches). Olive gray (5Y 5/2) light silty clay; faces of peds gray (5Y 5/1) common fine yellowish brown (10YR 5/4) mottles on faces of peds and many fine strong brown (7.5YR 5/6) mottles in peds; moderate fine and medium subangular blocky structure; firm; few thin discontinuous clay films; common thin silt coats on some peds; few fine inped tubular pores; common fine hard black concretions of an oxide; gradual smooth boundary.

B24 18028 85 to 100 cm (34 to 39 inches). Olive gray (5Y 5/2) heavy silty clay loam; weak medium prismatic structure parting to weak to moderate medium subangular blocky; common fine strong brown (7.5YR 5/6) mottles; firm; few ped faces are gray (5Y 5/1); very few discontinuous clay films and coats in some pores of dark gray color; common fine inped tubular pores; very few very fine hard black concretions of an oxide; clear smooth boundary.

B31 18029 100 to 113 cm (39 to 44 inches). Mixed olive gray (5Y 5/2) and 30 percent strong brown (7.5YR 5/6) medium silty clay loam; weak medium to coarse prismatic structure parting to weak medium and coarse subangular blocky; firm; few thin discontinuous dark gray clay films on prism faces and some clay coats in pores; common fine inped tubular pores; abundant fine and medium soft black accumulations of an oxide; clear wavy boundary.

B32 18030 113 to 128 cm (44 to 50 inches). Olive gray (5Y 5/2) medium silty clay loam; weak coarse prismatic structure parting to weak coarse subangular blocky; diffuse, ½-inch wide, nearly vertical oriented zone of strong brown (7.5YR 5/6) mottles; very few dark gray clay flows in some crevices and very thin discontinuous clay films on a few prism faces; common fine inped tubular pores; very few very fine soft black accumulations of an oxide; diffuse irregular boundary.

B33 18031 128 to 145 cm (50 to 57 inches). Same as the B32 except there are fewer fine mottles; indistinct thin silt coats; pores same as C1; diffuse smooth boundary.

C 18032 145 to 165 cm (57 to 65 inches). Same as the B33 except mottles are brown (7.5YR 4/4) in color; pores same as B32; abrupt wavy boundary.

IIAb? 18033 165 to 178 cm (65 to 70 inches). Dark gray (10YR 4/1) silty clay loam with noticeable sand; abundant fine brown (7.5YR 4/4) and strong brown (7.5YR 5/8) mottles; firm; distinct tonguing of olive gray (5Y 5/2) loess into the paleosol.

Remarks: Consistence at moist field conditions. See description for Seymour, S62-Iowa-93-2, for elevation transect.

U S DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SOIL Seymour silt loam SOIL Nos. S62Iowa-93-6 LOCATION Wayne County, Iowa

SOIL SURVEY LABORATORY, Lincoln, Nebraska LAB. Nos. 18034-18044 February 1967

General Methods: 1A, 1B1b, 2A1, 2B

Depth (In.)	Horizon	Size class and particle diameter (mm) 3A1 — Total: Sand (2-0.05)	Total: Silt (0.05-0.002)	Total: Clay (< 0.002)	Sand: Very coarse (2-1)	Sand: Coarse (1-0.5)	Sand: Medium (0.5-0.25)	Sand: Fine (0.25-0.1)	Sand: Very fine (0.1-0.05)	Silt: 0.05-0.02	Silt: Int. III (0.02-0.002)	Silt: Int. II (0.2-0.02)	(2-0.1)			Coarse fragments 2A2: > 2 Pct	2-19 (Pct of < 76mm)	19-76 (Pct of < 76mm)
		Pct of < 2 mm																
0-7	A1p	4.0a	73.5	22.5	0.3	1.3	0.9	0.7	0.8	33.5	40.0	34.6	3.2			-		
7-11	A12	4.1a	70.5	25.4	0.7	1.4	0.8	0.7	0.5	30.7	39.8	31.5	3.6			-		
11-15	A3	4.2a	67.6	28.2	0.6	1.3	0.8	0.7	0.8	30.2	37.4	31.3	3.4			-		
15-19	B1	3.9b	61.2	34.9	0.9	1.0	0.6	0.6	0.8	26.3	34.9	27.4	3.1			-		
19-23	B21	2.0b	50.5	47.5	0.2	0.4	0.3	0.4	0.7	24.4	26.1	25.3	1.3			-		
23-28	B22	1.6b	47.4	51.0	tr	0.3	0.2	0.4	0.7	19.6	27.8	20.5	0.9			-		
28-36	B23	1.9b	51.9	46.2	0.1	0.4	0.3	0.5	0.6	21.7	30.2	22.6	1.3			-		
36-45	B31	1.9b	59.1	39.0	0.2	0.4	0.4	0.4	0.5	28.1	31.0	28.8	1.4			-		
45-54	B32	1.8a	62.5	35.7	0.1	0.3	0.3	0.4	0.7	26.6	35.9	27.5	1.1			-		
54-64	C1	2.3a	66.1	31.6	0.2	0.4	0.4	0.7	0.6	26.2	39.9	27.2	1.7			-		
64-70	IIAb(?)	7.9	67.5	24.6	0.3	1.3	1.5	2.7	2.1	26.1	41.4	29.6	5.8			-		

Depth (In.)	6A1a Organic carbon (Pct)	6B1a Nitrogen (Pct)	C/N		6E2a Carbonate as $CaCO_3$ (Pct.)	6C2a Ext. Iron as Fe (Pct.)	Bulk density: 4A1a Field-State (g/cc)	4A1d 1/3-Bar (g/cc)	4A1b Air-Dry (g/cc)	4D1 COLE	Water content: 4B4 Field-State (Pct)	4B1c 1/3-Bar (Pct)	4B2 15-Bar (Pct)	4C1 1/3-minus 15-Bar (in./in.)		pH		8C1a (1:1) H_2O
0-7	2.06	0.172	12			1.0	1.33	1.32	1.38	0.01	25.6	25.7	10.4	0.20				5.7
7-11	1.46	0.114	13			1.2	1.31	1.30	1.36	0.01	27.2	25.5	10.6	0.19				5.2
11-15	0.87	0.082	11			1.2	1.34	1.32	1.40	0.02	25.0	24.5	12.0	0.16				5.2
15-19	0.73	0.070	10			1.3	1.36	1.34	1.44	0.02	24.4	24.5	14.6	0.13				5.2
19-23	0.75	0.067	11			1.3		1.34					20.4					5.3
23-28	0.62	0.056	11			1.3	1.29	1.24	1.80	0.12	34.1	35.0	22.6	0.15				5.5
28-36	0.32					1.1	1.32	1.25	1.80	0.12	33.0	33.9	21.4	0.16				5.8
36-45	0.15				-(s)	1.0	1.45	1.31	1.85	0.11	26.7	31.8	18.7	0.17				6.3
45-54	0.15				-(s)	1.0	1.58	1.41	1.82	0.08	21.3	27.9	16.8	0.16				6.2
54-64	0.07					1.2	1.62	1.47	1.76	0.06	20.6	26.4	14.7	0.17				6.4
64-70	0.11					1.1	1.66	1.56	1.72	0.03	19.4	23.1	9.8	0.21				6.2

Depth (In.)	Extractable bases 6M2a Ca	6O2a Mg	6P2a Na	6Q2a K	Sum	6H1a Ext. Acidity	Cat. Exch. Cap. 5A3a Sum Cations	5A1a NH_4OAc						8D3 Ca/Mg		Base saturation 5C3 Sum Cations	5C1 NH_4OAc
	meq/100 g															Pct.	Pct
0-7	13.9	3.2	0.1	0.2	17.4	10.2	27.6	20.0						4.3		63	87
7-11	10.2	3.9	0.1	0.3	14.5	11.8	26.3	19.3						2.6		55	75
11-15	10.2	4.7	0.2	0.4	15.5	10.6	26.1	19.8						2.2		59	78
15-19	12.9	6.9	0.3	0.5	20.6	11.2	31.8	24.1						1.9		65	85
19-23	18.9	10.8	0.5	0.8	31.0	12.9	43.9	32.1						1.8		71	97
23-28	21.3	12.6	0.7	0.9	35.5	11.4	46.9	34.3						1.7		76	103
28-36	20.6	12.3	0.8	0.8	34.5	8.2	42.7	32.0						1.7		81	108
36-45	18.7	10.8	0.8	0.6	30.9	5.8	36.7	27.5						1.7		84	112
45-54	17.4	10.0	0.7	0.6	28.7	5.0	33.7	25.6						1.7		85	112
54-64	14.9	8.4	0.7	0.5	24.5	5.1	29.6	22.2						1.8		83	110
64-70	10.0	5.2	0.5	0.3	16.0	4.2	20.2	15.2						1.9		79	105

Depth (In.)	Ratios to Clay 8D1: NH_4OAc CEC	Ext. Iron	15-Bar Water
0-7	0.89	0.044	0.46
7-11	0.76	0.047	0.42
11-15	0.70	0.043	0.43
15-19	0.69	0.037	0.42
19-23	0.68	0.027	0.43
23-28	0.67	0.025	0.44
28-36	0.69	0.024	0.46
36-45	0.71	0.026	0.48
45-54	0.72	0.028	0.47
54-64	0.70	0.038	0.47
64-70	0.62	0.045	0.40

a. Fe-Mn nodules: > 50 percent (2-0.1 mm); 5-25 percent (0.1-0.05 mm).
b. Fe-Mn nodules: > 50 percent (2-0.1 mm); 25-50 percent (0.1-0.05 mm).
c. 13 kg/m^2 to 60 inches (Method 6A).
d. Estimated.

Pedon classification: Aquic Argiudoll; fine, montmorillonitic, mesic.
Series classification: (Same as pedon).
Soil: Seymour silt loam.
Soil no.: S62-Iowa-93-6 (LSL Nos. 18034 - 18044).
Location: Wayne County, Iowa; 342 feet west and 497 feet south of the center of road in the northeast corner of SW ¼ Sec. 3, T. 68 N., R 20 W., about 2 miles south of Promise City.
Vegetation and land use: Oats stubble; cropland.
Parent material: Wisconsin loess.
Slope: About 2 percent.
Physiography: Somewhat stable interfluve summit with slope slightly convex toward the north.
Elevation: 0.00 feet in respect to other sites in Promise City transect.
Drainage: Somewhat poorly drained.
Ground water: None noted.
Moisture: Slightly moist.
Permeability: Moderately slow.
Described by: A. R. Hidlebaugh and R. I. Dideriksen; October 18, 1962.

(Colors are for moist soil unless otherwise stated)

Alp 18034 0 to 18 cm (0 to 7 inches). Very dark gray (10YR 3/1) heavy silt loam, gray (10YR 5/1) when dry; very weak thick platy structure parting to weak fine subangular blocky and fine granular; friable; platy structure at contact with horizon below and due to compaction; very few very fine dark brown soft accumulations of an oxide; abundant fine roots; slightly acid (pH 6.2); abrupt smooth boundary.

A12 18035 18 to 28 cm (7 to 11 inches). Very dark gray (10YR 3/1) with some very dark grayish brown (10YR 3/2) heavy silt loam; gray (10YR 5/1 to 6/1) when dry; kneaded color very dark gray (10YR 3/1); weak very fine subangular blocky and weak fine granular structure; friable; few krotovinas; weak platiness between 7 and 8 inches due to compaction; abundant fine roots; common very fine moderately hard dark brown and black concretions of an oxide; medium acid (pH 5.6); clear smooth boundary.

A3 18036 28 to 38 cm (11 to 15 inches). Very dark gray (10YR 3/1) with 20 percent very dark grayish brown (10YR 3/2) medium silty clay loam; 3/2 color increases with depth, kneaded color very dark grayish brown (10YR 3/2); moderate very fine subangular blocky structure; friable; few wormcasts or mixings of dark grayish brown (10YR 4/2) color, few krotovinas; few thin silt coats peds; abundant fine roots; few very fine soft dark brown and black accumulations of an oxide; clear smooth boundary.

B1 18037 38 to 48 cm (15 to 19 inches). Dark grayish brown (2.5Y 4/2) light silty clay, gray (10YR 6/1) to light brownish gray (10YR 6/2) when dry; few fine olive brown (2.5Y 4/4) mottles; moderate very fine subangular blocky structure; friable to firm; few thin silt coats on peds; few fine dark brown and black concretions of an oxide; common fine roots; medium acid (pH 5.8); clear smooth boundary.

B21 18038 48 to 58 cm (19 to 23 inches). Dark grayish brown (10YR 4/2) silty clay; faces of peds are dark gray (10YR 4/1); common fine dark yellowish brown (10YR 4/4) mottles on faces and many distinct yellowish brown (10YR 5/4) mottles in peds; strong very fine subangular blocky structure; firm; thin discontinuous clay films; few silt coats on some peds; krotovina (1 by 3 inches) filled with very dark gray silty clay loam at side of pit; few fine roots; common very fine soft dark brown and black accumulations of an oxide; medium acid (pH 6.0); clear smooth boundary.

B22 18039 58 to 70 cm (23 to 28 inches). Very dark gray (10YR 3/1) silty clay; strong very fine angular and subangular blocky structure; few fine brown (10YR 4/3) mottles on the faces of peds and many fine yellowish brown (10YR 5/4 to 5/6) mottles in peds; firm; thin continuous clay films; few fine inped tubular pores; some large oblique pressure faces; few fine roots; common fine moderately hard black concretions of an oxide; few very fine roots; clear smooth boundary.

B23 18040 70 to 90 cm (28 to 36 inches). Dark gray (10YR 4/1), dark grayish brown (10YR 4/2), and grayish brown (2.5Y 5/2) light silty clay; faces of peds are dark gray (10YR 4/1) and dark grayish brown (10YR 4/2) with common fine yellowish brown (10YR 5/4) mottles, and interiors of peds are grayish brown (2.5Y 5/2) with common to many fine yellowish brown (10YR 5/6) to strong brown (7.5YR 5/8) mottles; weak medium prismatic structure parting to moderate fine and medium subangular blocky; firm; thin discontinuous clay films and some very dark gray clay coats in a few pores; some oblique pressure faces; very few thin silt coats; few fine inped tubular pores; less oxides than above horizon; slightly acid (pH 6.5); clear irregular boundary.

B31 18041 90 to 115 cm (36 to 45 inches). Olive gray (5Y 5/2) with some dark gray (2.5Y 4/1) heavy silty clay loam; common medium to fine yellowish brown (10YR 5/6) mottles; moderate medium prismatic structure parting to moderate medium subangular blocky; firm; very thin discontinuous clay films on prism faces and as coats in a few pores; oxides same as B22; few thin silt coats on some peds; common fine inped tubular pores; some oblique pressure faces; neutral (pH 6.7); gradual smooth boundary.

B32 18042 115 to 138 cm (45 to 54 inches). Same color, texture, and structure as the B31 horizon; common to many fine and medium strong brown (7.5YR 5/6) mottles; firm; few very dark gray clay coats in pores and dark gray clay films on some vertical faces; several ½-inch clay ball accumulations; some oblique pressure faces; common fine inped tubular pores; neutral (pH 6.7); gradual smooth boundary.

B33 18043 138 to 163 cm (54 to 64 inches). Same color as the B22 horizon; medium silty clay loam; few to common fine yellowish brown (10YR 5/6) to strong brown (7.5YR 5/6) mottles; very weak coarse prismatic structure parting to very weak coarse angular blocky; firm; very dark gray clay coats in a few pores; several ½-inch clay ball accumulations; common fine inped tubular pores; abrupt wavy boundary.

IIAb? 18044 163 to 178 cm (64 to 70 inches). Dark gray (10YR 4/1) medium silty clay loam with noticeable sand; many medium yellowish brown (10YR 5/6) mottles; firm; quartz grains visible; paleosol; very few dark gray clay flows from loess into paleosol on vertical channels.

Remarks: Consistence at moist field conditions. See description for Seymour, S62Iowa-93-4, for elevation transect.

SOIL CLASSIFICATION-ARGIAQUIC ARGIALBOLL
FINE-SILTY, MIXED, MESIC
SERIES - - - - - - -VESSER

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE MRTSC
SOIL SURVEY INVESTIGATIONS UNIT
LINCOLN, NEBRASKA

SOIL NO - - - - 4 - S71IOWA-93-3 COUNTY - - - WAYNE

GENERAL METHODS- - -1A,1B1B,2A1,2B SAMPLE NOS. 71L1156-71L1163

DEPTH CM	HORIZON	SAND 2-.05	SILT .05-.002	CLAY LT .002	FINE CLAY LT .0002	VCOS 2-1	CORS 1-.5	MEDS .5-.25	FNES .25-.10	VFNS .10-.05	COSI .05-.02	FNSI .02-.002	VFSI .005-.002	FAML TEXT SAND 2-.1	INTR II .2-.02	FINE CLAY TO CLAY PCT	NON-CO3-CLAY PCT	RATIO 8D1 15-BAR TO CLAY
		(- - - PARTICLE SIZE ANALYSIS, LT 2MM, 3A1, 3A1A, 3A1B	PCT LT 2MM															
000-20	AP	4.6A	66.4	29.0	17.8	.0	.2	.5	1.7	2.2	20.3	46.1	6.4	2.4	23.4	61		.45
020-30	A12	5.5A	66.1	28.4	16.5	.1	.3	.6	2.1	2.4	21.0	45.1	6.8	3.1	24.6	58		.48
030-51	A21	8.1A	66.1	25.8	14.0	.2	.6	1.1	3.2	3.0	21.0	45.1	6.7	5.1	25.7	54		.48
051-79	A22	10.6A	63.1	26.3	15.3	.4	1.2	1.4	4.0	3.6	21.0	42.1	5.5	7.0	26.8	58		.45
079-94	B21TG	9.8A	54.9	35.3	23.7	.1	.3	1.1	4.5	3.8	18.4	36.5	4.5	6.0	24.6	67		.47
094-117	B22TG	12.0A	53.2	34.8	24.2	TR	.2	1.4	6.0	4.4	18.6	34.6	4.3	7.6	26.3	70		.47
117-152	B31TG	21.9A	48.1	30.0	19.9	.1	.4	2.1	11.6	7.7	16.8	31.3	4.0	14.2	31.1	66		.46
152-183	B32TG	31.4A	40.9	27.7	17.7	TR	.3	3.2	17.5	10.4	16.0	24.9	2.7	21.0	36.9	64		.45

DEPTH CM	PARTICLE SIZE ANALYSIS, MM, 3B, 3B1, 3B2: VOL. GT 2 PCT	WEIGHT GT 75 PCT	75-20 (PCT LT 75)	20-5	5-2	LT .074	20-2 PCT LT20	BULK DENSITY 4A1D 1/3-BAR G/CC	4A1H OVEN DRY G/CC	4D1 COLE	WATER CONTENT 4B1C 1/10 BAR PCT	4B1C 1/3-BAR PCT	4B2 15-BAR PCT	4C1 WRD CM/CM		CARBONATE 6E1B LT 2 PCT	3A1A LT .002 PCT	PH 8C1A 1/1 H2O	8C1E 1/2 CACL
000-20	0	0	0	0	0	97	0	1.34	1.50	.038	29.1	26.7	13.0	.18	2.3C			5.7	5.5
020-30	0	0	0	0	0	96	0	1.35	1.50	.036	31.3	29.2	13.5	.21	3.3C			5.6	5.1
030-51	0	0	0	0	0	94	0	1.40B					12.3					5.2	4.7
051-79	0	0	0	0	0	92	0	1.45	1.55	.023	28.2	26.3	11.8	.21	2.8C			5.0	4.5
079-94	0	0	0	0	0	93	0	1.50					16.7					5.3	4.6
094-117	0	0	0	0	0	91	0	1.46	1.76	.064	28.1	26.5	16.3	.15	2.3C			5.5	4.8
117-152	0	0	0	0	0	83	0	1.50B					13.9					5.6	5.0
152-183	0	0	0	0	0	74	0	1.63	1.83	.039	21.3	19.5	12.4	.12	2.6C			5.8	5.3

DEPTH CM	ORGANIC MATTER 6A1A ORGN CARB PCT	6B1A NITG PCT	C/N	IRON 6C2A EXT FE PCT	PHOS 6S1A TOTL PCT	EXTRACTABLE BASES 5B4A 6N2E CA	6O2D MG	6P2A NA	6Q2A K	SUM EXTB	ACTY 6H1A BACL TEA	AL 6G1D KCL EXT	CAT EXCH 5A3A EXTB ACTY	5A6A NHAC	RATIO 8D1 NHAC TO CLAY	RATIO 8D3 CA TO MG	CA 5F SAT NHAC PCT	BASE SAT 5C3 EXTB ACTY PCT	5C1 NHAC PCT
						(MEQ / 100 G)													
000-20	1.67D	.152	11	.9		19.0	3.9	.1	.3	23.3	7.4		30.7	26.7	.92	4.9	71	76	87
020-30	1.79	.159	11	.8		17.0	3.9	.1	.3	21.3	9.7		31.0	26.6	.94	4.4	64	69	80
030-51	1.38	.110	13	.9		12.7	3.3	.1	.2	16.3	11.1	.1	27.4	22.6	.88	3.9	56	59	72
051-79	.72	.060	12	.9		10.4	3.6	.2	.2	14.4	9.9	.4	24.3	20.8	.79	2.9	50	59	69
079-94	.69	.065	11	.8		14.4	5.4	.4	.5	20.7	10.4	.3	31.1	27.0	.76	2.7	53	67	77
094-117	.66			.8		15.2	5.9	.5	.5	22.1	8.8	.1	30.9	27.3	.78	2.6	56	72	81
117-152	.53			.8		14.1	5.4	.4	.4	20.3	6.3		26.6	23.6	.79	2.6	60	76	86
152-183	.32			.7		12.7	4.9	.4	.4	18.4	4.4		22.8	20.4	.74	2.6	62	81	90

DEPTH CM	SATURATED PASTE 8E1 REST OHM-CM	8C1B PH	8A H2O PCT	NA 5D2 ESP PCT	NA 5E SAR	SALT 8D5 TOTL SOLU PPM	GYP 6F1A PCT	SATURATION EXTRACT 8A1 8A1A EC MMHOS/CM	6N1B CA	6O1B MG	6P1A NA	6Q1A K	6I1A CO3	6J1A HCO3	6K1A CL	6L1A SO4	6M1A NO3	ATTERBERG 4F1 LQID LMIT PCT	4F2 PLST INDX
									(MEQ / LITER)										
000-20																		43E	18
020-30																			
030-51																		42E	16
051-79																			
079-94																		47E	24
094-117	2900	4.9	53.4					.22											
117-152																		40E	20
152-183																			

CLAY MINERALOGY (7A2C).
000-20 MT3 KK2 MI2 QZ1
030-51 MT5 KK3 MI2 QZ1
152-183 MT4 KK3 MI2 QZ1

PLACEMENT (S71IA-93-3) - MONTMORILLONITIC.
COMMENTS - SMECTITE CRYSTALLINITY DECREASES IN SURFACE HORIZON. MICA INCREASES SOME WITH DEPTH. KAOLINITE NEAR SMALL - MODERATE BORDER (EST 10-15 PCT).

MINERAL CODE* MT-MONTMORILLONITE KK-KAOLINITE MI-MICA QZ-QUARTZ.
RELATIVE ABUNDANCE* 5-DOMINANT 4-ABUNDANT 3-MODERATE 2-SMALL 1-TRACE.

(A) FE-MN NODULES 10-25 PCT.
(B) ESTIMATED.
(C) MICRO-PENETRATION RESISTANCE - A ROD 0.6 CM DIA IS SLOWLY PUSHED INTO BULK DENSITY CLOD, EQUILIBRATED AT 1/10-BAR, A DISTANCE OF 0.6 CM USING A POCKET PENETROMETER. UNITS ARE FORCE (KG) AND NOT ESTIMATES OF UNCONFINED COMPRESSIVE STRENGTH.
(D) ORGANIC CARBON IS 16 KG/M SQ TO A DEPTH OF 1 M (6A).
(E) BY USDA-SCS, SOIL MECHANICS LAB, LINCOLN, NE.

Pedon classification: Argiaquic Argialboll; fine-silty, mixed, mesic.
Series classification: (Same as pedon).
Soil: Vesser silt loam.
Soil no.: S71-Iowa-93-3 (LSL Nos. 71L1156 - 71L1163).
Location: Wayne County, Iowa, 655 feet west and 935 feet south of the northeast corner of the SE¼ sec. 5, T. 69 N., R. 21 W., or 150 feet south and 25 feet west of the old bridge into field.
Vegetation and land use: Recently harvested corn; cropland.
Parent material: Silty alluvium that has less than 15 percent sand.
Physiography: On a nearly level bottom land about 50 feet west of bank of the straightened channel of the south fork of the Chariton River.
Relief: Plane to slightly convex.
Slope: Less than 1 percent.
Drainage: Somewhat poorly or poorly drained.
Erosion: None.
Ground water: None within 6 feet (seasonal rainfall below normal).
Permeability: Moderate in the upper part and moderately slow in the lower part.
Described by: J. D. Highland, L. D. Lockridge, and J. D. Worster, October 1971.

(Colors are for moist soil unless otherwise stated)

Ap 71L1156 0 to 20 cm (0 to 8 inches). Very dark gray (10YR 3/1) silt loam, dark gray (10YR 4/1) dry; moderate fine subangular blocky structure parting to moderate fine granular; friable; between 7 and 8 inches zone is more compacted than above or below (plow sole); slightly acid (pH 6.5); abrupt wavy boundary.

A12 71L1157 20 to 30 cm (8 to 12 inches). Very dark gray (10YR 3/1) heavy silt loam, dark gray (10YR 4/1) to gray (10YR 5/1) dry; weak medium platy structure parting to moderate fine granular; friable; few fine dark brown oxides; common fine pores; medium acid (pH 6.0); clear wavy boundary.

A21 71L1158 20 to 51 cm (12 to 20 inches). Very dark gray (10YR 3/1) and dark gray (10YR 4/1) silt loam, dark gray (10YR 4/1) kneaded; light gray (10YR 6/1) dry; few fine distinct dark brown (7.5YR 3/2) mottles; weak coarse platy structure parting to weak very fine subangular blocky; friable; thin discontinuous light gray (10YR 6/1) silt coatings on peds; common fine dark brown to brown oxide concretions; strongly acid (pH 5.4); gradual wavy boundary.

A22 71L1159 51 to 79 cm (20 to 31 inches). Dark gray (10YR 4/1) silt loam, grayish brown (10YR 5/2) coatings on peds, dark grayish brown (10YR 4/2) kneaded; few fine distinct dark brown (7.5YR 3/2) mottles; weak coarse platy structure parting to weak fine subangular blocky; friable; many fine tubular pores; few fine reddish brown and black oxide concretions; nearly continuous light gray (10YR 7/1) silt coatings on peds; strongly acid (pH 5.4); clear wavy boundary.

B21tg 71L1160 79 to 94 cm (31 to 37 inches). Very dark gray (10YR 3/1) silty clay loam, dark gray (10YR 4/1) coatings on peds; common fine distinct dark brown (7.5YR 3/2) mottles; moderate medium prismatic structure parting to moderate medium subangular blocky; firm; light gray (10YR 7/1 dry) silt and fine sand coatings on faces of some peds; some faces of prisms have thick patchy light gray (10YR 7/1 dry) silt and fine sand coatings; black (10YR 2/1) clay accumulations in some root channels; common dark brown accumulations (oxides) and hard concretions; strongly acid (pH 5.4); gradual smooth boundary.

B22tg 71L1161 94 to 117 cm (37 to 46 inches). Dark gray (10YR 4/1) medium silty clay loam; moderate medium prismatic structure parting to weak moderate medium subangular blocky; firm; common thin patchy very dark gray (10YR 3/1) clay films; common black (N 2/) clay filled pores; few thick patchy light gray (10YR 7/1 dry) silt and fine sand coatings on some prisms; few dark brown and black accumulations (oxides) and hard concretions; medium acid (pH 5.8); gradual smooth boundary.

B31tg 71L1162 117 to 152 cm (46 to 60 inches). Dark gray (10YR 4/1) medium silty clay loam, very dark gray (10YR 3/1) coatings on peds; weak medium prismatic structure; firm; common fine dark brown oxides; light gray (10YR 7/1 dry) silt and fine sand coatings on some peds; few patchy black clay films; slightly acid (pH 6.4); gradual smooth boundary.

B32tg 71L1163 152 to 183 cm (60 to 72 inches). Dark grayish brown (2.5Y 4/2) light silty clay loam high in fine sand, very dark gray (10YR 3/1) coatings on some peds; common fine faint olive brown (2.5Y 4/4) mottles; weak coarse prismatic structure; friable; few thin patchy light gray (10YR 7/1 dry) silt and fine sand coatings on some prisms; few black (N 2/) clay filled pores and thick films on prisms; krotovinas 1 to 2 inches in diameter filled with black (N 2/) clayey material; few fine dark brown oxides; slightly acid (pH 6.4).

SOIL CLASSIFICATION-TYPIC HAPLUDOLL
FINE-LOAMY OVER SANDY OR SANDY-SKELETAL, MIXED, MESIC
SERIES - - - - - - -WADENA LOAM

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE MRTSC
SOIL SURVEY INVESTIGATIONS UNIT
LINCOLN, NEBRASKA

SOIL NO - - - - - - S59IA-21-1 COUNTY - - - CLAY

GENERAL METHODS- - -1A,1B1A,2A1,2B SAMPLE NOS. 11121-11127

DEPTH CM	HORIZON	PARTICLE SIZE ANALYSIS, LT 2MM, 3A1, 3A1A, 3A1B (PCT LT 2MM) SAND 2- .05	SILT .05- .002	CLAY LT .002	FINE CLAY LT .0002	SAND VCOS 2- 1	CORS 1- .5	MEDS .5- .25	FNES .25- .10	VFNS .10- .05	SILT COSI .05- .02	FNSI .02- .002	VFSI .005- .002	FAML TEXT SAND 2-.1	INTR II .2- .02	FINE CLAY TO CLAY PCT	NON-CO3-CLAY PCT	RATIO 8D1 15-BAR TO CLAY
000-20	A1P	39.7	38.7	21.6		4.4	13.0	10.7	9.0	2.6		20.3		37.1	24.2			.43
020-28	A3	33.2	42.9	23.9		2.9	10.6	9.7	8.0	2.0		24.1		31.2	23.5			.45
028-38	B1	27.4	46.5	26.1		1.8	8.0	8.2	7.6	1.8		26.7		25.6	24.1			.40
038-56	B21	36.7	37.8	25.5		4.3	9.3	10.0	10.6	2.5		21.5		34.2	22.4			.40
056-66	1C2B22	73.9	11.7	14.4		7.4	17.3	23.2	23.2	2.8		7.1		71.1	14.0			.43
066-89	2B3	89.0	4.8	6.2		11.6	26.5	27.3	22.0	1.6		2.5		87.4	9.0			.42
089-140	2C	94.4	3.8	1.8		21.9	30.2	29.4	11.7	1.2		1.7		93.2	6.1			.50

DEPTH CM	PARTICLE SIZE ANALYSIS, MM, 3B, 3B1, 3B2 (PCT LT 75) VOL. GT 2	WEIGHT GT 75	75-20	20-5	5-2	LT .074	BULK DENSITY LT20	4A1C 1/3-BAR G/CC	4A1H OVEN DRY G/CC	4D1 COLE	WATER CONTENT 4B3 1/10 BAR PCT	4B1C 1/3-BAR PCT	4B2 15-BAR PCT	4C1 WRD CM/CM	CARBONATE 6E1A LT 2 PCT	3A1A LT .002 PCT	PH 8C1A 1/1 H2O	8C1E 1/2 CACL
000-20							TR	1.30A					9.3				5.8	
020-28							TR	1.35	1.44	.020		26	10.8	.21			6.0	
028-38							TR	1.40A					10.4				6.0	
038-56							TR	1.39	1.49	.024		21	10.1	.15			6.3	
056-66							TR	1.65	1.70	.010		9	6.2	.05			6.6	
066-89							14	1.60A					2.6		TR		7.4	
089-140							34						.9		13		8.6	

DEPTH CM	ORGANIC MATTER 6A1A ORGN CARB PCT	6B1A NITG PCT	C/N	IRON 6C1A EXT FE PCT	PHOS 6S1A TOTL PCT	EXTRACTABLE BASES 584A- (MEQ) 6N2B CA	6O2B MG	6P2A NA	6Q2A K	SUM EXTB / 100	ACTY 6H1A BACL TEA	AL 6G1D KCL EXT	CAT EXCH 5A3A EXTB ACTY (MEQ / 100 G)	RATIO 5A1A NHAC	RATIO 8D1 NHAC TO CLAY	RATIO 8D3 CA TO MG	CA 5F SAT NHAC PCT	BASE SAT 5C3 EXTB ACTY PCT	5C1 NHAC PCT
000-20	2.57B	.219	12	.8		12.1	3.5	.1	.4	16.1	10.4		26.5	20.5	.95	3.4	59	61	78
020-28	1.81	.169	11	1.0		12.9	3.6	.1	.2	16.8	8.4		25.2	19.9	.83	3.6	65	67	84
028-38	1.30	.129	10	1.0		12.8	4.4	.1	.2	17.5	7.5		25.0	19.3	.74	2.9	66	70	91
038-56	.82	.081	10	1.1		12.6	4.8	.1	.2	17.7	4.7		22.4	18.3	.72	2.6	69	79	97
056-66	.34	.040	8	.8		8.0	3.5	TR	.2	11.7	2.7		14.4	11.5	.80	2.3	70	81	102
066-89	.14			.6		4.1	1.6	.1	.1	5.9	1.5		7.4	5.2	.84	2.6	79	80	113
089-140				.6				TR	TR					1.7	.96				

DEPTH CM	SATURATED PASTE 8E1 REST OHM-CM	8C1B PH	8A H2O PCT	NA 5D2 ESP PCT	NA 5E SAR	SALT 8D5 TOTL SOLU PPM	GYP PCT	SATURATION EXTRACT 8A1 (MEQ / LITER) 8A1A EC MMHOS/CM	6N1B CA	6O1B MG	6P1A NA	6Q1A K	6I1A CO3	6J1A HCO3	6K1A CL	6L1A SO4	6M1A NO3	ATTERBERG 4F1 LQID LMIT PCT	4F2 PLST INDX
000-20																		37C	2
020-28																			
028-38																			
038-56																		36C	16
056-66																			
066-89																			
089-140																			

(A) ESTIMATED.
(B) ORGANIC CARBON IS 14 KG/M SQ TO A DEPTH OF 1 M (6A).
(C) LL AND PI DETERMINED BY STATE HWY DEPT, AMES, IOWA.

Pedon classification: Typic Hapludoll; fine-loamy over sandy or sandy-skeletal, mixed, mesic.
Series classification: Same as pedon.
Soil: Wadena loam.
Soil no.: S59-Iowa-21-1 (LSL Nos. 11121 - 11127).
Location: Clay County, Iowa; 80 feet east of road center, 0.1 mile south of northwest corner of SW¼ of Sec. 9, T. 96 N., R. 37 W.
Vegetation and land use: Alfalfa; cropland.
Parent material: Glacial outwash of the Late Wisconsin glaciation; about 22 inches of quite silty but gritty material overlying calcareous and stratified gravel and sand; gravel is predominantly fine gravel. Sand and gravel extend to at least 100 inches.
Slope: Broad, level outwash plain; slope less than 1 percent.
Described by: F. J. Carlisle and R. I. Turner; June 8, 1959.

(Colors are for moist soil unless otherwise stated)

Alp 11121 0 to 20 cm (0 to 8 inches). Very dark brown (10YR 2/2) very dark grayish brown (10YR 3/2) dry; heavy loam (approaching silt loam); cloddy crushing to weak fine granular; friable; sand grains are predominantly clear and do not appear to be coated; gradual smooth boundary.

A3 11122 20 to 28 cm (8 to 11 inches). Very dark brown (10YR 2/2) very dark grayish brown (10YR 3/2) with small spots of dark grayish brown (10YR 4/2) dry, heavy loam (approaching silt loam); appears nearly massive in place but crushes readily to fine granules without change in color, then increases about one unit in value on further crushing; friable; common dark spherical wormcasts and a few dark brown spots (approximately ½ cm) of material mixed from below; horizontal parting suggests plow sole in upper part; gradual smooth boundary.

B1 11123 28 to 38 cm (11 to 15 inches). A horizon of mixed materials apparently due to earthworm activity; predominantly very dark grayish brown (10YR 3/2) and about one-third very dark brown (10YR 2/2); dark grayish brown (10YR 4/2) and brown (10YR 4/3) dry; gritty light silty clay loam approaching clay loam (estimated about 29 percent clay); essentially massive but with suggestion of very weak subangular blocky structure; cleaves more readily along horizontal and vertical planes than diagonal ones; friable but slightly more firm in place than A horizons; gradual boundary.

B21 11124 38 to 55 cm (15 to 22 inches). Brown (10YR 4/3) clay loam approaching silty clay loam; evident vertical cleavage suggests very weak prismatic structure; horizontal cleavage is very weak; slightly firm in place but friable when removed; smooth, patchy, dark brown to very dark brown coats on sand and fine gravel grains, on cleavage faces, and in some fine pores may be thin clay films but they are not distinct enough (thick enough?) to be seen in cross section; some very dark brown wormcasts in upper part of horizon; gradual to clear boundary.

I&IIB22 11125 55 to 65 cm (22 to 26 inches). Brown (10YR 4/3) heavy sandy loam; essentially massive but with very weak vertical cleavage; friable; smooth, patchy, dark brown to very dark brown coats on fine gravel pieces, pores and cleavage faces as in horizon above; clear boundary.

IIB3 11126 65 to 88 cm (26 to 35 inches). Dark brown (10YR 3/3) loamy sand; massive; very friable but slightly coherent; smooth, patchy, dark brown coats on coarse sand and fine gravels suggest clay films; upper one-half of horizon is slightly more coherent and probably contains slightly more fine material than lower one-half; effervesces slightly with HCl; clear boundary.

IIC 11127 88 to 140 cm (35 to 55 inches). Dark yellowish brown and brown stratified medium sand and fine gravel; strata mostly 3 to 10 inches thick; single grain; loose; calcareous; carbonate films about 0.1 to 0.5 mm thick cement small clusters of sand to bottom surface of many gravels. The abundance of carbonate films and amount of distinctly brownish colors seems to diminish with depth below about 55 inches.

Remarks: Krotovina about 12 by 18 inches and tapering to about 6 by 6 inches across one side of sampling pit in B22 and B3 horizons. Material of krotovina is distinctly darker colored and appears appreciably higher in organic matter than surrounding soil material. Fibrous fine roots are abundant in upper 15 inches, are common in the B2 horizon, and sparse in the C horizon. Color value of crushed soil material from the B horizon is very slightly higher than uncrushed material. The pedon was moist but below field capacity when described and sampled. Boring indicated a water table at 100-inch depth.

SOIL CLASSIFICATION-TYPIC HAPLUDOLL
FINE-LOAMY OVER SANDY OR SANDY-SKELETAL, MIXED, MESIC
SERIES - - - - - - -WADENA LOAM

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE NRTSC
SOIL SURVEY INVESTIGATIONS UNIT
LINCOLN, NEBRASKA

SOIL NO - - - - - - S59IA-21-2 COUNTY - - - CLAY

GENERAL METHODS- - -1A,1B1A,2A1,2B SAMPLE NOS. 11128-11134 REVISED 4/75

DEPTH CM	HORIZON	PARTICLE SIZE ANALYSIS, LT 2MM, 3A1, 3A1A, 3A1B (PCT LT 2MM) SAND 2-.05	SILT .05-.002	CLAY LT .002	FINE SAND CLAY LT .0002	VCOS 2-1	CORS 1-.5	MEDS .5-.25	FNES .25-.10	VFNS .10-.05	COSI .05-.02	SILT FNSI .02-.002	VFSI .005-.002	FAML TEXT SAND 2-.1	INTR II .2-.02	FINE CLAY TO CLAY	NON-COS CLAY	RATIO 8D1 15-BAR TO CLAY
000-18	A1P	36.6	39.2	24.2		3.7	12.3	10.9	7.6	2.1		20.7		34.5	23.0			.46
018-28	A12	29.2	44.9	25.9		2.4	9.8	8.7	6.4	1.9		24.6		27.3	24.2			.43
028-41	B1	14.9	56.1	29.0		1.2	4.7	4.3	3.5	1.2		32.0		13.7	26.5			.39
041-56	B21	18.4	50.0	31.6		1.7	4.5	4.9	4.9	2.4		27.4		16.0	26.8			.38
056-66	1B22B22	47.6	30.7	21.7		5.0	11.1	11.8	16.0	3.7		15.3		43.9	25.6			.40
066-81	2B3	84.5	8.7	6.8		18.1	25.6	21.6	16.3	2.9		4.4		81.6	12.4			.50
081-140	2C	89.2	6.6	4.2		13.8	31.6	30.2	12.2	1.4		3.4		87.8	7.1			.67

DEPTH CM	(PARTICLE SIZE ANALYSIS, MM, 3B, 3B1, 3B2) VOL. GT 2 PCT	WEIGHT GT 75 PCT	75-20	20-5	5-2	LT .074	20-2 PCT LT20	BULK DENSITY 4A1C 1/3-BAR G/CC	4A1H OVEN DRY G/CC	4D1 COLE	WATER CONTENT 4B1C 1/10 BAR PCT	4B3 1/3-BAR PCT	4B2 15-BAR PCT	4C1 WRD CM/CM	CARBONATE 6E1A LT 2 PCT	3A1A LT .002 PCT	PH 8C1A 1/1 H2O	8C1E 1/2 CACL
000-18							TR	1.20A					11.2				5.9	
018-28							TR	1.25	1.32	.017		27	11.2	.20			5.8	
028-41							TR	1.23	1.30	.017		26	11.4	.18			5.8	
041-56							TR	1.37	1.49	.028		24	11.9	.17			5.8	
056-66							TR	1.58	1.67	.017		16	8.7	.12			5.9	
066-81							49	1.60A					3.4		0		7.1	
081-140							45						2.8		1I		8.3	

DEPTH CM	(ORGANIC MATTER) 6A1A ORGN CARB PCT	6B1A NITG PCT	C/N	IRON 6C1A EXT FE PCT	PHOS 6S1A TOTL PCT	(EXTRACTABLE BASES 5B4A) 6N2B CA	6O2B MG	6P2A NA	6Q2A K	SUM EXTB / 100 MEQ	ACTY 6H1A BACL TEA G	AL 6G1D KCL EXT	(CAT EXCH) 5A3A EXTB ACTY	5A1A NHAC	RATIO 8D1 NHAC TO CLAY	RATIO 8D3 CA TO MG	CA 5F SAT NHAC PCT	(BASE SAT) 5C3 EXTB ACTY PCT	5C1 NHAC PCT
000-18	3.68B	.306	12	.9F		15.6	4.0	.1	.5	20.2	11.5		31.7	23.1	.95	3.9	68	64	87
018-28	2.19	.195	11	.9F		12.6	4.2	.1	.2	17.1	11.2		28.3	20.9	.81	3.0	60	60	82
028-41	1.39	.133	10	1.2F		12.1	4.6	.1	.2	17.0	10.2		27.2	20.0	.69	2.6	61	62	85
041-56	.92	.091	10	1.2F		14.0	6.0	.1	.3	20.4	6.8		27.2	22.2	.70	2.3	63	75	92
056-66	.64	.063	10	1.1F		10.5	4.6	.1	.2	15.4	4.7		20.1	16.4	.76	2.3	64	77	94
066-81	.39			1.1F		5.2	2.2	TR	.1	7.5	2.7		10.2	6.5	.96	2.4	80	74	115
081-140	.01			.7F				TR	.1					3.8	.90				

(A) ESTIMATED.
(B) ORGANIC CARBON IS 16 KG/M SQ TO A DEPTH OF 1 M (6A).

Pedon classification: Typic Hapludoll; fine-loamy over sandy or sandy-skeletal, mixed, mesic.
Series classification: (Same as pedon).
Soil: Wadena loam.
Soil no.: S59-Iowa-21-2 (LSL Nos. 11128 - 11134).
Location: Clay County, Iowa, 104 yards east and 93 yards south (from road center) of the northwest corner of the NE¼ of sec. 18, T. 97 N., R. 37 W.
Vegetation and land use: Alfalfa; cropland.
Parent material: Glacial outwash of the Lake Wisconsin glaciation; about 26 inches of medium-textured silty sediments over coarse-textured stratified sand and gravel. Parent materials are thought to have been calcareous.
Drainage: Well drained.
Described by: F. J. Carlisle and R. I. Turner; June 9, 1959.

(Colors are for moist soil unless otherwise stated)

Alp 11128 0 to 18 cm (0 to 7 inches). Black (10YR 2/1) gritty silt loam; dark gray (10YR 4/1) dry; cloddy (with distinct horizontal parting when nearly dry) crushing to weak fine granular; friable; most sand grains are clear and do not appear to be coated, but many have patchy, dark brown coating; indistinct boundary.

A12 11129 18 to 28 cm (7 to 11 inches). Very dark brown (10YR 2/2) gritty heavy silt loam; seems massive but easy vertical parting and some horizontal parting suggest very weak prisms; color remains the same when gently crushed to medium and fine granular sizes, then becomes slightly browner when crushed further; friable; uppermost inch is distinct medium angular blocky "plow sole" or "traffic pan" that contrasts in structure to the material below; gradual boundary.

B1 11130 28 to 40 cm (11 to 16 inches). Very dark brown (10YR 2/2), dark grayish brown (10YR 4/2) dry; gritty heavy silt loam; very weak subangular blocky arranged in weak fine prisms; friable; crushes to slightly browner color (about 2.5Y 2/2); abundant fine tubular pores; patches of smooth, very dark brown coatings on sand grains and in fine pores look like clay films but are exceedingly thin; gradual boundary.

B21 11131 40 to 55 cm (16 to 22 inches). Predominantly dark brown (10YR 3/3) with about 20 percent very dark brown (10YR 2/2), slightly gritty light silty clay loam; very weak subangular blocky arranged in weak to moderate coarse prisms; slightly firm; abundant fine tubular pores; patches of smooth shiny material on pore, prism, and sand grains surfaces may be very thin clay films; gradual boundary.

I&IIB22 11132 55 to 65 cm (22 to 26 inches). Brown (10YR 4/3) light clay loam; weak medium subangular blocky arranged in weak medium prisms; smooth, slightly darker patches on prism faces may be very thin clay films; common fine tubular pores.

IIB3 11133 65 to 80 cm (26 to 32 inches). Brown (10YR 4/3) gravelly sandy loam (about 20 to 25 percent fine gravel); massive and very friable; coheres in some fairly durable coarse subangular blocky lumps and much very slightly coherent (nearly single grain) material; patchy, smooth dark brown and very dark brown coatings on most sand and gravel pieces look like very thin clay films; effervesces weakly with HCl (probably limestone gravel); clear boundary.

IIC 11134 80 to 140 cm (32 to 55 inches). Yellowish brown calcareous sand and gravel; single grain; loose; a silt stratum 1 inch thick at 3-foot depth is nearly continuous in sample pit but is slightly wavy and shows some breaks.

Remarks: The numbers of plant roots decrease gradually with depth. They are abundant in the upper 16 inches, common from 16 to 26 inches, and scarce below 26 inches. From 55 to 61 inches is banded silt and medium sand strata about one-half to 1 inch thick. The silt is predominantly gray and the sand strong brown.

SOIL CLASSIFICATION-AQUIC HAPLUDALF
FINE, MONTMORILLONITIC, MESIC
SERIES - - - - - - - -WELLER

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE MRTSC
SOIL SURVEY INVESTIGATIONS UNIT
LINCOLN, NEBRASKA

SOIL NO - - - - - - S69IOWA-68-1 COUNTY - - - MONROE

GENERAL METHODS- - -1A2A,1B1B,1B2,1B SAMPLE NOS. 69L1041-69L1051

DEPTH CM	HORIZON	PARTICLE SIZE ANALYSIS, LT 2MM, 3A1, 3A1A, 3A1B (PCT LT 2MM) SAND 2-.05	SILT .05-.002	CLAY LT .002	FINE CLAY LT .0002	SAND VCOS 2-1	CORS 1-.5	MEDS .5-.25	FNES .25-.10	VFNS .10-.05	SILT COSI .05-.02	FNSI .02-.002	VFSI .005-.002	TEXT SAND 2-.1	INTR II .2-.02	FINE CLAY TO CLAY PCT	NON-CO3-CLAY PCT	RATIO 801 15-BAR TO CLAY
000-010	A1	2.9A	77.5	19.6		.2	.7	.6	.8	.6	31.6	45.9		2.3	32.6			.56
010-018	A21	2.1A	77.3	20.6		.1	.4	.5	.6	.5	31.3	46.0		1.6	32.1			.41
018-038	A22	1.7A	76.5	21.8		.0	.3	.4	.5	.5	30.1	46.4		1.2	30.9			.38
038-048	AB	2.1A	72.0	25.9		.1	.4	.5	.6	.5	28.6	43.4		1.6	29.4			.39
048-058	B1	1.7A	67.7	30.6		.1	.4	.3	.4	.5	26.2	41.5		1.2	26.9			.42
058-071	B21T	1.2A	51.3	47.5		TR	.3	.2	.3	.4	20.4	30.9		.8	20.9			.43
071-084	B22T	1.1A	52.3	46.6		.0	.2	.2	.3	.4	19.2	33.1		.7	19.7			.41
084-097	B23T	.7A	55.6	43.7		.0	.1	.1	.2	.3	20.4	35.2		.4	20.8			.47
097-119	B31T	.7A	59.4	39.9		.0	.1	.1	.2	.3	23.2	36.2		.4	23.6			.48
119-145	B32	1.1A	64.0	34.9		.0	.2	.2	.3	.4	24.9	39.1		.7	25.4			.49
145-175	C	.8A	68.0	31.2		TR	.1	.1	.3	.3	27.0	41.0		.5	27.5			.48

DEPTH CM	(PARTICLE SIZE ANALYSIS, MM, 3B, 3B1, 3B2) VOL. GT 2 PCT	WEIGHT GT 75 PCT	75-20	20-5	5-2	LT .074	20-2 PCT. LT75	BULK DENSITY 4A1D 1/3-BAR G/CC	4A1H OVEN DRY G/CC	4D1 COLE	4B1C 1/10 BAR PCT	4B1C 1/3-BAR PCT	WATER CONTENT 4B2 15-BAR PCT	4C1 WRD CM/CM	6E1B LT .2 PCT	CARBONATE 3A1A LT .002 PCT	PH 8C1A 1/1 H2O	8C1E 1/2 CACL
000-010	0	0	0	0	0	98	0	1.08	1.21	.039	39.7	36.6	10.5	.28	3.3C		6.7	6.4
010-018	0	0	0	0	0	98	0	1.42	1.47	.012	29.8	26.6	8.5	.26	4.1C		5.3	4.8
018-038	0	0	0	0	0	99	0	1.35	1.42	.017	28.2	25.8	8.2	.24	1.7C		4.6	3.9
038-048	0	0	0	0	0	98	0	1.35	1.49	.034	26.7	24.6	10.1	.20	1.6C		4.6	3.8
048-058	0	0	0	0	0	99	0	1.47	1.60	.029	26.9	25.5	13.0	.18	2.8C		4.6	3.7
058-071	0	0	0	0	0	99	0	1.37	1.84	.103	34.0	32.5	20.5	.16	1.6C		4.3	3.9
071-084	0	0	0	0	0	99	0	1.37	1.89	.113	35.4	33.3	19.2	.19	1.5C		4.4	3.9
084-097	0	0	0	0	0	100	0	1.38	1.86	.105	33.1	31.9	20.4	.16	1.3C		4.3	4.0
097-119	0	0	0	0	0	100	0	1.49	1.80	.065	28.5	25.1	19.0	.09	1.5C		4.5	4.1
119-145	0	0	0	0	0	99	0	1.40B					17.2				5.1	4.5
145-175	0	0	0	0	0	100	0	1.44	1.61	.038	24.9	23.3	15.1	.12	0.4C		5.8	5.3

DEPTH CM	(ORGANIC MATTER) 6A1A ORGN CARB PCT	6B1A NITG PCT	C/N	IRON 6C2A EXT FE PCT	PHOS 6S1A TOTL PCT	(EXTRACTABLE BASES 5B4A) 6N2E CA	6O2D MG	6P2A NA	6Q2A K	SUM EXTB	ACTY 6H1A BACL TEA	AL 6G1D KCL EXT	(CAT EXCH) 5A3A EXTB ACTY	5A6A NHAC	RATIO 8D1 NHAC TO CLAY	RATIO 8D3 CA TO MG	CA 5F SAT NHAC PCT	(BASE SAT) 5C3 EXTB ACTY PCT	5C1 NHAC PCT
						(MEQ / 100 G)													
000-010	3.04D	.241	13			18.5	2.3	0.1	0.3	21.2	6.8		28.0	20.6	1.05	8.0	90	76	103
010-018	1.89	.141	13			7.3	2.0	0.1	0.2	9.6	11.0	0.2	20.6	15.1	0.73	3.7	48	47	64
018-038	0.57	.071	8			2.1	1.6	0.2	0.2	4.1	12.6	3.5	16.7	12.4	0.57	1.3	17	25	33
038-048	0.30	.047	6			2.4	2.6	0.3	0.3	5.6	14.1	5.2	19.7	15.1	0.58	0.9	16	28	37
048-058	0.27	.042	6			3.9	4.1	0.4	0.4	8.8	15.8	5.7	24.6	19.4	0.63	1.0	20	36	45
058-071	0.31	.047	7			8.2	7.9	0.8	0.7	17.6	21.4	8.0	39.0	32.3	0.68	1.0	25	45	54
071-084	0.31					9.1	8.6	1.0	0.7	19.4	21.7	6.4	41.1	32.5	0.70	1.1	28	47	60
084-097	0.26					9.7	8.9	1.1	0.7	20.4	17.4	4.6	37.8	31.0	0.71	1.1	31	54	66
097-119	0.16					10.8	9.5	1.2	0.8	22.3	13.5	2.9	35.8	29.3	0.73	1.1	37	62	76
119-145	0.11					12.3	9.4	1.3	0.8	23.8	8.7	0.8	32.5	26.7	0.77	1.3	46	73	89
145-175	0.11					12.3	8.9	1.2	0.7	23.1	4.9		28.0	24.4	0.78	1.4	50	83	95

DEPTH CM	(SATURATED PASTE) 8E1 REST OHM-CM	8C1B PH	8A H2O PCT	NA 5D2 ESP PCT	NA 5E SAR	SALT 8D5 TOTL SOLU PPM	GYP 6F1A PCT	(SATURATION EXTRACT 8A1) 8A1A EC MMHOS/CM	6N1B CA	6O1B MG	6P1A NA	6Q1A K	6I1A CO3	6J1A HCO3	6K1A CL	6L1A SO4	6M1A NO3	ATTERBERG 4F1 LQID LMIT PCT	4F2 PLST INDX
								(MEQ / LITER)											
000-010																		36E	12
010-018																			
018-038																		35E	13
038-048																			
048-058																			
058-071																		58E	33
071-084																			
084-097																			
097-119	2400	4.1	58.0			100		0.27											
119-145																		54E	32
145-175																			

(A) FE/MN NODULES COMPRISE MORE THAN 75 PCT OF THE SAND.
(B) BULK DENSITY ESTIMATED FOR HORIZON FROM 119-145 CM.
(C) MICRO-PENETRATION RESISTANCE - A ROD 0.6 CM DIA IS SLOWLY PUSHED INTO BULK DENSITY CLOD, EQUILIBRATED AT 1/10- BAR, A DISTANCE OF 0.6 CM USING A POCKET PENETROMETER. UNITS ARE FORCE (KG) AND NOT ESTIMATES OF UNCONFINED COMPRESSIVE STRENGTH.
(D) ORGANIC CARBON IS 9 KG PER SQ M TO A DEPTH OF 1 METER (METHOD 6A).
(E) BY IOWA HWY DEPT, AMES IOWA.

Pedon classification: Aquic Hapludalf; fine, montmorillonitic, mesic.
Series classification: (Same as pedon).
Soil: Weller silt loam.
Soil no.: S69-Iowa-68-1 (LSL Nos. 69L1041 - 69L1051).
Location: Monroe County, Iowa, 510 feet south and 155 feet west of the gate along road in SW¼ Sec. 2 or 1,190 feet north and 830 feet west of SE corner of SW ¼, Sec. 2, T. 71 N., R. 18 W.
Vegetation and land use: Improved bluegrass pasture; recently cleared forested land.
Parent material: Deoxidized-leached and oxidized-leached loess (Wisconsin) low in sand (less than 5 percent).
Physiography: Convex summit of a gently sloping extended interfluve. Breaks sharply to E and F slopes (14 to 24 percent) to the west, east, and south.
Relief: Gently sloping interfluve with a south axis.
Slope: 3 percent south facing.
Drainage: Moderately well drained.
Ground water: None observed.
Permeability: Slow.
Described by: J. D. Highland, J. R. Culver, and T. E. Fenton; November 6, 1969.

(Colors for moist conditions unless otherwise stated)

A1 69L1041 0 to 10 cm (0 to 4 inches). Very dark gray (10YR 3/1) silt loam, very dark grayish brown (10YR 3/2) crushed, some mixing of grayish brown (10YR 4/2), gray (10YR 6/1) dry; weak coarse platy structure; friable; few soft dark reddish brown (10YR 2/2) oxides; many fine roots; slightly acid; clear wavy boundary.

A21 69L1042 10 to 18 cm (4 to 7 inches). Brown (10YR 4/3) silt loam, dark grayish brown (10YR 4/2) coatings on plates; moderate thin platy structure; friable; common fine soft dark reddish brown (5YR 3/2) oxides; very strongly acid; clear smooth boundary.

A22 69L1043 18 to 38 cm (7 to 15 inches). Yellowish brown (10YR 5/4) silt loam, brown (10YR 5/3) coatings on plates; weak medium platy structure; friable; few dark gray (10YR 3/1) wormcasts; very strongly acid; clear smooth boundary.

AB 69L1044 38 to 48 cm (15 to 19 inches). Yellowish brown (10YR 5/4) light silty clay loam; brown (10YR 5/3) coatings on peds; moderate fine angular and subangular blocky structure; friable; thin discontinuous light gray (10YR 7/1 dry) silt coats on peds; very strongly acid; clear smooth boundary.

B1 69L1045 48 to 58 cm (19 to 23 inches). Yellowish brown (10YR 5/4) medium silty clay loam, grayish brown (10YR 5/2) coatings on peds; strong fine and very fine angular and subangular blocky structure; firm; thin discontinuous dark gray (10YR 4/1) clay films on faces of peds; thick continuous light gray (10YR 7/1 dry) silt coats on peds; few soft dark brown (7.5YR 4/4) oxides; very strongly acid; abrupt smooth boundary.

B21t 69L1046 58 to 71 cm (23 to 28 inches). Mottled yellowish brown (10YR 5/4) and grayish brown (10YR 5/2) medium silty clay; yellowish brown (10YR 5/4) kneaded; common fine distinct strong brown (7.5YR 5/6) mottles; moderate fine angular and subangular blocky structure; firm; thick discontinuous dark gray (10YR 4/1) clay films on faces of peds; light gray (10YR 7/1) silt coats on peds in upper inch; few very fine soft dark brown (7.5YR 3/2) oxides; very strongly acid; gradual smooth boundary.

B22t 69L1047 71 to 84 cm (28 to 33 inches). Colors same as above; medium silty clay; moderate fine and medium angular and subangular blocky structure; firm; moderately thick discontinuous dark gray (10YR 4/1) clay films on faces of peds; few fine soft dark reddish brown (5YR 3/2) oxides; very strongly acid; gradual smooth boundary.

B23t 69L1048 84 to 97 cm (33 to 38 inches). Mottled grayish brown (2.5Y 5/2) and yellowish brown (10YR 5/6) heavy silty clay loam; common fine distinct strong brown (7.5YR 5/6) mottles; weak fine and medium angular and subangular blocky structure; firm; thin discontinuous dark gray (10YR 4/1) clay films on faces of peds; few fine soft dark reddish brown (5YR 3/2) oxides; very strongly acid; gradual smooth boundary.

B31t 69L1049 97 to 119 cm (38 to 47 inches). Mottled olive gray (5Y 5/2) and yellowish brown (10YR 5/6) medium silty clay loam; common medium distinct strong brown (7.5YR 5/6) mottles; weak coarse prismatic structure parting to weak medium subangular blocky; deoxidized and leached weathering zone; thin discontinuous clay films; many fine soft dark reddish brown (5YR 3/2) oxides; strongly acid; gradual smooth boundary.

B32 69L1050 119 to 145 cm (47 to 57 inches). Colors same as above; medium silty clay loam; weak coarse prismatic structure; deoxidized and leached weathering zone; firm; thin discontinuous clay films; few thin discontinuous light gray (10YR 7/1 dry) silt coats on prisms; common medium dark reddish brown (5YR 2/2) oxides; common fine soft Fe-Mn oxides; medium acid; gradual smooth boundary.

C 69L1051 145 to 175 cm (57 to 69 inches). Grayish brown (2.5Y 5/2) light silty clay loam; many fine and medium distinct yellowish brown (10YR 5/6) mottles; weak coarse prismatic structure; firm; deoxidized and leached weathering zone; few thin colloidal clay coatings on vertical prism faces; many fine soft dark reddish brown (5YR 3/2) oxides; few to common fine soft Fe-Mn oxides; slightly acid.

SOIL CLASSIFICATION-AQUIC HAPLUDALF
FINE, MONTMORILLONITIC, MESIC
SERIES - - - - - - -WELLER

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE MRTSC
SOIL SURVEY INVESTIGATIONS UNIT
LINCOLN, NEBRASKA

SOIL NO - - - - - -S69IOWA-59-1 COUNTY - - - LUCAS

GENERAL METHODS- - -1A2A,1B1B,1B2,1B SAMPLE NOS. 69L1052-69L1063

DEPTH	HORIZON	(- - - - PARTICLE SIZE ANALYSIS, LT 2MM, 3A1, 3A1A, 3A1B - - - -																)RATIO
					FINE (- - - - -	SAND - - - - -				)(- - -SILT- - - -)			FAML	INTR	FINE	NON-	8D1
		SAND 2-.05	SILT .05-.002	CLAY LT .002	CLAY LT .0002	VCOS 2-1	CORS 1-.5	MEDS .5-.25	FNES .25-.10	VFNS .10-.05	COSI .05-.02	FNSI .02-.002	VFSI .005-.002	TEXT SAND 2-.1	II .2-.02	CLAY TO CLAY	CO3-CLAY	15-BAR TO CLAY
CM		(- - - -							PCT LT 2MM						- - -)	PCT	PCT	
000-018	AP	2.0B	78.1	19.9	7.8	TR	.2	.4	.8	.6	32.3	45.8		1.4	33.3	39		.40
018-030	A2	1.9B	73.6	24.5	10.5	TR	.3	.4	.7	.5	29.9	43.7		1.4	30.7	43		.38
030-038	AB	1.6B	67.2	31.2	15.6	TR	.2	.4	.6	.4	24.8	42.4		1.2	25.5	50		.40
038-046	B1	1.2B	61.4	37.4	19.6	.1	.2	.2	.4	.3	23.3	38.1		.9	23.9	52		.42
046-064	B21T	.8B	52.0	47.2	29.1	.0	.1	.1	.3	.3	18.5	33.5		.5	18.9	62		.45
064-086	B22T	.8B	55.8	43.4	26.7	.0	.1	.1	.3	.3	20.7	35.1		.5	21.2	62		.47
086-109	B31T	.8B	59.4	39.8	22.9	.0	.1	.1	.3	.3	23.6	35.8		.5	24.0	58		.47
109-140	B32T	.7B	62.6	36.7	20.8	.0	.1	.1	.2	.3	21.8	40.8		.4	22.2	57		.48
140-170	B33T	.7B	65.9	33.4	20.6	.0	.1	.1	.2	.3	27.3	38.6		.4	27.7	61		.49
000-010	A1 (A)	2.3B	80.0	17.7	6.4	.1	.4	.4	.7	.7	33.9	46.1		1.6	35.0	36		.40
010-020	A21 (A)	1.7B	80.0	18.3	6.6	.1	.2	.3	.5	.6	33.1	46.9		1.1	34.0	36		.34
020-030	A22 (A)	1.3B	78.0	20.7	7.0	.1	.2	.2	.4	.4	32.0	46.0		.9	32.6	34		.33

DEPTH	(PARTICLE SIZE ANALYSIS, MM, 3B, 3B1, 3B2)							(BULK DENSITY		)	(- - -WATER CONTENT- - - -)					AVAIL	(- -PH - -)	
	VOL.	(- - - - - - WEIGHT - - - - - - -)						4A1D	4A1H	4D1	4B1C	4B1C	4B2	4C1		P(G)/	8C1A	8C1E
	GT 2	GT 75	75-20	20-5	5-2	LT .074	20-2 PCT LT20	1/3-BAR	OVEN DRY	COLE	1/10 BAR	1/3-BAR	15-BAR	WRD CM/CM		LBS/ACRE	1/1 H2O	1/2 CACl
CM	PCT	PCT	(- - - PCT LT 75 - - -)					G/CC	G/CC		PCT	PCT	PCT					
000-018	0	0	0	0	0	99	0	1.41	1.46	.012	29.1	26.3	7.9	.26		7.0	5.0	4.6
018-030	0	0	0	0	0	98	0	1.45	1.51	.014	27.3	24.4	9.4	.22		5.5	4.7	4.1
030-038	0	0	0	0	0	99	0	1.50	1.63	.028	26.3	24.3	12.6	.18	2.60	8.0	4.6	4.0
038-046	0	0	0	0	0	99	0	1.42	1.72	.066	29.8	28.3	15.7	.18	2.30	18.0	4.5	4.1
046-064	0	0	0	0	0	99	0	1.35	1.89	.119	36.5	33.9	21.3	.17	1.20	26.5	4.5	4.0
064-086	0	0	0	0	0	99	0	1.41	1.87	.099	32.5	30.9	20.2	.15	1.70	47.5	4.4	4.1
086-109	0	0	0	0	0	99	0	1.40C					18.7			53.0	4.6	4.2
109-140	0	0	0	0	0	100	0	1.42	1.74	.070	31.6	30.2	17.7	.18	1.30	37.5	5.0	4.5
140-170	0	0	0	0	0	100	0	1.45	1.73	.061	32.4	30.4	16.5	.20	1.30		5.5	5.0
000-010	0	0	0	0	0	98	0						7.1				5.5	5.2
010-020	0	0	0	0	0	99	0						6.2				4.6	4.2
020-030		0	0	TR	0	99	TR						6.9				4.4	4.0

DEPTH	(ORGANIC MATTER	)		IRON	PHOS	(- -EXTRACTABLE BASES 5B4A- -)					ACTY	AL	(CAT EXCH)		RATIO	RATIO	CA	(BASE SAT)	
	6A1A ORGN CARB	6B1A NITG	C/N	6C2A EXT FE	6S1A TOTL	6N2E CA	6O2D MG	6P2A NA	6Q2A K	SUM EXTB	6H1A BACL TEA	6G1D KCL EXT	5A3A EXTB ACTY	5A6A NHAC	8D1 NHAC TO CLAY	8D3 CA TO MG	5E SAT NHAC	5C3 EXTB ACTY	5C1 NHAC
CM	PCT	PCT		PCT	PCT	(- - - - - - - - - -MEQ / 100 G- - - - - - - - - -)											PCT	PCT	PCT
000-018	1.16E	.127	9	0.7		5.7	1.8	0.2	0.3	8.0	9.4	0.4	17.4	13.3	0.67	3.2	43	46	60
018-030	0.30	.043	7	0.8		3.7	2.7	0.2	0.3	6.9	10.4	2.8	17.3	13.4	0.55	1.4	28	40	51
030-038	0.27	.043	6	1.0		5.0	4.6	0.3	0.5	10.4	13.2	3.9	23.6	18.3	0.59	1.1	27	44	57
038-046	0.24	.042	6	1.2		6.6	6.4	0.4	0.6	14.0	15.2	4.9	29.2	23.4	0.63	1.0	28	48	60
046-064	0.20	.040	5	1.3		11.3	9.5	0.7	0.8	22.3	18.0	5.8	40.3	33.1	0.70	1.2	34	55	67
064-086	0.12			1.3		11.8	9.9	0.9	0.8	23.4	17.0	4.2	40.4	31.8	0.73	1.2	37	58	74
086-109	0.11			1.3		11.3	9.8	1.0	0.8	22.9	12.0	2.2	34.9	30.0	0.75	1.2	38	66	76
109-140	0.12			1.3		12.9	10.0	1.1	0.8	24.8	9.1	1.1	33.9	28.4	0.77	1.3	45	73	87
140-170	0.16			1.1		12.8	9.8	1.1	0.8	24.5	7.5		32.0	26.3	0.79	1.3	40	77	93
000-010	1.81																		
010-020	0.56																		
020-030	0.36																		

DEPTH	(SATURATED PASTE)			NA	NA	SALT	GYP	(- - - - - - - - - SATURATION EXTRACT 8A1- - - - - - - - - -)										ATTERBERG	
	8E1 REST OHM-CM	8C1B PH	8A H2O PCT	5D2 ESP PCT	5E SAR	8D5 TOTL SOLU PPM	6F1A PCT	8A1A EC MMHOS/CM	6N1B CA	6O1B MG	6P1A NA	6Q1A K	6I1A CO3	6J1A HCO3	6K1A CL	6L1A SO4	6M1G NO3	4F1 LQID LMIT	4F2 PLST INDX
CM									(- - - - - - - - - - MEQ / LITER								- - -)	PCT	
000-018																		31F	7
018-030																		33F	11
030-038																			
038-046																			
046-064																		65F	37
064-086																			
086-109	3000	4.2	57.7			52		0.14											
109-140																		51F	28
140-170																			
000-010																			
010-020																			
020-030																			

CLAY MINERALOGY (7A2C) PLACEMENT (S69IA-59-1) MONTMORILLONITIC.
018-30 KK3 MI3 MT2 VM2 QZ1.
046-64 MT5 KK3 MI2 QZ1.
140-170 MT3 KK2 MI1.
COMMENTS-- CLAYS WELL-ORDERED EXCEPT POORLY-ORDERED MONTMORILLONITE IN A2 (18-30CM).
RELATIVE AMOUNTS-- (X-RAY) 5 = DOMINANT 4 = ABUNDANT 3 = MODERATE 2 = SMALL 1 = TRACE. (DTA) AS PERCENT.
MINERAL CODE-- MT = MONTMORILLONITE MI = MICA KK = KAOLINITE CL = CHLORITE VM = VERMICULITE QZ = QUARTZ

MICROMORPHOLOGY (4E1)--AB(69L1054), B1(69L1055), B21T(69L1056) HORIZONS.
THE AB LACKS CLAY FILMS. THE B1 CONTAINS A FEW CLAY FILMS AND THEY ARE COMMON IN THE B21T. REMOVAL OF CLAY FROM NEAR MACROSURFACES AND ENRICHMENT IN PARTS REMOVED ARE WELL EXPRESSED IN THE B21T AND WEAKLY EXPRESSED IN TH B1. IN BREWER'S TERMINOLOGY, THE AB IS ASEPIC, THE B1 IS INSEPIC, AND THE B21T IS INTERMEDIATE BETWEEN VOSEPIC AND MASEPIC. FLAKES OF MICA ARE FAIRLY COMMON. A HIGH PROPORTION OF THE GRAINS OF BIOTITE( ) BUT NOT MUSCOVITE( ) APPEAR ALTERED. IRON-RICH SEGREGATIONS (GLAEBULES) MOSTLY CIRCULAR IN CROSS SECTION ARE COMMON. THE DIAMETER OF MOST EXCEEDS 0.05 MM WITH AN UPPER LIMIT NEAR 2 MM. IRON CONCENTRATION APPEARS TO INCREASE TOWARD THE PERIPHERY OF THE SEGREGATION. A FEW SEGREGATIONS HAVE A CONCENTRIC RING ORGANIZATION. THE SEGREGATIONS HAVE SHARP BOUNDARIES. SEGREGATIONS IN THE B21T BUT NOT THE B1 OR AB COMMONLY ARE SURROUNDED BY ORIENTED CLAY. THE AB HORIZON CONTAINS 8 TO 9 PERCENT BY VOLUME. THE AMOUNT DROPS TO 5 PERCENT IN THE LOWER PART. THE B1 AND B21T CONTAIN 2 TO 6 PERCENT. THESE PERCENTAGES HAVE A LARGE UNCERTAINTY BECAUSE OF THE SMALL AREA OF THIN SECTION OBSERVED.

(A) SAMPLED 32 M EAST OF 59-1.
(B) FE/MN NODULES COMPRISE MORE THAN 75 PCT OF THE SAND.
(C) BULK DENSITY ESTIMATED FOR HORIZON FROM 86-109 CM.
(D) MICRO-PENETRATION RESISTANCE - A ROD 0.6 CM DIA IS SLOWLY PUSHED INTO BULK DENSITY CLOD, EQUILIBRATED AT 1/10- BAR, A DISTANCE OF 0.6 CM USING A POCKET PENETROMETER. UNITS ARE FORCE (KG) AND NOT ESTIMATES OF UNCONFINED COMPRESSIVE STRENGTH.
(E) ORGANIC CARBON IS 5 KG PER SQ M TO A DEPTH OF 1 METER (METHOD 6A).
(F) BY IOWA HWY DEPT, AMES, IOWA.
(G) IOWA STATE UNIVERSITY DATA.

Pedon classification: Aquic Hapludalf ; fine, montmorillonitic, mesic.
Series classification: (Same as pedon).
Soil: Weller silt loam.
Soil no.: S69-Iowa-59-1 (LSL Nos. 69L1052 - 69L1063).
Location: Lucas County, Iowa, 400 feet south and 100 feet west of the NE corner of the NW¼ NW¼ Sec. 9, T 72 N., R 20 W.
Vegetation and land use: Pasture; area formerly in large, deciduous trees.
Parent material: Deoxidized-leached and oxidized-leached (Wisconsin) loess low in sand, less than 5 percent.
Physiography: Convex south facing interfluve adjoining stable, nearly level loess-covered Kansan and Nebraskan till. Breaks to 9 to 24 percent slopes on backslope below summit.
Relief: Gently sloping upland interfluve.
Slope: 3 percent, south aspect.
Drainage: Moderately well drained.
Ground water: None.
Permeability: Slow.
Described by: J. D. Highland, J. R. Culver and T. E. Fenton; November 6, 1969.

(Colors for moist conditions unless otherwise stated)

Ap 69L1052 0 to 18 cm (0 to 7 inches). Dark grayish brown (10YR 4/2) and 30 to 40 percent mixing of brown (10YR 5/3); silt loam; light gray (10YR 7/2) dry; weak to moderate thin platy structure; friable; common very fine soft dark reddish brown (5YR 3/2) oxides; strongly acid; abrupt smooth boundary.

A2 69L1053 18 to 30 cm (7 to 12 inches). Brown (10YR 5/3) silt loam, very pale brown (10YR 7/3) dry; kneaded brown (10YR 5/3); moderate medium platy structure; friable; discontinuous grayish brown (10YR 5/2) coatings on plates; few very fine soft dark reddish brown (5YR 3/2) oxide concretions; very strongly acid; clear smooth boundary.

AB 69L1054 30 to 38 cm (12 to 15 inches). Yellowish brown (10YR 5/4) medium silty clay loam; discontinuous grayish brown (10YR 5/2) coatings on peds; moderate fine subangular blocky structure; friable; few very fine soft dark reddish brown (5YR 3/2) oxides; few thin patchy light gray (10YR 7/1) dry silt coats; very strongly acid; clear smooth boundary.

B1 69L1055 38 to 46 cm (15 to 18 inches). Yellowish brown (10YR 5/4) heavy silty clay loam; grayish brown (10YR 5/2) coatings on peds; kneaded yellowish brown (10YR 5/4); moderate to strong subangular blocky and angular blocky structure; friable to firm; nearly continuous horizontal band of light gray (10YR 7/1 dry) silt coats; few very fine soft dark reddish brown (5YR 3/2) oxides; very strongly acid; abrupt smooth boundary.

B21t 69L1056 46 to 64 cm (18 to 25 inches). Yellowish brown (10YR 5/4) medium silty clay; brown (10YR 5/2) coatings on peds; kneaded yellowish brown (10YR 5/4); few fine distinct grayish brown (2.5Y 5/2) mottles; moderate very fine and fine subangular and angular blocky structure; very firm; continuous moderately thick clay films; few very fine soft dark reddish brown (5YR 3/2) oxides; very strongly acid; gradual smooth boundary.

B22t 69L1057 64 to 86 cm (25 to 34 inches). Yellowish brown (10YR 5/4) light to medium silty clay; discontinuous grayish brown (10YR 5/2) coatings on peds; kneaded yellowish brown (10YR 5/4); few fine faint grayish brown (2.5Y 5/2) and few fine distinct dark brown (7.5YR 4/4) mottles; weak very fine subangular blocky structure; very firm; continuous clay films; common fine soft dark reddish brown (5YR 2/2) oxides; very strongly acid; gradual smooth boundary.

B31t 69L1058 86 to 109 cm (34 to 43 inches). Mottled yellowish brown (10YR 5/6), dark yellowish brown (10YR 4/4) and grayish brown (2.5Y 5/2) light silty clay; weak fine and medium subangular blocky structure; firm; continuous clay films; common fine soft dark reddish brown (5YR 2/2) oxides; strongly acid; gradual smooth boundary.

B32t 69L1059 109 to 140 cm (43 to 55 inches). Mottled grayish brown (2.5Y 5/2) and yellowish brown (10YR 5/6); brown (10YR 5/3) coatings on peds; heavy silty clay loam; few fine prominent strong brown (7.5YR 5/6) mottles; weak medium subangular blocky structure; firm; nearly continuous clay films; few fine soft reddish brown (5YR 4/4) oxides; few thin discontinuous light brownish gray (10YR 6/2) silt coats mainly on vertical ped faces; mottled deoxidized and leached weathering zone; strongly acid; diffuse smooth boundary.

B33t 69L1060 140 to 170 cm (55 to 67 inches). Color same as above; medium silty clay loam; weak medium subangular blocky structure; firm; thin discontinuous clay films; few clay-lined and filled old channels; mottled deoxidized and leached weathering zone; medium acid.

Remarks: A1 and A2 mixed by plowing. Satellite site 105 feet east of principal site from which samples of A1, 0-4 in.; A21, 4-8 in.; and A22, 8-12 in. were collected.

Satellite Weller site 105 feet east of prime site under oak trees:

A1 69L1061 0 to 10 cm (0 to 4 inches). Very dark gray (10YR 3/1) silt loam, gray (10YR 6/1) dry; moderate thin platy structure; friable; common very fine soft dark reddish brown (5YR 3/2) oxides; many fine roots; medium acid; abrupt smooth boundary.

A21 69L1062 10 to 20 cm (4 to 8 inches). Dark grayish brown (10YR 4/2) silt loam; light gray (10YR 7/2) dry; kneaded grayish brown (10YR 5/2); moderate thin platy structure; friable; common very fine soft dark reddish brown (5YR 3/2) oxides; very strongly acid; clear smooth boundary.

A22 69L1063 20 to 30 cm (8 to 12 inches). Brown (10YR 5/3), thin discontinuous grayish brown (10YR 5/2) coatings on plates silt loam; very pale brown (10YR 7/3) dry, kneaded brown (10YR 5/3); moderate medium platy structure; friable; few very fine soft dark reddish brown (5YR 3/2) oxides; many fine roots; very strongly acid; clear smooth boundary.

SOIL CLASSIFICATION-CUMULIC HAPLAQUOLL
FINE, MONTMORILLONITIC, MESIC

SERIES - - - - - - -ZOOK

SOIL NO - - - - - - S71IOWA-93-1 COUNTY - - - WAYNE

GENERAL METHODS- - -1A,1B1B,2A1,2B SAMPLE NOS. 71L1164-71L1171

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE MRTSC
SOIL SURVEY INVESTIGATIONS UNIT
LINCOLN, NEBRASKA

OCTOBER 1974

DEPTH CM	HORIZON	SAND 2-.05	SILT .05-.002	CLAY .002 LT	CLAY .0002 LT	VCOS 2- 1	CORS 1- .5	MEDS .5- .25	FNES .25- .10	VFNS .10- .05	COSI .05-.02	FNSI .02-.002	VFSI .005-.002	TEXT SAND 2-.1	FAML II .2-.02	INTR FINE CLAY TO CLAY	NON-CO3-CLAY PCT	BD1 15-BAR TO CLAY
		PARTICLE SIZE ANALYSIS, LT 2MM, 3A1, 3A1A, 3A1B (PCT LT 2MM)																RATIO
000-18	AP	3.5A	58.2	38.3	22.4	TR	.1	.2	1.0	2.2	14.5	43.7	10.5	1.3	17.2	58		.42
018-30	A12	4.6A	51.1	44.3	26.6	TR	.1	.3	2.0	2.2	11.5	39.6	10.5	2.4	14.9	60		.45
030-48	A13	5.0A	51.0	44.0	26.6	TR	.1	.4	2.2	2.3	10.9	40.1	11.3	2.7	14.4	60		.45
048-66	A14	5.4A	52.8	41.8	26.6	.1	.1	.4	2.5	2.3	12.4	40.4	10.9	3.1	16.2	64		.45
066-94	A15	8.1A	51.6	40.3	25.1	TR	.1	.6	4.0	3.4	11.9	39.7	10.9	4.7	17.6	62		.43
094-122	AC	8.0A	51.7	40.3	25.4	TR	.1	.6	3.9	3.4	11.9	39.8	10.5	4.6	17.6	63		.44
122-145	C1	10.0A	50.1	39.9	24.3	.1	.1	.9	5.2	3.7	12.3	37.8	9.8	6.3	19.0	61		.43
145-191	C2G	11.4A	52.6	36.0	19.5	.3	.6	1.0	5.2	4.3	13.0	39.6	10.3	7.1	20.3	54		.44

DEPTH CM	VOL. GT 2 PCT	WEIGHT GT 75 PCT	75-20	20-5	5-2	LT .074 PCT LT 75	PCT LT20	4A1D 1/3-BAR G/CC	4A1H OVEN DRY G/CC	4D1 COLE	4B1C 1/10 BAR PCT	4B1C 1/3-BAR PCT	4B2 15-BAR PCT	4C1 WRD CM/CM	6E1B LT 2 PCT	3A1A LT .002 PCT	8C1A 1/1 H2O	8C1E 1/2 CACL
	PARTICLE SIZE ANALYSIS, MM, 3B, 3B1, 3B2							BULK DENSITY			WATER CONTENT				CARBONATE		PH	
000-18	0	0	0	0	0	98	0	1.45	1.72	.059	28.7	27.5	16.2	.16	3.8C		5.4	5.0
018-30	0	0	0	0	0	97	0	1.39	1.76	.082	28.5	27.6	19.8	.11	4.8C		5.4	5.2
030-48	0	0	0	0	0	96	0	1.40B					20.0				5.9	5.3
048-66	0	0	0	0	0	96	0	1.43	1.80	.080	29.8	27.3	18.8	.12	3.6C		5.8	5.4
066-94	0	0	0	0	0	94	0	1.40B					17.5				6.1	5.6
094-122	0	0	0	0	0	94	0	1.47	1.84	.078	28.5	26.9	17.7	.14	1.7C		6.1	5.7
122-145	0	0	0	0	0	92	0	1.50B					17.3				6.2	5.6
145-191	0	0	0	0	0	91	0	1.51	1.83	.066	27.0	26.3	16.0	.16	2.1C		6.0	5.5

DEPTH CM	6A1A ORGN CARB PCT	6B1A NITG PCT	C/N	6C2A EXT FE PCT	6S1A TOTL PCT	6N2E CA	6Q2D MG	6P2A NA	6Q2A K	SUM EXTB / 100	6H1A BACL TEA	6G1D KCL EXT	5A3A EXTB ACTY	5A6A NHAC	8D1 NHAC TO CLAY	8D3 TO MG	5F CA SAT NHAC PCT	5C3 EXTB ACTY PCT	5C1 NHAC PCT
	ORGANIC MATTER			IRON	PHOS	EXTRACTABLE BASES 5B4A- MEQ					ACTY	AL	(CAT EXCH)		RATIO	RATIO	CA	(BASE SAT)	
000-18	2.05D	.169	12	.9		19.7	5.7	.1	.6	26.1	10.3	TR	36.4	32.5	.85	3.5	61	72	80
018-30	1.81	.166	11	.7		24.2	7.0	.1	.5	31.8	9.7	.0	41.5	37.0	.84	3.5	65	77	86
030-48	1.40	.081	17	.7		25.0	7.5	.1	.5	33.1	8.8		41.9	36.2	.82	3.3	69	79	91
048-66	1.10	.095	12	.6		23.7	7.3	.2	.5	31.7	7.5		39.2	34.6	.83	3.3	69	81	92
066-94	.89	.072	12	.6		23.1	7.4	.2	.6	31.3	5.9		37.2	32.9	.82	3.1	70	84	95
094-122	.69	.054	13	.5		22.7	7.6	.2	.6	31.1	4.8		35.9	32.3	.80	3.0	70	87	96
122-145	.49			.7		21.0	7.2	.2	.6	29.0	5.1		34.1	30.4	.76	2.9	69	85	95
145-191	.32			.9		18.1	6.5	.2	.7	25.5	5.1		30.6	27.4	.76	2.8	66	83	93

DEPTH CM	8E1 REST OHM-CM	8C1B PH	8A H2O PCT	5D2 ESP PCT	5E SAR	8D5 TOTL SOLU PPM	6F1A PCT	8A1A EC MMHOS/CM	6N1B CA	6O1B MG	6P1A NA	6Q1A K	6I1A CO3	6J1A HCO3	6K1A CL	6L1A SO4	6M1A NO3	4F1 LQID LMIT PCT	4F2 PLST INDX
	SATURATED PASTE			NA	NA	SALT	GYP	SATURATION EXTRACT 8A1 (MEQ / LITER)										ATTERBERG[F]	
000-18																		60	31
018-30																			
030-48																			
048-66																			
066-94																		53	31
094-122	1900	5.6	60.3					.23											
122-145																			
145-191																		45	25

(A) FE-MN NODULES 5 PCT.
(B) ESTIMATED.
(C) MICRO-PENETRATION RESISTANCE - A ROD 0.6 CM DIA IS SLOWLY PUSHED INTO BULK DENSITY CLOD, EQUILIBRATED AT 1/10-BAR, A DISTANCE OF 0.6 CM USING A POCKET PENETROMETER. UNITS ARE FORCE (KG) AND NOT ESTIMATES OF UNCONFINED COMPRESSIVE STRENGTH.
(D) ORGANIC CARBON IS 19 KG/M SQ TO A DEPTH OF 1 M (6A).
(E) IOWA STATE HIGHWAY COMMISSION DATA.

Pedon classification: Cumulic Haplaquoll; fine, montmorillonitic, mesic.
Series classification: (Same as pedon).
Soil: Zook silty clay loam.
Soil no.: S71-Iowa-93-1 (LSL NOS. 71L1164 - 71L1171).
Location: Wayne County, Iowa; 20 feet east and 100 feet north of the southwest corner of the SE¼ NE¼ sec. 4, T. 69 N., R. 21 W.
Vegetation and land use: Soybeans; cropland.
Parent material: Fine textures alluvium that contains less than 15 percent sand.
Physiography: Low, flat flood plain about 1/4-mile north of the straightened channel of the south fork of the Chariton River.
Relief: Plan to slightly concave.
Slope: Less than 1 percent.
Drainage: Poorly drained.
Erosion: None.
Ground water: None within 8 feet (seasonal rainfall below normal).
Permeability: Slow.
Described by: J. D. Highland and L. D. Lockridge, October 1971.

(Colors are for moist soil unless otherwise stated)

Ap 71L1164 0 to 18 cm (0 to 7 inches). Black (10YR 2/1) heavy silty clay loam, kneaded very dark gray (10YR 3/1); cloddy parting to weak fine granular structure; firm; few patchy grayish brown (10YR 7/2 dry) silt and sand coatings on some peds; common fine roots; strongly acid (pH 5.4); abrupt wavy boundary.

A12 71L1165 18 to 30 cm (7 to 12 inches). Black (10YR 2/1) light silty clay, kneaded same; weak fine subangular blocky parting to weak fine granular structure; firm; few fine roots; strongly acid (pH 5.4); gradual smooth boundary.

A13 71L1166 30 to 48 cm (12 to 19 inches). Black (10YR 2/1) light silty clay, kneaded same; weak fine subangular blocky structure; firm; few hard dark reddish brown oxide concretions 1 to 3 mm in size; medium acid (pH 5.6); gradual smooth boundary.

A14 71L1167 48 to 66 cm (19 to 26 inches). Black (10YR 2/1) light silty clay; weak medium prismatic parting to weak fine subangular blocky structure; firm; few soft reddish brown oxide accumulations 1 to 3 mm in size; medium acid (pH 5.6); gradual smooth boundary.

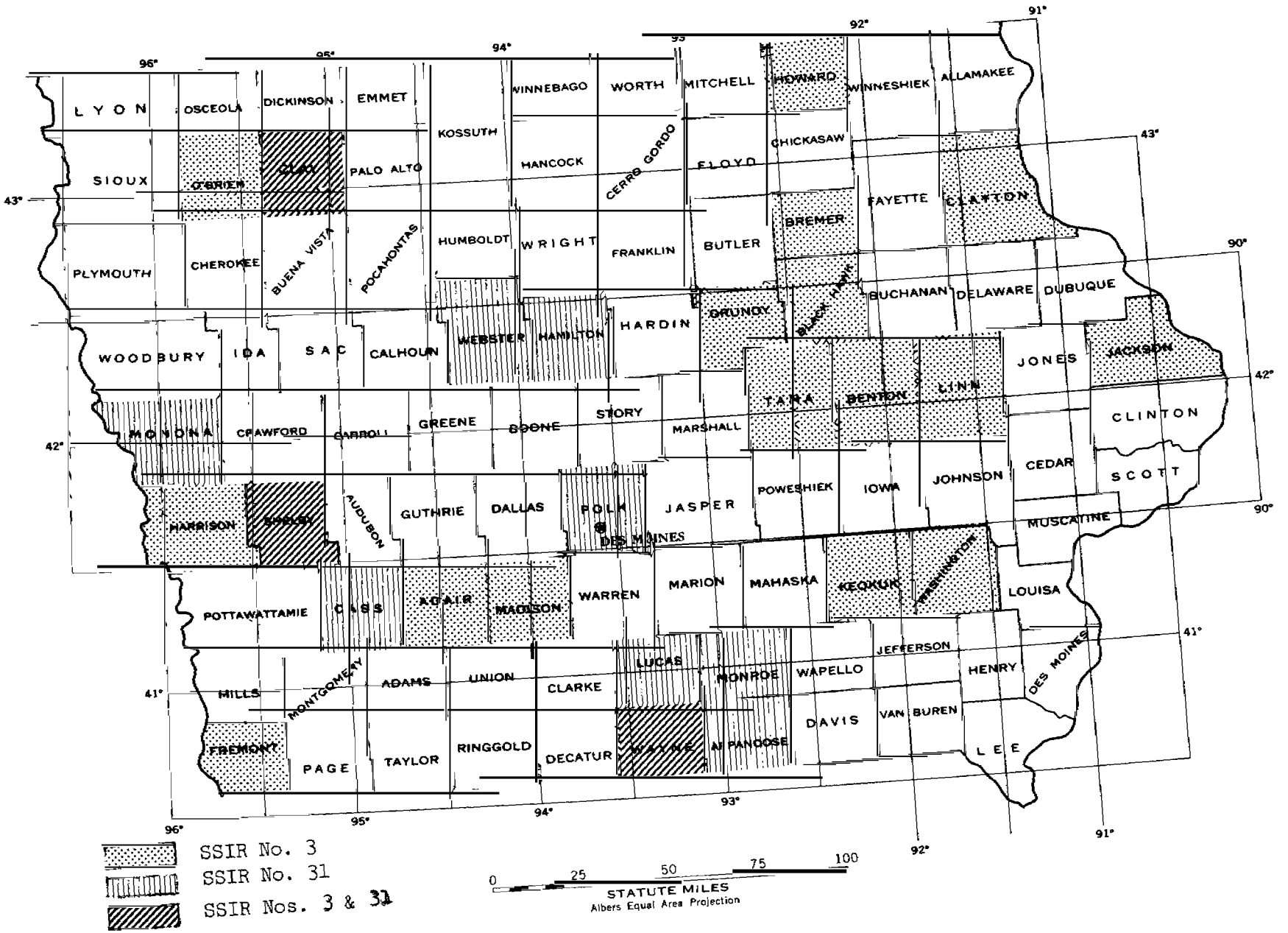
A15 71L1168 66 to 94 cm (26 to 37 inches). Black (10YR 2/1) silty clay, kneaded very dark gray (10YR 3/1); weak medium prismatic parting to weak medium angular and subangular blocky structure; firm; few soft dark brown oxide accumulations 1 to 3 mm in size; medium acid (pH 5.8); gradual smooth boundary.

AC 71L1169 94 to 122 cm (37 to 48 inches). Black (10YR 2/1) silty clay, kneaded very dark gray (10YR 3/1); weak medium prismatic parting to moderate medium angular and subangular blocky structure; firm; few soft dark brown oxide accumulations 1 to 3 mm in size; medium acid (pH 5.8); gradual smooth boundary.

C1 71L1170 122 to 145 cm (48 to 57 inches). Very dark gray (10YR 3/1) light silty clay; few fine distinct dark grayish brown (2.5Y 4/2) mottles; weak medium prismatic parting to weak medium angular and subangular blocky structure; firm; few thin patchy light gray (10YR 7/1 dry) silt coatings on some peds; few soft dark brown oxide accumulations 1 to 3 mm in size; some oblique pressure faces; sheen on some peds; medium acid (pH 5.8); gradual smooth boundary.

C2g 71L1171 145 to 191 cm (57 to 75 inches). Dark gray (10YR 4/1) light silty clay, very dark gray coatings on some prisms; common fine faint dark grayish brown (2.5Y 4/2) mottles; weak medium prismatic structure; firm; common fine soft dark brown oxide accumulations 1 to 3 mm in size; some oblique pressure faces; sheen on some peds; few patchy light gray (10YR 7/1 dry) silt accumulations on some prism faces; medium acid (pH 5.8)

* U.S. GOVERMENT PRINTING OFFICE : 1978 0-726-154/559


LYON
OSCEOLA
DICKINSON
EMMET
KOSSUTH
WINNEBAGO
WORTH
MITCHELL
HOWARD
WINNESHIEK
ALLAMAKEE
SIOUX
O'BRIEN
CLAY
PALO ALTO
HANCOCK
CERRO GORDO
FLOYD
CHICKASAW
FAYETTE
CLAYTON
PLYMOUTH
CHEROKEE
BUENA VISTA
POCAHONTAS
HUMBOLDT
WRIGHT
FRANKLIN
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DELAWARE
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WEBSTER
HAMILTON
HARDIN
GRUNDY
BLACK HAWK
JONES
JACKSON
MONONA
CRAWFORD
CARROLL
GREENE
BOONE
STORY
MARSHALL
TAMA
BENTON
LINN
CLINTON
HARRISON
SHELBY
AUDUBON
GUTHRIE
DALLAS
POLK
DES MOINES
JASPER
POWESHIEK
IOWA
JOHNSON
CEDAR
SCOTT
MUSCATINE
POTTAWATTAMIE
CASS
ADAIR
MADISON
WARREN
MARION
MAHASKA
KEOKUK
WASHINGTON
LOUISA
MILLS
MONTGOMERY
ADAMS
UNION
CLARKE
LUCAS
MONROE
WAPELLO
JEFFERSON
HENRY
DES MOINES
FREMONT
PAGE
TAYLOR
RINGGOLD
DECATUR
WAYNE
APPANOOSE
DAVIS
VAN BUREN
LEE
96°
95°
94°
93°
92°
91°
90°
43°
42°
41°
SSIR No. 3
SSIR No. 31
SSIR Nos. 3 & 31
0
25
50
75
100
STATUTE MILES
Albers Equal Area Projection