Chemical Properties of the Soils
Griggs County, North Dakota

The Chemical Properties table shows estimates of some characteristics and features that affect soil behavior. These estimates are given for the major layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

Depth to the upper and lower boundaries of each layer is indicated.

Cation−exchange capacity is the total amount of extractable bases that can be held by the soil,expressed in terms of milliequivalents per 100 grams of soil at neutrality (pH 7.0) or at some other stated pH value. Soils having a low cation−exchange capacity hold fewer cations and may require more frequent applications of fertilizer than soils having a high cation−exchange capacity. Soils having a high cation−exchange capacity can retain cations. The ability to retain cations helps to prevent the pollution of ground water.

Soil reaction is a measure of acidity or alkalinity and is expressed as a range in pH values. The range in pH of each major horizon is based on many field tests. For many soils, values have

Calcium carbonate equivalent is the percent of carbonates, by weight, in the fraction of the soil less than 2 millimeters in size. The availability of plant nutrients is influenced by the amount of carbonates in the soil. Incorporating nitrogen fertilizer into calcareous soils helps to prevent nitrite accumulation and ammonium−N volatilization.

Gypsum is expressed as a percent, by weight, of hydrated calcium sulfates in the fraction of the soil less than 20 millimeters in size. Gypsum is partially soluble in water and can be dissolved and removed by water. Soils that have a high content of gypsum may collapse if the gypsum is removed by percolating water.

Salinity is a measure of soluble salts in the soil at saturation. It is expressed as the electrical conductivity of the saturation extract, in millimhos per centimeter at 25 degrees C. Estimates are based on field and laboratory measurements at representative sites of nonirrigated soils. The salinity of irrigated soils is affected by the quality of the irrigation water and by the frequency of water application. Hence, the salinity of soils in individual fields can differ greatly from the value given in the table. Salinity affects the suitability of a soil for crop production, the stability of soil if used as construction material, and the potential of the soil to corrode metal and concrete.

Sodium adsorption ratio (SAR) is a measure of the amount of sodium (Na) relative to calcium (Ca) and magnesium (Mg) in the water extract from saturated soil paste. It is the ratio of the Na concentration divided by the square root of one−half of the Ca + Mg concentration. Soils that have SAR values of 13 or more may be characterized by an increased dispersion of organic matter and clay particles, reduced permeability and aeration, and a general degradation of soil structure.

Chemical Properties of the Soils--continued
Griggs County, North Dakota

Map symbol and soil name	Depth	Clay	Cation exchange capacity	Soil reaction	Calcium carbon-ate	Gypsum	Salinity	Sodium adsorp-tion ratio
	In	Pct	meq/100 g	pH	Pct	Pct	mmhos/cm	
61:								
Arveson----------	0-9	10-20	15-30	7.4-8.4	5-20	0	0	0
	9-39	10-27	5-25	7.4-8.4	15-30	0-1	0	0
	39-60	5-20	2-15	7.4-8.4	10-20	0-5	0	0-1
Tiffany----------	0-24	10-18	10-25	6.1-7.8	0	0	0	0
	24-60	5-18	5-15	6.6-7.8	0-5	0	0	0-1
Arveson, SALINE------	0-9	10-20	15-30	7.4-8.4	5-20	---	4.0-16.0	0
	9-39	10-27	5-25	7.4-8.4	15-30	---	4.0-16.0	0
	39-60	5-20	2-25	7.4-8.4	10-20	---	4.0-16.0	0-1
Wyndmere----------	0-10	5-15	10-25	6.6-8.4	10-20	0-1	0	0-1
	10-30	3-15	3-20	7.4-8.4	15-35	0-1	0.0-2.0	0-1
	30-60	3-15	2-10	7.4-8.4	5-20	0-1	0.0-2.0	0-3
Hamar----------	0-8	5-10	7-12	6.1-7.8	0	0	0.0-2.0	0
	8-17	0-7	3-9	6.6-8.4	0-1	0	0.0-2.0	0
	17-60	0-7	3-9	7.4-8.4	0-2	0	0.0-2.0	0
Manfred----------	0-7	18-26	20-40	6.1-8.4	0-5	0-1	2.0-4.0	1-5
	7-60	18-34	10-25	7.9-9.0	10-30	0-2	2.0-16.0	5-25
Rosewood----------	0-9	8-18	---	7.9-8.4	---	---	0	---
	9-26	6-18	---	7.9-8.4	---	---	0	---
	26-60	1-6	---	7.4-8.4	---	---	0	---
118:								
Barnes----------	0-9	15-27	10-30	5.6-7.8	0	0	0.0-2.0	0
	9-14	18-35	10-30	6.1-7.8	0-3	0	0.0-4.0	0
	14-60	18-35	5-25	7.4-8.4	10-30	0-1	0.0-4.0	0
Buse----------	0-7	18-27	10-30	6.6-8.4	1-10	0	0	0
	7-60	18-35	5-25	7.4-8.4	10-30	0-1	0.0-4.0	0-2
Svea----------	0-9	15-27	10-30	5.6-7.8	0	0	0.0-2.0	0
	9-14	18-35	10-30	6.1-7.8	0-3	0	0.0-4.0	0
	14-60	18-35	5-25	7.4-8.4	10-30	0-1	0.0-4.0	0
Hamerly----------	0-10	18-27	15-30	6.6-8.4	0-10	0	0.0-2.0	0
	10-29	18-35	10-20	7.4-8.4	15-35	0-2	0.0-4.0	0-2
	29-60	18-35	10-20	7.4-8.4	10-30	0-2	0.0-4.0	0-2
Langhei----------	0-7	18-30	---	6.6-8.4	---	---	0	---
	7-60	18-32	---	7.4-8.4	---	---	0	---
Parnell----------	0-9	27-40	25-45	6.1-7.8	0	0	0	0
	9-49	35-60	20-45	6.1-7.8	0	0	0	0
	49-60	35-45	15-30	6.6-8.4	0-3	0-2	0	0
Tonka----------	0-17	18-27	15-35	5.6-7.8	0	0	0	0
	17-40	35-45	15-35	5.6-7.8	0-1	0-1	0.0-2.0	0-1
	40-60	18-39	10-25	6.6-8.4	5-20	0-2	0.0-4.0	0-2
Vallers----------	0-12	18-28	20-40	7.4-8.4	5-10	0-1	0.0-4.0	0
	12-32	18-35	10-25	7.4-8.4	15-30	0-2	0.0-4.0	0-5
	32-60	18-35	10-20	7.4-8.4	15-30	0-2	0.0-4.0	0-10
120:								
Buse----------	0-7	18-27	10-30	6.6-8.4	1-10	0	0	0
	7-60	18-35	5-25	7.4-8.4	10-30	0-1	0.0-4.0	0-2
Barnes----------	0-9	15-27	10-30	5.6-7.8	0	0	0.0-2.0	0
	9-14	18-35	10-30	6.1-7.8	0-3	0	0.0-4.0	0
	14-60	18-35	5-25	7.4-8.4	10-30	0-1	0.0-4.0	0
Svea----------	0-18	18-27	15-30	6.1-7.8	0	0	0	0
	18-28	18-35	10-30	6.6-7.8	0-3	0	0	0
	28-60	18-35	10-25	7.4-8.4	3-15	0-1	0.0-4.0	0-2

Chemical Properties of the Soils--continued
Griggs County, North Dakota

Map symbol and soil name	Depth	Clay	Cation exchange capacity	Soil reaction	Calcium carbon-ate	Gypsum	Salinity	Sodium adsorp-tion ratio
	In	Pct	meq/100 g	pH	Pct	Pct	mmhos/cm	
Brantford----------	0-8	10-19	10-25	6.1-7.8	0	0	0	0
	8-16	18-27	10-20	6.6-7.8	0-1	0	0	0
	16-60	2-8	1-5	7.4-8.4	5-20	0	0	0
Langhei----------	0-7	18-30	---	6.6-8.4	---	---	0	---
	7-60	18-32	---	7.4-8.4	---	---	0	---
Hamerly----------	0-10	18-27	15-30	6.6-8.4	0-10	0	0.0-2.0	0
	10-29	18-35	10-20	7.4-8.4	15-35	0-2	0.0-4.0	0-2
	29-60	18-35	10-20	7.4-8.4	10-30	0-2	0.0-4.0	0-2
Parnell----------	0-9	27-40	25-45	6.1-7.8	0	0	0	0
	9-49	35-60	20-45	6.1-7.8	0	0	0	0
	49-60	35-45	15-30	6.6-8.4	0-3	0-2	0	0
Tonka----------	0-17	18-27	15-35	5.6-7.8	0	0	0	0
	17-40	35-45	15-35	5.6-7.8	0-1	0-1	0.0-2.0	0-1
	40-60	18-39	10-25	6.6-8.4	5-20	0-2	0.0-4.0	0-2
156:								
Barnes----------	0-9	15-27	10-30	5.6-7.8	0	0	0.0-2.0	0
	9-14	18-35	10-30	6.1-7.8	0-3	0	0.0-4.0	0
	14-60	18-35	5-25	7.4-8.4	10-30	0-1	0.0-4.0	0
Svea----------	0-18	18-27	15-30	6.1-7.8	0	0	0	0
	18-28	18-35	10-30	6.6-7.8	0-3	0	0	0
	28-60	18-35	10-25	7.4-8.4	3-15	0-1	0.0-4.0	0-2
Buse----------	0-7	18-27	10-30	6.6-8.4	1-10	0	0	0
	7-60	18-35	5-25	7.4-8.4	10-30	0-1	0.0-4.0	0-2
Hamerly----------	0-10	18-27	15-30	6.6-8.4	0-10	0	0.0-2.0	0
	10-29	18-35	10-20	7.4-8.4	15-35	0-2	0.0-4.0	0-2
	29-60	18-35	10-20	7.4-8.4	10-30	0-2	0.0-4.0	0-2
Tonka----------	0-17	18-27	15-35	5.6-7.8	0	0	0	0
	17-40	35-45	15-35	5.6-7.8	0-1	0-1	0.0-2.0	0-1
	40-60	18-39	10-25	6.6-8.4	5-20	0-2	0.0-4.0	0-2
Parnell----------	0-9	27-40	25-45	6.1-7.8	0	0	0	0
	9-49	35-60	20-45	6.1-7.8	0	0	0	0
	49-60	35-45	15-30	6.6-8.4	0-3	0-2	0	0
Wyard----------	0-15	18-27	20-40	6.6-7.8	0	0	0	0
	15-21	18-27	15-30	6.6-7.8	0	0	0	0
	21-35	18-35	15-30	7.4-8.4	10-25	0	0	0
	35-60	15-35	15-30	7.4-8.4	10-20	0	0	0
167:								
Bearden----------	0-9	18-26	15-30	7.4-8.4	0-10	0-1	0.0-4.0	0-2
	9-20	18-34	5-25	7.4-8.4	10-45	0-1	0.0-4.0	0-3
	20-60	18-34	5-20	7.4-8.4	5-20	0-5	0.0-4.0	0-10
Perella----------	0-7	18-26	---	6.6-7.8	---	---	0	---
	7-22	18-34	---	6.6-7.8	---	---	0	---
	22-60	18-34	---	7.4-8.4	---	---	0	---
Overly----------	0-16	10-26	20-40	6.6-7.8	0	0	0	0
	16-25	18-34	15-30	6.6-8.4	0-10	0-2	0.0-2.0	0
	25-60	18-59	15-30	7.9-8.4	10-20	0-2	0.0-4.0	0
Bearden, SALINE------	0-9	18-26	15-30	7.4-7.8	0-10	0-1	4.0-16.0	0-2
	9-20	18-34	5-25	7.4-8.4	10-45	0-5	4.0-16.0	0-3
	20-60	18-34	5-20	7.4-8.4	5-20	0-5	4.0-16.0	0-10
Colvin----------	0-10	18-26	15-30	6.6-8.4	0-10	0-1	0.0-4.0	0-2
	10-30	18-34	5-30	7.4-8.4	10-45	0-1	0.0-4.0	0-3
	30-60	18-34	5-20	7.4-8.4	5-20	0-5	0.0-4.0	0-10
Wyndmere----------	0-10	5-15	10-25	6.6-8.4	10-20	0-1	0	0-1
	10-30	3-15	3-20	7.4-8.4	15-35	0-1	0.0-2.0	0-1
	30-60	3-15	2-10	7.4-8.4	5-20	0-1	0.0-2.0	0-3

Chemical Properties of the Soils--continued
Griggs County, North Dakota

Map symbol and soil name	Depth	Clay	Cation exchange capacity	Soil reaction	Calcium carbon-ate	Gypsum	Salinity	Sodium adsorp-tion ratio
	In	Pct	meq/100 g	pH	Pct	Pct	mmhos/cm	
Enloe----------	0-14	27-40	---	5.6-7.3	---	---	0	---
	14-38	45-60	---	6.1-7.8	---	---	0	---
	38-60	27-50	---	7.4-7.8	---	---	0	---
296:								
Brantford----------	0-8	10-19	10-25	6.1-7.8	0	0	0	0
	8-15	18-27	10-20	6.6-7.8	0-1	0	0	0
	15-60	2-8	1-5	7.4-8.4	5-20	0	0	0
Vang----------	0-11	18-27	15-25	5.6-7.3	0	0-1	0	0-1
	11-27	18-30	10-20	5.6-8.4	0-10	0-1	0	0-1
	27-60	0-5	5-10	5.6-8.4	5-15	0-1	0	0-2
Binford----------	0-8	6-18	5-20	5.6-7.8	0	0	0	0
	8-17	6-18	5-15	5.6-8.4	0-1	0	0	0
	17-60	2-8	1-5	7.4-8.4	5-20	0	0	0
Coe----------	0-8	6-18	5-15	6.6-7.8	0-5	0	0	0
	8-60	2-8	1-5	7.4-8.4	5-20	0	0	0
Divide----------	0-9	15-27	10-30	7.4-8.4	1-15	0	0	0
	9-28	18-35	10-30	7.4-8.4	15-35	0-1	0.0-2.0	0
	28-60	1-10	2-10	7.4-8.4	10-30	0	0	0
Kensal----------	0-9	18-25	---	6.6-7.3	---	---	0	---
	9-23	18-25	---	6.6-7.3	---	---	0	---
	23-60	0-10	---	7.4-8.4	---	---	0	---
Renshaw----------	0-9	8-18	---	7.9-8.4	---	---	0	---
	9-26	6-18	---	7.9-8.4	---	---	0	---
	26-60	1-6	---	7.4-8.4	---	---	0	---
314:								
Buse----------	0-7	18-27	10-30	6.6-8.4	1-10	0	0	0
	7-60	18-35	5-25	7.4-8.4	10-30	0-1	0.0-4.0	0-2
Barnes----------	0-9	15-27	10-30	5.6-7.8	0	0	0.0-2.0	0
	9-14	18-35	10-30	6.1-7.8	0-3	0	0.0-4.0	0
	14-60	18-35	5-25	7.4-8.4	10-30	0-1	0.0-4.0	0
Svea----------	0-20	18-26	---	6.1-7.8	---	---	0	---
	20-25	18-28	---	6.6-7.8	---	---	0	---
	25-60	18-28	---	7.4-8.4	---	---	0	---
Hamerly----------	0-10	18-27	15-30	6.6-8.4	0-10	0	0.0-2.0	0
	10-29	18-35	10-20	7.4-8.4	15-35	0-2	0.0-4.0	0-2
	29-60	18-35	10-20	7.4-8.4	10-30	0-2	0.0-4.0	0-2
Coe----------	0-8	6-18	5-15	6.6-7.8	0-5	0	0	0
	8-60	2-8	1-5	7.4-8.4	5-20	0	0	0
Lamoure----------	0-23	27-35	25-30	6.6-7.8	---	---	0	---
	23-43	27-35	20-30	7.4-8.4	4-25	---	0.0-4.0	---
	43-60	25-35	15-25	7.4-8.4	4-15	0-2	0.0-4.0	0-1
Maddock----------	0-11	2-10	3-10	6.6-7.8	0-3	0	0.0-2.0	0
	11-60	2-8	1-8	6.6-8.4	0-10	0	0.0-2.0	0
Tonka----------	0-17	18-27	15-35	5.6-7.8	0	0	0	0
	17-40	35-45	15-35	5.6-7.8	0-1	0-1	0.0-2.0	0-1
	40-60	18-39	10-25	6.6-8.4	5-20	0-2	0.0-4.0	0-2
319:								
Buse----------	0-7	18-27	10-30	6.6-8.4	1-10	0	0	0
	7-60	18-35	5-25	7.4-8.4	10-30	0-1	0.0-4.0	0-2
Barnes----------	0-9	15-27	10-30	5.6-7.8	0	0	0.0-2.0	0
	9-14	18-35	10-30	6.1-7.8	0-3	0	0.0-4.0	0
	14-60	18-35	5-25	7.4-8.4	10-30	0-1	0.0-4.0	0

Chemical Properties of the Soils--continued
Griggs County, North Dakota

Map symbol and soil name	Depth	Clay	Cation exchange capacity	Soil reaction	Calcium carbon-ate	Gypsum	Salinity	Sodium adsorp-tion ratio
	In	Pct	meq/100 g	pH	Pct	Pct	mmhos/cm	
Svea----------	0-8	18-26	---	6.1-7.8	---	---	0	---
	8-22	18-28	---	6.6-7.8	---	---	0	---
	22-60	18-28	---	7.4-8.4	---	---	0	---
Langhei----------	0-4	18-30	---	6.6-8.4	---	---	0	---
	4-60	18-32	---	7.4-8.4	---	---	0	---
Lamoure----------	0-23	27-35	25-30	6.6-7.8	---	---	0	---
	23-43	27-35	20-30	7.4-8.4	4-25	---	0.0-4.0	---
	43-60	25-35	15-25	7.4-8.4	4-15	0-2	0.0-4.0	0-1
Vang----------	0-11	18-27	15-25	5.6-7.3	0	0-1	0	0-1
	11-27	18-30	10-20	5.6-8.4	0-10	0-1	0	0-1
	27-60	0-5	5-10	5.6-8.4	5-15	0-1	0	0-2
Coe----------	0-8	6-18	5-15	6.6-7.8	0-5	0	0	0
	8-60	2-8	1-5	7.4-8.4	5-20	0	0	0
Maddock----------	0-8	2-10	3-10	6.6-7.8	0-3	0	0.0-2.0	0
	8-60	2-8	1-8	6.6-8.4	0-10	0	0.0-2.0	0
391:								
Cresbard----------	0-12	20-26	15-30	5.6-7.3	0	0	0.0-2.0	0
	12-25	35-50	20-45	5.6-7.8	0	0	2.0-4.0	1-10
	25-32	35-50	20-40	6.1-8.4	10-20	1-5	2.0-4.0	5-15
	32-60	25-35	15-30	7.4-9.0	10-20	1-5	2.0-8.0	5-15
Cavour----------	0-10	18-25	15-30	6.1-7.8	0	0	0.0-2.0	0
	10-20	35-50	25-45	6.6-9.0	0-10	0-1	4.0-16.0	5-18
	20-60	25-35	15-30	7.4-9.0	10-30	1-10	8.0-16.0	5-10
Svea----------	0-18	18-27	15-30	6.1-7.8	0	0	0	0
	18-28	18-35	10-30	6.6-7.8	0-3	0	0	0
	28-60	18-35	10-25	7.4-8.4	3-15	0-1	0.0-4.0	0-2
Ferney----------	0-5	18-26	15-35	6.1-7.3	0	0	0.0-2.0	0-3
	5-13	35-50	20-45	6.6-8.4	0-1	1-3	4.0-16.0	16-21
	13-60	35-45	20-40	7.4-9.0	2-15	1-5	8.0-16.0	8-16
Hamerly, SALINE------	0-10	18-27	15-30	7.4-8.4	1-15	0-3	4.0-16.0	0
	10-29	18-35	10-30	7.4-8.4	15-35	0-5	4.0-16.0	0-2
	29-60	18-35	10-25	7.4-8.4	10-30	0-5	4.0-16.0	0-4
Hamerly----------	0-10	18-27	15-30	6.6-8.4	0-10	0	0.0-2.0	0
	10-29	18-35	10-20	7.4-8.4	15-35	0-2	0.0-4.0	0-2
	29-60	18-35	10-20	7.4-8.4	10-30	0-2	0.0-4.0	0-2
Edgeley----------	0-8	18-26	15-27	6.1-7.3	0	0	0	0
	8-32	18-34	10-16	6.1-8.4	0-15	0	0	0
	32-60	---	---	---	---	---	---	---
Tonka----------	0-17	18-27	15-35	5.6-7.8	0	0	0	0
	17-40	35-45	15-35	5.6-7.8	0-1	0-1	0.0-2.0	0-1
	40-60	18-39	10-25	6.6-8.4	5-20	0-2	0.0-4.0	0-2
450:								
Colvin----------	0-10	18-26	15-30	6.6-8.4	0-10	0-1	0.0-4.0	0-2
	10-30	18-34	5-30	7.4-8.4	10-45	0-1	0.0-4.0	0-3
	30-60	18-34	5-20	7.4-8.4	5-20	0-5	0.0-4.0	0-10
Perella----------	0-7	18-26	---	6.6-7.8	---	---	0	---
	7-22	18-34	---	6.6-7.8	---	---	0	---
	22-60	18-34	---	7.4-8.4	---	---	0	---
Colvin----------	0-7	18-26	25-40	6.6-8.4	0-10	0-1	0	0-2
	7-36	18-34	15-25	7.4-8.4	10-35	0-1	0	0-3
	36-60	18-34	10-20	7.4-8.4	5-20	0-5	0	0-10
Marysland----------	0-8	18-35	15-35	7.9-8.4	1-15	0	0	0
	8-30	18-35	10-25	7.9-8.4	15-35	0-3	0.0-2.0	0
	30-60	1-5	2-10	7.9-8.4	5-20	0	0	0

Chemical Properties of the Soils--continued
Griggs County, North Dakota

Map symbol and soil name	Depth	Clay	Cation exchange capacity	Soil reaction	Calcium carbon-ate	Gypsum	Salinity	Sodium adsorp-tion ratio
	In	Pct	meq/100 g	pH	Pct	Pct	mmhos/cm	
Bearden----------	0-9	18-26	15-30	7.4-8.4	0-10	0-1	0.0-4.0	0-2
	9-20	18-34	5-25	7.4-8.4	10-45	0-1	0.0-4.0	0-3
	20-60	18-34	5-20	7.4-8.4	5-20	0-5	0.0-4.0	0-10
Fram----------	0-18	10-18	---	7.4-8.4	---	---	0	---
	18-60	7-18	---	7.4-8.4	---	---	0	---
Wyndmere----------	0-10	5-15	10-25	6.6-8.4	10-20	0-1	0	0-1
	10-30	3-15	3-20	7.4-8.4	15-35	0-1	0.0-2.0	0-1
	30-60	3-15	2-10	7.4-8.4	5-20	0-1	0.0-2.0	0-3
511:								
Divide----------	0-9	15-27	10-30	7.4-8.4	1-15	0	0	0
	9-28	18-35	10-30	7.4-8.4	15-35	0-1	0.0-2.0	0
	28-60	1-10	2-10	7.4-8.4	10-30	0	0	0
Wyrene----------	0-24	8-18	18-30	6.6-8.4	15-30	0	0	0
	24-60	0-5	0-3	7.4-8.4	10-25	0	0	0
Marysland----------	0-8	18-35	15-35	7.9-8.4	1-15	0	0	0
	8-30	18-35	10-25	7.9-8.4	15-35	0-3	0.0-2.0	0
	30-60	1-5	2-10	7.9-8.4	5-20	0	0	0
Hamerly----------	0-10	18-27	15-30	6.6-8.4	0-10	0	0.0-2.0	0
	10-29	18-35	10-20	7.4-8.4	15-35	0-2	0.0-4.0	0-2
	29-60	18-35	10-20	7.4-8.4	10-30	0-2	0.0-4.0	0-2
Wyard----------	0-15	18-27	20-40	6.6-7.8	0	0	0	0
	15-21	18-27	15-30	6.6-7.8	0	0	0	0
	21-35	18-35	15-30	7.4-8.4	10-25	0	0	0
	35-60	15-35	15-30	7.4-8.4	10-20	0	0	0
Fram----------	0-18	10-18	---	7.4-8.4	---	---	0	---
	18-60	7-18	---	7.4-8.4	---	---	0	---
Hamar----------	0-11	5-10	7-12	6.1-7.8	0	0	0.0-2.0	0
	11-16	0-7	3-9	6.6-8.4	0-1	0	0.0-2.0	0
	16-60	0-7	3-9	7.4-8.4	0-2	0	0.0-2.0	0
536:								
Zell----------	0-8	10-18	10-20	6.6-8.4	0-5	0	0.0-2.0	0
	8-20	10-18	5-15	7.4-8.4	10-20	0	0.0-2.0	0
	20-60	5-18	2-10	7.4-8.4	5-15	0	0.0-2.0	0
Eckman----------	0-8	12-18	10-25	6.6-7.8	0	0	0	0
	8-19	10-18	4-15	6.6-8.4	0-15	0	0	0
	19-60	10-18	4-10	7.4-8.4	0-15	0	0	0
Gardena----------	0-15	12-18	10-25	6.6-7.8	0-3	0	0	0
	15-60	10-18	5-15	7.4-8.4	0-15	0-2	0.0-2.0	0-2
Overly----------	0-14	10-26	20-40	6.6-7.8	0	0	0	0
	14-60	18-34	15-30	6.6-8.4	10-30	0	0	0
Coe----------	0-8	6-18	5-15	6.6-7.8	0-5	0	0	0
	8-60	2-8	1-5	7.4-8.4	5-20	0	0	0
Bearden----------	0-9	18-26	15-30	7.4-8.4	0-10	0-1	0.0-4.0	0-2
	9-20	18-34	5-25	7.4-8.4	10-45	0-1	0.0-4.0	0-3
	20-60	18-34	5-20	7.4-8.4	5-20	0-5	0.0-4.0	0-10
Colvin----------	0-10	18-26	15-30	6.6-8.4	0-10	0-1	0.0-4.0	0-2
	10-30	18-34	5-30	7.4-8.4	10-45	0-1	0.0-4.0	0-3
	30-60	18-34	5-20	7.4-8.4	5-20	0-5	0.0-4.0	0-10
Maddock----------	0-14	2-10	3-10	6.6-7.8	0-3	0	0.0-2.0	0
	14-60	2-8	1-8	6.6-8.4	0-10	0	0.0-2.0	0
539:								
Edgeley----------	0-8	18-26	15-35	6.1-7.3	0	0	0	0
	8-32	18-34	15-25	6.1-8.4	0-15	0	0	0
	32-60	35-45	---	---	0-10	0-5	2.0-8.0	---

Chemical Properties of the Soils--continued
Griggs County, North Dakota

Map symbol and soil name	Depth	Clay	Cation exchange capacity	Soil reaction	Calcium carbon-ate	Gypsum	Salinity	Sodium adsorp-tion ratio
	In	Pct	meq/100 g	pH	Pct	Pct	mmhos/cm	
Walsh----------	0-9	15-26	---	6.1-7.3	---	---	0	---
	9-60	25-35	---	6.1-7.8	---	---	0	---
Barnes----------	0-9	15-27	10-30	5.6-7.8	0	0	0.0-2.0	0
	9-14	18-35	10-30	6.1-7.8	0-3	0	0.0-4.0	0
	14-60	18-35	5-25	7.4-8.4	10-30	0-1	0.0-4.0	0
Cresbard----------	0-12	20-26	15-30	5.6-7.3	0	0	0.0-2.0	0
	12-25	35-50	20-45	5.6-7.8	0	0	2.0-4.0	1-10
	25-32	35-50	20-40	6.1-8.4	10-20	1-5	2.0-4.0	5-15
	32-60	25-35	15-30	7.4-9.0	10-20	1-5	2.0-8.0	5-15
Hamerly, SALINE------	0-10	18-27	15-30	7.4-8.4	1-15	0-3	4.0-16.0	0
	10-29	18-35	10-30	7.4-8.4	15-35	0-5	4.0-16.0	0-2
	29-60	18-35	10-25	7.4-8.4	10-30	0-5	4.0-16.0	0-4
Kloten----------	0-9	18-26	15-25	6.1-8.4	0-5	0	0	0
	9-60	---	---	---	---	---	---	---
Svea----------	0-18	18-27	15-30	6.1-7.8	0	0	0	0
	18-28	18-35	10-30	6.6-7.8	0-3	0	0	0
	28-60	18-35	10-25	7.4-8.4	3-15	0-1	0.0-4.0	0-2
541:								
Edgeley----------	0-8	18-26	15-27	6.1-7.3	0	0	0	0
	8-32	18-34	10-16	6.1-8.4	0-15	0	0	0
	32-60	35-45	---	---	0-10	0-5	2.0-8.0	---
Kloten----------	0-9	18-26	15-25	6.1-8.4	0-5	0	0	0
	9-60	35-45	---	---	---	---	---	---
Brantford----------	0-8	10-19	10-25	6.1-7.8	0	0	0	0
	8-15	18-27	10-20	6.6-7.8	0-1	0	0	0
	15-60	2-8	1-5	7.4-8.4	5-20	0	0	0
Svea----------	0-18	18-27	15-30	6.1-7.8	0	0	0	0
	18-28	18-35	10-30	6.6-7.8	0-3	0	0	0
	28-60	18-35	10-25	7.4-8.4	3-15	0-1	0.0-4.0	0-2
Walsh----------	0-8	27-35	---	6.1-7.3	---	---	0	---
	8-60	25-35	---	6.1-7.8	---	---	0	---
Cresbard----------	0-12	20-26	15-30	5.6-7.3	0	0	0.0-2.0	0
	12-25	35-50	20-45	5.6-7.8	0	0	2.0-4.0	1-10
	25-32	35-50	20-40	6.1-8.4	10-20	1-5	2.0-4.0	5-15
	32-60	25-35	15-30	7.4-9.0	10-20	1-5	2.0-8.0	5-15
Vang----------	0-9	18-27	15-25	5.6-7.3	0	0-1	0	0-1
	9-27	18-30	10-20	5.6-8.4	1-10	0-1	0	0-1
	27-60	0-5	5-10	5.6-8.4	5-15	0-1	0	0-2
569:								
Embden----------	0-16	10-18	10-25	6.6-7.3	0	0	0	0
	16-38	10-18	5-20	6.6-7.8	0	0	0	0
	38-60	5-18	2-15	6.6-8.4	0-15	0	0.0-2.0	0
Embden, GRAVEL SUBSTRATUM----------	0-11	10-18	---	6.6-7.3	---	---	0	---
	11-24	10-18	---	6.6-7.8	---	---	0	---
	24-40	5-18	---	7.4-8.4	---	---	0	---
	40-60	0-10	---	7.4-8.4	---	---	0	---
Maddock----------	0-13	2-10	3-10	6.6-7.8	0-3	0	0.0-2.0	0
	13-60	2-8	1-8	6.6-8.4	0-10	0	0.0-2.0	0
Egeland----------	0-9	10-18	10-15	5.6-7.3	0	0	0.0-2.0	0
	9-40	10-18	5-15	6.1-7.8	0	0	0.0-2.0	0
	40-60	5-10	2-5	6.6-8.4	0-10	0-1	0.0-2.0	0
Tiffany----------	0-24	10-18	10-25	6.1-7.8	0	0	0	0
	24-60	5-18	5-15	6.6-7.8	0-5	0	0	0-1

Chemical Properties of the Soils--continued
Griggs County, North Dakota

Map symbol and soil name	Depth	Clay	Cation exchange capacity	Soil reaction	Calcium carbon-ate	Gypsum	Salinity	Sodium adsorp-tion ratio
	In	Pct	meq/100 g	pH	Pct	Pct	mmhos/cm	
Perella----------	0-7	18-26	---	6.6-7.8	---	---	0	---
	7-22	18-34	---	6.6-7.8	---	---	0	---
	22-60	18-34	---	7.4-8.4	---	---	0	---
Wyndmere----------	0-10	5-15	10-25	6.6-8.4	10-20	0-1	0	0-1
	10-30	3-15	3-20	7.4-8.4	15-35	0-1	0.0-2.0	0-1
	30-60	3-15	2-10	7.4-8.4	5-20	0-1	0.0-2.0	0-3
579:								
Embden----------	0-16	10-18	10-25	6.6-7.3	0	0	0	0
	16-38	10-18	5-20	6.6-7.8	0	0	0	0
	38-60	5-18	2-15	6.6-8.4	0-15	0	0.0-2.0	0
Egeland----------	0-9	10-18	10-15	5.6-7.3	0	0	0.0-2.0	0
	9-40	10-18	5-15	6.1-7.8	0	0	0.0-2.0	0
	40-60	5-10	2-5	6.6-8.4	0-10	0-1	0.0-2.0	0
Divide----------	0-9	15-27	10-30	7.4-8.4	1-15	0	0	0
	9-28	18-35	10-30	7.4-8.4	15-35	0-1	0.0-2.0	0
	28-60	1-10	2-10	7.4-8.4	10-30	0	0	0
Binford----------	0-8	6-18	5-20	5.6-7.8	0	0	0	0
	8-17	6-18	5-15	5.6-8.4	0-1	0	0	0
	17-60	2-8	1-5	7.4-8.4	5-20	0	0	0
Zell----------	0-7	10-18	10-20	6.6-8.4	0-5	0	0.0-2.0	0
	7-29	10-18	5-15	7.4-8.4	10-20	0	0.0-2.0	0
	29-60	5-18	2-10	7.4-8.4	5-15	0	0.0-2.0	0
Glyndon----------	0-13	15-27	---	7.4-8.4	---	---	0.0-4.0	---
	13-33	10-18	---	7.9-8.4	---	---	0.0-4.0	---
	33-43	10-18	---	7.4-8.4	---	---	0.0-4.0	---
	43-60	15-35	---	7.4-8.4	---	---	0.0-4.0	---
Tiffany----------	0-24	10-18	10-25	6.1-7.8	0	0	0	0
	24-60	5-18	5-15	6.6-7.8	0-5	0	0	0-1
Wyndmere----------	0-10	5-15	10-25	6.6-8.4	10-20	0-1	0	0-1
	10-30	3-15	3-20	7.4-8.4	15-35	0-1	0.0-2.0	0-1
	30-60	3-15	2-10	7.4-8.4	5-20	0-1	0.0-2.0	0-3
595:								
Emrick----------	0-13	10-18	10-30	6.6-7.8	0	0	0	0
	13-32	10-18	5-20	6.6-7.8	0-5	0	0	0
	32-60	7-18	3-15	7.4-8.4	5-20	0	0	0-5
Cathay----------	0-10	10-27	10-25	6.1-7.8	0	0	0.0-2.0	0
	10-22	18-35	10-25	6.6-8.4	0	0-1	4.0-8.0	1-10
	22-60	7-18	3-10	7.4-9.0	5-20	1-5	4.0-8.0	5-15
Heimdal----------	0-7	10-20	20-30	6.1-7.3	0	0	0	0
	7-14	10-18	10-25	6.1-7.8	0-5	0	0	0-1
	14-60	7-18	5-20	7.4-8.4	5-20	0	0	0-5
Larson----------	0-8	10-27	15-30	6.1-7.3	0	0	0.0-2.0	0
	8-21	18-35	10-20	7.4-9.0	1-10	0-2	4.0-16.0	5-15
	21-60	10-35	5-15	7.9-9.0	10-35	0-4	2.0-8.0	5-10
Towner----------	0-7	2-10	5-10	6.6-7.8	0	0	0	0
	7-26	2-10	2-5	6.6-7.8	0	0	0	0
	26-60	18-40	10-20	7.4-8.4	10-30	0-2	0.0-2.0	0
Esmond----------	0-7	10-18	---	7.4-8.4	---	---	0	---
	7-60	7-18	---	7.4-8.4	---	---	0	---
Fram----------	0-18	10-18	---	7.4-8.4	---	---	0	---
	18-60	7-18	---	7.4-8.4	---	---	0	---
Tonka----------	0-17	18-27	15-35	5.6-7.8	0	0	0	0
	17-40	35-45	15-35	5.6-7.8	0-1	0-1	0.0-2.0	0-1
	40-60	18-39	10-25	6.6-8.4	5-20	0-2	0.0-4.0	0-2

Chemical Properties of the Soils--continued
Griggs County, North Dakota

Map symbol and soil name	Depth	Clay	Cation exchange capacity	Soil reaction	Calcium carbon-ate	Gypsum	Salinity	Sodium adsorp-tion ratio
	In	Pct	meq/100 g	pH	Pct	Pct	mmhos/cm	
597:								
Emrick	0-13	10-18	10-30	6.6-7.8	0	0	0	0
	13-32	10-18	5-20	6.6-7.8	0-5	0	0	0
	32-60	7-18	3-15	7.4-8.4	5-20	0	0	0-5
Heimdal	0-7	10-20	20-30	6.1-7.3	0	0	0	0
	7-14	10-18	10-25	6.1-7.8	0-5	0	0	0-1
	14-60	7-18	5-20	7.4-8.4	5-20	0	0	0-5
Fram	0-18	10-18	---	7.4-8.4	---	---	0	---
	18-60	7-18	---	7.4-8.4	---	---	0	---
Wyard	0-15	18-27	20-40	6.6-7.8	0	0	0	0
	15-21	18-27	15-30	6.6-7.8	0	0	0	0
	21-35	18-35	15-30	7.4-8.4	10-25	0	0	0
	35-60	15-35	15-30	7.4-8.4	10-20	0	0	0
Esmond	0-7	10-18	---	7.4-8.4	---	---	0	---
	7-60	7-18	---	7.4-8.4	---	---	0	---
Lanona	0-8	10-20	10-17	6.1-7.3	0	0	0	0
	8-28	10-18	6-8	6.6-7.8	0-1	0	0	0
	28-60	20-35	11-17	7.4-8.4	3-20	0	0.0-4.0	0
Tiffany	0-24	10-18	10-25	6.1-7.8	0	0	0	0
	24-60	5-18	5-15	6.6-7.8	0-5	0	0	0-1
Tonka	0-17	18-27	15-35	5.6-7.8	0	0	0	0
	17-40	35-45	15-35	5.6-7.8	0-1	0-1	0.0-2.0	0-1
	40-60	18-39	10-25	6.6-8.4	5-20	0-2	0.0-4.0	0-2
605:								
Esmond	0-8	10-18	5-15	7.4-8.4	0-10	0	0	0
	8-60	7-18	3-15	7.4-8.4	5-20	0-1	0	0
Heimdal	0-7	10-20	20-30	6.1-7.3	0	0	0	0
	7-14	10-18	10-25	6.1-7.8	0-5	0	0	0-1
	14-60	7-18	5-20	7.4-8.4	5-20	0	0	0-5
Emrick	0-11	10-18	20-30	6.6-7.8	0	0	0	0
	11-22	10-18	10-25	6.6-7.8	0-5	0	0	0
	22-60	7-18	5-20	7.4-8.4	5-20	0	0	0-5
Binford	0-8	6-18	5-20	5.6-7.8	0	0	0	0
	8-17	6-18	5-15	5.6-8.4	0-1	0	0	0
	17-60	2-8	1-5	7.4-8.4	5-20	0	0	0
Coe	0-8	6-18	5-15	6.6-7.8	0-5	0	0	0
	8-60	2-8	1-5	7.4-8.4	5-20	0	0	0
Maddock	0-11	2-10	3-10	6.6-7.8	0-3	0	0.0-2.0	0
	11-60	2-8	1-8	6.6-8.4	0-10	0	0.0-2.0	0
Tonka	0-17	18-27	15-35	5.6-7.8	0	0	0	0
	17-40	35-45	15-35	5.6-7.8	0-1	0-1	0.0-2.0	0-1
	40-60	18-39	10-25	6.6-8.4	5-20	0-2	0.0-4.0	0-2
Wyard	0-15	18-27	20-40	6.6-7.8	0	0	0	0
	15-21	18-27	15-30	6.6-7.8	0	0	0	0
	21-35	18-35	15-30	7.4-8.4	10-25	0	0	0
	35-60	15-35	15-30	7.4-8.4	10-20	0	0	0
753:								
Fram	0-18	10-18	10-25	7.4-8.4	0-25	0-1	0	0-2
	18-60	7-18	5-20	7.4-8.4	15-30	0-5	0	0-2
Wyard	0-15	18-27	15-30	6.6-7.8	0	0	0	0
	15-21	18-27	15-25	6.6-7.8	0	0	0	0
	21-35	18-35	10-25	7.4-8.4	10-25	0	0	0
	35-60	15-35	5-20	7.4-8.4	10-20	0	0	0

Chemical Properties of the Soils--continued
Griggs County, North Dakota

Map symbol and soil name	Depth	Clay	Cation exchange capacity	Soil reaction	Calcium carbon-ate	Gypsum	Salinity	Sodium adsorp-tion ratio
	In	Pct	meq/100 g	pH	Pct	Pct	mmhos/cm	
Tonka----------	0-17	18-27	15-35	5.6-7.8	0	0	0	0
	17-40	35-45	15-35	5.6-7.8	0-1	0-1	0.0-2.0	0-1
	40-60	18-39	10-25	6.6-8.4	5-20	0-2	0.0-4.0	0-2
Divide----------	0-9	15-27	10-30	7.4-8.4	1-15	0	0	0
	9-28	18-35	10-30	7.4-8.4	15-35	0-1	0.0-2.0	0
	28-60	1-10	2-10	7.4-8.4	10-30	0	0	0
Emrick----------	0-13	10-18	20-30	6.6-7.8	0	0	0	0
	13-32	10-18	10-25	6.6-7.8	0-5	0	0	0
	32-60	7-18	5-20	7.4-8.4	5-20	0	0	0-5
Heimdal----------	0-7	10-20	20-30	6.1-7.3	0	0	0	0
	7-14	10-18	10-25	6.1-7.8	0-5	0	0	0-1
	14-60	7-18	5-20	7.4-8.4	5-20	0	0	0-5
Vallers----------	0-12	18-28	20-40	7.4-8.4	5-10	0-1	0.0-4.0	0
	12-32	18-35	10-25	7.4-8.4	15-30	0-2	0.0-4.0	0-5
	32-60	18-35	10-20	7.4-8.4	15-30	0-2	0.0-4.0	0-10
Wyndmere, SALINE-----	0-8	5-15	20-40	7.4-8.4	10-25	0-1	4.0-16.0	0-1
	8-24	0-10	10-20	7.4-8.4	15-40	0-1	4.0-16.0	0-1
	24-60	0-10	5-15	7.4-8.4	5-25	0-1	4.0-8.0	0-3
769:								
Gardena----------	0-18	12-18	10-25	6.6-7.8	0	0	0	0
	18-60	10-18	5-15	7.4-8.4	0-15	0-2	0.0-2.0	0-2
Overly----------	0-16	10-26	20-40	6.6-7.8	0	0	0	0
	16-25	18-34	15-30	6.6-8.4	0-10	0-2	0.0-2.0	0
	25-60	18-59	15-30	7.9-8.4	10-20	0-2	0.0-4.0	0
Eckman----------	0-8	12-18	10-25	6.6-7.8	0-3	0	0	0
	8-16	10-18	5-20	6.6-8.4	0-15	0	0	0
	16-60	10-18	5-20	7.4-8.4	0-15	0	0	0
Glyndon----------	0-13	15-27	---	7.4-8.4	---	---	0.0-4.0	---
	13-33	10-18	---	7.9-8.4	---	---	0.0-4.0	---
	33-43	10-18	---	7.4-8.4	---	---	0.0-4.0	---
	43-60	15-35	---	7.4-8.4	---	---	0.0-4.0	---
Bearden----------	0-9	18-26	15-30	7.4-8.4	0-10	0-1	0.0-4.0	0-2
	9-20	18-34	5-25	7.4-8.4	10-45	0-1	0.0-4.0	0-3
	20-60	18-34	5-20	7.4-8.4	5-20	0-5	0.0-4.0	0-10
Lindaas----------	0-12	18-26	15-30	6.6-7.3	0	0	0	0
	12-29	40-50	20-40	6.6-7.8	0	0	0	0-1
	29-60	25-40	10-30	7.4-8.4	0-5	0-1	0	0-2
Zell----------	0-6	10-18	10-20	6.6-8.4	0-5	0	0.0-2.0	0
	6-12	10-18	5-15	7.4-8.4	10-20	0	0.0-2.0	0
	12-60	5-18	2-10	7.4-8.4	5-15	0	0.0-2.0	0
773:								
Gardena----------	0-18	12-18	10-25	6.6-7.8	0	0	0	0
	18-60	10-18	5-15	7.4-8.4	0-15	0-2	0.0-2.0	0-2
Eckman----------	0-8	12-18	10-25	6.6-7.8	0	0	0	0
	8-19	10-18	4-15	6.6-8.4	0-15	0	0	0
	19-60	10-18	4-10	7.4-8.4	0-15	0	0	0
Great Bend----------	0-6	18-26	10-25	6.1-7.8	0	0	0.0-2.0	0
	6-13	18-34	10-25	6.6-8.4	0	0	0.0-2.0	0
	13-30	18-34	5-20	7.4-8.4	0-10	0	0.0-2.0	0
	30-60	18-34	5-20	7.4-8.4	0-10	0	0.0-4.0	0
Overly----------	0-16	10-26	20-40	6.6-7.8	0	0	0	0
	16-25	18-34	15-30	6.6-8.4	0-10	0-2	0.0-2.0	0
	25-60	18-59	15-30	7.9-8.4	10-20	0-2	0.0-4.0	0

Chemical Properties of the Soils--continued
Griggs County, North Dakota

Map symbol and soil name	Depth	Clay	Cation exchange capacity	Soil reaction	Calcium carbon-ate	Gypsum	Salinity	Sodium adsorp-tion ratio
	In	Pct	meq/100 g	pH	Pct	Pct	mmhos/cm	
Bearden----------	0-9	18-26	15-30	7.4-8.4	0-10	0-1	0.0-4.0	0-2
	9-20	18-34	5-25	7.4-8.4	10-45	0-1	0.0-4.0	0-3
	20-60	18-34	5-20	7.4-8.4	5-20	0-5	0.0-4.0	0-10
Zell----------	---	---	---	---	---	---	---	---
Colvin----------	0-10	18-26	15-30	6.6-8.4	0-10	0-1	0.0-4.0	0-2
	10-30	18-34	5-30	7.4-8.4	10-45	0-1	0.0-4.0	0-3
	30-60	18-34	5-20	7.4-8.4	5-20	0-5	0.0-4.0	0-10
Lankin----------	0-10	18-27	---	6.6-7.3	---	---	0	---
	10-25	18-35	---	6.6-7.8	---	---	0	---
	25-60	18-35	---	7.9-8.4	---	---	0	---
881:								
Hamerly----------	0-10	18-27	15-30	6.6-8.4	1-10	0	0.0-2.0	0
	10-29	18-35	10-20	7.4-8.4	10-30	0-2	0.0-4.0	0-2
	29-60	18-35	10-20	7.4-8.4	5-25	0-2	0.0-4.0	0-2
Tonka----------	0-17	18-27	20-40	5.6-7.8	0	0	0	0
	17-40	35-45	25-40	5.6-7.8	0-1	0-1	0.0-2.0	0-1
	40-60	18-39	10-35	6.6-8.4	5-20	0-2	0.0-4.0	0-2
Wyard----------	0-15	18-27	20-40	6.6-7.8	0	0	0	0
	15-21	18-27	15-30	6.6-7.8	0	0	0	0
	21-35	18-35	15-30	7.4-8.4	10-25	0	0	0
	35-60	15-35	15-30	7.4-8.4	10-20	0	0	0
Vallers----------	0-12	18-28	20-40	7.4-8.4	5-10	0-1	0.0-4.0	0
	12-32	18-35	10-25	7.4-8.4	15-30	0-2	0.0-4.0	0-5
	32-60	18-35	10-20	7.4-8.4	15-30	0-2	0.0-4.0	0-10
Parnell----------	0-9	27-40	25-45	6.1-7.8	0	0	0	0
	9-49	35-60	20-45	6.1-7.8	0	0	0	0
	49-60	35-45	15-30	6.6-8.4	0-3	0-2	0	0
Cresbard----------	0-12	20-26	15-30	5.6-7.3	0	0	0.0-2.0	0
	12-25	35-50	20-45	5.6-7.8	0	0	2.0-4.0	1-10
	25-32	35-50	20-40	6.1-8.4	10-20	1-5	2.0-4.0	5-15
	32-60	25-35	15-30	7.4-9.0	10-20	1-5	2.0-8.0	5-15
Hamerly, SALINE------	0-10	18-27	15-30	7.4-8.4	1-15	0-3	4.0-16.0	0
	10-29	18-35	10-30	7.4-8.4	15-35	0-5	4.0-16.0	0-2
	29-60	18-35	10-25	7.4-8.4	10-30	0-5	4.0-16.0	0-4
Svea----------	0-18	18-27	15-30	6.1-7.8	0	0	0	0
	18-28	18-35	10-30	6.6-7.8	0-3	0	0	0
	28-60	18-35	10-25	7.4-8.4	3-15	0-1	0.0-4.0	0-2
884:								
Hamerly----------	0-10	18-27	15-30	6.6-8.4	1-10	0	0.0-2.0	0
	10-29	18-35	10-20	7.4-8.4	10-30	0-2	0.0-4.0	0-2
	29-60	18-35	10-20	7.4-8.4	5-25	0-2	0.0-4.0	0-2
Wyard----------	0-15	18-27	15-30	6.6-7.8	0	0	0	0
	15-21	18-27	15-25	6.6-7.8	0	0	0	0
	21-35	18-35	10-25	7.4-8.4	10-25	0	0	0
	35-60	15-35	5-20	7.4-8.4	10-20	0	0	0
Tonka----------	0-17	18-27	15-35	5.6-7.8	0	0	0	0
	17-40	35-45	15-35	5.6-7.8	0-1	0-1	0.0-2.0	0-1
	40-60	18-39	10-25	6.6-8.4	5-20	0-2	0.0-4.0	0-2
Vallers----------	0-12	18-28	20-40	7.4-8.4	5-10	0-1	0.0-4.0	0
	12-32	18-35	10-25	7.4-8.4	15-30	0-2	0.0-4.0	0-5
	32-60	18-35	10-20	7.4-8.4	15-30	0-2	0.0-4.0	0-10
Divide----------	0-9	15-27	10-30	7.4-8.4	1-15	0	0	0
	9-28	18-35	10-30	7.4-8.4	15-35	0-1	0.0-2.0	0
	28-60	1-10	2-10	7.4-8.4	10-30	0	0	0

Chemical Properties of the Soils--continued
Griggs County, North Dakota

Map symbol and soil name	Depth	Clay	Cation exchange capacity	Soil reaction	Calcium carbon-ate	Gypsum	Salinity	Sodium adsorp-tion ratio
	In	Pct	meq/100 g	pH	Pct	Pct	mmhos/cm	
Barnes----------	0-9	15-27	10-30	5.6-7.8	0	0	0.0-2.0	0
	9-14	18-35	10-30	6.1-7.8	0-3	0	0.0-4.0	0
	14-60	18-35	5-25	7.4-8.4	10-30	0-1	0.0-4.0	0
Fram----------	0-18	10-18	---	7.4-8.4	---	---	0	---
	18-60	7-18	---	7.4-8.4	---	---	0	---
Hamerly, SALINE------	0-10	18-27	15-30	7.4-8.4	1-15	0-3	4.0-16.0	0
	10-29	18-35	10-30	7.4-8.4	15-35	0-5	4.0-16.0	0-2
	29-60	18-35	10-25	7.4-8.4	10-30	0-5	4.0-16.0	0-4
893:								
Harriet----------	0-2	12-25	13-30	6.6-8.4	0	0	0.0-2.0	0
	2-10	35-50	17-45	7.4-9.0	1-45	0-5	4.0-16.0	13-25
	10-60	18-40	10-35	7.9-9.0	10-45	0-5	4.0-16.0	5-20
Manfred----------	0-7	18-26	20-40	6.1-8.4	0-5	0-1	2.0-4.0	1-5
	7-60	18-34	10-25	7.9-9.0	10-30	0-2	2.0-16.0	5-25
Colvin, SALINE-------	0-10	18-26	25-35	7.4-8.4	0-10	0-1	4.0-16.0	0-2
	10-60	18-34	10-25	7.4-8.4	5-45	0-5	4.0-16.0	0-10
Stirum----------	0-8	10-20	10-20	7.4-8.4	1-10	0	2.0-8.0	0-2
	8-23	10-25	5-15	7.9-9.0	10-45	0-2	2.0-16.0	5-15
	23-60	5-20	5-10	7.9-9.0	10-45	0-4	2.0-16.0	5-10
Ojata----------	0-8	18-26	---	7.4-9.0	---	---	16.0-32.0	---
	8-60	18-34	---	7.4-9.0	---	---	8.0-32.0	---
Colvin----------	0-7	18-26	25-40	6.6-8.4	0-10	0-1	0	0-2
	7-36	18-34	15-25	7.4-8.4	10-35	0-1	0	0-3
	36-60	18-34	10-20	7.4-8.4	5-20	0-5	0	0-10
Bearden----------	0-9	18-26	15-30	7.4-8.4	0-10	0-1	0.0-4.0	0-2
	9-20	18-34	5-25	7.4-8.4	10-45	0-1	0.0-4.0	0-3
	20-60	18-34	5-20	7.4-8.4	5-20	0-5	0.0-4.0	0-10
988:								
Heimdal----------	0-7	10-20	10-20	6.1-7.3	0	0	0	0
	7-14	10-18	5-20	6.1-7.8	0-5	0	0	0-1
	14-60	7-18	3-15	7.4-8.4	5-20	0	0	0-5
Emrick----------	0-13	10-18	10-30	6.6-7.8	0	0	0	0
	13-32	10-18	5-20	6.6-7.8	0-5	0	0	0
	32-60	7-18	3-15	7.4-8.4	5-20	0	0	0-5
Esmond----------	0-7	10-18	---	7.4-8.4	---	---	0	---
	7-60	7-18	---	7.4-8.4	---	---	0	---
Coe----------	0-8	6-18	5-15	6.6-7.8	0-5	0	0	0
	8-60	2-8	1-5	7.4-8.4	5-20	0	0	0
Fram----------	0-18	10-18	---	7.4-8.4	---	---	0	---
	18-60	7-18	---	7.4-8.4	---	---	0	---
Binford----------	0-8	6-18	5-20	5.6-7.8	0	0	0	0
	8-17	6-18	5-15	5.6-8.4	0-1	0	0	0
	17-60	2-8	1-5	7.4-8.4	5-20	0	0	0
Cathay----------	0-10	10-27	10-25	6.1-7.8	0	---	0.0-2.0	0
	10-22	18-35	10-25	6.6-8.4	0	---	4.0-8.0	1-10
	22-60	7-18	3-10	7.4-9.0	5-20	---	4.0-8.0	5-15
Wyard----------	0-15	18-27	20-40	6.6-7.8	0	0	0	0
	15-21	18-27	15-30	6.6-7.8	0	0	0	0
	21-35	18-35	15-30	7.4-8.4	10-25	0	0	0
	35-60	15-35	15-30	7.4-8.4	10-20	0	0	0
998:								
Heimdal----------	0-7	10-20	10-20	6.1-7.3	0	0	0	0
	7-14	10-18	5-20	6.1-7.8	0-5	0	0	0-1
	14-60	7-18	3-15	7.4-8.4	5-20	0	0	0-5

Chemical Properties of the Soils--continued
Griggs County, North Dakota

Map symbol and soil name	Depth	Clay	Cation exchange capacity	Soil reaction	Calcium carbon-ate	Gypsum	Salinity	Sodium adsorp-tion ratio
	In	Pct	meq/100 g	pH	Pct	Pct	mmhos/cm	
Esmond----------	0-8	10-18	5-15	7.4-8.4	0-10	0	0	0
	8-60	7-18	3-15	7.4-8.4	5-20	0-1	0	0
Emrick----------	0-11	10-18	20-30	6.6-7.8	0	0	0	0
	11-22	10-18	10-25	6.6-7.8	0-5	0	0	0
	22-60	7-18	5-20	7.4-8.4	5-20	0	0	0-5
Maddock----------	0-14	2-10	3-10	6.6-7.8	0-3	0	0.0-2.0	0
	14-60	2-8	1-8	6.6-8.4	0-10	0	0.0-2.0	0
Binford----------	0-8	6-18	5-15	6.6-7.8	0-5	0	0	0
	8-60	2-8	1-5	7.4-8.4	5-20	0	0	0
Coe----------	0-8	6-18	5-15	6.6-7.8	0-5	0	0	0
	8-60	2-8	1-5	7.4-8.4	5-20	0	0	0
Fram----------	0-18	10-18	---	7.4-8.4	---	---	0	---
	18-60	7-18	---	7.4-8.4	---	---	0	---
Vallers----------	0-12	18-28	20-40	7.4-8.4	5-10	0-1	0.0-4.0	0
	12-32	18-35	10-25	7.4-8.4	15-30	0-2	0.0-4.0	0-5
	32-60	18-35	10-20	7.4-8.4	15-30	0-2	0.0-4.0	0-10
1001:								
Esmond----------	0-8	10-18	5-15	7.4-8.4	0-10	0	0	0
	8-60	7-18	3-15	7.4-8.4	5-20	0-1	0	0
Heimdal----------	0-7	10-20	10-20	6.1-7.3	0	0	0	0
	7-14	10-18	5-20	6.1-7.8	0-5	0	0	0-1
	14-60	7-18	3-15	7.4-8.4	5-20	0	0	0-5
Emrick----------	0-11	10-18	20-30	6.6-7.8	0	0	0	0
	11-22	10-18	10-25	6.6-7.8	0-5	0	0	0
	22-60	7-18	5-20	7.4-8.4	5-20	0	0	0-5
Sioux----------	0-7	10-18	15-20	6.6-8.4	0	0	0.0-2.0	0
	7-10	10-20	15-20	7.4-8.4	0-15	0	0.0-2.0	0
	10-60	0-10	15-20	7.4-8.4	0-15	0	0.0-2.0	0
Maddock----------	0-8	2-10	3-10	6.6-7.8	0-3	0	0.0-2.0	0
	8-60	2-8	1-8	6.6-8.4	0-10	0	0.0-2.0	0
Binford----------	0-8	6-18	5-20	5.6-7.8	0	0	0	0
	8-17	6-18	5-15	5.6-8.4	0-1	0	0	0
	17-60	2-8	1-5	7.4-8.4	5-20	0	0	0
Coe----------	0-8	6-18	5-20	5.6-7.8	0	0	0	0
	8-17	6-18	5-15	5.6-8.4	0-1	0	0	0
	17-60	2-8	1-5	7.4-8.4	5-20	0	0	0
Dickey----------	0-5	2-14	---	6.1-7.8	---	---	0.0-2.0	---
	5-32	2-14	---	6.1-7.8	---	---	0.0-2.0	---
	32-60	18-39	---	7.4-8.4	10-20	---	0.0-2.0	---
1015:								
Kensal----------	0-9	18-25	15-30	6.6-7.3	0	0	0	0
	9-23	18-25	10-25	6.6-7.3	0-15	0	0	0
	23-60	0-10	0-5	7.4-8.4	5-20	0	0	0
Walum----------	0-16	8-18	---	6.6-7.3	---	---	0	---
	16-30	5-18	---	6.6-7.3	---	---	0	---
	30-60	0-10	---	7.4-8.4	---	---	0	---
Overly----------	0-16	10-26	20-40	6.6-7.8	0	0	0	0
	16-25	18-34	15-30	6.6-8.4	0-10	0-2	0.0-2.0	0
	25-60	18-59	15-30	7.9-8.4	10-20	0-2	0.0-4.0	0
Binford----------	0-8	6-18	5-20	5.6-7.8	0	0	0	0
	8-17	6-18	5-15	5.6-8.4	0-1	0	0	0
	17-60	2-8	1-5	7.4-8.4	5-20	0	0	0

Chemical Properties of the Soils--continued
Griggs County, North Dakota

Map symbol and soil name	Depth	Clay	Cation exchange capacity	Soil reaction	Calcium carbon-ate	Gypsum	Salinity	Sodium adsorp-tion ratio
	In	Pct	meq/100 g	pH	Pct	Pct	mmhos/cm	
Gardena----------	0-18	12-18	10-25	6.6-7.8	0-3	0	0	0
	18-60	10-18	5-15	7.4-8.4	0-15	0-2	0.0-2.0	0-2
Coe----------	0-8	6-18	5-15	6.6-7.8	0-5	0	0	0
	8-60	2-8	1-5	7.4-8.4	5-20	0	0	0
Divide----------	0-9	15-27	10-30	7.4-8.4	1-15	0	0	0
	9-28	18-35	10-30	7.4-8.4	15-35	0-1	0.0-2.0	0
	28-60	1-10	2-10	7.4-8.4	10-30	0	0	0
1062:								
Ladelle----------	0-23	27-35	20-35	6.6-7.8	0	0	0	0
	23-43	27-35	15-30	7.4-8.4	4-25	0	0.0-4.0	0
	43-60	25-35	10-25	7.4-8.4	4-15	0-2	0.0-4.0	0-1
Wahpeton----------	0-19	40-59	---	6.1-7.8	---	---	0	---
	19-60	35-59	---	6.6-8.4	---	---	0	---
Laprairie----------	0-7	18-27	20-35	6.6-8.4	0-3	0-1	0	0
	7-18	18-35	20-35	6.6-8.4	0-10	0-1	0	0
	18-50	18-30	20-25	6.6-8.4	10-30	0-1	0	0
Ludden----------	0-35	40-60	25-50	6.1-8.4	0-10	0	0.0-4.0	0
	35-42	40-60	20-30	7.9-8.4	5-20	0-2	0.0-4.0	0-2
	42-60	35-60	20-30	7.9-8.4	5-20	0-2	0.0-8.0	0-2
Rauville----------	0-28	15-26	20-28	7.4-8.4	5-15	0	0.0-2.0	1-2
	28-60	20-45	20-29	7.4-8.4	10-20	0-1	0.0-4.0	1-3
Velva----------	0-15	7-18	10-25	6.6-7.3	0	0	0	0
	15-60	7-18	5-10	6.6-8.4	5-10	0	0	0
Lamoure----------	0-23	27-35	25-30	6.6-7.8	---	---	0	---
	23-43	27-35	20-30	7.4-8.4	4-25	---	0.0-4.0	---
	43-60	25-35	15-25	7.4-8.4	4-15	0-2	0.0-4.0	0-1
1108:								
Larson----------	0-8	10-27	10-25	6.1-7.3	0	0	0.0-2.0	0
	8-21	18-35	10-25	7.4-9.0	1-10	0-2	4.0-16.0	5-18
	21-60	10-35	5-20	7.9-9.0	10-35	0-4	2.0-8.0	5-10
Cathay----------	0-10	10-27	10-25	6.1-7.8	0	0	0.0-2.0	0
	10-22	18-35	10-25	6.6-8.4	0	0-1	4.0-8.0	1-10
	22-60	7-18	3-10	7.4-9.0	5-20	1-5	4.0-8.0	5-15
Fram----------	0-18	10-18	---	7.4-8.4	---	---	0	---
	18-60	7-18	---	7.4-8.4	---	---	0	---
Emrick----------	0-13	10-18	20-30	6.6-7.8	0	0	0	0
	13-32	10-18	10-25	6.6-7.8	0-5	0	0	0
	32-60	7-18	5-20	7.4-8.4	5-20	0	0	0-5
Tonka----------	0-17	18-27	15-35	5.6-7.8	0	0	0	0
	17-40	35-45	15-35	5.6-7.8	0-1	0-1	0.0-2.0	0-1
	40-60	18-39	10-25	6.6-8.4	5-20	0-2	0.0-4.0	0-2
Uranda----------	0-5	15-26	15-20	6.1-7.3	0	0-1	0	0-7
	5-8	23-34	15-30	6.6-8.4	0-1	1-5	2.0-8.0	10-25
	8-60	8-30	15-30	7.9-9.0	2-15	1-10	4.0-16.0	10-40
Fram, SALINE---------	0-31	10-18	---	7.4-8.4	---	---	4.0-16.0	---
	31-60	7-18	---	7.4-8.4	---	---	4.0-16.0	---
Esmond----------	0-7	10-18	---	7.4-8.4	---	---	0	---
	7-60	7-18	---	7.4-8.4	---	---	0	---
1188:								
Ludden, NONSALINE----	0-35	40-60	25-50	6.1-8.4	0-10	0	0.0-4.0	0
	35-42	40-60	20-30	7.9-8.4	5-20	0-2	0.0-4.0	0-2
	42-60	35-60	20-30	7.9-8.4	5-20	0-2	0.0-8.0	0-2

Chemical Properties of the Soils--continued
Griggs County, North Dakota

Map symbol and soil name	Depth	Clay	Cation exchange capacity	Soil reaction	Calcium carbon-ate	Gypsum	Salinity	Sodium adsorp-tion ratio
	In	Pct	meq/100 g	pH	Pct	Pct	mmhos/cm	
Ludden, SALINE-------	0-35	40-60	28-48	6.1-8.4	0-10	0-2	4.0-8.0	0-2
	35-42	40-60	20-30	7.9-8.4	5-20	0-4	8.0-16.0	0-4
	42-60	35-60	19-29	7.9-8.4	5-20	0-4	8.0-16.0	0-4
Ladelle----------	0-23	27-35	25-30	6.6-7.8	---	---	0	---
	23-43	27-35	20-30	7.4-8.4	4-25	---	0.0-4.0	---
	43-60	25-35	15-25	7.4-8.4	4-15	0-2	0.0-4.0	0-1
Rauville----------	0-28	15-26	20-28	7.4-8.4	5-15	0	0.0-2.0	1-2
	28-60	20-45	20-29	7.4-8.4	10-20	0-1	0.0-4.0	1-3
Lamoure----------	0-23	27-35	25-30	6.6-7.8	---	---	0	---
	23-43	27-35	20-30	7.4-8.4	4-25	---	0.0-4.0	---
	43-60	25-35	15-25	7.4-8.4	4-15	0-2	0.0-4.0	0-1
1189:								
Ludden, SALINE-------	0-35	40-60	30-65	6.1-8.4	0-10	0-2	4.0-8.0	0-2
	35-42	40-60	25-55	7.9-8.4	5-20	0-4	8.0-16.0	0-4
	42-60	35-60	20-50	7.9-8.4	5-20	0-4	8.0-16.0	0-4
Ludden, NONSALINE----	0-35	40-60	25-50	6.1-8.4	0-10	0	0.0-4.0	0
	35-42	40-60	20-30	7.9-8.4	5-20	0-2	0.0-4.0	0-2
	42-60	35-60	20-30	7.9-8.4	5-20	0-2	0.0-8.0	0-2
Ryan----------	0-8	40-60	25-45	7.4-8.4	1-5	0-1	0	0-2
	8-60	40-65	20-35	7.4-9.0	5-25	0-3	4.0-16.0	0-4
Ladelle----------	0-23	27-35	25-30	6.6-7.8	---	---	0	---
	23-43	27-35	20-30	7.4-8.4	4-25	---	0.0-4.0	---
	43-60	25-35	15-25	7.4-8.4	4-15	0-2	0.0-4.0	0-1
Lamoure----------	0-23	27-35	25-30	6.6-7.8	---	---	0	---
	23-43	27-35	20-30	7.4-8.4	4-25	---	0.0-4.0	---
	43-60	25-35	15-25	7.4-8.4	4-15	0-2	0.0-4.0	0-1
Rauville----------	0-28	15-26	20-28	7.4-8.4	5-15	0	0.0-2.0	1-2
	28-60	20-45	20-29	7.4-8.4	10-20	0-1	0.0-4.0	1-3
1221:								
Maddock----------	0-11	2-10	3-10	6.6-7.8	0-3	0	0.0-2.0	0
	11-60	2-8	1-8	6.6-8.4	0-10	0	0.0-2.0	0
Hecla----------	0-10	2-10	3-10	6.1-7.8	0-3	0	0	0
	10-32	2-10	3-10	6.1-7.8	0-3	0	0	0
	32-60	3-8	1-8	6.1-8.4	0-10	0	0	0
Serden----------	0-2	3-8	3-5	6.1-7.3	0	0	0	0
	2-60	3-8	2-3	6.6-7.8	0-3	0	0	0
Maddock----------	0-7	5-15	5-15	6.6-7.8	0-3	0	0	0
	7-60	3-9	2-7	6.6-8.4	0-10	0	0	0
Towner----------	0-16	2-10	5-10	6.6-7.8	0	0	0	0
	16-35	2-10	2-5	6.6-7.8	0	0	0	0
	35-60	18-40	10-20	7.4-8.4	10-30	0-2	0.0-2.0	0
Coe----------	0-8	6-18	5-15	6.6-7.8	0-5	0	0	0
	8-60	2-8	1-5	7.4-8.4	5-20	0	0	0
Dickey----------	0-5	2-14	---	6.1-7.8	---	---	0.0-2.0	---
	5-32	2-14	---	6.1-7.8	---	---	0.0-2.0	---
	32-60	18-39	---	7.4-8.4	10-20	---	0.0-2.0	---
Esmond----------	0-7	10-18	---	7.4-8.4	---	---	0	---
	7-60	7-18	---	7.4-8.4	---	---	0	---
1267:								
Marysland----------	0-8	18-35	15-35	7.9-8.4	1-15	0	0	0
	8-30	18-35	10-25	7.9-8.4	15-35	0-3	0.0-2.0	0
	30-60	1-5	2-10	7.9-8.4	5-20	0-5	0	0

Chemical Properties of the Soils--continued
Griggs County, North Dakota

Map symbol and soil name	Depth	Clay	Cation exchange capacity	Soil reaction	Calcium carbon-ate	Gypsum	Salinity	Sodium adsorp-tion ratio
	In	Pct	meq/100 g	pH	Pct	Pct	mmhos/cm	
Marysland, SALINE----	0-9	10-20	---	7.4-8.4	---	---	4.0-16.0	---
	9-39	10-27	---	7.4-8.4	---	---	4.0-16.0	---
	39-60	5-20	---	7.4-8.4	---	---	4.0-16.0	---
Colvin----------	0-10	18-26	15-30	6.6-8.4	0-10	0-1	0.0-4.0	0-2
	10-30	18-34	5-30	7.4-8.4	10-45	0-1	0.0-4.0	0-3
	30-60	18-34	5-20	7.4-8.4	5-20	0-5	0.0-4.0	0-10
Divide----------	0-9	15-27	10-30	7.4-8.4	1-15	0	0	0
	9-28	18-35	10-30	7.4-8.4	15-35	0-1	0.0-2.0	0
	28-60	1-10	2-10	7.4-8.4	10-30	0	0	0
Vallers----------	0-12	18-28	20-40	7.4-8.4	5-10	0-1	0.0-4.0	0
	12-32	18-35	10-25	7.4-8.4	15-30	0-2	0.0-4.0	0-5
	32-60	18-35	10-20	7.4-8.4	15-30	0-2	0.0-4.0	0-10
Wyrene----------	0-10	6-18	---	6.6-8.4	---	---	0	---
	10-49	0-5	---	7.4-8.4	---	---	0	---
	49-60	18-35	---	7.4-8.4	---	---	0	---
1268:								
Marysland----------	0-8	18-30	15-35	7.9-8.4	1-15	0	0	0
	8-30	18-30	10-25	7.9-8.4	15-35	0-3	0	0
	30-60	1-5	0-4	7.9-8.4	5-20	0-5	0	0
Colvin----------	0-7	18-26	25-40	6.6-8.4	0-10	0-1	0	0-2
	7-36	18-34	15-25	7.4-8.4	10-35	0-1	0	0-3
	36-60	18-34	10-20	7.4-8.4	5-20	0-5	0	0-10
Marysland----------	0-8	18-35	15-35	7.9-8.4	1-15	0	0	0
	8-30	18-35	10-25	7.9-8.4	15-35	0-3	0.0-2.0	0
	30-60	1-5	2-10	7.9-8.4	5-20	0	0	0
Lamoure----------	0-23	27-35	25-30	6.6-7.8	---	---	0	---
	23-43	27-35	20-30	7.4-8.4	4-25	---	0.0-4.0	---
	43-60	25-35	15-25	7.4-8.4	4-15	0-2	0.0-4.0	0-1
Southam----------	0-10	27-40	25-50	6.6-8.4	0-10	0-1	2.0-8.0	0-2
	10-48	35-50	25-65	6.6-8.4	3-25	0-1	2.0-8.0	0-2
	48-60	18-50	15-45	7.4-8.4	10-30	0-5	2.0-8.0	0-2
Divide----------	0-9	15-27	10-30	7.4-8.4	1-15	0	0	0
	9-28	18-35	10-30	7.4-8.4	15-35	0-1	0.0-2.0	0
	28-60	1-10	2-10	7.4-8.4	10-30	0	0	0
Tiffany----------	0-24	10-18	10-25	6.1-7.8	0	0	0	0
	24-60	5-18	5-15	6.6-7.8	0-5	0	0	0-1
1427:								
Parnell----------	0-9	27-40	30-50	6.1-7.8	0	0	0	0
	9-49	35-60	25-60	6.1-7.8	0	0	0	0
	49-60	35-45	20-40	6.6-8.4	0-3	0-2	0	0
Vallers----------	0-12	18-28	20-40	7.4-8.4	5-10	0-1	0.0-4.0	0
	12-32	18-35	10-25	7.4-8.4	15-30	0-2	0.0-4.0	0-5
	32-60	18-35	10-20	7.4-8.4	15-30	0-2	0.0-4.0	0-10
Grano----------	0-14	40-60	---	7.4-8.4	---	---	0	---
	14-60	40-60	---	7.4-8.4	---	---	0	---
Colvin----------	0-7	18-26	25-40	6.6-8.4	0-10	0-1	0	0-2
	7-36	18-34	15-25	7.4-8.4	10-35	0-1	0	0-3
	36-60	18-34	10-20	7.4-8.4	5-20	0-5	0	0-10
Hamerly----------	0-10	18-27	15-30	6.6-8.4	0-10	0	0.0-2.0	0
	10-29	18-35	10-20	7.4-8.4	15-35	0-2	0.0-4.0	0-2
	29-60	18-35	10-20	7.4-8.4	10-30	0-2	0.0-4.0	0-2
Tonka----------	0-17	18-27	15-35	5.6-7.8	0	0	0	0
	17-40	35-45	15-35	5.6-7.8	0-1	0-1	0.0-2.0	0-1
	40-60	18-39	10-25	6.6-8.4	5-20	0-2	0.0-4.0	0-2

Chemical Properties of the Soils--continued
Griggs County, North Dakota

Map symbol and soil name	Depth	Clay	Cation exchange capacity	Soil reaction	Calcium carbon-ate	Gypsum	Salinity	Sodium adsorp-tion ratio
	In	Pct	meq/100 g	pH	Pct	Pct	mmhos/cm	
Southam----------	0-10	27-40	25-50	6.6-8.4	0-10	0-1	2.0-8.0	0-2
	10-48	35-50	25-65	6.6-8.4	3-25	0-1	2.0-8.0	0-2
	48-60	18-50	15-45	7.4-8.4	10-30	0-5	2.0-8.0	0-2
1454:								
Wyndmere----------	0-9	5-15	10-25	7.4-8.4	10-25	0-1	0	0-1
	9-28	0-10	2-15	7.4-8.4	15-40	0-1	0	0-1
	28-42	0-10	0-10	7.4-8.4	5-25	0-1	0	0-3
	42-60	18-35	5-25	7.4-8.4	5-25	0-1	0	0-3
Wyrene----------	0-24	8-18	18-30	6.6-8.4	15-30	0	0	0
	24-60	0-5	0-3	7.4-8.4	10-25	0	0	0
Divide----------	0-9	15-27	10-30	7.4-8.4	1-15	0	0	0
	9-28	18-35	10-30	7.4-8.4	15-35	0-1	0.0-2.0	0
	28-60	1-10	2-10	7.4-8.4	10-30	0	0	0
Tiffany----------	0-9	10-18	10-25	6.1-7.8	0	0	0	0
	9-46	5-18	5-20	6.1-8.4	0-5	0	0	0
	46-60	10-35	5-25	7.4-8.4	0-5	0	0	0
Embden----------	0-16	10-18	10-25	6.6-7.3	0	0	0	0
	16-38	10-18	5-20	6.6-7.8	0	0	0	0
	38-60	5-18	2-15	6.6-8.4	0-15	0	0.0-2.0	0
Hamar----------	0-8	5-10	7-12	6.1-7.8	0	0	0.0-2.0	0
	8-17	0-7	3-9	6.6-8.4	0-1	0	0.0-2.0	0
	17-60	0-7	3-9	7.4-8.4	0-2	0	0.0-2.0	0
Arveson----------	0-9	10-20	15-30	7.4-8.4	5-20	---	0	0
	9-39	10-27	5-25	7.4-8.4	15-30	---	0	0
	39-60	5-20	2-15	7.4-8.4	10-20	---	0	0-1
1466:								
Pits, Sand And Gravel	0-6	5-15	2-12	6.6-8.4	0-3	0	0	0
	6-60	0-15	1-10	6.6-8.4	5-20	0	0	0
Sioux----------	0-7	10-18	15-20	6.6-8.4	0	0	0.0-2.0	0
	7-10	10-20	15-20	7.4-8.4	0-15	0	0.0-2.0	0
	10-60	0-10	15-20	7.4-8.4	0-15	0	0.0-2.0	0
Arvilla----------	0-8	6-18	5-20	6.1-8.4	0	0	0	0
	8-17	6-18	5-15	6.6-8.4	0	0	0	0
	17-60	2-10	1-5	7.4-8.4	1-5	0	0	0
Water----------	---	---	---	---	---	---	---	---
1710:								
Southam----------	0-10	27-40	25-60	6.6-8.4	0-10	0-1	2.0-8.0	0-2
	10-48	35-50	25-60	6.6-8.4	3-25	0-1	2.0-8.0	0-2
	48-60	18-50	10-45	7.4-8.4	10-30	0-5	2.0-8.0	0-2
Parnell----------	0-9	27-40	25-45	6.1-7.8	0	0	0	0
	9-49	35-60	20-45	6.1-7.8	0	0	0	0
	49-60	35-45	15-30	6.6-8.4	0-3	0-2	0	0
Vallers----------	0-12	18-28	20-40	7.4-8.4	5-10	0-1	0.0-4.0	0
	12-32	18-35	10-25	7.4-8.4	15-30	0-2	0.0-4.0	0-5
	32-60	18-35	10-20	7.4-8.4	15-30	0-2	0.0-4.0	0-10
Colvin----------	0-7	18-26	25-40	6.6-8.4	0-10	0-1	0	0-2
	7-36	18-34	15-25	7.4-8.4	10-35	0-1	0	0-3
	36-60	18-34	10-20	7.4-8.4	5-20	0-5	0	0-10
Water----------	---	---	---	---	---	---	---	---
Colvin, SALINE-------	0-10	18-26	25-35	7.4-8.4	0-10	0-1	4.0-16.0	0-2
	10-60	18-34	10-25	7.4-8.4	5-45	0-5	4.0-16.0	0-10

Chemical Properties of the Soils--continued
Griggs County, North Dakota

Map symbol and soil name	Depth	Clay	Cation exchange capacity	Soil reaction	Calcium carbon-ate	Gypsum	Salinity	Sodium adsorp-tion ratio
	In	Pct	meq/100 g	pH	Pct	Pct	mmhos/cm	
1762:								
Svea----------	0-18	18-27	15-30	6.1-7.8	0	0	0	0
	18-28	18-35	10-30	6.6-7.8	0-3	0	0	0
	28-60	18-35	10-25	7.4-8.4	3-15	0-1	0.0-4.0	0-2
Barnes----------	0-9	15-27	10-30	5.6-7.8	0	0	0.0-2.0	0
	9-14	18-35	10-30	6.1-7.8	0-3	0	0.0-4.0	0
	14-60	18-35	5-25	7.4-8.4	10-30	0-1	0.0-4.0	0
Hamerly----------	0-10	18-27	15-30	6.6-8.4	0-10	0	0.0-2.0	0
	10-29	18-35	10-20	7.4-8.4	15-35	0-2	0.0-4.0	0-2
	29-60	18-35	10-20	7.4-8.4	10-30	0-2	0.0-4.0	0-2
Tonka----------	0-17	18-27	15-35	5.6-7.8	0	0	0	0
	17-40	35-45	15-35	5.6-7.8	0-1	0-1	0.0-2.0	0-1
	40-60	18-39	10-25	6.6-8.4	5-20	0-2	0.0-4.0	0-2
Wyard----------	0-15	18-27	20-40	6.6-7.8	0	0	0	0
	15-21	18-27	15-30	6.6-7.8	0	0	0	0
	21-35	18-35	15-30	7.4-8.4	10-25	0	0	0
	35-60	15-35	15-30	7.4-8.4	10-20	0	0	0
Cresbard----------	0-12	20-26	15-30	5.6-7.3	0	0	0.0-2.0	0
	12-25	35-50	20-45	5.6-7.8	0	0	2.0-4.0	1-10
	25-32	35-50	20-40	6.1-8.4	10-20	1-5	2.0-4.0	5-15
	32-60	25-35	15-30	7.4-9.0	10-20	1-5	2.0-8.0	5-15
Vang----------	0-9	18-27	15-25	5.6-7.3	0	0-1	0	0-1
	9-27	18-30	10-20	5.6-8.4	1-10	0-1	0	0-1
	27-60	0-5	5-10	5.6-8.4	5-15	0-1	0	0-2
1765:								
Svea----------	0-18	18-27	15-30	6.1-7.8	0	0	0	0
	18-28	18-35	10-30	6.6-7.8	0-3	0	0	0
	28-60	18-35	10-25	7.4-8.4	3-15	0-1	0.0-4.0	0-2
Buse----------	0-7	18-27	10-30	6.6-8.4	1-10	0	0	0
	7-60	18-35	5-25	7.4-8.4	10-30	0-1	0.0-4.0	0-2
Barnes----------	0-9	15-27	10-30	5.6-7.8	0	0	0.0-2.0	0
	9-14	18-35	10-30	6.1-7.8	0-3	0	0.0-4.0	0
	14-60	18-35	5-25	7.4-8.4	10-30	0-1	0.0-4.0	0
Hamerly----------	0-10	18-27	15-30	6.6-8.4	0-10	0	0.0-2.0	0
	10-29	18-35	10-20	7.4-8.4	15-35	0-2	0.0-4.0	0-2
	29-60	18-35	10-20	7.4-8.4	10-30	0-2	0.0-4.0	0-2
Tonka----------	0-17	18-27	15-35	5.6-7.8	0	0	0	0
	17-40	35-45	15-35	5.6-7.8	0-1	0-1	0.0-2.0	0-1
	40-60	18-39	10-25	6.6-8.4	5-20	0-2	0.0-4.0	0-2
Brantford----------	0-8	10-19	10-25	6.1-7.8	0	0	0	0
	8-15	18-27	10-20	6.6-7.8	0-1	0	0	0
	15-60	2-8	1-5	7.4-8.4	5-20	0	0	0
Parnell----------	0-9	27-40	25-45	6.1-7.8	0	0	0	0
	9-49	35-60	20-45	6.1-7.8	0	0	0	0
	49-60	35-45	15-30	6.6-8.4	0-3	0-2	0	0
Swenoda----------	0-13	10-20	10-25	6.1-7.3	0	0	0.0-2.0	0
	13-33	10-18	5-15	6.6-7.8	0	0	0.0-2.0	0
	33-60	20-35	2-25	7.4-8.4	10-30	0-1	0.0-4.0	0-2
1766:								
Buse----------	0-7	18-27	10-30	6.6-8.4	1-10	0	0	0
	7-60	18-35	5-25	7.4-8.4	10-30	0-1	0.0-4.0	0-2
Svea----------	0-18	18-27	15-30	6.1-7.8	0	0	0	0
	18-28	18-35	10-30	6.6-7.8	0-3	0	0	0
	28-60	18-35	10-25	7.4-8.4	3-15	0-1	0.0-4.0	0-2

Chemical Properties of the Soils--continued
Griggs County, North Dakota

Map symbol and soil name	Depth	Clay	Cation exchange capacity	Soil reaction	Calcium carbon-ate	Gypsum	Salinity	Sodium adsorp-tion ratio
	In	Pct	meq/100 g	pH	Pct	Pct	mmhos/cm	
Barnes----------	0-9	15-27	10-30	5.6-7.8	0	0	0.0-2.0	0
	9-14	18-35	10-30	6.1-7.8	0-3	0	0.0-4.0	0
	14-60	18-35	5-25	7.4-8.4	10-30	0-1	0.0-4.0	0
Hamerly----------	0-10	18-27	15-30	6.6-8.4	0-10	0	0.0-2.0	0
	10-29	18-35	10-20	7.4-8.4	15-35	0-2	0.0-4.0	0-2
	29-60	18-35	10-20	7.4-8.4	10-30	0-2	0.0-4.0	0-2
Tonka----------	0-17	18-27	15-35	5.6-7.8	0	0	0	0
	17-40	35-45	15-35	5.6-7.8	0-1	0-1	0.0-2.0	0-1
	40-60	18-39	10-25	6.6-8.4	5-20	0-2	0.0-4.0	0-2
Brantford----------	0-8	10-19	10-25	6.1-7.8	0	0	0	0
	8-16	18-27	10-20	6.6-7.8	0-1	0	0	0
	16-60	2-8	1-5	7.4-8.4	5-20	0	0	0
Parnell----------	0-9	27-40	25-45	6.1-7.8	0	0	0	0
	9-49	35-60	20-45	6.1-7.8	0	0	0	0
	49-60	35-45	15-30	6.6-8.4	0-3	0-2	0	0
Towner----------	0-14	2-10	5-10	6.6-7.8	0	0	0	0
	14-34	2-10	2-5	6.6-7.8	0	0	0	0
	34-60	18-40	10-20	7.4-8.4	10-30	0-2	0.0-2.0	0
1769:								
Cresbard----------	0-12	20-26	15-30	5.6-7.3	0	0	0.0-2.0	0
	12-25	35-50	20-45	5.6-7.8	0	0	2.0-4.0	1-10
	25-32	35-50	20-40	6.1-8.4	10-20	1-5	2.0-4.0	5-15
	32-60	25-35	15-30	7.4-9.0	10-20	1-5	2.0-8.0	5-15
Svea----------	0-18	18-27	15-30	6.1-7.8	0	0	0	0
	18-28	18-35	10-30	6.6-7.8	0-3	0	0	0
	28-60	18-35	10-25	7.4-8.4	3-15	0-1	0.0-4.0	0-2
Barnes----------	0-9	15-27	10-30	5.6-7.8	0	0	0.0-2.0	0
	9-14	18-35	10-30	6.1-7.8	0-3	0	0.0-4.0	0
	14-60	18-35	5-25	7.4-8.4	10-30	0-1	0.0-4.0	0
Cavour----------	0-11	18-25	15-30	6.1-7.8	0	---	0.0-2.0	0
	11-20	35-50	25-45	6.6-9.0	0-10	---	4.0-16.0	5-15
	20-60	25-35	15-30	7.4-9.0	10-30	---	8.0-16.0	5-10
Hamerly----------	0-10	18-27	15-30	6.6-8.4	0-10	0	0.0-2.0	0
	10-29	18-35	10-20	7.4-8.4	15-35	0-2	0.0-4.0	0-2
	29-60	18-35	10-20	7.4-8.4	10-30	0-2	0.0-4.0	0-2
Buse----------	0-7	18-27	10-30	6.6-8.4	1-10	0	0	0
	7-60	18-35	5-25	7.4-8.4	10-30	0-1	0.0-4.0	0-2
Ferney----------	0-5	18-26	15-35	6.1-7.3	0	0	0.0-2.0	0-3
	5-13	35-50	20-45	6.6-8.4	0-1	1-3	4.0-16.0	16-21
	13-60	35-45	20-40	7.4-9.0	2-15	1-5	8.0-16.0	8-16
Tonka----------	0-17	18-27	15-35	5.6-7.8	0	0	0	0
	17-40	35-45	15-35	5.6-7.8	0-1	0-1	0.0-2.0	0-1
	40-60	18-39	10-25	6.6-8.4	5-20	0-2	0.0-4.0	0-2
1781:								
Swenoda----------	0-13	10-20	10-25	6.1-7.3	0	0	0.0-2.0	0
	13-33	10-18	5-15	6.6-7.8	0	0	0.0-2.0	0
	33-60	20-35	2-25	7.4-8.4	10-30	0-1	0.0-4.0	0-2
Lanona----------	0-8	10-20	10-17	6.1-7.3	0	0	0	0
	8-28	10-18	6-8	6.6-7.8	0-1	0	0	0
	28-60	20-35	11-17	7.4-8.4	3-20	0	0.0-4.0	0
Svea----------	0-18	18-27	15-30	6.1-7.8	0	0	0	0
	18-28	18-35	10-30	6.6-7.8	0-3	0	0	0
	28-60	18-35	10-25	7.4-8.4	3-15	0-1	0.0-4.0	0-2

Chemical Properties of the Soils--continued
Griggs County, North Dakota

Map symbol and soil name	Depth	Clay	Cation exchange capacity	Soil reaction	Calcium carbon-ate	Gypsum	Salinity	Sodium adsorp-tion ratio
	In	Pct	meq/100 g	pH	Pct	Pct	mmhos/cm	
Towner----------	0-12	5-15	5-15	6.6-7.8	0	0	0	0
	12-31	2-10	3-5	6.6-7.8	0	0	0	0
	31-60	18-40	10-20	7.4-8.4	10-30	0	0	0
Fram----------	0-18	10-18	---	7.4-8.4	---	---	0	---
	18-60	7-18	---	7.4-8.4	---	---	0	---
Tiffany----------	0-24	10-18	10-25	6.1-7.8	0	0	0	0
	24-60	5-18	5-15	6.6-7.8	0-5	0	0	0-1
Buse----------	0-7	18-27	10-30	6.6-8.4	1-10	0	0	0
	7-60	18-35	5-25	7.4-8.4	10-30	0-1	0.0-4.0	0-2
1843:								
Towner----------	0-16	2-10	3-10	6.6-7.8	0	0	0	0
	16-35	2-10	1-10	6.6-7.8	0	0	0	0
	35-60	18-40	5-25	7.4-8.4	10-30	0-2	0.0-2.0	0
Maddock----------	0-11	2-10	3-10	6.6-7.8	0-3	0	0.0-2.0	0
	11-60	2-8	1-8	6.6-8.4	0-10	0	0.0-2.0	0
Swenoda----------	0-13	10-20	10-25	6.1-7.3	0	0	0.0-2.0	0
	13-33	10-18	5-15	6.6-7.8	0	0	0.0-2.0	0
	33-60	20-35	2-25	7.4-8.4	10-30	0-1	0.0-4.0	0-2
Tiffany----------	0-24	10-18	10-25	6.1-7.8	0	0	0	0
	24-60	5-18	5-15	6.6-7.8	0-5	0	0	0-1
Barnes----------	0-9	15-27	10-30	5.6-7.8	0	0	0.0-2.0	0
	9-14	18-35	10-30	6.1-7.8	0-3	0	0.0-4.0	0
	14-60	18-35	5-25	7.4-8.4	10-30	0-1	0.0-4.0	0
Hamar----------	0-12	5-10	7-12	6.1-7.8	0	0	0.0-2.0	0
	12-22	0-7	3-9	6.6-8.4	0-1	0	0.0-2.0	0
	22-60	0-7	3-9	7.4-8.4	0-2	0	0.0-2.0	0
Grimstad----------	0-21	10-18	---	7.4-8.4	---	---	---	---
	21-37	2-15	---	7.4-8.4	---	---	---	---
	37-60	10-30	---	7.4-8.4	---	---	---	---
1883:								
Parnell----------	0-9	27-40	30-50	6.1-7.8	0	0	0	0
	9-49	35-60	25-60	6.1-7.8	0	0	0	0
	49-60	35-45	20-40	6.6-8.4	0-3	0-2	0	0
Vallers----------	0-12	18-27	20-40	7.4-8.4	5-10	0-1	0.0-4.0	0
	12-32	18-35	10-30	7.4-8.4	15-30	0-2	0.0-4.0	0-5
	32-60	18-35	10-20	7.4-8.4	15-30	0-2	0.0-4.0	0-10
Hamerly----------	0-10	18-27	15-30	6.6-8.4	0-10	0	0.0-2.0	0
	10-29	18-35	10-20	7.4-8.4	15-35	0-2	0.0-4.0	0-2
	29-60	18-35	10-20	7.4-8.4	10-30	0-2	0.0-4.0	0-2
Vallers, SALINE------	0-12	18-27	15-30	7.4-8.4	5-10	0-1	4.0-16.0	0-3
	12-32	18-35	10-25	7.4-8.4	15-35	0-3	4.0-16.0	0-5
	32-60	18-35	10-20	7.4-8.4	15-30	0-3	4.0-16.0	0-10
Marysland----------	0-8	18-35	15-35	7.9-8.4	1-15	0	0	0
	8-30	18-35	10-25	7.9-8.4	15-35	0-3	0.0-2.0	0
	30-60	1-5	2-10	7.9-8.4	5-20	0	0	0
Southam----------	0-10	27-40	25-50	6.6-8.4	0-10	0-1	2.0-8.0	0-2
	10-48	35-50	25-65	6.6-8.4	3-25	0-1	2.0-8.0	0-2
	48-60	18-50	15-45	7.4-8.4	10-30	0-5	2.0-8.0	0-2
Perella----------	0-7	18-26	---	6.6-7.8	---	---	0	---
	7-22	18-34	---	6.6-7.8	---	---	0	---
	22-60	18-34	---	7.4-8.4	---	---	0	---
Tonka----------	0-17	18-27	15-35	5.6-7.8	0	0	0	0
	17-40	35-45	15-35	5.6-7.8	0-1	0-1	0.0-2.0	0-1
	40-60	18-39	10-25	6.6-8.4	5-20	0-2	0.0-4.0	0-2

Chemical Properties of the Soils--continued
Griggs County, North Dakota

Map symbol and soil name	Depth	Clay	Cation exchange capacity	Soil reaction	Calcium carbon-ate	Gypsum	Salinity	Sodium adsorp-tion ratio
	In	Pct	meq/100 g	pH	Pct	Pct	mmhos/cm	
1886:								
Hamerly----------	0-10	18-27	15-30	7.4-8.4	1-15	0-3	4.0-16.0	0
	10-29	18-35	10-30	7.4-8.4	15-35	0-5	4.0-16.0	0-2
	29-60	18-35	10-25	7.4-8.4	10-30	0-5	4.0-16.0	0-4
Vallers----------	0-12	18-27	15-30	7.4-8.4	5-10	0-1	4.0-16.0	0-3
	12-32	18-35	10-25	7.4-8.4	15-35	0-3	4.0-16.0	0-5
	32-60	18-35	10-20	7.4-8.4	15-30	0-3	4.0-16.0	0-10
Tonka----------	0-17	18-27	15-35	5.6-7.8	0	0	0	0
	17-40	35-45	15-35	5.6-7.8	0-1	0-1	0.0-2.0	0-1
	40-60	18-39	10-25	6.6-8.4	5-20	0-2	0.0-4.0	0-2
Parnell----------	0-9	27-40	25-45	6.1-7.8	0	0	0	0
	9-49	35-60	20-45	6.1-7.8	0	0	0	0
	49-60	35-45	15-30	6.6-8.4	0-3	0-2	0	0
Wyard----------	0-15	18-27	20-40	6.6-7.8	0	0	0	0
	15-21	18-27	15-30	6.6-7.8	0	0	0	0
	21-35	18-35	15-30	7.4-8.4	10-25	0	0	0
	35-60	15-35	15-30	7.4-8.4	10-20	0	0	0
Cavour----------	0-11	18-25	15-30	6.1-7.8	0	---	0.0-2.0	0
	11-20	35-50	25-45	6.6-9.0	0-10	---	4.0-16.0	5-15
	20-60	25-35	15-30	7.4-9.0	10-30	---	8.0-16.0	5-10
Ferney----------	0-5	18-26	15-35	6.1-7.3	0	0	0.0-2.0	0-3
	5-13	35-50	20-45	6.6-8.4	0-1	1-3	4.0-16.0	16-21
	13-60	35-45	20-40	7.4-9.0	2-15	1-5	8.0-16.0	8-16
1970:								
Walum----------	0-16	8-18	5-15	6.6-7.3	0	0	0	0
	16-30	5-18	2-15	6.6-7.3	0-15	0	0	0
	30-60	0-10	0-5	7.4-8.4	5-20	0	0	0
Wyrene----------	0-24	8-18	18-30	6.6-8.4	15-30	0	0	0
	24-60	0-5	0-3	7.4-8.4	10-25	0	0	0
Embden----------	0-16	10-18	10-25	6.6-7.3	0	0	0	0
	16-38	10-18	5-20	6.6-7.8	0	0	0	0
	38-60	5-18	2-15	6.6-8.4	0-15	0	0.0-2.0	0
Coe----------	0-8	6-18	5-15	6.6-7.8	0-5	0	0	0
	8-60	2-8	1-5	7.4-8.4	5-20	0	0	0
Divide----------	0-9	15-27	10-30	7.4-8.4	1-15	0	0	0
	9-28	18-35	10-30	7.4-8.4	15-35	0-1	0.0-2.0	0
	28-60	1-10	2-10	7.4-8.4	10-30	0	0	0
Fram----------	0-18	10-18	---	7.4-8.4	---	---	0	---
	18-60	7-18	---	7.4-8.4	---	---	0	---
Vallers----------	0-12	18-28	20-40	7.4-8.4	5-10	0-1	0.0-4.0	0
	12-32	18-35	10-25	7.4-8.4	15-30	0-2	0.0-4.0	0-5
	32-60	18-35	10-20	7.4-8.4	15-30	0-2	0.0-4.0	0-10
1978:								
Water----------	---	---	---	---	---	---	---	---
Colvin----------	0-10	18-26	15-30	6.6-8.4	0-10	0-1	0.0-4.0	0-2
	10-30	18-34	5-30	7.4-8.4	10-45	0-1	0.0-4.0	0-3
	30-60	18-34	5-20	7.4-8.4	5-20	0-5	0.0-4.0	0-10
Southam----------	0-10	27-40	25-50	6.6-8.4	0-10	0-1	2.0-8.0	0-2
	10-48	35-50	25-65	6.6-8.4	3-25	0-1	2.0-8.0	0-2
	48-60	18-50	15-45	7.4-8.4	10-30	0-5	2.0-8.0	0-2
2118:								
Fram----------	0-18	10-18	10-25	7.4-8.4	0-25	0-1	0	0-2
	18-60	7-18	5-20	7.4-8.4	15-30	0-5	0	0-2

Chemical Properties of the Soils--continued
Griggs County, North Dakota

Map symbol and soil name	Depth	Clay	Cation exchange capacity	Soil reaction	Calcium carbon-ate	Gypsum	Salinity	Sodium adsorp-tion ratio
	In	Pct	meq/100 g	pH	Pct	Pct	mmhos/cm	
Tonka----------	0-17	18-27	20-40	5.6-7.8	0	0	0	0
	17-40	35-45	25-40	5.6-7.8	0-1	0-1	0.0-2.0	0-1
	40-60	18-39	10-35	6.6-8.4	5-20	0-2	0.0-4.0	0-2
Wyard----------	0-15	18-27	20-40	6.6-7.8	0	0	0	0
	15-21	18-27	15-30	6.6-7.8	0	0	0	0
	21-35	18-35	15-30	7.4-8.4	10-25	0	0	0
	35-60	15-35	15-30	7.4-8.4	10-20	0	0	0
Heimdal----------	0-7	10-20	20-30	6.1-7.3	0	0	0	0
	7-14	10-18	10-25	6.1-7.8	0-5	0	0	0-1
	14-60	7-18	5-20	7.4-8.4	5-20	0	0	0-5
Vallers----------	0-12	18-28	20-40	7.4-8.4	5-10	0-1	0.0-4.0	0
	12-32	18-35	10-25	7.4-8.4	15-30	0-2	0.0-4.0	0-5
	32-60	18-35	10-20	7.4-8.4	15-30	0-2	0.0-4.0	0-10
Glyndon----------	0-13	15-27	---	7.4-8.4	---	---	0.0-4.0	---
	13-33	10-18	---	7.9-8.4	---	---	0.0-4.0	---
	33-43	10-18	---	7.4-8.4	---	---	0.0-4.0	---
	43-60	15-35	---	7.4-8.4	---	---	0.0-4.0	---
Parnell----------	0-9	27-40	25-45	6.1-7.8	0	0	0	0
	9-49	35-60	20-45	6.1-7.8	0	0	0	0
	49-60	35-45	15-30	6.6-8.4	0-3	0-2	0	0
Wyndmere----------	0-11	5-15	20-40	7.4-8.4	10-25	0-1	0	0-1
	11-29	0-10	10-20	7.4-8.4	15-40	0-1	0	0-1
	29-55	0-10	5-15	7.4-8.4	5-25	0-1	0	0-3
	55-60	18-35	5-20	7.4-8.4	5-25	0-1	0	0-3
2121:								
Ferney----------	0-5	18-26	15-35	6.1-7.3	0	0	0.0-2.0	0-3
	5-13	35-50	20-45	6.6-8.4	0-1	1-3	4.0-16.0	16-21
	13-60	35-45	20-40	7.4-9.0	2-15	1-5	8.0-16.0	8-16
Hamerly, SALINE------	0-10	18-27	15-30	7.4-8.4	1-15	0-3	4.0-16.0	0
	10-29	18-35	10-30	7.4-8.4	15-35	0-5	4.0-16.0	0-2
	29-60	18-35	10-25	7.4-8.4	10-30	0-5	4.0-16.0	0-4
Cavour----------	0-11	18-25	15-30	6.1-7.8	0	---	0.0-2.0	0
	11-20	35-50	25-45	6.6-9.0	0-10	---	4.0-16.0	5-15
	20-60	25-35	15-30	7.4-9.0	10-30	---	8.0-16.0	5-10
Manfred----------	0-7	18-26	20-40	6.1-8.4	0-5	0-1	2.0-4.0	1-5
	7-60	18-34	10-25	7.9-9.0	10-30	0-2	2.0-16.0	5-25
Wyard----------	0-15	18-27	20-40	6.6-7.8	0	0	0	0
	15-21	18-27	15-30	6.6-7.8	0	0	0	0
	21-35	18-35	15-30	7.4-8.4	10-25	0	0	0
	35-60	15-35	15-30	7.4-8.4	10-20	0	0	0
Cresbard----------	0-12	20-26	15-30	5.6-7.3	0	0	0.0-2.0	0
	12-25	35-50	20-45	5.6-7.8	0	0	2.0-4.0	1-10
	25-32	35-50	20-40	6.1-8.4	10-20	1-5	2.0-4.0	5-15
	32-60	25-35	15-30	7.4-9.0	10-20	1-5	2.0-8.0	5-15
Marysland, SALINE----	0-9	10-20	---	7.4-8.4	---	---	4.0-16.0	---
	9-39	10-27	---	7.4-8.4	---	---	4.0-16.0	---
	39-60	5-20	---	7.4-8.4	---	---	4.0-16.0	---
2151:								
Binford----------	0-8	6-18	5-20	5.6-7.8	0	0	0	0
	8-17	6-18	5-15	5.6-8.4	0-1	0	0	0
	17-60	2-8	1-5	7.4-8.4	5-20	0	0	0
Coe----------	0-8	6-18	5-15	6.6-7.8	0-5	0	0	0
	8-60	2-8	1-5	7.4-8.4	5-20	0	0	0
Brantford----------	0-8	10-19	10-25	6.1-7.8	0	0	0	0
	8-15	18-27	10-20	6.6-7.8	0-1	0	0	0
	15-60	2-8	1-5	7.4-8.4	5-20	0	0	0

Chemical Properties of the Soils--continued
Griggs County, North Dakota

Map symbol and soil name	Depth	Clay	Cation exchange capacity	Soil reaction	Calcium carbon-ate	Gypsum	Salinity	Sodium adsorp-tion ratio
	In	Pct	meq/100 g	pH	Pct	Pct	mmhos/cm	
Vang	0-11	18-27	15-25	5.6-7.3	0	0-1	0	0-1
	11-27	18-30	10-20	5.6-8.4	0-10	0-1	0	0-1
	27-60	0-5	5-10	5.6-8.4	5-15	0-1	0	0-2
Divide	0-9	15-27	10-30	7.4-8.4	1-15	0	0	0
	9-28	18-35	10-30	7.4-8.4	15-35	0-1	0.0-2.0	0
	28-60	1-10	2-10	7.4-8.4	10-30	0	0	0
Kensal	0-9	18-25	---	6.6-7.3	---	---	0	---
	9-23	18-25	---	6.6-7.3	---	---	0	---
	23-60	0-10	---	7.4-8.4	---	---	0	---
Marysland	0-8	18-35	15-35	7.9-8.4	1-15	0	0	0
	8-30	18-35	10-25	7.9-8.4	15-35	0-3	0.0-2.0	0
	30-60	1-5	2-10	7.9-8.4	5-20	0	0	0
Walum	0-16	8-18	---	6.6-7.3	---	---	0	---
	16-30	5-18	---	6.6-7.3	---	---	0	---
	30-60	0-10	---	7.4-8.4	---	---	0	---
2152:								
Coe	0-8	6-18	5-15	6.6-7.8	0-5	0	0	0
	8-60	2-8	1-5	7.4-8.4	5-20	0	0	0
Binford	0-8	6-18	5-20	5.6-7.8	0	0	0	0
	8-17	6-18	5-15	5.6-8.4	0-1	0	0	0
	17-60	2-8	1-5	7.4-8.4	5-20	0	0	0
Vang	0-11	18-27	15-25	5.6-7.3	0	0-1	0	0-1
	11-27	18-30	10-20	5.6-8.4	0-10	0-1	0	0-1
	27-60	0-5	5-10	5.6-8.4	5-15	0-1	0	0-2
Heimdal	0-7	10-20	20-30	6.1-7.3	0	0	0	0
	7-14	10-18	10-25	6.1-7.8	0-5	0	0	0-1
	14-60	7-18	5-20	7.4-8.4	5-20	0	0	0-5
Esmond	0-8	10-18	---	7.4-8.4	---	---	0	---
	8-60	7-18	---	7.4-8.4	---	---	0	---
Brantford	0-8	10-19	10-25	6.1-7.8	0	0	0	0
	8-16	18-27	10-20	6.6-7.8	0-1	0	0	0
	16-60	2-8	1-5	7.4-8.4	5-20	0	0	0
Divide	0-9	15-27	10-30	7.4-8.4	1-15	0	0	0
	9-28	18-35	10-30	7.4-8.4	15-35	0-1	0.0-2.0	0
	28-60	1-10	2-10	7.4-8.4	10-30	0	0	0
Fram	0-18	10-18	---	7.4-8.4	---	---	0	---
	18-60	7-18	---	7.4-8.4	---	---	0	---
2153:								
Edgeley	0-8	18-26	15-27	6.1-7.3	0	0	0	0
	8-26	18-34	10-16	6.1-8.4	0-15	0	0	0
	26-60	35-45	---	---	0-10	0-5	2.0-8.0	0
Kloten	0-11	18-26	15-25	6.1-8.4	0	0	0	0
	11-60	35-45	10-25	---	0-10	0-5	2.0-8.0	0
Esmond	0-8	10-18	5-15	7.4-8.4	1-10	0	0	0
	8-60	7-18	3-15	7.4-8.4	5-20	0-1	0	0
Walsh	---	---	---	---	---	---	---	---
Coe	0-8	6-18	5-15	6.6-7.8	0-5	0	0	0
	8-60	2-8	1-5	7.4-8.4	5-20	0	0	0
Egeland	0-6	10-20	10-17	6.1-7.3	0	0	0	0
	6-32	10-18	6-8	6.6-7.8	0-1	0	0	0
	32-60	20-35	11-17	7.4-8.4	3-20	0	0.0-4.0	0

Chemical Properties of the Soils--continued
Griggs County, North Dakota

Map symbol and soil name	Depth	Clay	Cation exchange capacity	Soil reaction	Calcium carbon-ate	Gypsum	Salinity	Sodium adsorp-tion ratio
	In	Pct	meq/100 g	pH	Pct	Pct	mmhos/cm	
Lamoure, CHANNELED---	0-23	27-35	25-30	6.6-7.8	---	---	0	---
	23-43	27-35	20-30	7.4-8.4	4-25	---	0.0-4.0	---
	43-60	25-35	15-25	7.4-8.4	4-15	0-2	0.0-4.0	0-1
Mekinock----------	0-2	18-27	---	5.6-7.8	---	---	0	---
	2-25	35-55	---	6.1-9.0	---	---	4.0-16.0	---
	25-60	---	---	---	---	---	---	---
Nutley----------	0-9	40-60	---	6.6-8.4	---	---	0.0-2.0	---
	9-60	35-60	---	7.4-8.4	---	---	0.0-2.0	---
2156:								
Lamoure----------	0-9	20-26	22-29	7.4-8.4	0-10	0	0.0-4.0	1-2
	9-30	20-34	24-31	7.4-8.4	9-20	0	0.0-4.0	1-3
	30-60	20-34	20-29	7.4-8.4	9-20	0-1	0.0-4.0	1-3
Rauville----------	0-28	15-26	15-35	7.4-8.4	5-15	0	0.0-2.0	1-2
	28-60	20-45	20-35	7.4-8.4	10-20	0-1	0.0-4.0	1-3
Marysland----------	0-8	18-35	15-35	7.9-8.4	1-15	0	0	0
	8-30	18-35	10-25	7.9-8.4	15-35	0-3	0.0-2.0	0
	30-60	1-5	2-10	7.9-8.4	5-20	0	0	0
Velva----------	0-15	7-18	10-25	6.6-7.3	0	0	0	0
	15-60	7-18	5-10	6.6-8.4	5-10	0	0	0
Divide----------	0-9	15-27	10-30	7.4-8.4	1-15	0	0	0
	9-28	18-35	10-30	7.4-8.4	15-35	0-1	0.0-2.0	0
	28-60	1-10	2-10	7.4-8.4	10-30	0	0	0
Fairdale----------	0-10	18-27	15-30	7.4-7.8	3-10	0	0	0
	10-60	18-35	10-20	7.4-8.4	5-35	0	0.0-2.0	0
Harriet----------	0-2	12-25	13-23	6.6-8.4	0	0	0.0-2.0	0
	2-10	35-50	17-26	7.4-9.0	1-45	0-5	4.0-16.0	13-25
	10-60	18-40	12-17	7.9-9.0	10-45	0-5	4.0-16.0	5-20
Vallers----------	0-12	18-28	20-40	7.4-8.4	5-10	0-1	0.0-4.0	0
	12-32	18-35	10-25	7.4-8.4	15-30	0-2	0.0-4.0	0-5
	32-60	18-35	10-20	7.4-8.4	15-30	0-2	0.0-4.0	0-10
2157:								
Maddock----------	0-11	2-10	3-10	6.6-7.8	0-3	0	0.0-2.0	0
	11-60	2-8	1-8	6.6-8.4	0-10	0	0.0-2.0	0
Esmond----------	0-8	10-18	5-15	7.4-8.4	1-10	0	0	0
	8-60	7-18	3-15	7.4-8.4	5-20	0-1	0	0
Embden----------	0-16	10-18	10-25	6.6-7.3	0	0	0	0
	16-38	10-18	5-20	6.6-7.8	0	0	0	0
	38-60	5-18	2-10	6.6-8.4	5-15	0	0	0
Serden----------	0-3	3-8	3-5	6.1-7.3	0	0	0	0
	3-60	3-8	2-3	6.6-7.8	0-3	0	0	0
Heimdal----------	0-7	10-20	20-30	6.1-7.3	0	0	0	0
	7-14	10-18	10-25	6.1-7.8	0-5	0	0	0-1
	14-60	7-18	5-20	7.4-8.4	5-20	0	0	0-5
Hecla----------	0-12	2-10	3-10	6.1-7.8	0-3	0	0	0
	12-26	2-10	3-10	6.1-7.8	0-3	0	0	0
	26-60	3-8	1-8	6.1-8.4	0-10	0	0	0
Binford----------	0-8	6-18	5-20	5.6-7.8	0	0	0	0
	8-17	6-18	5-15	5.6-8.4	0-1	0	0	0
	17-60	2-8	1-5	7.4-8.4	5-20	0	0	0
Coe----------	0-8	6-18	5-15	6.6-7.8	0-5	0	0	0
	8-60	2-8	1-5	7.4-8.4	5-20	0	0	0

Chemical Properties of the Soils--continued
Griggs County, North Dakota

Map symbol and soil name	Depth	Clay	Cation exchange capacity	Soil reaction	Calcium carbon-ate	Gypsum	Salinity	Sodium adsorp-tion ratio
	In	Pct	meq/100 g	pH	Pct	Pct	mmhos/cm	
Ulen----------	0-9	8-20	---	7.4-8.4	---	---	0.0-4.0	---
	9-42	5-12	---	7.9-8.4	---	---	0.0-4.0	---
	42-60	1-7	---	7.4-8.4	---	---	0.0-4.0	---
2158:								
Velva----------	0-15	7-18	10-25	6.6-7.3	0-5	0	0	0
	15-60	7-18	3-20	6.6-8.4	5-10	0	0	0
Banks----------	0-5	10-27	10-15	6.6-7.8	0-3	0	0	0
	5-60	0-10	2-4	7.4-8.4	1-5	0-2	0.0-4.0	0-1
Rauville----------	0-7	10-19	20-25	6.1-7.8	0-1	---	0.0-2.0	0
	7-15	18-27	1-10	6.6-8.4	1-15	---	0.0-2.0	0
	15-60	0-5	1-10	6.6-8.4	1-15	---	0.0-2.0	0
Lamoure----------	0-23	27-35	25-30	6.6-7.8	---	---	0	---
	23-43	27-35	20-30	7.4-8.4	4-25	---	0.0-4.0	---
	43-60	25-35	15-25	7.4-8.4	4-15	0-2	0.0-4.0	0-1
Ladelle----------	0-23	27-35	25-30	6.6-7.8	---	---	0	---
	23-43	27-35	20-30	7.4-8.4	4-25	---	0.0-4.0	---
	43-60	25-35	15-25	7.4-8.4	4-15	0-2	0.0-4.0	0-1
Tiffany----------	0-24	10-18	10-25	6.1-7.8	0	0	0	0
	24-60	5-18	5-15	6.6-7.8	0-5	0	0	0-1
Water----------	---	---	---	---	---	---	---	---
2159:								
Walsh----------	0-8	27-35	20-35	6.1-7.3	0	0	0	0
	8-60	25-35	10-30	6.1-7.8	0-15	0-1	0	0
Barnes----------	0-9	15-27	10-30	5.6-7.8	0	0	0.0-2.0	0
	9-14	18-35	10-30	6.1-7.8	0-3	0	0.0-4.0	0
	14-60	18-35	5-25	7.4-8.4	10-30	0-1	0.0-4.0	0
Sinai----------	0-6	35-40	---	6.1-7.3	---	---	0.0-2.0	---
	6-21	35-60	---	6.6-7.8	---	---	0.0-2.0	---
	21-29	35-60	---	7.4-8.4	---	---	0.0-2.0	---
	29-60	30-50	---	7.4-8.4	---	---	0.0-2.0	---
Nutley----------	0-7	40-60	---	6.6-8.4	---	---	0.0-2.0	---
	7-60	35-60	---	7.4-8.4	---	---	0.0-2.0	---
Binford----------	0-8	6-18	5-20	5.6-7.8	0	0	0	0
	8-17	6-18	5-15	5.6-8.4	0-1	0	0	0
	17-60	2-8	1-5	7.4-8.4	5-20	0	0	0
Edgeley----------	0-8	18-26	15-27	6.1-7.3	0	0	0	0
	8-32	18-34	10-16	6.1-8.4	0-15	0	0	0
	32-60	---	---	---	---	---	---	---
Kensal----------	0-9	18-25	---	6.6-7.3	---	---	0	---
	9-23	18-25	---	6.6-7.3	---	---	0	---
	23-60	0-10	---	7.4-8.4	---	---	0	---
2196:								
Colvin, SALINE-------	0-10	18-26	25-35	7.4-8.4	0-10	0-1	4.0-16.0	0-2
	10-60	18-34	10-25	7.4-8.4	5-45	0-5	4.0-16.0	0-10
Bearden, SALINE------	0-9	18-26	15-30	7.4-8.4	0-10	0-1	4.0-16.0	0-2
	9-20	18-34	5-25	7.4-8.4	10-45	0-5	4.0-16.0	0-3
	20-60	18-34	5-20	7.4-8.4	5-20	0-5	4.0-16.0	0-10
Bearden, NONSALINE---	0-9	18-26	15-30	7.4-8.4	0-10	0-1	0.0-4.0	0-2
	9-20	18-34	5-25	7.4-8.4	10-45	0-1	0.0-4.0	0-3
	20-60	18-34	5-20	7.4-8.4	5-20	0-5	0.0-4.0	0-10
Colvin, NONSALINE----	0-10	18-26	15-30	6.6-8.4	0-10	0-1	0.0-4.0	0-2
	10-30	18-34	5-30	7.4-8.4	10-45	0-1	0.0-4.0	0-3
	30-60	18-34	5-20	7.4-8.4	5-20	0-5	0.0-4.0	0-10

Chemical Properties of the Soils--continued
Griggs County, North Dakota

Map symbol and soil name	Depth	Clay	Cation exchange capacity	Soil reaction	Calcium carbon-ate	Gypsum	Salinity	Sodium adsorp-tion ratio
	In	Pct	meq/100 g	pH	Pct	Pct	mmhos/cm	
Exline----------	0-1	20-26	11-20	6.1-7.8	0	0	0.0-2.0	0
	1-10	35-55	18-27	6.6-9.0	0-15	0-2	4.0-16.0	5-20
	10-28	35-50	17-26	7.9-9.0	3-20	0-10	4.0-8.0	5-20
	28-60	25-35	12-18	7.9-9.0	3-20	0-5	2.0-8.0	5-15
Harriet----------	0-2	12-25	13-23	6.6-8.4	0	0	0.0-2.0	0
	2-10	35-50	17-26	7.4-9.0	1-45	0-5	4.0-16.0	13-25
	10-60	18-40	12-17	7.9-9.0	10-45	0-5	4.0-16.0	5-20
Colvin, SALINE-------	0-10	18-26	25-35	7.4-8.4	0-10	0-1	4.0-16.0	0-2
	10-60	18-34	10-25	7.4-8.4	5-45	0-5	4.0-16.0	0-10
Perella----------	0-28	15-26	20-28	7.4-8.4	5-15	0	0.0-2.0	1-2
	28-60	20-45	20-29	7.4-8.4	10-20	0-1	0.0-4.0	1-3
2197:								
Edgeley----------	0-8	18-26	15-27	6.1-7.3	0	0	0	0
	8-32	18-34	10-16	6.1-8.4	0-15	0	0	0
	32-60	35-45	---	---	0-10	0-5	2.0-8.0	---
Kloten----------	0-11	18-26	15-25	6.1-8.4	0-5	0	0	0
	11-60	35-45	10-25	---	0-10	0-5	2.0-8.0	---
Heimdal----------	0-7	10-20	20-30	6.1-7.3	0	0	0	0
	7-14	10-18	10-25	6.1-7.8	0-5	0	0	0-1
	14-60	7-18	5-20	7.4-8.4	5-20	0	0	0-5
Nutley----------	0-9	40-60	---	6.6-8.4	---	---	0.0-2.0	---
	9-60	35-60	---	7.4-8.4	---	---	0.0-2.0	---
Walsh----------	0-8	27-35	---	6.1-7.3	---	---	0	---
	8-60	25-35	---	6.1-7.8	---	---	0	---
Cavour----------	0-7	18-25	15-30	6.1-7.8	0	---	0.0-2.0	0
	7-39	35-50	25-45	6.6-9.0	0-10	---	4.0-16.0	5-15
	39-60	25-35	15-30	7.4-9.0	10-30	---	8.0-16.0	5-10
Emrick----------	0-11	10-18	20-30	6.6-7.8	0	0	0	0
	11-22	10-18	10-25	6.6-7.8	0-5	0	0	0
	22-60	7-18	5-20	7.4-8.4	5-20	0	0	0-5
Darnen----------	0-18	18-27	15-35	6.6-7.8	0-15	0	0	0
	18-32	18-30	10-25	6.1-7.8	0-15	0	0	0
	32-60	18-30	10-25	7.4-8.4	5-30	0	0	0
2198:								
Hamar----------	0-17	5-10	4-10	6.1-7.8	0	0	0.0-2.0	0
	17-25	0-7	0-10	6.6-8.4	0-1	0	0.0-2.0	0
	25-60	0-7	0-5	7.4-8.4	0-2	0-1	0.0-2.0	0
Hecla----------	0-10	2-10	3-10	6.1-7.8	0-3	0	0	0
	10-32	2-10	3-10	6.1-7.8	0-3	0	0	0
	32-60	3-8	1-8	6.1-8.4	0-10	0	0	0
Ulen----------	0-9	8-20	---	7.4-8.4	---	---	0.0-4.0	---
	9-42	5-12	---	7.9-8.4	---	---	0.0-4.0	---
	42-60	1-7	---	7.4-8.4	---	---	0.0-4.0	---
Arveson----------	0-9	10-20	15-30	7.4-8.4	5-20	---	0	0
	9-39	10-27	5-25	7.4-8.4	15-30	---	0	0
	39-60	5-20	2-15	7.4-8.4	10-20	---	0	0-1
Towner----------	0-12	5-15	5-15	6.6-7.8	0	0	0	0
	12-31	2-10	3-5	6.6-7.8	0	0	0	0
	31-60	18-40	10-20	7.4-8.4	10-30	0	0	0
Wyndmere----------	0-10	5-15	10-25	6.6-8.4	10-20	0-1	0	0-1
	10-30	3-15	3-20	7.4-8.4	15-35	0-1	0.0-2.0	0-1
	30-60	3-15	2-10	7.4-8.4	5-20	0-1	0.0-2.0	0-3

Chemical Properties of the Soils--continued
Griggs County, North Dakota

Map symbol and soil name	Depth	Clay	Cation exchange capacity	Soil reaction	Calcium carbon-ate	Gypsum	Salinity	Sodium adsorp-tion ratio
	In	Pct	meq/100 g	pH	Pct	Pct	mmhos/cm	
Fossum----------	0-17	4-12	---	7.4-8.4	---	---	---	---
	17-24	1-10	---	7.4-8.4	---	---	---	---
	24-60	1-5	---	7.4-8.4	---	---	---	---
Letcher----------	0-8	5-10	10-15	5.1-7.8	0	0	0.0-2.0	0
	8-9	10-18	10-16	5.1-7.8	0-7	0	0.0-2.0	1-7
	9-28	10-15	7-14	6.6-9.0	10-20	1-3	2.0-8.0	5-15
	28-60	10-15	7-14	7.4-9.0	5-15	1-3	2.0-8.0	5-15
2199:								
Hamerly, VERY STONY--	0-10	18-27	15-30	6.6-8.4	0-10	0	0.0-2.0	0
	10-29	18-35	10-25	7.4-8.4	10-30	0-2	0.0-4.0	0-2
	29-60	18-35	5-25	7.4-8.4	5-25	0-2	0.0-4.0	0-2
Barnes, VERY STONY---	0-9	18-26	15-30	5.6-7.8	0	0	0.0-2.0	0
	9-14	18-35	10-30	6.1-7.8	0-3	0	0.0-4.0	0
	14-60	18-35	5-25	7.4-8.4	10-30	0-2	0.0-4.0	0
Vallers----------	0-12	18-28	20-40	7.4-8.4	5-10	0-1	0.0-4.0	0
	12-32	18-35	10-25	7.4-8.4	15-30	0-2	0.0-4.0	0-5
	32-60	18-35	10-20	7.4-8.4	15-30	0-2	0.0-4.0	0-10
Emrick----------	0-13	10-18	20-30	6.6-7.8	0	0	0	0
	13-32	10-18	10-25	6.6-7.8	0-5	0	0	0
	32-60	7-18	5-20	7.4-8.4	5-20	0	0	0-5
Tonka, VERY STONY----	0-17	18-27	20-40	5.6-7.8	0	0	0	0
	17-40	35-45	25-40	5.6-7.8	0-1	0-1	0.0-2.0	0-1
	40-60	18-39	10-35	6.6-8.4	5-20	0-2	0.0-4.0	0-2
Parnell----------	0-9	27-40	25-45	6.1-7.8	0	0	0	0
	9-49	35-60	20-45	6.1-7.8	0	0	0	0
	49-60	35-45	15-30	6.6-8.4	0-3	0-2	0	0
Cresbard----------	0-12	20-26	15-30	5.6-7.3	0	0	0.0-2.0	0
	12-25	35-50	20-45	5.6-7.8	0	0	2.0-4.0	1-10
	25-32	35-50	20-40	6.1-8.4	10-20	1-5	2.0-4.0	5-15
	32-60	25-35	15-30	7.4-9.0	10-20	1-5	2.0-8.0	5-15
Hamerly, SALINE------	0-10	18-27	15-30	7.4-8.4	1-15	0-3	4.0-16.0	0
	10-29	18-35	10-30	7.4-8.4	15-35	0-5	4.0-16.0	0-2
	29-60	18-35	10-25	7.4-8.4	10-30	0-5	4.0-16.0	0-4
Cavour----------	0-11	18-25	15-30	6.1-7.8	0	---	0.0-2.0	0
	11-20	35-50	25-45	6.6-9.0	0-10	---	4.0-16.0	5-15
	20-60	25-35	15-30	7.4-9.0	10-30	---	8.0-16.0	5-10
2200:								
Letcher----------	0-8	5-10	10-15	5.1-7.8	0	0	0.0-2.0	0
	8-9	10-18	10-16	5.1-7.8	0-7	0	0.0-2.0	1-7
	9-28	10-15	7-14	6.6-9.0	1-15	1-3	2.0-12.0	5-18
	28-60	10-15	7-14	7.4-9.0	5-20	1-3	2.0-12.0	5-15
Swenoda----------	0-13	10-20	10-25	6.1-7.3	0	0	0.0-2.0	0
	13-33	10-18	5-15	6.6-7.8	0	0	0.0-2.0	0
	33-60	20-35	2-25	7.4-8.4	10-30	0-1	0.0-4.0	0-2
Lanona----------	0-8	10-20	10-17	6.1-7.3	0	0	0	0
	8-28	10-18	6-8	6.6-7.8	0-1	0	0	0
	28-60	20-35	11-17	7.4-8.4	3-20	0	0.0-4.0	0
Cathay----------	0-10	10-27	10-25	6.1-7.8	0	---	0.0-2.0	0
	10-22	18-35	10-25	6.6-8.4	0	---	4.0-8.0	1-10
	22-60	7-18	3-10	7.4-9.0	5-20	---	4.0-8.0	5-15
Lemert----------	0-5	10-18	---	6.6-9.0	---	---	4.0-8.0	---
	5-12	10-18	---	8.5-9.0	---	---	8.0-16.0	---
	12-27	10-18	---	8.5-9.0	---	---	4.0-8.0	---
	27-60	0-35	---	7.4-8.4	---	---	0.0-8.0	---

Chemical Properties of the Soils--continued
Griggs County, North Dakota

Map symbol and soil name	Depth	Clay	Cation exchange capacity	Soil reaction	Calcium carbon-ate	Gypsum	Salinity	Sodium adsorp-tion ratio
	In	Pct	meq/100 g	pH	Pct	Pct	mmhos/cm	
Stirum----------	0-8	10-20	10-20	7.4-8.4	1-10	0	2.0-8.0	0-2
	8-23	10-25	5-15	7.9-9.0	10-45	0-2	2.0-16.0	5-15
	23-60	5-20	5-10	7.9-9.0	10-45	0-4	2.0-16.0	5-10
Wyndmere----------	0-11	5-15	20-40	7.4-8.4	10-25	0-1	0	0-1
	11-29	0-10	10-20	7.4-8.4	15-40	0-1	0	0-1
	29-55	0-10	5-15	7.4-8.4	5-25	0-1	0	0-3
	55-60	18-35	5-20	7.4-8.4	5-25	0-1	0	0-3
Towner----------	0-12	5-15	5-15	6.6-7.8	0	0	0	0
	12-31	2-10	3-5	6.6-7.8	0	0	0	0
	31-60	18-40	10-20	7.4-8.4	10-30	0	0	0
2201:								
Stirum----------	0-8	10-20	10-25	7.4-8.4	1-10	0	2.0-8.0	0-2
	8-23	10-25	5-20	7.9-9.0	10-45	0-2	2.0-16.0	5-18
	23-60	5-20	2-15	7.9-9.0	10-45	0-4	2.0-16.0	5-15
Arveson, SALINE------	0-9	10-20	15-30	7.4-8.4	5-20	---	4.0-16.0	0-2
	9-39	10-27	5-25	7.4-8.4	15-30	---	4.0-16.0	0-4
	39-60	5-20	2-25	7.4-8.4	10-20	---	4.0-16.0	2-8
Marysland, SALINE----	---	---	---	---	---	---	---	---
Hamar----------	0-8	5-10	7-12	6.1-7.8	0	0	0.0-2.0	0
	8-17	0-7	3-9	6.6-8.4	0-1	0	0.0-2.0	0
	17-60	0-7	3-9	7.4-8.4	0-2	0	0.0-2.0	0
Manfred----------	0-7	18-26	20-40	6.1-8.4	0-5	0-1	2.0-4.0	1-5
	7-60	18-34	10-25	7.9-9.0	10-30	0-2	2.0-16.0	5-25
Gilby, SALINE--------	0-8	10-18	---	7.4-8.4	---	---	4.0-16.0	---
	8-26	10-18	---	7.9-8.4	---	---	4.0-16.0	---
	26-60	18-34	---	7.9-8.4	---	---	2.0-16.0	---
Letcher----------	0-8	5-10	10-15	5.1-7.8	0	0	0.0-2.0	0
	8-9	10-18	10-16	5.1-7.8	0-7	0	0.0-2.0	1-7
	9-28	10-15	7-14	6.6-9.0	10-20	1-3	2.0-8.0	5-15
	28-60	10-15	7-14	7.4-9.0	5-15	1-3	2.0-8.0	5-15
Marysland----------	0-8	18-35	15-35	7.9-8.4	1-15	0	0	0
	8-30	18-35	10-25	7.9-8.4	15-35	0-3	0.0-2.0	0
	30-60	1-5	2-10	7.9-8.4	5-20	0	0	0
2202:								
Swenoda----------	0-13	10-20	10-25	6.1-7.3	0	0	0.0-2.0	0
	13-33	10-18	5-15	6.6-7.8	0	0	0.0-2.0	0
	33-60	20-35	2-25	7.4-8.4	10-30	0-1	0.0-4.0	0-2
Barnes----------	0-9	10-20	10-25	5.6-7.8	0	0	0.0-2.0	0
	9-14	18-35	10-30	6.1-7.8	0-3	0	0.0-4.0	0
	14-60	18-35	5-25	7.4-8.4	10-30	0-2	0.0-4.0	0
Gardena----------	0-18	12-18	10-25	6.6-7.8	0-3	0	0	0
	18-60	10-18	5-15	7.4-8.4	0-15	0-2	0.0-2.0	0-2
Buse----------	0-7	18-27	10-30	6.6-8.4	1-10	0	0	0
	7-60	18-35	5-25	7.4-8.4	10-30	0-1	0.0-4.0	0-2
Binford----------	0-8	6-18	5-20	5.6-7.8	0	0	0	0
	8-17	6-18	5-15	5.6-8.4	0-1	0	0	0
	17-60	2-8	1-5	7.4-8.4	5-20	0	0	0
Towner----------	0-16	2-10	5-10	6.6-7.8	0	0	0	0
	16-35	2-10	2-5	6.6-7.8	0	0	0	0
	35-60	18-40	10-20	7.4-8.4	10-30	0-2	0.0-2.0	0
Maddock----------	0-11	2-10	3-10	6.6-7.8	0-3	0	0.0-2.0	0
	11-60	2-8	1-8	6.6-8.4	0-10	0	0.0-2.0	0

Chemical Properties of the Soils--continued
Griggs County, North Dakota

Map symbol and soil name	Depth	Clay	Cation exchange capacity	Soil reaction	Calcium carbon-ate	Gypsum	Salinity	Sodium adsorp-tion ratio
	In	Pct	meq/100 g	pH	Pct	Pct	mmhos/cm	
Tonka----------	0-17	18-27	15-35	5.6-7.8	0	0	0	0
	17-40	35-45	15-35	5.6-7.8	0-1	0-1	0.0-2.0	0-1
	40-60	18-39	10-25	6.6-8.4	5-20	0-2	0.0-4.0	0-2
2203:								
Swenoda----------	0-13	10-20	10-25	6.1-7.3	0	0	0.0-2.0	0
	13-33	10-18	5-15	6.6-7.8	0	0	0.0-2.0	0
	33-60	20-35	2-25	7.4-8.4	10-30	0-1	0.0-4.0	0-2
Barnes----------	0-9	10-20	10-25	5.6-7.8	0	0	0.0-2.0	0
	9-14	18-35	10-30	6.1-7.8	0-3	0	0.0-4.0	0
	14-60	18-35	5-25	7.4-8.4	10-30	0-2	0.0-4.0	0
Buse----------	0-7	18-27	10-30	6.6-8.4	1-10	0	0	0
	7-60	18-35	5-25	7.4-8.4	10-30	0-1	0.0-4.0	0-2
Maddock----------	0-14	2-10	3-10	6.6-7.8	0-3	0	0.0-2.0	0
	14-60	2-8	1-8	6.6-8.4	0-10	0	0.0-2.0	0
Binford----------	0-8	6-18	5-20	5.6-7.8	0	0	0	0
	8-17	6-18	5-15	5.6-8.4	0-1	0	0	0
	17-60	2-8	1-5	7.4-8.4	5-20	0	0	0
Coe----------	0-8	6-18	5-15	6.6-7.8	0-5	0	0	0
	8-60	2-8	1-5	7.4-8.4	5-20	0	0	0
Towner----------	0-17	5-15	5-15	6.6-7.8	0	0	0	0
	17-28	2-10	3-5	6.6-7.8	0	0	0	0
	28-60	18-40	10-20	7.4-8.4	10-30	0	0	0
Vallers----------	0-12	18-28	20-40	7.4-8.4	5-10	0-1	0.0-4.0	0
	12-32	18-35	10-25	7.4-8.4	15-30	0-2	0.0-4.0	0-5
	32-60	18-35	10-20	7.4-8.4	15-30	0-2	0.0-4.0	0-10
2204:								
Walsh----------	0-8	27-35	20-35	6.1-7.3	0	0	0	0
	8-60	25-35	10-30	6.1-7.8	0-15	0-1	0	0
Sinai----------	0-9	35-40	---	6.1-7.3	---	---	0.0-2.0	---
	9-18	35-60	---	6.6-7.8	---	---	0.0-2.0	---
	18-49	35-60	---	7.4-8.4	---	---	0.0-2.0	---
	49-60	30-50	---	7.4-8.4	---	---	0.0-2.0	---
Barnes----------	0-9	15-27	10-30	5.6-7.8	0	0	0.0-2.0	0
	9-14	18-35	10-30	6.1-7.8	0-3	0	0.0-4.0	0
	14-60	18-35	5-25	7.4-8.4	10-30	0-1	0.0-4.0	0
Nutley----------	0-9	40-60	---	6.6-8.4	---	---	0.0-2.0	---
	9-60	35-60	---	7.4-8.4	---	---	0.0-2.0	---
Edgeley----------	0-8	18-26	15-27	6.1-7.3	0	0	0	0
	8-32	18-34	10-16	6.1-8.4	0-15	0	0	0
	32-60	---	---	---	---	---	---	---
Wahpeton----------	0-33	40-59	---	6.1-7.8	---	---	0	---
	33-60	35-59	---	6.6-8.4	---	---	0	---
Vang----------	0-11	18-27	15-25	5.6-7.3	0	0-1	0	0-1
	11-27	18-30	10-20	5.6-8.4	0-10	0-1	0	0-1
	27-60	0-5	5-10	5.6-8.4	5-15	0-1	0	0-2
2205:								
Zell----------	0-8	10-18	10-20	6.6-8.4	0-5	0	0.0-2.0	0
	8-20	10-18	5-15	7.4-8.4	10-20	0	0.0-2.0	0
	20-60	5-18	2-10	7.4-8.4	5-15	0	0.0-2.0	0
Eckman----------	0-8	12-18	10-25	6.6-7.8	0	0	0	0
	8-19	10-18	4-15	6.6-8.4	0-15	0	0	0
	19-60	10-18	4-10	7.4-8.4	0-15	0	0	0
Gardena----------	0-15	12-18	10-25	6.6-7.8	0-3	0	0	0
	15-60	10-18	5-15	7.4-8.4	0-15	0-2	0.0-2.0	0-2

Chemical Properties of the Soils--continued
Griggs County, North Dakota

Map symbol and soil name	Depth	Clay	Cation exchange capacity	Soil reaction	Calcium carbon-ate	Gypsum	Salinity	Sodium adsorp-tion ratio
	In	Pct	meq/100 g	pH	Pct	Pct	mmhos/cm	
Emrick----------	0-11	10-18	20-30	6.6-7.8	0	0	0	0
	11-22	10-18	10-25	6.6-7.8	0-5	0	0	0
	22-60	7-18	5-20	7.4-8.4	5-20	0	0	0-5
Maddock----------	0-6	2-10	3-10	6.6-7.8	0-3	0	0.0-2.0	0
	6-60	2-8	1-8	6.6-8.4	0-10	0	0.0-2.0	0
Great Bend----------	0-6	18-26	10-25	6.1-7.8	0	0	0.0-2.0	0
	6-13	18-34	10-25	6.6-8.4	0	0	0.0-2.0	0
	13-30	18-34	5-20	7.4-8.4	0-10	0	0.0-2.0	0
	30-60	18-34	5-20	7.4-8.4	0-10	0	0.0-4.0	0
Coe----------	0-8	6-18	5-15	6.6-7.8	0-5	0	0	0
	8-60	2-8	1-5	7.4-8.4	5-20	0	0	0
Esmond----------	0-8	10-18	---	7.4-8.4	---	---	0	---
	8-60	7-18	---	7.4-8.4	---	---	0	---