A DETAILED SOIL SURVEY AND MORPHOLOGICAL STUDY OF THE PERKINS AGRONOMY RESEARCH STATION, PERKINS, OKLAHOMA

By

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CHAPTER I

INTRODUCTION

Most of the soils in Oklahoma have been surveyed and classified using the system as proposed in the 1938 Agricultural Yearbook[1] and as revised in 1949[2]. A more comprehensive classification system has been under development for a number of years and has been used by the Soil Survey in Oklahoma since 1965. The newer system permits more accurate grouping of soils because greater emphasis is placed on the actual soil properties rather than on soil genesis.

This study is concerned with the morphology of the soils on the Perkins Agronomy Research Station, Perkins, Oklahoma, and with the analyses of the more important soils on that station to obtain more quantitative data than is presently available. These data can be utilized as a basis for soil classification and for interpretations in regard to agricultural and non-agricultural uses.

The specific objectives of this study were to:

(a) Obtain a modern and accurate soil map of the Perkins Agronomy Research Station outlined by the 7th Approximation and

(b) Collect and utilize all available information for making interpretations in regard to land use and management purposes through the

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1 [1]H. G. Byers, et al., Soils and Men (Washington, 1938).

[2]Firman E. Bear and H. B. Kitchen, eds., Soil Science (Baltimore, 1949).

use of the detailed soil survey.

It is hoped that the results of this study will be used by present and future agronomists for improving their research.

CHAPTER II

REVIEW OF LITERATURE

Soil Forming Factors

True soil is the product of joint action by climate and living organisms upon parent material, as conditioned by local relief. The length of time during which these forces are operative is of major importance in determining the character of the soil in question.

Parent Material

Soil material is the product of physical and chemical weathering of rocks and minerals (25). Joffe (8) indicated that various parent materials (the conditions for the other factors of soil formation being similar) give rise to the same type of soil. On the other hand, when the conditions for the activities of the other factors of soil formation are dissimilar, similar parent materials may give rise to entirely different soil types.

The physical and chemical properties of parent materials dictate, to a large extent, the processes of soil formation. The texture (relative proportions of particle-size fractions) of the parent material, to a degree, dictates the depth of the soil profile. That is, under normal conditions, other factors being the same, the profile is deeper on coarse-than on fine-textured parent materials. The nature of elements released, or base status, during rock and mineral decay also has a specific bearing on soil formation.

The Perkins Agronomy Research Station is mantled with old alluvial and/or loessial sediments from the Cimarron River. This mantle thins on the northwest corner of the station where the Permian Red Beds are visible. The mantle is underlain by the Wellington formation, a member of the Sumner group. This in turn is underlain possibly by the Chase group. This group contains less sandstone than the Sumner group. Members of the Chase group are the Herington limestone, Enterprise shale, Winfield limestone, Doyle shale, Fort Riley limestone and the Wreford limestone. However, none of these have been recognized for certain except for the Wellington. Members of the Chase group could probably be recognizable through the Doyle shale (14).

Relief

"Relief implies relative elevation and has been defined as the elevations or inequalities of a land surface considered collectively (22)." The effects of moisture and temperature on soil development are partially controlled by shape, gradient, length and exposure of slopes. Relief influences soil formation through its effects on soil drainage, erosion and runoff. Slope exposure is also a distinctive feature of the effect of relief (7).

The Perkins Agronomy Research Station is located on two distinct levels. Elevations decrease to the south, being some 30 feet above the present floodplain of the Cimarron River. Elevations to the north vary some 40 feet or more above the level of the south boundary (5). The west half of the station is much smoother than the east half. The west half is very uniform and suitable for experimental plots while the east half is rolling and hammocky with moderate to strong slopes. All drainage from the station flows in a southerly direction.

Time

Time is necessary for the development of soil from parent materials. Of coarse, the length of time required in the formation of a given type of soil depends on the other soil forming factors as well (25).

According to Zakharov (24), a soil continues for a time with all of its attributes. Then, it begins gradually to change or degrade i.e., each soil undergoes a process of evolution. Like individual organisms, the soil has stages of youth, maturity, and senility. Thorp and Smith (23) have suggested that minimal, medial, and maximal subgroups be established for various great soil groups. Minimal soils show no textural differences between A and B horizons; the medial soils have a B horizon which is slightly heavier than the A; and the maximal soils have a B horizon that is considerably more clayey than the A.

Most of the surface material on the Research Station probably dates from the Pleistocene. Sufficient time has elasped for an argillic horizon to develop in most of the soils in the study area; therefore, most soils studied herein were in the medial stage of soil development.

Climate

Joffe (9) indicated that climate influences soil formation both directly and indirectly. Directly, the two primary elements of climate (temperature and moisture) furnish heat and water to react with the parent material. Indirectly, the climate is responsible to a certain extent for the type of flora and fauna in an area which in turn furnish energy in the form of organic matter.

The morphological, chemical, and physical features of a soil are molded by the movement and deposition of substances in solution. Some substances may be leached from the profile completely, others accumulate on the surface or at certain depths. Thus, the soil forming processes, as affected by temperature and moisture, give rise to horizon differentiation.

Under each ecological regime a certain type of vegetation will establish itself. This vegetation in conjunction with bacteria, fungi, and other microbes in turn will influence future development of that soil (7). This soil development will also be influenced by the animals in the ecological regime but to a lesser degree than the plants.

The climate of Payne County wherein the Research Station is located is subhumid. The average annual rainfall for the 38 year period, 1893-1930, was 33.57 inches. The average snowfall was 6.9 inches and the average annual temperature was 59.4° F. The average maximum temperature was 71.2° F while the average minimum temperature was 47.5° F. The prevailing wind direction at Stillwater (the location of the nearest weather station) was from the south. The average date of the last killing frost in the Spring was April 1, and the average date of the first killing frost in the Fall was October 28. The average length of the growing season, last killing frost to first killing frost, was estimated to be 210 days (3).

Living Organisms

As the parent material is gradually weathered by physical and chemical means, plants can gain a foothold in the recently deposited soil. This is one of the major steps in soil development.

Decayed plant and animal residues are mixed with the mineral matter of the soil. This decayed organic matter (humus) imparts color, promotes good structure, and stabilizes the soil. Acids released from organic decomposition enhance the breakdown of base-containing minerals yielding soluable nutrients and secondary minerals such as the silicate clays and oxides of iron and aluminum. Under these conditions, nutrient depletion may occur in the upper horizons while the lower horizons are enriched. The extreme of this condition is generally associated with forested soils. Living organisms (primarily plants) tend to stabilize the acid-base ratio of the soil solution in a given weathering situation by a process known as nutrient recycling. "Soluble elements are absorbed by plants from the soil body, translocated to the upper plant parts, released again upon death of the plant, and moved downward into the soil by percolating water ready to be recycled again (2)."

Payne County appears to lie in a transition belt between the prairies and the plains with the soils and vegetation suggesting that it is more closely related to the prairies. The greater part of it is treeless; but the more broken areas of sandy soil are forested, and there is usually a forested belt along streams (20).

The soils of the west half of the Research Station have developed under the influence of mixed grasses such as little bluestem, big bluestem, switchgrass, and indiangrass together with such grasses as blue grama, sand dropseed, buffalograss, western wheat grass, and side-oats grama. The east half of the station is sandier; and its soils have developed under in influence of blackjack and post-oak, greenbrier, and other subordiante plants of the central crosstimbers (19).

Processes of Soil Formation

Soil formation (horizon differentiation) is due to changes by means of additions, removals, transfers, and transformations within the soil system. Each of the four kinds of change affects many substances comprising soil. Examples of important changes that contribute to the development or horizons are additions of organic matter, removal of soluble salts and carbonates, transfer of humus and sesquioxides, and transformations of primary into secondary minerals. It is likely that these kinds of changes proceed simultaneously in all soils. It is also probable that the balance between these combinations of changes governs the ultimate nature of the soil profile (15).

Soil Classification

The previous soil classification system was based on soil formation (i.e., genesis), and it was concerned primarily with genetic terms. "The basing of classification schemes solely on interpretations of soil genesis is consequently subject to large risks of error (16)." Another defect of the older system was the vagueness of the definitions between the classes. The great soil groups were defined in the American system in terms of soil properties; but the definitions were brief, and serious differences of opinion developed on the interpretation of a number of those definitions. Ideally, the meaning of a definition should be precise enough to convey approximately the same understanding to a diverse public.

Another general defect of previous systems was that they were based primarily on the genesis or properties of virgin soils in the natural landscape. This has resulted in some soils being classified on properties that were thought to have been present at one time, and such classifications are subject to individual bias. In some cases, soils have been ignored when no general agreement could be reached as to the genesis of the virgin soil (16).

The present system was put into effect in 1965 by the Cooperative Soil Survey. This system is based on the present knowledge of soils, but it is flexible enough to change as the knowledge of soils increases or as the soil itself changes. "The new classification differs from that of Baldwin, Kellogg, and Thorp which it replaces in two important respects: (a) The nomenclature of the higher categories is entirely new and (b) the definitions of the classes are much more quantitative and specific regarding limits between classes (11)."

The new system designated as the "7th Approximation" is a multiple-category system having six higher categories above the individual soil within the scheme. These categories in order of decreasing rank are orders, suborders, great group, subgroups, families, and series. The 7th Approximation attempts to define a small volume of soil (i.e., a soil individual) as the basic entity for which the term "pedon" has been suggested. A group of contiguous pedons within a single class of the lowest category (i.e., the soil series) would be called a polypedon. A polypedon is technically defined as a group of pedons contiguous within the soil continuum and having a range in characteristics within the limits of a single soil series (16). Also, under the 7th Approximation, soil type is no longer considered a category but a subunit of the soil series used in the mapping of soils.

Although this system is based on our present knowledge of soils, it is by no means the ultimate in soil classification schemes. It is recognized that as knowledge and understanding of soils continue to grow, modification or replacement of the scheme will eventually become necessary. The basic objectives of the 7th Approximation are to organize, define, and name classes in the lowest category and then group those classes into progressively broader categories and provide distinctive names for these classes. Its general purposes are to render the characteristics of specific soils easier to remember, to compare and contrast the relationships among like and unlike soils in conjunction with other elements of the environment, and to provide a sound basis for developing principles of soil genesis and soil behavior which have predictive value.

Criteria of Classification

The criteria proposed by Marbut (7) in 1920 for differentiation among soils at the level of the soil type were used in making the previous soil survey of the Perkins Agronomy Research Station. By using his criteria which follow in a systematic approach, similarities and differences between individual soil profiles could be distinguished:

1. Number of horizons,
2. Color of the various horizons, with special emphasis on the upper one or two; or where color denotes reduction or change in parent material,
3. Texture of the horizons,
4. Structure of the horizons,
5. Relative arrangements of the horizons,
6. Chemical composition of each horizon,
7. Thickness of each horizon,

8. Geology of the parent material where significant,

9. Minerological content of the soil material, and

10. Relative landscape position.

These criteria have withstood the test of time. Closer scrutiny of the soil itself has led to an increased application of Marbut's ten requirements for a soil unit. The 7th Approximation still adheres to Marbut's criteria in defining a soil unit, but in it these criteria are supplemented with important quantitative data as well. With the increasing knowledge of the chemical and physical properties of a particular soil, the more narrow the limits or ranges in that soil become. This in turn leads to a more homogeneous soil unit.

CHAPTER III

MATERIALS AND METHODS

Preparation of Soils Map

The new soils map of the Perkins Agronomy Research Station was constructed using the grid system, an aerial photograph to locate various boundaries and points, and the guidelines of the "7th Approximation" to locate and correct inconsistancies as mapped under the previous classification system. The soil was probed every 200 feet on the east half and approximately every 500 feet on the west half of the Station. Field descriptions of the soil characteristics were made, and the points were located on the aerial photograph.

Ten sampling sites were selected for further study. These sites were considered representative of the mapping units and were utilized for describing typical profiles for those units. Samples were collected according to the USDA guidelines set forth for collection of soil samples (18). The previously constructed soils map along with soil descriptions were useful in obtaining the modern soils map and for making comparisons between pedons.

Yield data for various crops and soils were collected using fertility and performance test records and for crops on similar soils in surrounding counties.

Physical Analyses

Soil samples were air dried under laboratory conditions and processed sufficiently to pass through a two mm screen. Percents of sand, silt, and clay were determined using the method outlined by Day (4). The sand fractions were measured by passing the sample through a sieve column and collecting the very coarse sand, coarse sand, medium sand, fine sand, and very fine sand.

Chemical Analyses

Chemical analyses were conducted using the methods outlined below which are employed by the Oklahoma State Soils Classification Laboratory.

Soil reaction was measured by mixing a 1:1 paste of soil and distilled water and a 1:1 paste of soil and 1.0N potassium chloride. The pH was then measured using a glass-electrode meter.

The perchloric acid-digestion method was used to measure total phosphorus by developing a yellow color and measuring percent transmittance on a colorimeter (18). A blue color was also developed using the ascorbin acid method (24). This procedure was used for total phosphorus determination in the first seven profiles.

The extractable cations were determined using soil extracts obtained by washing the soil samples with ammonium acetate. Sodium and potassium were estimated using atomic absorption and plotting the results against a standard curve. Calcium and magnesium were measured by titrating with EDTA solution (13).

Exchangeable aluminum was determined by leaching the soil with 100 ml of 1.0N potassium chloride. The extract was then titrated with

0.1N sodium hydroxide. Next, one drop of hydrochloric acid was added to bring back the colorless condition. Ten ml of sodium fluoride were added, and the sample was titrated with hydrochloric acid (1).

Extractable hydrogen was calculated by leaching the soil with barium chloride TEA solution and titrating the extract to a pink end-point using 0.25 N hydrochloric acid (12).

Cation exchange capacity was measured by washing the soil four times with sodium acetate, three times with 95% ethanol, and three times with ammonium acetate. The soil extracts were then read utilizing atomic absorption (13).

The percent base saturation (i.e., the sum of the cations) was determined by adding calcium, magnesium, potassium, and sodium together and dividing that total by the sum of calcium, magnesium, potassium, sodium, hydrogen, and aluminum. That answer is multiplied by 100 to convert the decimal fraction into a percentage. The percent base saturation using the sodium acetate method was determined by dividing the sum of calcium, magnesium, potassium, and sodium by the cation exchange capacity and multiplying by 100 (4).

Determination of organic matter was accomplished by grinding the oven-dry soil to a 60-mesh fineness. Ten ml of 0.4 N potassium dicromate and 15 ml of concentrated sulfuric acid were added. The solution was heated to 161^{o}C and allowed to cool. Approximately 100 ml of distilled water was added, and the specimen was titrated with 0.2 N ferrous ammonium sulfate solution (13).

Clay Mineralogical Analyses

The particle-size separation of soil as outlined by Kittrick and

Hope (10) was used to prepare samples for clay mineralogy studies.

Organic matter was removed by adding 25 ml of 30% hydrogen peroxide and heating the sample. The iron oxide coatings were removed by washing the sample with sodium chloride, then adding 100 ml of citrate buffer and heating the solution to 75^{o} to 80^{o}C. Dithionate was then added to the sample and stirred vigorously. The sample was then centrifuged, and the liquid was decanted.

The first step in particle-size separation was to separate the sand fractions by passing the sample through a 270 mesh sieve. The sand fractions were dried and weighed. The remaining silt and clay was transferred to a two quart plastic pitcher. The water level is brought to a height of 10 cm; and after three and one half hours, the upper five cm were siphoned off into a two liter bottle. This procedure was repeated seven times. Silt-size particles remain in the plastic pitcher and are dried and weighed. The clay samples were placed in the super centrifuge for separation of fine clay ($< 0.2\ \mu$) and coarse clay (0.2 to $2.0\ \mu$). These clay samples were then transferred into centrifuge bottles, saturated with magnesium chloride, and washed with distilled water. Samples were transferred to plastic bottles for further use.

The clay samples were mounted on ceramic slides by the use of a suction plate. The samples were then placed in the X-ray diffractometer, and the 2$\emptyset$ angle for the clay minerals was obtained for magnesium saturation. The 2$\emptyset$ angles are again determined after glycerol-solvation, potassium saturation, and heating of the potassium-saturated specimen. The 2$\emptyset$ angles were then converted into a diffraction spacing.

CHAPTER IV

RESULTS AND DISCUSSION

Field Studies of the Soils

A detailed field investigation was conducted to form a central concept and allowable range in morphological characteristics for each soil to be characterized. The reason for this was to make each mapping unit as uniform as possible. Sampling pits were dug within each of the major mapping units. The morphology of each pedon was studied in detail to determine the thickness and number of soil horizons. These pedons were then described according to standard procedures, and samples for laboratory analyses were collected from each horizon (22).

Soils of the Study Area

The series present on the Research Station are representative of those soils which develop within a few miles of major rivers in central Oklahoma. Soil Associations which occur in the surrounding area are shown in Figure I. Soils which occur in the association are classified in Table I. The Zaneis, Teller, and Farnum series are typical Mollisols that have developed from loamy materials under the influence of grass vegetation. Zaneis is found on the highest parts of the Research Station where the mantle is thinning out over the Permian sediments. These are well-developed soils but bedrock is encountered within 40 to 60 inches of the soil surface. Teller soils are developed from materi-

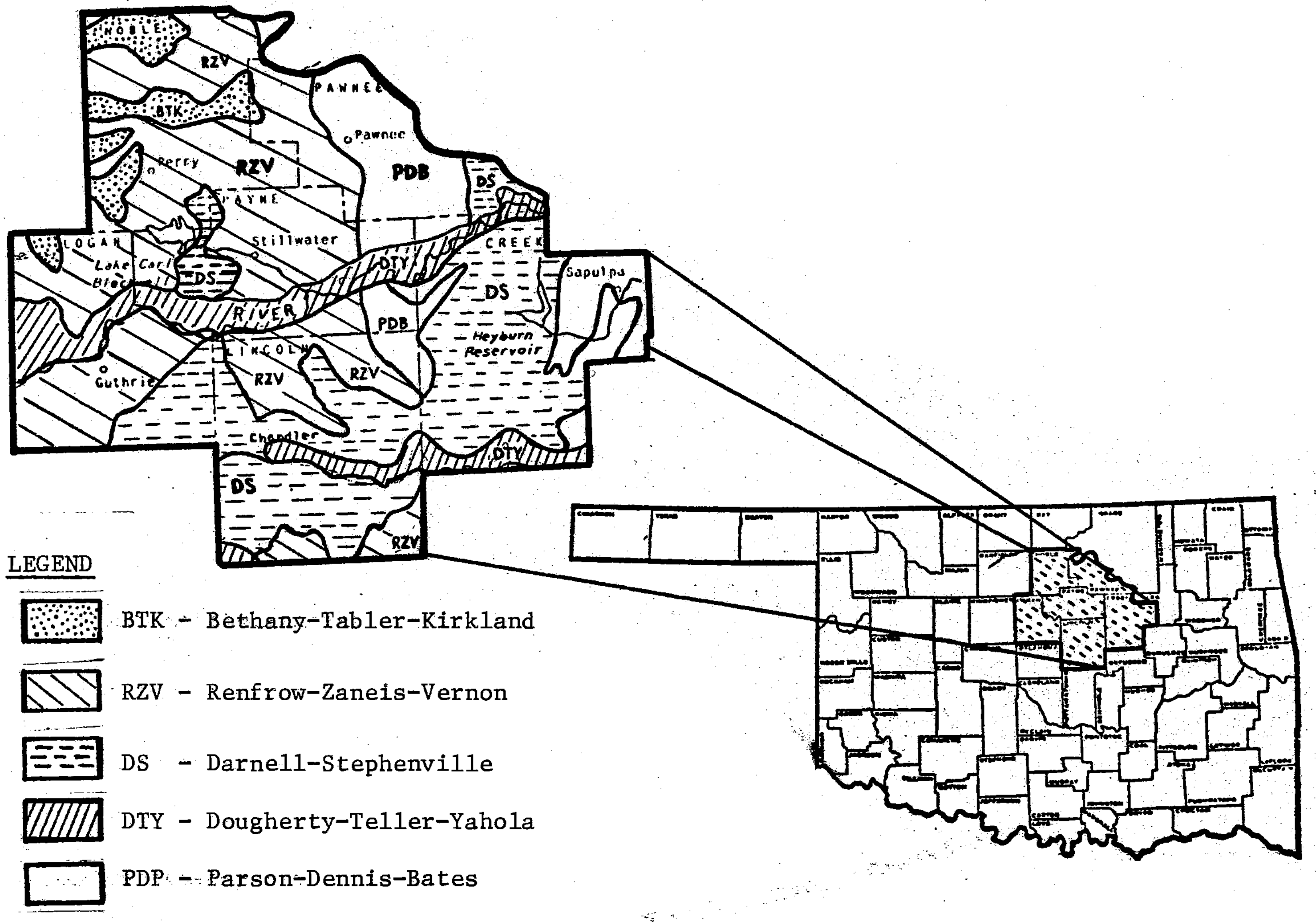

Figure 1. General Soils Map of Payne County and Surrounding Areas

TABLE I

CLASSIFICATION OF THE SOILS ON THE GENERAL SOILS MAP (SOIL SURVEY STATE, JANUARY, 1972)

Soil Series	Family	Subgroup	Order
Bethany	Fine, mixed, thermic	Pachic Paleustolls	Mollisols
Brewer	Fine, mixed, thermic	Pachic Argiustolls	Mollisols
Chickasha	Fine-loamy, mixed, thermic	Udic Argiustolls	Mollisols
Dale	Fine-silty, mixed, thermic	Pachic Haplustolls	Mollisols
Darnell	Loamy, siliceous, thermic, shallow	Udic Ustochrepts	Inceptisols
Doutherty	Loamy, mixed, thermic	Arenic Haplustalfs	Alfisols
Eufaula	Sandy, siliceous, thermic	Psammentic Paleustalfs	Alfisols
Grant	Fine-silty, mixed, thermic	Udic Argiustolls	Mollisols
Kingfisher	Fine-silty, mixed, thermi	Udic Argiustolls	Mollisols
Kirkland	Fine, mixed, thermic	Abruptic Pachic Paleustolls	Mollisols
Lela	Fine, mixed, thermic	Typic Chromuderts	Vertisols
Lincoln	Sandy, mixed, thermic	Vertic Haplustolls	Mollisols
Lucien	Loamy, mixed, thermic, shallow	Udic Haplustolls	Mollisols
Mclain	Fine, mixed, thermic	Pachic Argiustolls	Mollisols
Miller	Fine, mixed, thermic	Vertic Haplustolls	Mollisols
Noble	Coarse-loamy, siliceous, thermic	Udic Ustochrepts	Inceptisols
Norge	Fine-silty, mixed, thermic	Udic Paleustolls	Mollisols
Port	Fine-silty, mixed, thermic	Cumulic Haplustolls	Mollisols
Pulaski	Coarse-loamy, mixed, nonacid, thermic	Typic Ustifluvents	Entisols
Reinach	Coarse-silty, mixed, thermic	Pachic Haplustolls	Mollisols
Renfrow	Fine, mixed, thermic	Udertic Paleustolls	Mollisols
Stephenville	Fine-loamy, siliceous, thermic	Ultic Haplustalfs	Alfisols
Stidham	Loamy, mixed, thermic	Arenic Haplustalfs	Alfisols

TABLE I (Continued)

Soil Series	Family	Subgroup	Order
Tabler	Fine, montmorillonitic, thermic	Pachic Argiustolls	Mollisols
Vanoss	Fine-silty, mixed, thermic	Udic Argiustolls	Mollisols
Vernon	Fine, mixed, thermic	Typic Ustachrepts	Inceptisols
Yahola	Coarse-loamy, mixed (calcareous), thermic	Typic Ustifluvents	Entisols
Zaneis	Fine-loamy, mixed, thermic	Pachic Haplustolls	Mollisols

als much like those under Zaneis but are thicker over the Permian. Teller soils occur on the more sloping areas of the north part of the Research Station and near tension zones between the Mollisols of the west side of the Research Station and the Alfisols of the east side. Teller also occupies a large area on the nearly plain southwest corner of the Research Station.

Farnum soils have loamy or silty profiles and occupy the nearly level area of the southwest part of the Research Station near the boundary of the lowest elevation and where the elevation begins to increase. These soils differ from Zaneis and Teller in that the profile is darker throughout and they have an extra thick mollic epipedon.

The Dougherty, Konawa, and Eufaula series are Alfisols that have developed from sandy materials under the influence of deciduous trees and tall grasses. Dougherty soils have thin, pale brown to brown A1 horizons and relatively thick light colored A2 horizons. The subsoil is a red or yellowish-red sandy clay loam about 20 to 36 inches from the surface. Dougherty soils have developed on smooth to gently sloping areas of the Research Station. In some areas the A horizon may be over 40 inches thick where sandy materials have collected due to wind action. These soils are similar to Dougherty except for the extra thick surface soil. Konawa soils are similar to Dougherty soils except the A horizon is less than 20 inches thick. These soils have developed on smooth to strongly sloping areas. Eufaula soils have thick sandy A horizons overlaying thin red or yellowish-red sandy clay loam horizons at 42 to 50 inches. Eufaula soils have developed on smooth, duney areas adjacent to local drainageways on the east half of the Research Station.

Alluvial soils of the area are Pulaski and Wet clayey alluvial land. The sandy Pulaski soils developed on nearly level floodplains of local drainageways. These soils are stratified sands and loams. Since most of the vegetation has been cleared from the east part of the Station, most of these soils have an overwash of loamy fine sand. The Wet clayey alluvial land is only a small area and is non-arable. The soils of this unit have possibly developed in the cut-off of an old river channel.

Carwile soils have developed in depressions from sands and sandy clays deposited from surrounding areas under the influence of grasses. Internal drainage is poor, and water is ponded during wet seasons. The Carwile soils on the Perkins farm have heavier and thicker clay layers than the modal for this series. The revised Detailed Soils Map of the Perkins Agronomy Research Station is shown in Figure 2 with accompanying Legend in Table 2.

Individual Soil Descriptions of the Research Station

Konawa Fine Sandy loam, 1-3% Slopes (1B)

This unit consists of sandy, light-colored soils developed on convex slopes. They have brown to dark brown surface horizons with a somewhat "bleached" lighter colored A2 horizon. The A horizons range from 12 to 20 inches in thickness. The B horizons are yellow-red to red sandy loam and sandy clay loam. Structure of the B2t horizon is subangular blocky while the B3 horizon is weak subangular blocky grading to structureless massive as is the C horizon below. The soils of this mapping unit fit the description of mapping unit 1B-3 below with the exception that no surface erosion has occurred.

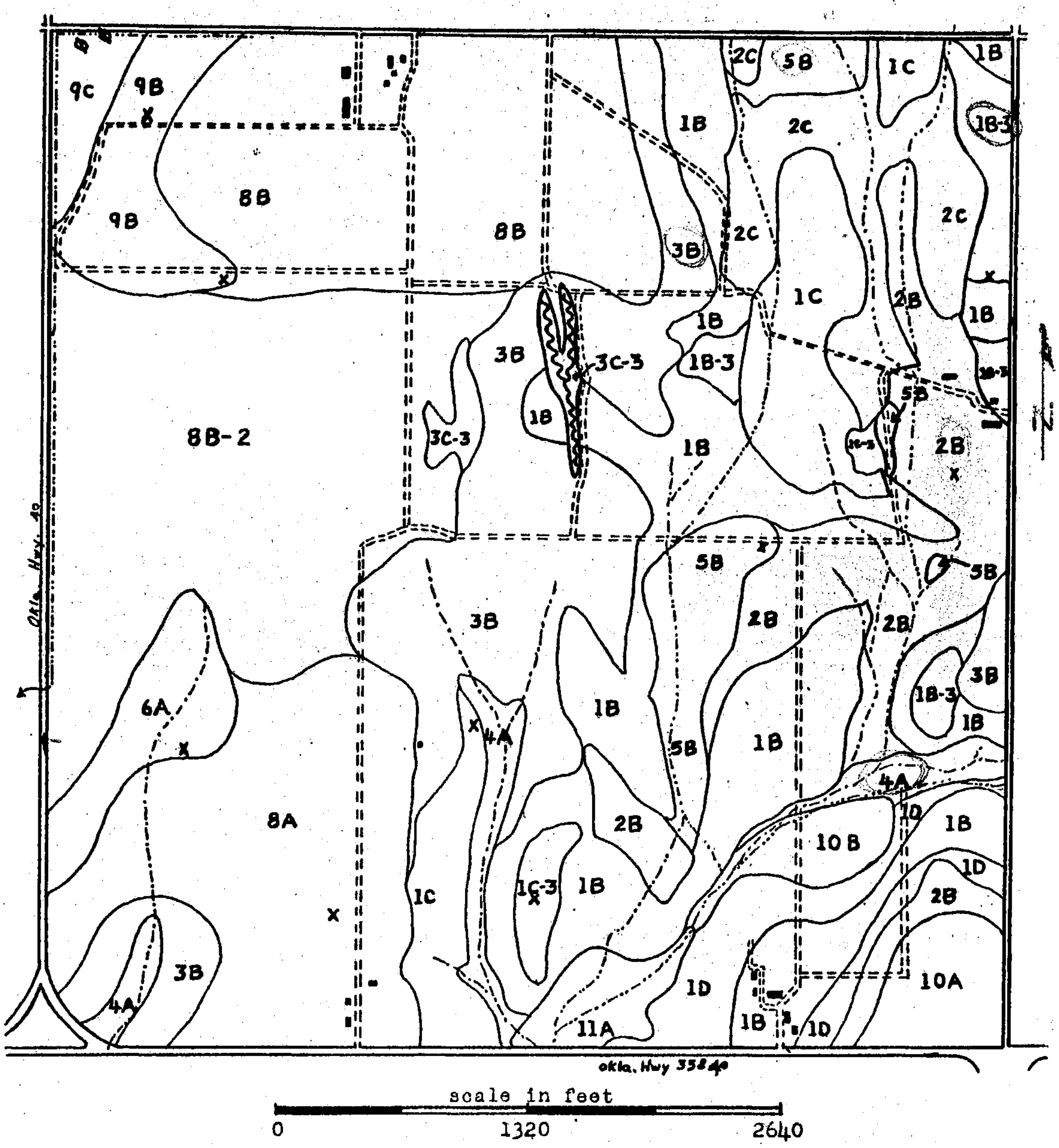

Figure 2. Detailed Soils Map of Perkins Agronomy Research Station, 1972. (All of Sec. 36, T18N, R2E, Perkins, Oklahoma

TABLE II

LEGEND FOR DETAILED SOILS MAP OF PERKINS AGRONOMY RESEARCH STATION, PERKINS, OKLAHOMA, 1972

MAP SYMBOLS

———	soil boundary	(building symbols)	buildings
—∘—∘—	stream (crossable with imp.)	(slickspot symbol)	slickspot
—··—	unclassified	x	soil sample locations
----- -----	poor motor road	(gully symbol)	gully (not crossable)
═══	good motor road	—··—	stream (not crossable with imp.)

SOIL LEGEND

Symbol	Soil Name	Symbol	Soil Name
1B	Konawa fine sandy loam 1-3% slopes	5B	Eufaula fine sandy loam 1-3% slopes
1B-3	Konawa fine sandy loam 1-3% slopes, moderately eroded	6A	Farnum silt loam 0-1% slopes
1C	Konawa fine sandy loam 3-5% slopes	8A	Teller loam 0-1% slopes
1C-3	Konawa fine sandy loam 3-5% slopes, moderately eroded	8B	Teller loam 1-3% slopes
1D	Konawa fine sandy loam 5-8% slopes	8B-2	Teller loam 1-3% slopes, slightly eroded
2B	Dougherty fine sandy loam 1-3% slopes	9B	Zaneis loam 1-3% slopes
2C	Dougherty fine sandy loam 3-5% slopes	9C	Zaneis loam 3-5% slopes
3B	Teller fine sandy loam 1-3% slopes	10A	Carwile fine sandy loam 0-1% slopes
3C-3	Teller fine sandy loam 3-5% slopes, moderately eroded	10B	Carwile fine sandy loam 1-3% slopes
4A	Pulaski soils 0-1% slopes	11A	Wet clayey alluvial land

Konawa Fine Sandy Loam, 1-3% Slopes, Moderately Eroded (1B-3)

These are sandy, light-colored soils which developed on convex slopes of the eastern half of the Station. They have brown to dark brown surface horizons with a somewhat lighter A2 horizon. The entire A horizon is 20 inches or less in thickness. The subsurface horizons are yellowish-red to red sandy clay loam.

The following profile of Konawa fine sandy loam was sampled 930 feet south and 80 feet west of the northeast corner of the northeast 1/4 of Section 36, T18N, R2E, Payne County. Laboratory and graph analyses are included in Table III and Figure 3.

Horizon	Depth (Inches)	Description*
Ap	0-6	Light brown (7.5YR 5/4 moist) fine sandy loam, weak medium granular structure; friable when moist; abrupt smooth boundary.
B21t	6-20	Yellowish red (5YR 5/6 moist) sandy clay loam, moderate medium subangular structure; firm when moist; moderate continuous clay films, gradual smooth boundary.
B22t	20-29	Light yellowish brown (10YR 6/4 moist) sandy clay loam, weak medium subangular blocky structure; firm when moist; gradual smooth boundary.
B31C	29-40	Light yellowish brown (10YR 6/4 moist) fine sandy loam, structureless, massive; friable when moist; gradual smooth boundary.
C1	40-50	Very pale brown (10YR 7/4 moist) loamy sand, structureless, massive; very friable when moist; gradual smooth boundary.
C2	50-70	Light yellowish brown (10YR 6/4 moist) loamy sand, structureless, massive; very friable when moist; gradual smooth boundary.
C3	70-91	Reddish yellow (7.5YR 6/6 moist) loamy sand, structureless, single-grain; very friable when moist; old alluvial deposits.

TABLE III

CHEMICAL AND PHYSICAL ANALYSES OF KONAWA FINE SANDY LOAM
1-3% SLOPES, MODERATELY ERODED (1B)

FIELD SOIL TYPE OR PHASE: KONAWA FINE SANDY LOAM

SOIL CLASSIFICATION: ULTIC HAPLUSTALFS, FINE-LOAMY, MIXED, THERMIC

LOCATION: PIT N. OF WOODS ON E. SIDE,
PERKINS FARM, PERKINS, PAYNE COUNTY.

SAMPLER: DALE ROGERS DATE: MAY 12, 1969

PROFILE DESCRIPTION:

SAMPLE NUMBER	HORIZON	DEPTH	THICKNESS	COLOR (M)	TEXTURE	STRUCTURE	CONSISTENCE
69-OK-60- 6- 1	AP	0- 6"	6	7.5YR 5/4	FSL	1GR	MFR
69-OK-60- 6- 2	B21T	6- 20"	14	5.0YR 5/6	SCL	2SBK	MFI
69-OK-60- 6- 3	B22T	20- 29"	9	10.0YR 6/4	SCL	1SBK	MFI
69-OK-60- 6- 4	B31C	29- 40"	11	10.0YR 6/4	FSL	M	MFR
69-OK-60- 6- 5	C1	40- 50"	10	10.0YR 7/4	LS	M	MVFR
69-OK-60- 6- 6	C2	50- 70"	20	10.0YR 6/4	LS	M	MVFR
69-OK-60- 6- 7	C3	70- 91"	21	7.5YR 6/6	LS	SG	MVFR

CHEMICAL DATA: ANALYST: JIM FORD

	PH1:1			EXTRACTABLE CATIONS,MEQ/100 GMS						%BASE SATURATION		%	P.P.M.
SAMPLE NUMBER	H2O	KCL	CEC	H	CA	MG	K	NA	AL	NAAC	SUM OF CAT.	OM	TOTAL P
69-OK-60- 6- 1	6.7	6.1	8.9	0.00	5.30	1.50	0.31	0.21	0.00	81.8	100.0	1.10	101.8
69-OK-60- 6- 2	6.9	6.0	18.6	4.10	6.80	4.10	0.34	0.24	0.00	61.9	73.7	0.90	101.8
69-OK-60- 6- 3	6.8	5.1	10.5	3.88	4.10	2.90	0.21	0.24	0.00	71.1	65.8	0.50	74.9
69-OK-60- 6- 4	6.9	5.9	3.5	1.29	2.10	0.90	0.14	0.23	0.00	96.4	72.3	0.30	74.9
69-OK-60- 6- 5	6.9	5.5	4.6	0.89	2.30	1.40	0.15	0.22	0.00	88.8	82.2	0.10	24.8
69-OK-60- 6- 6	6.8	5.1	5.2	0.78	2.00	1.50	0.20	0.23	0.00	75.0	83.6	0.00	49.5
69-OK-60- 6- 7	6.8	4.9	4.5	0.37	1.90	1.40	0.20	0.30	0.00	85.0	91.2	0.00	49.5

PHYSICAL DATA: ANALYST: JIM FORD

						% SAND SUBFRACTIONS				
SAMPLE NUMBER	%SAND	%SILT	%CLAY	TEXTURE	%>2MM	%VCS	%CS	%MS	%FS	%VFS
69-OK-60- 6- 1	62.8	20.6	16.6	SL	0.0	0.0	4.4	26.4	20.4	11.6
69-OK-60- 6- 2	51.0	24.0	25.0	SCL	0.0	0.0	3.2	15.4	20.4	12.0
69-OK-60- 6- 3	56.8	23.1	20.0	SCL	0.0	0.0	2.3	15.6	24.0	15.0
69-OK-60- 6- 4	68.6	21.4	10.0	SL	0.0	0.0	3.8	21.0	27.6	16.2
69-OK-60- 6- 5	76.8	12.2	11.0	SL	0.0	0.0	6.0	27.2	29.8	13.8
69-OK-60- 6- 6	76.2	15.8	8.0	SL	0.0	0.0	5.2	29.2	29.2	12.6
69-OK-60- 6- 7	83.4	7.6	9.0	LS	0.0	0.0	5.6	33.2	34.8	9.8

INTERPRETIVE CALCULATIONS:

			CLAY FREE PARTICLE SIZE DISTRIBUTION					
SAMPLE NUMBER:	CA/MG	CEC/CLAY	% SILT	% VCS	% CS	% MS	% FS	% VFS
69-OK-60- 6- 1	3.53	53.61	24.70	0.00	5.28	31.65	24.46	13.91
69-OK-60- 6- 2	1.66	74.40	32.00	0.00	4.27	20.53	27.20	16.00
69-OK-60- 6- 3	1.41	52.50	28.88	0.00	2.88	19.50	30.00	18.75
69-OK-60- 6- 4	2.33	35.00	23.78	0.00	4.22	23.33	30.67	18.00
69-OK-60- 6- 5	1.64	41.82	13.71	0.00	6.74	30.56	33.48	15.51
69-OK-60- 6- 6	1.33	65.00	17.17	0.00	5.65	31.74	31.74	13.70
69-OK-60- 6- 7	1.36	50.00	8.35	0.00	6.15	36.48	38.24	10.77

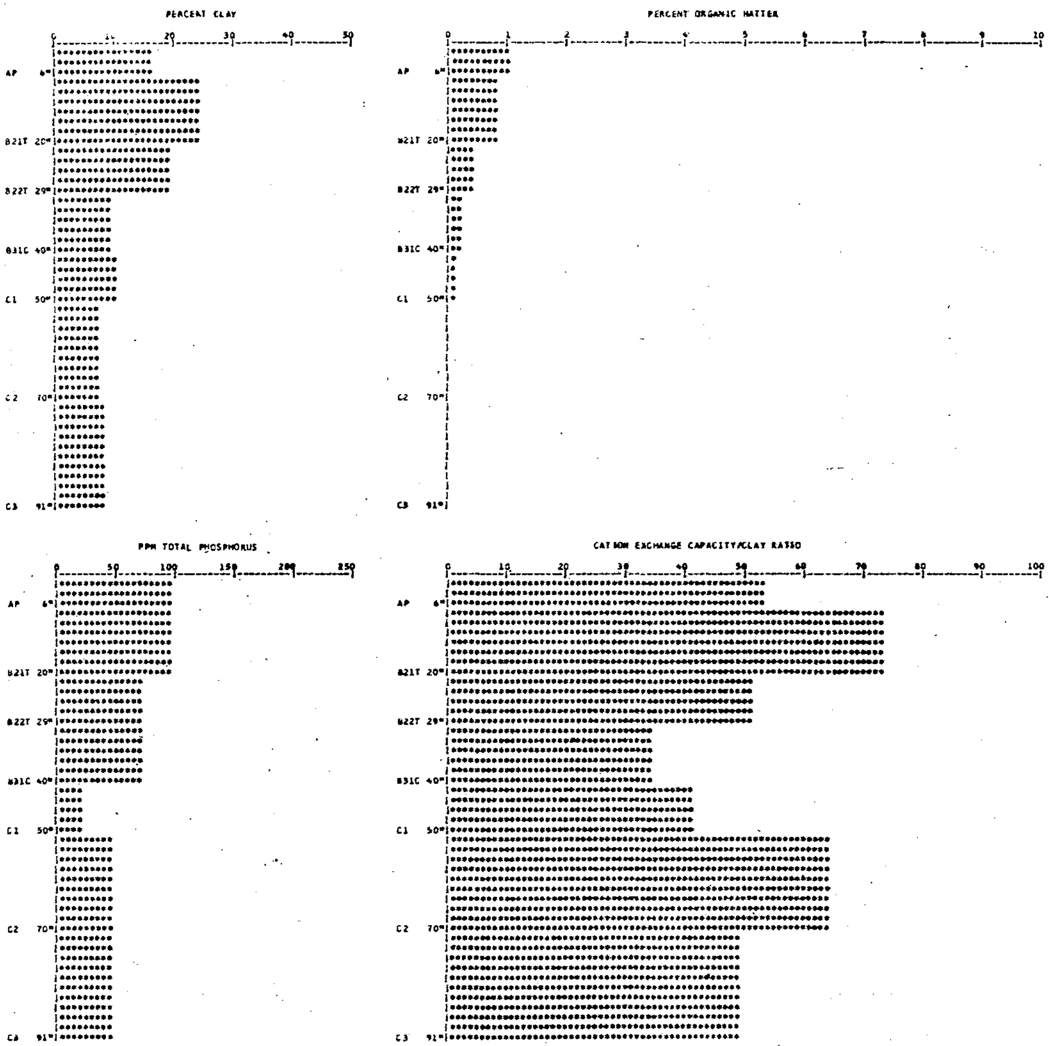

Figure 3. Graph Analyses of Konawa Fine Sandy Loam (1B), Profile No. 6

The solum thickness varies from 40 to 58 inches. Thickness of the A horizon varies from 4 to 15 inches, and textures are primarily fine sandy loam. The subsoil ranges from light sandy clay loam to sandy clay to sandy loam.

Konawa Fine Sandy Loam, 3-5% Slopes (1C)

These soils occur on gently to moderately sloping convex slopes. The major component of this mapping unit consists of a light-colored fine sandy loam A horizon, 10 to 20 inches thick. It is underlain by a yellowish red sandy clay loam B2t horizon which grades to a fine sandy loam to loamy fine sand C horizon.

The following profile of Konawa fine sandy loam was taken 200 feet east and 50 feet north of the present well house on the station or 2600 feet northeast of the southwest corner of Section 36, T18N, R2E, Payne County. Laboratory and graph analyses are included in Table IV and Figure 4.

Horizon	Depth (Inches)	Description*
Ap	0-9	Dark brown (7.5YR 3/2) fine sandy loam, weak medium granular; very friable; many fine roots; many worm casts; abrupt smooth boundary.
A2	9-14	Brown (7.5YR 4/4) fine sandy loam, with common medium distinct dark brown (7.5YR 3/2) mottles; weak medium subangular blocky; very friable; many fine roots; many worm casts; abrupt smooth boundary.
B22t	14-26	Dark red (3.5YR 3/6) sandy clay loam; compound moderate coarse prismatic and moderate medium subangular blocky; firm; many fine roots; common worm casts; moderate continuous clay films; gradual smooth boundary.

TABLE IV

CHEMICAL AND PHYSICAL ANALYSES OF KONAWA FINE SANDY LOAM 3-5% SLOPES (1C)

FIELD SOIL TYPE OR PHASE: KONAWA FINE SANDY LOAM

SOIL CLASSIFICATION: ULTIC HAPLUSTALFS, FINE-LOAMY, MIXED, THERMIC

LOCATION: 200' E. & 50' N. OF WELL HOUSE OR 2600' N.E. OF S.W. CORNER OF SEC. 36-T18N-R2E, PERKINS FARM, PERKINS, PAYNE COUNTY.

SAMPLER: DALE ROGERS DATE: MAY 12, 1969

PROFILE DESCRIPTION:

SAMPLE NUMBER	HORIZON	DEPTH	THICKNESS	COLOR (M)	TEXTURE	STRUCTURE	CONSISTENCE
69-OK-60- 3- 1	AP	0- 9"	9	7.5YR 3/2	FSL	1MGR	MVFR
69-OK-60- 3- 2	A2	9- 14"	5	7.5YR 4/4	FSL	1MSBK	MVFR
69-OK-60- 3- 3	B22T	14- 26"	12	3.5YR 3/6	SCL	2CPR-2MSBK	MFI
69-OK-60- 3- 4	B23T	26- 44"	18	2.5YR 4/6	FSL	1CPR-1MSBK	MFR
69-OK-60- 3- 5	B3	44- 55"	11	2.5YR 5/8	FSL	1MSBK	MFR
69-OK-60- 3- 6	C	55- 60"	5	2.5YR 5/6	FSL		

CHEMICAL DATA: ANALYST: JIM FORD

	PH1:1			EXTRACTABLE CATIONS,MEQ/100 GMS						%BASE SATURATION		%	P.P.M.
SAMPLE NUMBER	H2O	KCL	CEC	H	CA	MG	K	NA	AL	NAAC	SUM OF CAT.	OM	TOTAL P
69-OK-60- 3- 1	5.6	4.7	5.9	2.70	2.10	0.70	0.24	0.07	0.00	52.9	53.6	1.61	150.6
69-OK-60- 3- 2	6.5	5.5	3.6	1.85	2.40	0.30	0.11	0.06	0.00	79.7	60.9	0.53	100.3
69-OK-60- 3- 3	5.8	5.2	12.3	3.88	5.50	2.80	0.44	0.08	0.00	71.6	69.5	0.77	125.0
69-OK-60- 3- 4	5.4	4.8	9.7	3.14	4.00	2.80	0.32	0.08	0.00	74.2	69.7	0.36	74.9
69-OK-60- 3- 5	5.8	5.0	9.5	2.95	3.70	2.80	0.42	0.01	0.00	73.0	70.2	0.10	50.2
69-OK-60- 3- 6	5.9	5.0	6.3	2.40	2.60	2.30	0.09	0.09	0.00	80.3	68.0	0.05	50.2

PHYSICAL DATA: ANALYST: JIM FORD

						% SAND SUBFRACTIONS				
SAMPLE NUMBER	%SAND	%SILT	%CLAY	TEXTURE	%>2MM	%VCS	%CS	%MS	%FS	%VFS
69-OK-60- 3- 1	56.9	34.3	8.8	SL	0.0	10.2	23.5	17.8	5.5	0.0
69-OK-60- 3- 2	64.7	30.3	5.0	SL	0.0	12.0	26.4	19.6	6.7	0.0
69-OK-60- 3- 3	55.4	27.0	17.5	SL	0.0	7.4	25.2	17.6	5.3	0.0
69-OK-60- 3- 4	67.6	27.3	5.0	SL	0.0	10.3	32.2	18.2	7.0	0.0
69-OK-60- 3- 5	65.7	26.7	7.5	SL	0.0	11.6	37.6	14.0	2.6	0.0
69-OK-60- 3- 6	69.5	23.5	7.0	SL	0.0	10.9	37.5	16.6	4.6	****

INTERPRETIVE CALCULATIONS:

			CLAY FREE PARTICLE SIZE DISTRIBUTION					
SAMPLE NUMBER:	CA/MG	CEC/CLAY	% SILT	% VCS	% CS	% MS	% FS	% VFS
69-OK-60- 3- 1	3.00	67.05	37.61	11.18	25.77	19.52	6.03	0.00
69-OK-60- 3- 2	8.00	72.00	31.89	12.63	27.79	20.63	7.05	0.00
69-OK-60- 3- 3	1.96	70.29	32.73	8.97	30.55	21.33	6.42	0.00
69-OK-60- 3- 4	1.43	194.00	28.74	10.84	33.89	19.16	7.37	0.00
69-OK-60- 3- 5	1.32	126.67	28.86	12.54	40.65	15.14	2.81	0.00
69-OK-60- 3- 6	1.13	90.00	25.27	11.72	40.32	17.85	4.95	*****

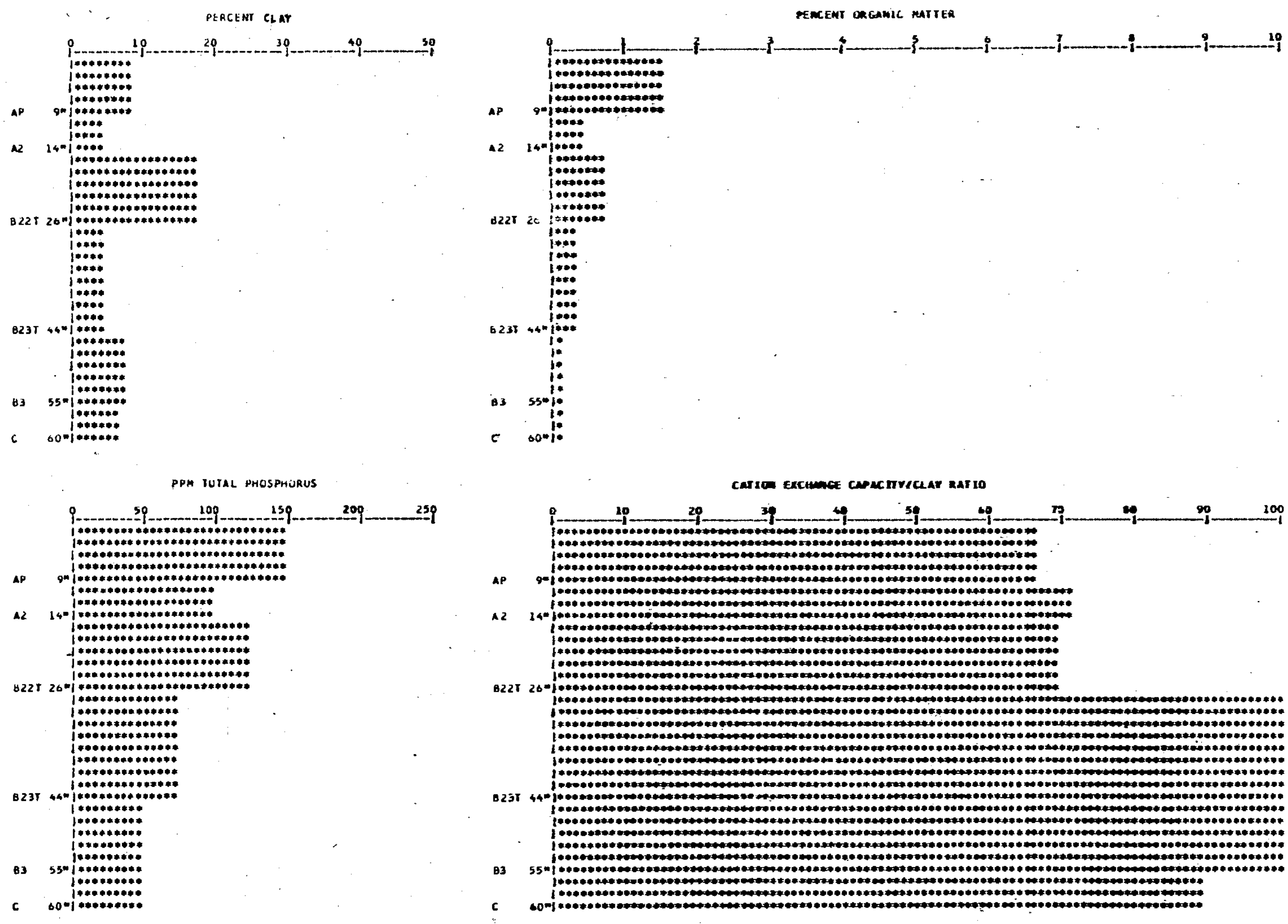

Figure 4. Graph Analyses of Konawa Fine Sandy Loam (1C), Profile No 3

Horizon	Depth (Inches)	Description*
B23t	26-44	Red (2.5YR 4/6) fine sandy loam, compound weak coarse prismatic and weak medium subangular blocky; friable; common fine roots; moderate discontinuous clay films; gradual smooth boundary.
B3	44-55	Red (2.5YR 5/8) fine sandy loam, weak medium subangular; friable; few fine roots; gradual smooth boundary.
C	55+	Red (2.5YR 5/6) fine sandy loam, old alluvium.

The A1 horizon ranges in hue from 10YR to 7.5YR with dry value of 4 to 6 and chroma of 2 and 3. The A2 horizon exhibits values greater than 4. Textures range from loamy fine sand to fine sandy loam. Color of the B2t ranges in hue from 2.5YR to 7.5YR with value of 4 to 6 and chroma of 4 to 8. Texture ranges from heavy fine sandy loam to sandy clay loam. The C horizon texture ranges from loamy fine sand to fine sandy loam.

Konawa Fine Sandy Loam, 3-5% Slopes, Moderately Eroded (1C-3)

The general characteristics of the soils in this mapping unit are the same as in the mapping unit (1C) described above.

The following profile of Konawa fine sandy loam was sampled 600 feet north of the southeast corner of the southwest 1/4 of Section 36, T18N, R2E, Payne County. Laboratory and graph analyses are included in Table V and Figure 5.

Horizon	Depth (Inches)	Description*
Ap	0-7	Dark brown (7.5YR 3/2) fine sandy loam, with few distinct red (2.5YR 4/6) mottles; weak medium subangular blocky and weak medium granular; very friable; many fine roots; many worm casts; abrupt smooth boundary.

TABLE V

CHEMICAL AND PHYSICAL ANALYSES OF KONAWA FINE SANDY LOAM 3-5% SLOPES, MODERATELY ERODED (1C-3)

FIELD SOIL TYPE OR PHASE: KONAWA FINE SANDY LOAM

SOIL CLASSIFICATION: ULTIC HAPLUSTALFS, FINE-LOAMY, MIXED, THERMIC

LOCATION: 600' N. OF S.E. CORNER OF S.W. 1/4 OF SEC. 36-T18N-R2E. PERKINS FARM, PERKINS, PAYNE COUNTY.

SAMPLER: DALE ROGERS DATE: MAY 12, 1969

PROFILE DESCRIPTION:

SAMPLE NUMBER	HORIZON	DEPTH	THICKNESS	COLOR (M)	TEXTURE	STRUCTURE	CONSISTENCE
69-OK-60- 2- 1	AP	0- 7"	7	7.5YR 3/2	FSL	1MSBK-1MGR	MVFR
69-OK-60- 2- 2	B21T	7- 23"	16	2.5YR 4/6	SCL	2CPR	MFI
69-OK-60- 2- 3	B22T	23- 32"	9	2.5YR 4/6	FSL	1CPR-1MSBK	MFR
69-OK-60- 2- 4	B31	32- 40"	8	2.5YR 4/6	FSL	1CPR-1MSBK	MFR
69-OK-60- 2- 5	B32	40- 56"	14	2.5YR 4/6	FSL		MFR
69-OK-60- 2- 6	C	56- 60"	4	2.5YR 4/6	FSL		

CHEMICAL DATA: ANALYST: JIM FORD

SAMPLE NUMBER	PH1:1		CEC	EXTRACTABLE CATIONS,MEQ/100 GMS						%BASE SATURATION		%	P.P.M.
	H2O	KCL		H	CA	MG	K	NA	AL	NAAC	SUM OF CAT.	OM	TOTAL P
69-OK-60- 2- 1	5.2	4.7	5.8	2.22	2.50	0.77	0.21	0.03	0.00	60.2	61.4	1.40	175.2
69-OK-60- 2- 2	6.2	5.4	14.8	3.51	7.50	3.30	0.18	0.05	0.00	74.6	75.9	1.09	100.3
69-OK-60- 2- 3	6.5	5.5	11.8	2.92	2.50	2.20	0.13	0.10	0.00	41.9	62.9	0.64	43.7
69-OK-60- 2- 4	6.1	5.1	14.6	3.14	6.20	4.20	0.15	0.08	0.00	72.7	77.3	0.79	74.9
69-OK-60- 2- 5	7.1	5.9	5.1	0.37	2.40	1.40	0.08	0.06	0.18	76.9	91.5	0.19	43.7
69-OK-60- 2- 6	7.1	6.0	3.9	0.00	2.00	1.40	0.06	0.07	0.32	89.9	100.0	0.17	25.5

PHYSICAL DATA: ANALYST: JIM FORD

SAMPLE NUMBER	%SAND	%SILT	%CLAY	TEXTURE	%>2MM	% SAND SUBFRACTIONS				
						%VCS	%CS	%MS	%FS	%VFS
69-OK-60- 2- 1	75.4	14.5	10.0	SL	0.0	0.0	5.2	22.6	29.5	18.3
69-OK-60- 2- 2	65.1	17.4	17.5	SL	0.0	0.0	4.5	19.6	25.4	15.8
69-OK-60- 2- 3	70.0	7.5	22.5	SCL	0.0	0.0	4.7	23.7	29.5	12.3
69-OK-60- 2- 4	85.0	0.0	15.0	LS	0.0	0.0	5.3	30.0	37.5	12.2
69-OK-60- 2- 5	82.2	5.2	12.5	SL	0.0	0.0	5.1	36.4	28.9	11.9
69-OK-60- 2- 6	90.0	0.0	10.0	LS	0.0	0.0	3.4	37.4	37.0	12.2

INTERPRETIVE CALCULATIONS:

SAMPLE NUMBER:	CA/MG	CEC/CLAY	CLAY FREE PARTICLE SIZE DISTRIBUTION					
			% SILT	% VCS	% CS	% MS	% FS	% VFS
69-OK-60- 2- 1	3.25	58.00	16.11	0.00	5.78	25.11	32.78	20.33
69-OK-60- 2- 2	2.27	84.57	21.09	0.00	5.45	23.76	30.79	19.15
69-OK-60- 2- 3	1.14	52.44	9.68	0.00	6.06	30.58	38.06	15.87
69-OK-60- 2- 4	1.48	97.33	0.00	0.00	6.24	35.29	44.12	14.35
69-OK-60- 2- 5	1.71	40.80	5.94	0.00	5.83	41.60	33.03	13.60
69-OK-60- 2- 6	1.43	39.00	0.00	0.00	3.78	41.56	41.11	13.56

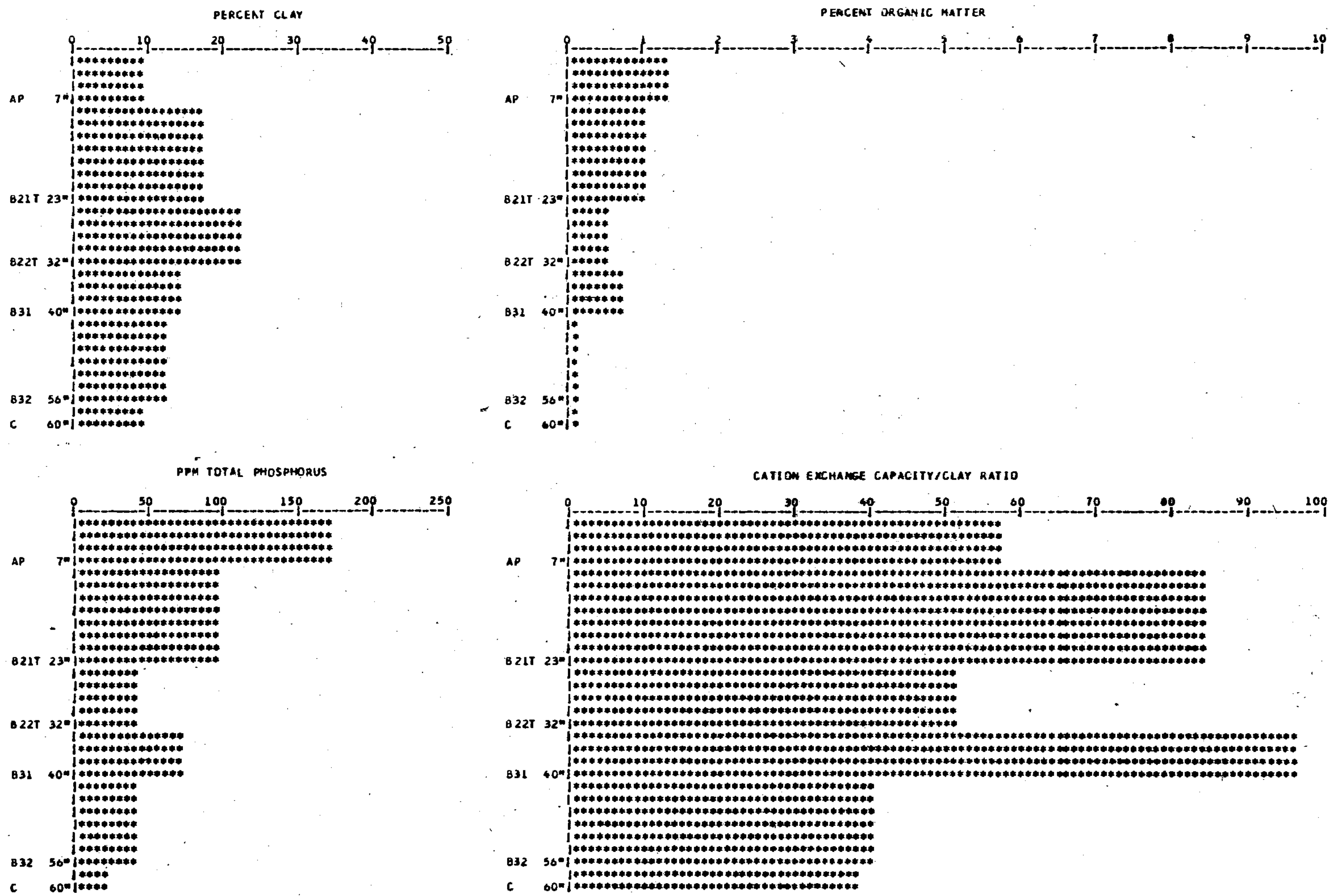

Figure 5. Graph Analyses of Konawa Fine Sandy Loam (1C-3), Profile No. 2

Horizon	Depth (Inches)	Description*
B22t	7-23	Dark reddish brown (2.5YR 4/6) sandy clay loam, moderate coarse prismatic; firm; many fine roots; common worm casts; moderate continuous clay films; gradual smooth boundary.
B23	23-32	Dark reddish brown (2.5YR 4/6) fine sandy loam, compound weak coarse prismatic and weak medium subangular blocky; friable; common fine roots; diffuse smooth boundary.
B31	32-40	Dark reddish brown (2.5YR 4/6) fine sandy loam with common coarse distinct light brown (7.5YR 5/4) mottles; weak coarse prismatic and weak medium subangular blocky; friable; few fine roots; diffuse smooth boundary.
B32	40-56	Red (2.5YR 4/6) fine sandy loam with common coarse distinct light brown (7.5YR 5/4) mottles; friable; diffuse smooth boundary.
C	56+	Mixed red (2.5YR 4/6) and light brown (7.5YR 5/4) fine sandy loam, old alluvium.

The A horizon ranges from 4 to 12 inches in thickness, and it is not uncommon for A1 and A2 to be mixed. See preceding description for ranges in other individual characteristics.

Konawa Fine Sandy Loam, 5-8% Slopes (1D)

The soils of this mapping unit occur on moderately sloping areas on the present turkey farm on the station on convex slopes. The surface soil is brown to dark brown with a lighter colored A2 horizon. About 35 percent of the unit is under cultivation.

The profile description is the same as that given for Konawa fine sandy loam, 3-5% Slopes (1C).

Dougherty Fine Sandy Loam, 1-3% Slopes (2B)

The soils in this mapping unit consist largely of light-colored loamy fine sand 20 to 30 inches thick with a red to yellowish red sandy clay loam B2t horizon which grades to fine sandy loam or loamy fine sand in the C horizon. These soils are low to moderate in fertility, internal drainage is medium, and water-holding capacity is moderate. Permeability is moderate, and they are well drained.

This profile was sampled 2227 feet ~~north~~ south and 289 feet west of the northeast corner of Section 36, T18N, R2E, Payne County. Laboratory and graph analyses are included in Table VI and Figure 6.

Horizon	Depth (Inches)	Description*
A1	0-14	Dark yellowish brown (10YR 3/4) loamy fine sand, weak fine granular structure; very friable; clear, wavy boundary.
A2	14-22	Brown (7.5YR 5/4) loamy fine sand, massive; very friable when moist; clear boundary.
B21t	22-35	Yellowish red (5YR 4/6) sandy clay loam, moderate medium subangular blocky structure; slightly firm when moist; gradual boundary.
B22t	35-53	Yellowish red (5YR 5/6) sandy clay loam, moderate medium subangular blocky structure; firm when moist; gradual boundary.
B3	53-62	Yellowish red (5YR 5/8) sandy clay loam, weak medium subangular blocky structure; friable when moist; gradual boundary.
C	62+	Strong brown (7.5YR 5/8) sandy loam, massive; friable.

The surface soil color varies from pale brown to light brown where these soils have been cultivated. The texture of the A horizon is fine sandy loam but may include some loamy fine sand. The color of the A1 horizon ranges from pale brown to dark yellowish brown to brown. The

TABLE VI

CHEMICAL AND PHYSICAL ANALYSES OF DOUGHERTY FINE SANDY LOAM 1-3% SLOPES (2B)

FIELD SOIL TYPE OR PHASE: DOUGHERTY LOAMY FINE SAND

SOIL CLASSIFICATION: ARENIC HAPLUSTALFS, LOAMY, MIXED, THERMIC

LOCATION: 1700' S & 200' W OF THE NE CORNER OF SEC. 36-T18N-R2E, PERKINS FARM, PERKINS, OKLAHOMA, PAYNE COUNTY.

SAMPLER: JIM FORD DATE SAMPLED: 9/23/71

PROFILE DESCRIPTION:

SAMPLE NUMBER	HORIZON	DEPTH	THICKNESS	COLOR (M)	TEXTURE	STRUCTURE	CONSISTENCE
71-OK-60- 8- 1	A1	0- 14"	14	10.0YR 3/4	LFS	1FGR	MVFR
71-OK-60- 8- 2	A2	14- 22"	8	7.5YR 5/4	LFS	M	MVFR
71-OK-60- 8- 3	B21T	22- 35"	13	5.0YR 4/6	SCL	2MSBK	MFI
71-OK-60- 8- 4	B22T	35- 53"	18	5.0YR 5/6	SCL	2MSBK	MFI
71-OK-60- 8- 5	B3	53- 62"	9	5.0YR 5/8	SCL	1MSBK	MFR
71-OK-60- 8- 6	C	62- 70"	8	7.5YR 5/8	SL	M	MFR

CHEMICAL DATA: ANALYST: JIM FORD

SAMPLE NUMBER	PH1:1 H2O	PH1:1 KCL	CEC	EXTRACTABLE CATIONS,MEQ/100 GMS H	CA	MG	K	NA	AL	%BASE SATURATION NAAC	SUM OF CAT.	% OM	P.P.M. TOTAL P
71-OK-60- 8- 1	6.6	5.6	4.0	1.38	0.70	2.20	0.21	0.03	0.00	77.6	69.5	0.99	29.8
71-OK-60- 8- 2	6.7	5.6	3.0	0.69	0.55	2.05	0.17	0.04	0.00	93.4	80.3	0.45	32.4
71-OK-60- 8- 3	6.6	5.3	11.4	2.38	3.60	3.80	0.25	0.04	0.00	67.6	76.4	0.71	35.7
71-OK-60- 8- 4	6.5	5.3	11.3	2.88	3.50	4.00	0.25	0.04	0.00	68.8	73.1	0.61	36.0
71-OK-60- 8- 5	6.5	5.2	12.9	3.31	3.20	5.30	0.27	0.07	0.00	68.7	72.8	0.26	29.1
71-OK-60- 8- 6	6.6	5.4	8.5	2.00	2.20	3.40	0.20	0.07	0.00	69.1	74.6	0.46	20.0

PHYSICAL DATA: ANALYST: JIM FORD

SAMPLE NUMBER	%SAND	%SILT	%CLAY	TEXTURE	%>2MM	% SAND SUBFRACTIONS %VCS	%CS	%MS	%FS	%VFS
71-OK-60- 8- 1	70.3	20.9	8.8	SL	0.1	0.1	4.3	23.3	27.5	15.3
71-OK-60- 8- 2	77.0	14.2	8.8	SL	0.1	0.1	5.1	25.1	29.5	17.3
71-OK-60- 8- 3	60.4	18.3	21.3	SCL	0.1	0.1	3.4	20.2	23.2	13.7
71-OK-60- 8- 4	54.7	24.0	21.3	SCL	0.1	0.1	1.6	14.8	23.3	15.2
71-OK-60- 8- 5	59.0	18.5	22.5	SCL	0.1	0.1	2.2	15.4	26.5	15.0
71-OK-60- 8- 6	71.4	12.9	15.7	SL	0.1	0.1	2.8	21.7	30.3	16.7

INTERPRETIVE CALCULATIONS:

SAMPLE NUMBER:	CA/MG	CEC/CLAY	CLAY FREE PARTICLE SIZE DISTRIBUTION % SILT	% VCS	% CS	% MS	% FS	% VFS
71-OK-60- 8- 1	0.32	45.45	22.92	0.11	4.71	25.35	30.15	16.78
71-OK-60- 8- 2	0.27	34.09	15.57	0.11	5.59	27.52	32.46	18.97
71-OK-60- 8- 3	0.95	53.52	23.25	0.13	4.32	25.67	29.48	17.41
71-OK-60- 8- 4	0.88	53.05	30.50	0.13	2.03	18.81	29.61	19.31
71-OK-60- 8- 5	0.60	57.33	23.67	0.13	2.84	19.67	34.19	19.35
71-OK-60- 8- 6	0.65	54.14	15.30	0.12	3.32	25.74	35.94	19.81

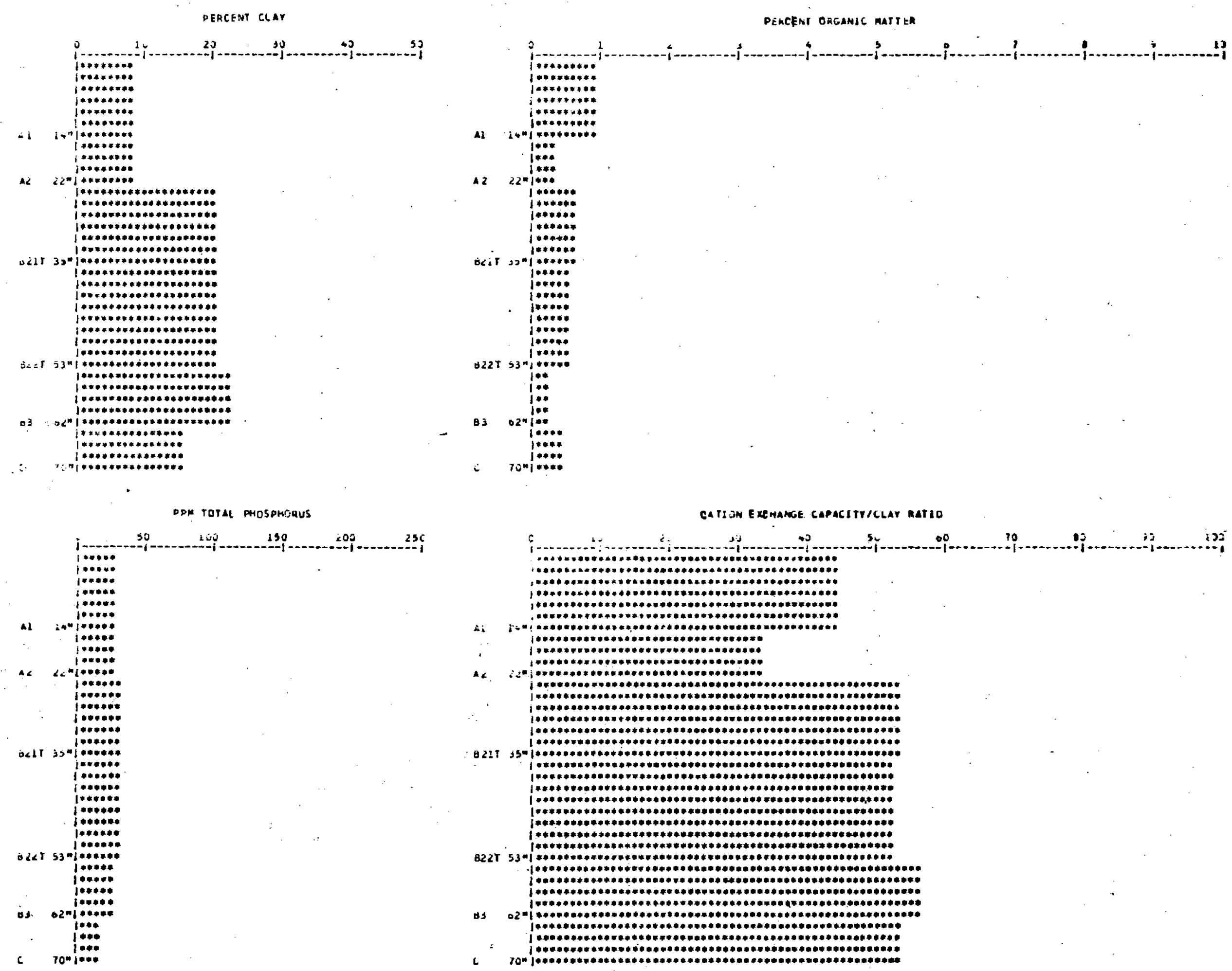

Figure 6. Graph Analyses of Dougherty Fine Sandy Loam (2B), Profile No. 8

A2 horizon ranges from very pale brown to pale brown to light yellowish brown. The B2t horizon ranges in color from red to reddish brown, yellowish red, and reddish yellow (hue varies from 2.5YR to 7.5YR). Texture varies from sandy clay loam to sandy clay. The texture of the C horizon ranges from loamy fine sand to light sandy clay loam.

Dougherty Fine Sandy Loam, 3-5% Slopes (2C)

The soils of this mapping unit are similar to the above unit but occur on steeper slopes. The surface horizons are from 20 inches to 36 inches deep. The profile is similar to the one described above. These soils are highly subject to erosion and should be carefully maintained. Surface thickness varies greatly due to removal of trees and of soil for building terraces.

Teller Fine Sandy Loam, 1-3% Slopes (3B)

The soils in this mapping unit are transitional between the forested soils of the east side and the prairie soils of the west side of the Research Station. This mapping unit typically consists of a dark brown or brown fine sandy loam A horizon which grades into a brown light sandy clay loam B1 horizon. The B2t horizon is typically a yellowish red sandy clay loam. It becomes more red with depth. These soils are well suited to small grains, sorghums, cotton, legumes, and grasses. They are naturally well drained. Internal drainage is medium; permeability and water-holding capacity is moderate. These soils are moderately high in natural fertility, but they are susceptible to wind and water erosion under cultivation.

This profile was sampled 1567 feet west and 1237 feet south of the northeast corner of Section 36, T18N, R2E, Payne County.

Horizon	Depth (Inches)	Description
Ap	0-10	Dark brown (10YR 3/3 moist) fine sandy loam, moderate medium granular structure; very friable; abrupt smooth boundary.
A1	10-14	Dark brown (10YR 3/3 moist) fine sandy loam, strong granular to weak subangular blocky structure; friable; gradual smooth boundary.
B1	14-20	Brown to dark brown (7.5YR 4/4 moist) light sandy clayloam, weak medium subangular blocky structure; friable; gradual smooth boundary; very few black concretions.
B21t	20-32	Brown to dark brown (7.5YR 4/4 moist) sandy clay loam, moderate medium subangular blocky structure; slightly firm; few gray mottles; few black concretions; gradual smooth boundary.
B22t	32-40	Strong brown (7.5YR 5/6 moist) sandy clay loam, moderate medium subangular blocky structure; slightly firm; few gray mottles; few black concretions; gradual smooth boundary.
B3	40-50	Strong brown (7.5YR 5/6 moist) sandy loam, strong granular to weak subangular blocky structure; friable common reddish mottles; gradual smooth boundary.
C1	50-56	Strong brown (7.5YR 5/8 moist) sandy loam, massive; friable; streaked with reddish brown mottles; gradual smooth boundary.
C2	56+	Sandy loam, grading into loamy sands.

The A horizon is largely a fine sandy loam but may vary into a loam. The A horizon is dark brown to brown, hue 10YR to 7.5YR, value of 4 to 3, and chroma of 3 and 4. The B1 horizon ranges in color from brown to reddish brown, and the B2t horizons from strong brown to yellowish red to reddish brown. The texture of the B2t is sandy clay loam.

Teller Fine Sandy Loam, 3-5% Slopes, Moderately Eroded (3C-3)

This mapping unit has been dissected by local erosion. However, erosion is now being controlled by a bermudagrass cover. Soils of this mapping unit are similar to the one described above except for loss of surface soil.

Pulaski Soils, 0-1% Slopes (4A)

These soils occur along narrow drainageways which run through the more sandy east side of the station. They are typical along streams which drain from the crosstimber resource area. Some of the profiles sampled resembled the Port soils but were very restricted in area. The soils have a light brown color from 6 to 18 inches deep. Texture of the A horizon is loamy fine sand. The subsurface is a brown to pale brown fine sandy loam which is stratified with reddish sandy clay loams. There are some small areas of Pulaski soil "wet" included in the unit due to seepage in those areas. These soils are generally well drained except for the wet spots. Internal drainage is medium, permeability is moderately rapid, and water-holding capacity is moderate. Natural fertility is moderate. The following profile of Pulaski soil was described 1402 feet north and 742 feet west of the southeast corner of Section 36, T18N, R2E, Payne County.

Horizon	Depth (Inches)	Description
Ap	0-5	Brown (10YR 5/3 moist) loamy sand, weak fine granular structure; very friable; clear boundary.
A1	5-15	Dark brown (10YR 4/3 moist) fine sandy loam, moderate medium granular structure; friable; gradual boundary.

Horizon	Depth (Inches)	Description
C	15-23	Yellowish brown (10YR 5/4 moist) loamy sand, massive; very friable; abrupt boundary.
$A1_b$	23-30	Dark brown (7.5YR 4/2) sandy loam, weak medium granular structure; friable; clear boundary.
$A2_b$	30-45	Dark brown (10YR 4/3 moist) sandy loam, weak medium subangular blocky and weak medium granular structure; friable.
$B2t_b$	45+	Yellowish red (5YR 4/6) sandy clay loam, moderate medium subangular blocky structure; slightly firm when moist.

The recently deposited sandy material ranges from 5 to 26 inches deep. There are some areas where brown or dark brown loam and fine sandy loam buried surface layers can be found in this mapping unit. Texture of the surface soil ranges from loamy fine sand to fine sandy loam. The subsoil may be stratified loam and fine sandy loam, but it is more commonly a fine sandy loam. Colors of the A horizon range from pale brown to light brown to reddish brown, hue from 10YR to 7.5YR. The subsoil colors may be brown, yellowish red, or red; hue ranges from 2.5YR to 7.5YR.

Eufaula Fine Sandy Loam, 1-3% Slopes (5B)

This mapping unit consists of soils which have light-colored sandy surface horizons and have no illuviated clay above 40 inches. The B2t horizon consists of reddish sandy clay loams which occur in bands. Eufaula soils have thicker, more sandy surface layers than the closely competing Dougherty soils. The yellowish red fine sandy loam or sandy clay loam subsoil occurs at a depth of about 50 inches. Eufaula soils are excessively drained, and internal drainage and permeability are rapid. Water-holding capacity and natural fertility are low, and these soils are very susceptible to wind and water erosion.

The following profile of Eufaula fine sandy loam was sampled 1200 feet west of the northeast corner of the southwest 1/4 of Section 36, T18N, R2E, Payne County. Laboratory and graph analyses are included in Table VII and Figure 7.

Horizon	Depth (Inches)	Description*
Ap	0-9	Very dark grayish brown (10YR 3/2) loamy fine sand; single grain; very friable; few fine roots; abrupt smooth boundary.
A1 and A2	9-19	Very dark grayish brown (10YR 3/2) and brown (7.5YR 5/4) loamy fine sand, single grain; very friable; few fine roots; diffuse smooth boundary.
A21	19-36	Light brown (7.5YR 6/4) fine sand with common fine distinct very dark grayish brown (10YR 3/2) mottles, single grain; very friable; few fine roots; diffuse smooth boundary.
A22	36-50	Light brown (7.5YR 6/4) fine sand with common fine distinct red (2.5YR 4/6) mottles, single grain; very friable; few fine roots; abrupt smooth boundary.
B2t	50-56	Red (2.5YR 4/6) sandy clay loam, compound weak coarse prismatic and weak medium subangular blocky structure; friable; moderate continuous clay films; gradual smooth boundary.
B3	56-70	Red (2.5YR 5/8) fine sandy loam, weak subangular blocky structure; friable; diffuse smooth boundary.
C	70+	Yellowish red (5YR 5/6) fine sandy loam, old alluvium.

Texture of the A1 horizon ranges from fine sand to fine sandy loam although the dominant texture is fine sandy loam. The entire A horizon ranges from a very dark grayish brown to light brown to pink, hue from 10YR to 7.5YR. The B horizon ranges from pale brown to yellowish red

TABLE VII

CHEMICAL AND PHYSICAL ANALYSES OF EUFAULA FINE SANDY LOAM 1-3% SLOPES (5B)

FIELD SOIL TYPE OR PHASE: EUFAULA LOAMY FINE SAND

SOIL CLASSIFICATION: PSAMMENTIC PALEUSTALFS, SANDY, SILICEOUS, THERMIC

LOCATION: 1200' W. OF N.E. CORNER OF S.W. 1/4 OF SEC. 36-T18N-R2E,
PERKINS FARM, PERKINS, PAYNE COUNTY.

SAMPLER: DALE ROGERS   DATE: MAY 12, 1969

PROFILE DESCRIPTION:

SAMPLE NUMBER	HORIZON	DEPTH	THICKNESS	COLOR (M)	TEXTURE	STRUCTURE	CONSISTENCE
69-OK-60- 4- 1	AP	0- 9"	9	10.0YR 3/2	LFS	SG	MVFR
69-OK-60- 4- 2	A1A2	9- 19"	10	10.0YR 3/2	LFS	SG	MVFR
69-OK-60- 4- 3	A21	19- 36"	17	7.5YR 6/4	FS	SG	MVFR
69-OK-60- 4- 4	A22	36- 50"	14	2.5YR 4/6	FS	SG	MVFR
69-OK-60- 4- 5	B2T	50- 56"	6	2.5YR 5/8	SCL	1CPR-1MSBK	MFI
69-OK-60- 4- 6	B3	56- 70"	14	5.0YR 5/6	FSL	1SBK	MFRI

CHEMICAL DATA: ANALYST: JIM FORD

	PH1:1			EXTRACTABLE CATIONS, MEQ/100 GMS						%BASE SATURATION		%	P.P.M.
SAMPLE NUMBER	H2O	KCL	CEC	H	CA	MG	K	NA	AL	NAAC	SUM OF CAT.	OM	TOTAL P
69-OK-60- 4- 1	6.8	6.0	4.1	0.00	2.20	0.90	0.01	0.17	0.00	79.1	100.0	1.22	112.7
69-OK-60- 4- 2	7.2	6.3	2.6	0.00	1.40	0.60	0.01	0.11	0.00	82.7	100.0	0.60	75.6
69-OK-60- 4- 3	7.5	6.4	1.3	0.00	0.50	0.40	0.01	0.06	0.00	75.4	100.0	0.19	37.8
69-OK-60- 4- 4	7.3	6.0	1.4	0.00	0.40	0.50	0.01	0.04	0.00	70.3	100.0	0.14	50.2
69-OK-60- 4- 5	6.2	5.0	8.9	0.19	3.20	1.00	0.02	0.31	0.18	50.7	96.1	0.42	50.2
69-OK-60- 4- 6	5.8	4.6	12.9	0.26	2.80	2.30	0.02	0.32	0.32	42.3	95.5	0.24	88.0

PHYSICAL DATA: ANALYST: JIM FORD

						% SAND SUBFRACTIONS				
SAMPLE NUMBER	%SAND	%SILT	%CLAY	TEXTURE	%>2MM	%VCS	%CS	%MS	%FS	%VFS
69-OK-60- 4- 1	65.6	20.5	13.9	SL	0.0	0.0	0.0	20.0	33.2	12.6
69-OK-60- 4- 2	78.2	9.3	12.5	SL	0.0	0.0	3.3	26.5	33.8	14.7
69-OK-60- 4- 3	82.9	4.5	12.5	LS	0.0	0.0	3.2	31.2	34.5	14.1
69-OK-60- 4- 4	86.3	0.2	13.5	LS	0.0	0.0	3.9	30.5	37.6	14.5
69-OK-60- 4- 5	69.7	5.2	25.0	SCL	0.0	0.0	2.2	17.8	31.3	18.6
69-OK-60- 4- 6	47.6	23.6	28.8	SCL	0.0	0.0	1.9	14.3	14.3	17.3

INTERPRETIVE CALCULATIONS:

			CLAY FREE PARTICLE SIZE DISTRIBUTION					
SAMPLE NUMBER:	CA/MG	CEC/CLAY	% SILT	% VCS	% CS	% MS	% FS	% VFS
69-OK-60- 4- 1	2.44	29.50	23.81	0.00	0.00	23.23	38.56	14.63
69-OK-60- 4- 2	2.33	20.80	10.63	0.00	3.77	30.29	38.63	16.80
69-OK-60- 4- 3	1.25	10.40	5.14	0.00	3.66	35.66	39.43	16.11
69-OK-60- 4- 4	0.80	10.37	0.23	0.00	4.51	35.26	43.47	16.76
69-OK-60- 4- 5	3.20	35.60	6.93	0.00	2.93	23.73	41.73	24.80
69-OK-60- 4- 6	1.22	44.79	33.15	0.00	2.67	20.08	20.08	24.30

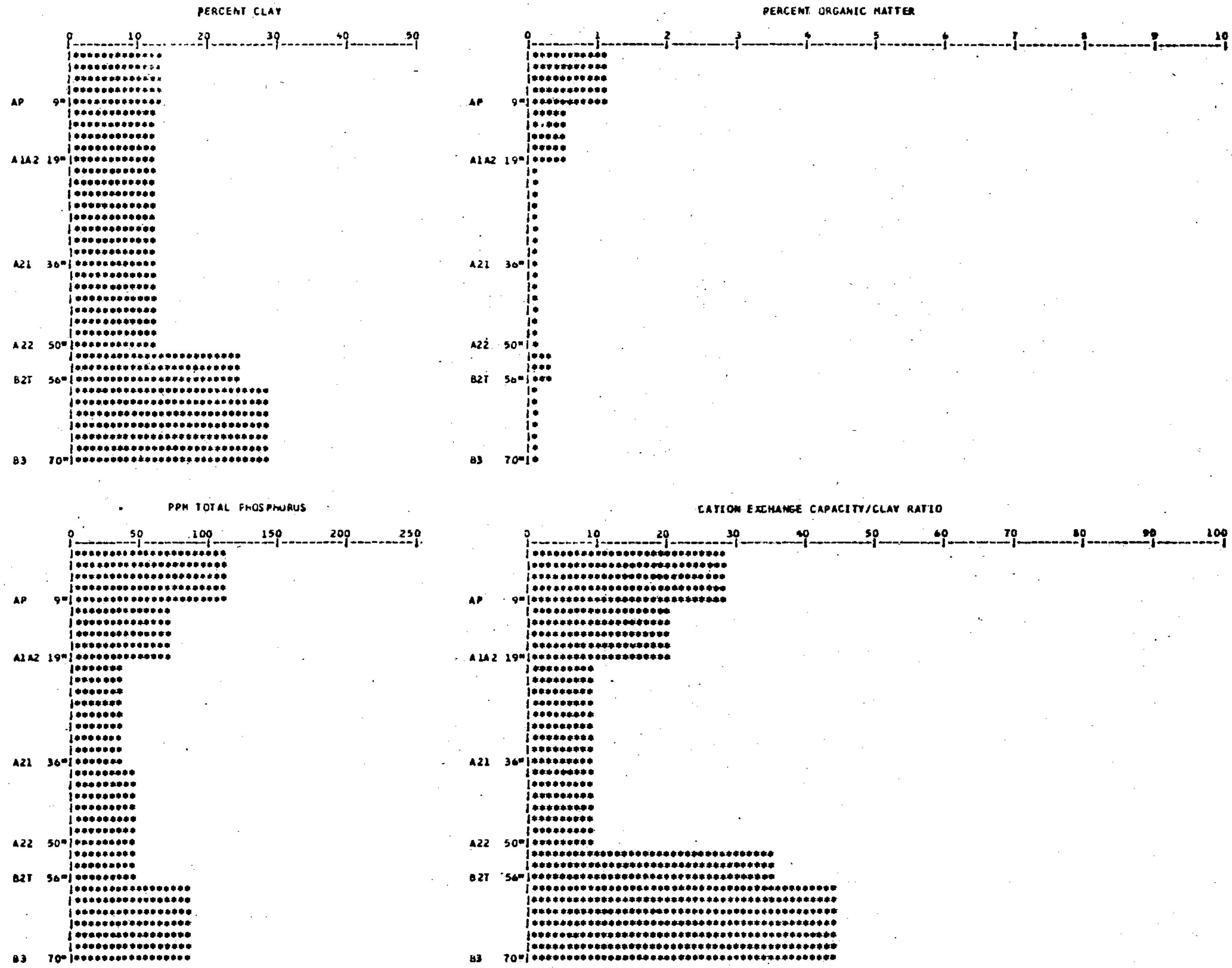

Figure 7. Graph Analyses of Eufaula Fine Sandy Loam (5B), Profile No. 4

to red in color, hue from 2.5YR to 5YR.

Farnum Silt Loam, 0-1% Slopes (6A)

The soils of this mapping unit have a dark surface layer to a depth of 26 to 36 inches. The dominant color of the A horizon is dark brown. These soils occur in a slight depressional area at the base of the south-facing slope on the west side of the station. The finer sediments which have been carried down and deposited from above are at least in part responsible for the thick, dark, silty surface layer. These soils have developed on what is thought to be an old Teller soil. At a depth of approximately 40 to 50 inches, a contrasting material of sandy clay loam is encountered which is possibly the remnants of the argillic horizon of an old Teller profile. The native vegetation of these soils was tall grass prairie. These soils are well drained, and internal drainage is medium. Permeability is moderately slow. Water-holding capacity is medium, and natural fertility is moderately high. The principle crops are wheat and sorghum; but cotton, legumes, and grasses do quite well.

The following profile was sampled 800 feet south and 500 feet east of the northeast corner of the southwest 1/4 of Section 36, T18N, R2E, Payne County. Laboratory and graph analyses are included in Table VIII and Figure 8.

Horizon	Depth (Inches)	Description*
Ap	0-6	Dark brown (7.5YR 3/2) silt loam, compound weak medium subangular blocky structure; weak medium granular and moderate platey; friable; many fine roots; many worm casts; abrupt smooth boundary.

TABLE VIII

CHEMICAL AND PHYSICAL ANALYSES OF FARNUM SILT LOAM, 0-1% SLOPES (6A)

FIELD SOIL TYPE OR PHASE: FARNUM SILT LOAM

SOIL CLASSIFICATION: PACHIC ARGIUSTOLLS, FINE-LOAMY, MIXED, THERMIC

LOCATION: PERKINS FARM, PERKINS, PAYNE COUNTY,
800' S. & 500' E. OF NW CORNER OF SW 1/4 OF SEC.36-T18N-R2E.

SAMPLER: DALE ROGERS DATE: MAY 12,1969

PROFILE DESCRIPTION:

SAMPLE NUMBER	HORIZON	DEPTH	THICKNESS	COLOR (M)	TEXTURE	STRUCTURE	CONSISTENCE
69-OK-60- 1- 1	AP	0- 6"	6	7.5YR 3/2	SIL	1MSBK-1MGR	MFR
69-OK-60- 1- 2	A3	6- 18"	12	7.5YR 3/2	SIL	1MSBK-2MGR	MFR
69-OK-60- 1- 3	B21T	18- 28"	10	7.5YR 3/2	SICL	2FSBK	MFI
69-OK-60- 1- 4	B22T	28- 40"	12	10.0YR 3/2	CL	2MABK-2CPR	MFI
69-OK-60- 1- 5	B3T	40- 63"	23	10.0YR 3/2	SCL	1MABK-1CPR	MFI
69-OK-60- 1- 6	C	63- 70"	7	10.0YR 4/3	SCL	0	MFI
69-OK-60- 1- 7	IIC	70- 75"	5	10.0YR 4/3	FSL	0	

CHEMICAL DATA: ANALYST: JIM FORD

SAMPLE NUMBER	PH1:1		CEC	EXTRACTABLE CATIONS,MEQ/100 GMS						%BASE SATURATION		%	P.P.M.
	H2O	KCL		H	CA	MG	K	NA	AL	NAAC	SUM OF CAT.	OM	TOTAL P
69-OK-60- 1- 1	6.0	5.2	9.2	0.40	5.00	1.40	0.60	0.10	0.00	72.2	94.7	1.70	250.0
69-OK-60- 1- 2	6.2	5.6	11.7	0.40	6.60	1.60	0.10	0.10	0.20	71.8	93.3	1.50	225.0
69-OK-60- 1- 3	6.5	5.7	13.0	0.50	6.80	2.80	0.40	0.10	0.00	77.7	95.2	1.40	175.0
69-OK-60- 1- 4	5.8	5.5	18.5	0.50	8.00	5.20	0.50	0.20	0.10	75.1	96.0	0.80	250.0
69-OK-60- 1- 5	6.2	5.5	8.6	0.20	4.40	3.40	0.30	0.10	0.00	95.3	97.6	0.30	175.0
69-OK-60- 1- 6	6.1	5.2	6.2	0.20	3.80	2.20	0.20	0.10	0.00	100.0	96.9	0.20	100.0
69-OK-60- 1- 7	6.0	4.2	6.6	0.20	2.80	1.80	0.20	0.10	0.40	74.2	89.1	0.10	100.0

PHYSICAL DATA: ANALYST: JIM FORD

SAMPLE NUMBER	%SAND	%SILT	%CLAY	TEXTURE	%>2MM	% SAND SUBFRACTIONS				
						%VCS	%CS	%MS	%FS	%VFS
69-OK-60- 1- 1	28.4	55.6	16.0	SIL	0.0	0.0	0.8	6.4	8.2	13.0
69-OK-60- 1- 2	22.6	53.4	24.0	SIL	0.0	0.0	1.0	5.6	6.0	10.0
69-OK-60- 1- 3	21.4	52.6	26.0	SIL	0.0	0.0	1.2	6.8	6.6	6.8
69-OK-60- 1- 4	38.5	44.5	27.0	CL	0.0	0.0	4.2	15.8	12.8	5.7
69-OK-60- 1- 5	70.6	15.4	14.0	SL	0.0	0.0	7.2	31.8	23.2	8.4
69-OK-60- 1- 6	77.8	12.0	10.2	SL	0.0	0.0	7.8	34.2	26.4	9.4
69-OK-60- 1- 7	57.5	29.0	13.5	SL	0.0	0.0	1.8	16.9	25.4	13.4

INTERPRETIVE CALCULATIONS:

SAMPLE NUMBER:	CA/MG	CEC/CLAY	CLAY FREE PARTICLE SIZE DISTRIBUTION					
			% SILT	% VCS	% CS	% MS	% FS	% VFS
69-OK-60- 1- 1	3.57	57.50	66.19	0.00	0.95	7.62	9.76	15.48
69-OK-60- 1- 2	4.12	48.75	70.26	0.00	1.32	7.37	7.89	13.16
69-OK-60- 1- 3	2.43	50.00	71.08	0.00	1.62	9.19	8.92	9.19
69-OK-60- 1- 4	1.54	68.52	60.96	0.00	5.75	21.64	17.53	7.61
69-OK-60- 1- 5	1.29	61.43	17.91	0.00	8.37	36.98	26.98	9.77
69-OK-60- 1- 6	1.73	60.78	13.36	0.00	8.69	38.08	29.40	10.47
69-OK-60- 1- 7	1.56	48.89	33.53	0.00	2.08	19.54	29.36	15.49

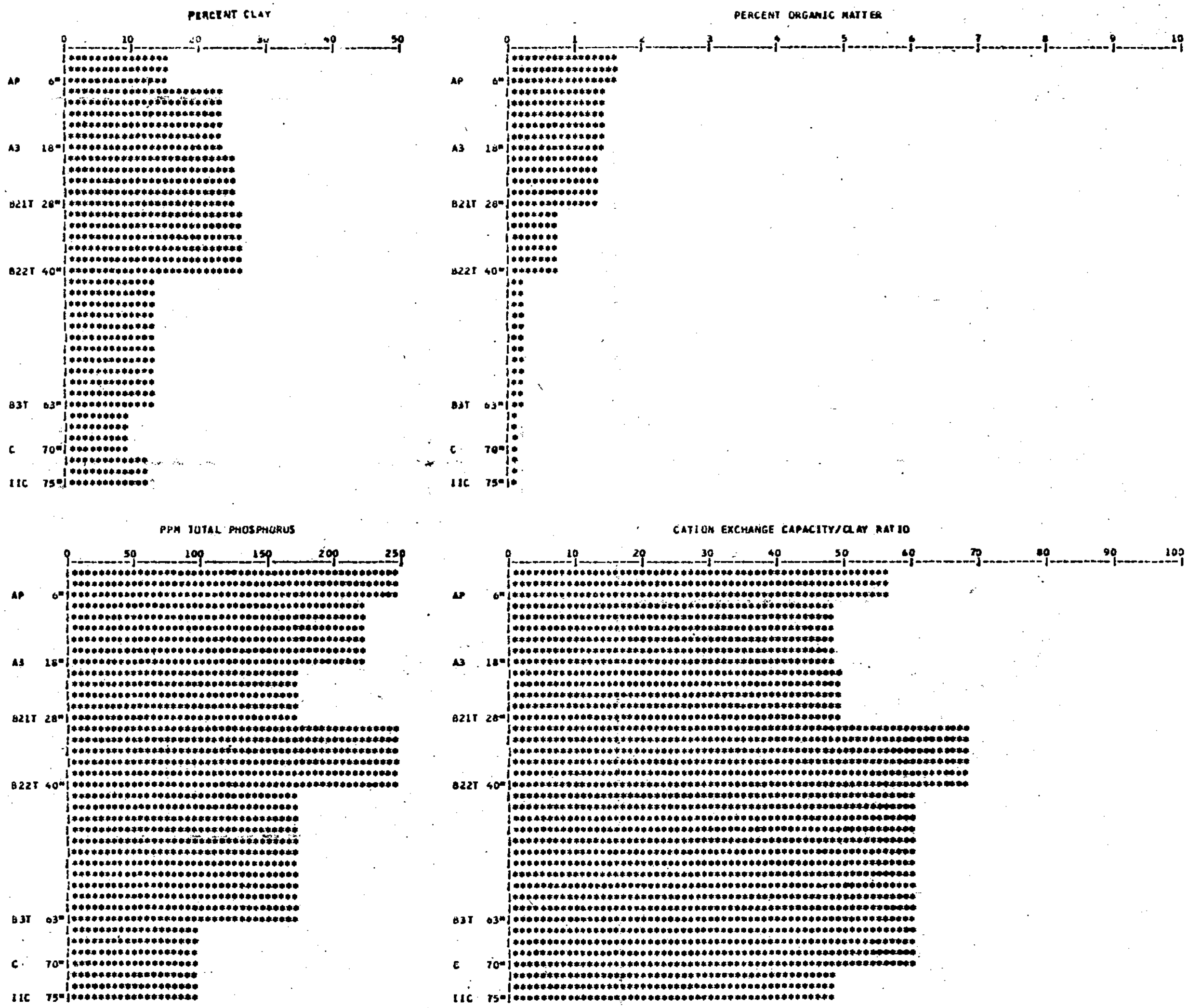

Figure 8. Graph Analyses of Farnum Silt Loam (6A), Profile No. 1

Horizon	Depth (Inches)	Description*
A3 and B1	6-18	Dark brown (7.5YR 3/2) silt loam, compound weak medium subangular blocky and moderate medium granular structure; friable; many fine roots; many worm casts; gradual smooth boundary.
B21t	18-28	Dark brown (7.5YR 3/2) silty clay loam, moderate fine subangular blocky structure; friable; many fine roots; many worm casts; gradual smooth boundary.
IIB22t	28-40	Very dark grayish brown (10YR 3/2) clay loam, compound moderate medium angular blocky and moderate coarse prismatic structure; firm; common fine roots; strong continuous clay films; gradual smooth boundary.
IIB3t	40-63	Very dark grayish brown (10YR 3/2) sandy clay loam, compound weak medium angular blocky and weak coarse prismatic structure; firm; few fine roots; moderate continuous clay films; gradual smooth boundary.
IIC1	63-70	Yellowish-brown (10YR 4/3) sandy clay loam, structureless; abrupt smooth boundary; old alluvium.
IIC2	70	Yellowish-brown (10YR 4/3) fine sandy loam with coarse distinct mottles and stratifications of reddish-yellow (7.5YR 5/5); old alluvium.

The A horizon is primarily a silt loam, but a small percentage is loam. Color ranges from dark brown to very dark grayish brown, hue from 10YR to 7.5YR, value of 4 to 3, and chroma 3 to 2. The A horizon is 26 to 36 inches deep.

The B2t horizon has an increase in fine and medium sand. Texture ranges from clay loam in the upper part to sandy clay loam in the lower part. Color ranges from dark brown through yellowish brown; hue, 10YR through 7.5YR; value, 4 through 3; and chroma, 2 through 3. The light sandy clay loam to sandy loam, yellowish brown B3 horizon grades into the sandy alluvial sediments of the C horizon below.

Teller Loam, 0-1% Slopes (8A)

This mapping unit consists of soils with a brown to dark brown A horizon which is 13 to 18 inches thick. The B1 horizon is a light clay loam to light sandy clay loam; color is brown to reddish brown. Texture of the B2t is predominately sandy clay. The C horizon begins between 40 and 60 inches below the surface.

These soils are well suited for small grains, sorghums, cotton, legumes, and grasses. Their permeabilities and water-holding capacities are moderate, and they are naturally well drained. Internal drainage is medium, and natural fertility is moderately high.

The following profile was sampled 660 feet north and 61 feet west of the west road off Highway 33 by the farmhouse, or 80 feet west of the northeast corner of plot 3700. Laboratory and graph analyses are presented in Table IX and Figure 9.

Horizon	Depth (Inches)	Description*
Ap	0-7	Dark brown (10YR 3/4) fine sandy loam, moderate medium granular structure; very friable when moist; abrupt boundary.
A1	7-13	Brownish black (7.5YR 3/2 moist) fine sandy loam; weak medium subangular blocky structure; friable when moist; gradual boundary.
B1	13-18	Dark brown (10YR 3/4 moist) light sandy clay loam, moderate medium subangular blocky structure; friable when moist; gradual boundary.
B21t	18-26	Brown (10YR 4/4 moist) sandy clay loam, strong medium subangular blocky structure; firm when moist; gradual boundary.

TABLE IX

CHEMICAL AND PHYSICAL ANALYSES OF TELLER LOAM 0-1% SLOPES (8A)

FIELD SOIL TYPE OR PHASE: TELLER FINE SANDY LOAM

SOIL CLASSIFICATION: UDIC ARGIUSTOLLS, FINE-LOAMY, MIXED, THERMIC

LOCATION: 450' N & 80' W OF THE WEST ROAD OFF OF HWY 33 BY FARMHOUSE OR 80' W OF THE NE CORNER OF PLOT 3700, PAYNE COUNTY

SAMPLER: JIM FORD DATE SAMPLED: 7/30/71

PROFILE DESCRIPTION:

SAMPLE NUMBER	HORIZON	DEPTH	THICKNESS	COLOR (M)	TEXTURE	STRUCTURE	CONSISTENCE
71-OK-60-10- 1	AP	0- 7"	7	10.0YR 3/4	FSL	2MGR	MVFR
71-OK-60-10- 2	A1	7- 13"	6	7.5YR 3/2	FSL	1MSBK	MFR
71-OK-60-10- 3	B1	13- 18"	5	10.0YR 3/4	SCL	2MSBK	MFR
71-OK-60-10- 4	B21T	18- 26"	8	10.0YR 4/4	SCL	3MSBK	MFI
71-OK-60-10- 5	B22T	26- 35"	9	7.5YR 4/4	SCL	3MSBK	MFI
71-OK-60-10- 6	B3	35- 43"	8	10.0YR 4/3	SCL	3MSBK	MFI
71-OK-60-10- 7	C1	43- 50"	7	10.0YR 5/4	SCL	1MSBK	MFR
71-OK-60-10- 8	C2	50- 55"	5	0.0YR 0/0	SL	0	MFR

CHEMICAL DATA: ANALYST: JIM FORD

SAMPLE NUMBER	PH(1:1) H2O	PH(1:1) KCL	CEC	EXTRACTABLE CATIONS, MEQ/100 GMS H	CA	MG	K	NA	AL	%BASE SATURATION NAAC	SUM OF CAT.	% OM	P.P.M. TOTAL P
71-OK-60-10- 1	6.0	5.0	8.1	2.16	5.28	0.24	0.37	0.06	0.00	73.4	73.4	1.07	138.1
71-OK-60-10- 2	5.9	5.0	11.1	2.77	5.40	1.56	0.26	0.12	0.00	66.1	72.7	1.36	61.5
71-OK-60-10- 3	5.8	4.9	11.9	3.37	6.03	1.99	0.22	0.13	0.01	80.2	71.3	1.21	73.5
71-OK-60-10- 4	5.9	4.9	12.6	2.59	6.74	1.36	0.23	0.11	0.02	67.0	76.6	1.02	67.3
71-OK-60-10- 5	5.8	4.8	11.9	2.59	4.30	2.52	0.23	0.08	0.05	59.9	73.4	0.76	53.5
71-OK-60-10- 6	5.9	4.9	9.0	0.89	3.55	2.82	0.24	0.09	0.07	74.4	88.3	0.46	37.1
71-OK-60-10- 7	6.1	5.0	7.4	0.93	3.76	2.67	0.29	0.09	0.05	92.0	88.0	0.37	39.7
71-OK-60-10- 8	6.1	5.1	9.5	0.89	3.52	2.29	0.31	0.18	0.08	66.3	87.6	0.39	30.6

PHYSICAL DATA: ANALYST: JIM FORD

SAMPLE NUMBER	%SAND	%SILT	%CLAY	TEXTURE	%>2MM	% SAND SUBFRACTIONS %VCS	%CS	%MS	%FS	%VFS
71-OK-60-10- 1	46.1	40.7	13.2	L	0.1	0.1	2.4	15.1	13.7	14.9
71-OK-60-10- 2	38.5	41.5	20.0	L	0.1	0.1	2.0	12.8	13.4	10.4
71-OK-60-10- 3	38.2	40.5	21.3	L	0.1	0.1	2.1	12.6	13.2	10.4
71-OK-60-10- 4	40.4	37.7	21.9	L	0.1	0.1	2.2	12.8	15.4	9.1
71-OK-60-10- 5	51.3	26.2	22.5	SCL	0.1	0.1	3.0	19.9	18.6	10.0
71-OK-60-10- 6	64.3	20.7	15.0	SL	0.1	0.1	3.8	23.6	25.1	11.9
71-OK-60-10- 7	69.6	16.6	13.8	SL	0.1	0.1	4.0	26.2	25.9	13.5
71-OK-60-10- 8	63.4	19.1	17.5	SL	0.1	0.1	3.4	24.3	22.1	13.7

INTERPRETIVE CALCULATIONS:

SAMPLE NUMBER:	CA/MG	CEC/CLAY	CLAY FREE PARTICLE SIZE DISTRIBUTION % SILT	% VCS	% CS	% MS	% FS	% VFS
71-OK-60-10- 1	22.00	61.36	46.89	0.12	2.76	17.40	15.78	17.17
71-OK-60-10- 2	3.46	55.50	51.88	0.13	2.50	16.00	16.75	13.00
71-OK-60-10- 3	3.03	55.87	51.46	0.13	2.67	16.01	16.77	13.21
71-OK-60-10- 4	4.96	57.53	48.27	0.13	2.82	17.67	19.72	11.65
71-OK-60-10- 5	1.71	52.89	33.81	0.13	3.87	25.68	24.00	12.90
71-OK-60-10- 6	1.26	60.00	24.35	0.12	4.47	27.76	29.53	14.00
71-OK-60-10- 7	1.41	53.62	19.26	0.12	4.64	38.39	30.05	15.66
71-OK-60-10- 8	1.54	54.29	23.15	0.12	4.12	29.45	26.79	16.61

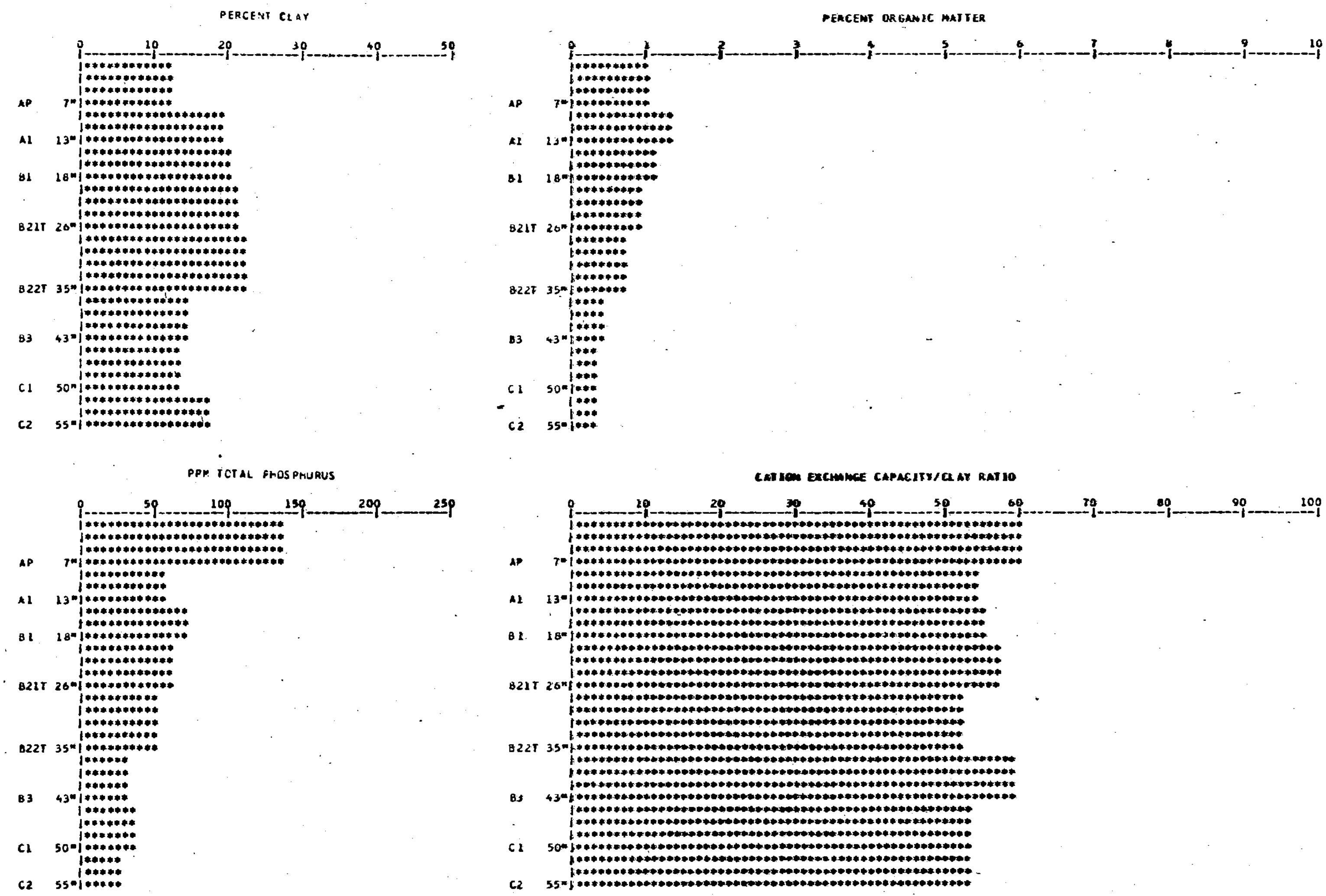

Figure 9. Graph Analyses of Teller Loam (8A), Profile No. 10

Horizon	Depth (Inches)	Description*
B22t	26-35	Brown (7.5YR 4/4 moist) sandy clay loam, strong medium subangular blocky structure; firm when moist; gradual boundary.
B3	35-43	Dull yellowish brown (10YR 4/3 moist) light sandy clay loam, weak medium subangular blocky structure; friable when moist; gradual boundary.
C1	43-50	Dull yellowish brown (10YR 5/4 moist) sandy loam, structureless, single grain; friable when moist; diffuse boundary.
C2	50-55	Dull yellowish brown (10YR 5/4) sandy loam, old alluvium.

The A horizon is brown to dark brown, hue ranges from 10YR to 7.5YR, value of 3, chroma of 2 through 4. The B1 horizon is typically a clay loam with color from brown to reddish brown and hue from 10YR to 7.5YR. The texture of the B2t horizon is typically a sandy clay. Color of the B2t horizon ranges from strong brown through reddish brown, hue from 10YR through 5YR. The B3 horizon is a light sandy clay loam to sandy loam grading into the sandy loam C horizon. The C horizon is composed of old alluvial sediments.

Teller Loam, 1-3% Slopes (8B)

This mapping unit is very similar to the one described above but was separated by slope. The typical soils of this mapping unit have A horizons which range from 13 to 18 inches in thickness. However, there are approximately 2 to 4 acres within which there are extra thick mollic epipedons up to 28 inches thick. A small area on the north end of this unit has a nearly level slope.

Teller Loam 1-3% Slopes, Slightly Eroded (8B-2)

This mapping unit consists of soil similar to those described above for the Teller loam mapping unit (8A). As much as 15 to 25 percent of the surface soil was lost by erosion before terracing was implemented. The A horizon ranges from 9 to 16 inches deep. The B2t horizon in this mapping unit is not as thick as it is on the more level areas. These soils are well suited for small grains, sorghums, cotton, legumes, and grasses.

Zaneis Loam, 1-3% Slopes (9B)

This mapping unit consists of reddish brown soils which occur on the west facing convex slope of the northwest 1/4 of the station where the mantle thins over the Permian Redbeds. These soils have a brown to dark brown A horizon 10 to 14 inches thick. The dominant texture of the A horizon is loam. These soils have a reddish-yellow sandy clay loam B2t horizon which becomes very hard when dry.

Zaneis soils are naturally well drained. Internal drainage is medium, permeability is slow, and water-holding capacity is high. Natural fertility is moderately high. The principle crop of Zaneis soils is winter wheat, but they are well suited to oats, barley, sorghum, cotton, legumes, and grasses. Good management is needed to control erosion and maintain soil structure and fertility.

The following profile was sampled at about the center of the northwest 1/4 of Section 36, T18N, R2E, or the west end of 1000 series, Payne County. Laboratory and graph analyses are included in Table X and Figure 10.

TABLE X

CHEMICAL AND PHYSICAL ANALYSES OF ZANEIS LOAM, 1-3% SLOPES (9B)

FIELD SOIL TYPE OR PHASE: ZANEIS LOAM

SOIL CLASSIFICATION: UDIC ARGIUSTOLLS, FINE-LOAMY, MIXED, THERMIC

LOCATION: ABOUT CENTER OF NW. 1/4 OF SEC. 36-T18N-R2E,
OR W. END OF 100 SERIES. PERKINS FARM, PERKINS, PAYNE COUNTY.

SAMPLER: DALE ROGERS DATE: MAY 12, 1969

PROFILE DESCRIPTION:

SAMPLE NUMBER	HORIZON	DEPTH	THICKNESS	COLOR (M)	TEXTURE	STRUCTURE	CONSISTENCE
69-OK-60-11- 1	AP	0- 7"	7	7.5YR 4/2	L	1MGR	MFR
69-OK-60-11- 2	A1	7- 11"	4	7.5YR 3/2	L	2MGR	MFR
69-OK-60-11- 3	B1	11- 17"	6	7.5YR 4/2	CL	2MGR	MFR-MFI
69-OK-60-11- 4	B21T	17- 26"	9	7.5YR 4/5	SC	1CPR-1MSBK	MFI
69-OK-60-11- 5	B22T	26- 44"	18	7.5YR 5/5	SC	1PR-1MSBK	MFI
69-OK-60-11- 6	B31	44- 60"	16	7.5YR 5/6	VFSL	1CPR	MFR

CHEMICAL DATA: ANALYST: JIM FORD

	PH1:1			EXTRACTABLE CATIONS,MEQ/100 GMS						%BASE SATURATION		%	P.P.M.
SAMPLE NUMBER	H2O	KCL	CEC	H	CA	MG	K	NA	AL	NAAC	SUM OF CAT.	OM	TOTAL P
69-OK-60-11- 1	6.1	5.3	9.2	2.70	3.10	3.80	0.57	0.05	0.41	82.1	73.7	1.87	250.8
69-OK-60-11- 2	5.2	4.5	11.0	2.51	5.30	3.00	0.48	0.07	0.09	80.3	77.9	1.76	225.3
69-OK-60-11- 3	5.6	4.9	11.8	2.22	6.50	1.20	0.40	0.09	0.00	69.5	78.8	1.59	225.3
69-OK-60-11- 4	6.0	5.2	15.6	3.69	7.70	5.00	0.47	0.10	0.00	85.1	78.3	1.32	175.2
69-OK-60-11- 5	5.9	5.3	14.2	2.70	6.90	5.20	0.44	0.12	0.00	89.2	82.5	0.67	175.2
69-OK-60-11- 6	6.2	5.2	10.9	3.69	4.90	4.00	0.35	0.12	0.00	85.9	71.8	0.26	125.0

PHYSICAL DATA: ANALYST: JIM FORD

						% SAND SUBFRACTIONS				
SAMPLE NUMBER	%SAND	%SILT	%CLAY	TEXTURE	%>2MM	%VCS	%CS	%MS	%FS	%VFS
69-OK-60-11- 1	38.0	47.0	15.0	L	0.0	0.0	1.3	7.7	8.7	20.4
69-OK-60-11- 2	38.2	41.8	20.0	L	0.0	0.2	1.3	9.0	12.5	15.3
69-OK-60-11- 3	34.7	44.0	21.2	L	0.0	0.3	1.3	8.0	11.7	13.6
69-OK-60-11- 4	36.0	38.9	25.0	L	0.0	0.5	1.4	8.2	11.7	14.4
69-OK-60-11- 5	54.5	23.0	22.5	SCL	0.0	0.1	2.6	15.5	19.5	17.0
69-OK-60-11- 6	66.4	16.1	17.5	SL	0.0	0.1	4.7	20.5	24.2	17.1

INTERPRETIVE CALCULATIONS:

			CLAY FREE PARTICLE SIZE DISTRIBUTION					
SAMPLE NUMBER:	CA/MG	CEC/CLAY	% SILT	% VCS	% CS	% MS	% FS	% VFS
69-OK-60-11- 1	0.82	61.33	55.29	0.00	1.53	9.06	10.24	24.00
69-OK-60-11- 2	1.77	55.00	52.25	0.25	1.63	11.25	15.63	19.13
69-OK-60-11- 3	5.42	55.66	55.84	0.38	1.65	10.15	14.85	17.26
69-OK-60-11- 4	1.54	62.40	51.87	0.67	1.87	10.93	15.60	19.20
69-OK-60-11- 5	1.33	63.11	29.68	0.13	3.35	20.00	25.16	21.94
69-OK-60-11- 6	1.22	62.29	19.52	0.12	5.70	24.85	29.33	20.73

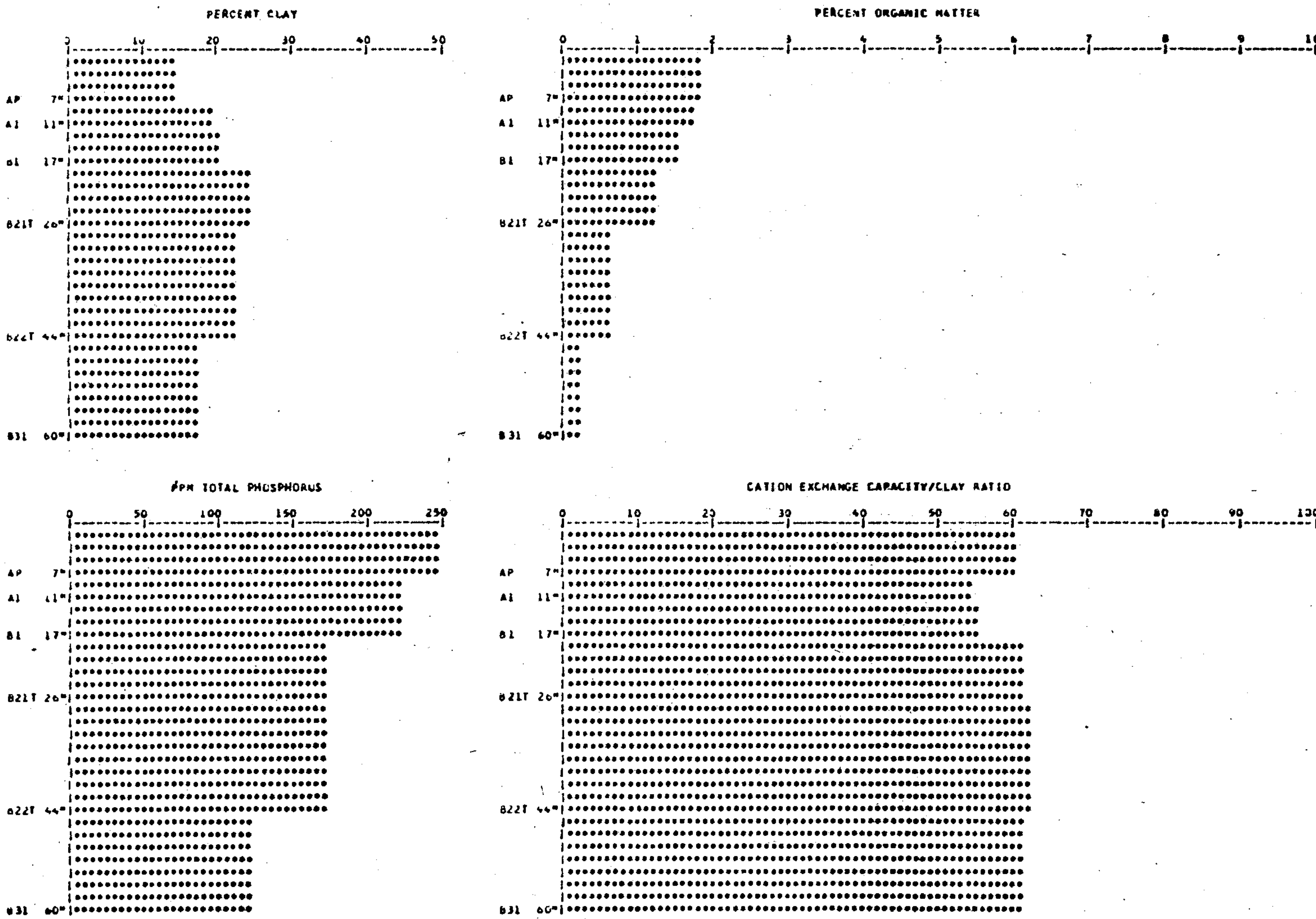

Figure 10. Graph Analyses of Zaneis Loam (9B) Profile No. 11

Horizon	Depth (Inches)	Description*
Ap	0-7	Brown (7.5YR 5/3; 4/2, moist) loam, weak medium granular structure; friable; pH 7.0; changes abruptly to horizon below.
A1	7-11	Dark brown (7.5YR 4/3; 3/2, moist) loam, moderate medium granular structure; friable; porous; pH 6.5; many worm holes and pockets of worm casts; many fine pin holes; gradual to the horizon below.
B1	11-17	Brown (7.5YR 5/3; 4/2, moist) clay loam, moderate medium granular structure; friable to firm; hard; pH 6.5; many pin holes and worm casts; gradual to the horizon below.
B21t	17-26	Reddish-brown (7.5YR 5/5; 4/5, moist) sandy clay mottled with yellowish red, compound weak coarse prismatic and weak, medium subangular blocky structure; firm; hard; pH 6.5; black concretions; gradual to horizon below.
B22t	26-44	Reddish-yellow (7.5YR 6/6; 5/5, moist) light sandy clay mottled with about 10% yellowish-red and strong brown, compound weak prismatic and weak medium subangular blocky structure; firm; hard; pH 6.5; occasional fine pores, fine black concretions and ferruginous and clay films; becomes more sandy in the lower portions and diffuses to the horizon below.
B31	44-60	Reddish-yellow (7.5YR 6/6; 5.5/6, moist) heavy very fine sandy loam, weak coarse prismatic; friable; pH 6.5; contains a few seams of sandy clay loam; occasional black concretions and a few ferruginous and patchy clay films; grades to the layer below.
C	60-84	Reddish-yellow (7.5YR 7/6; 6/6, moist) very fine sandy loam with occasional yellowish-red sandy clay loam seams, pH 7.0; occasional medium black concretions and ferruginous films. In the lower part there are compact sandy seams with dark reddish-brown coatings which crush yellowish-red; grades to layer below.
IIC	84-88+	Weakly consolidated non-calcareous sandy loams of Permian Redbeds.

The following additional profile of Zaneis loam was sampled 600 feet southeast of the northwest corner of Section 36, T18N, R2E, Payne County. Laboratory and graph analyses are included in Table XI and Figure 11.

Horizon	Depth (Inches)	Description*
Ap	0-6	Dark brown (7.5YR 3/2) loam, weak platey, weak medium granular, and weak medium subangular blocky structure; friable; many fine roots; common worm casts; abrupt smooth boundary.
A3	6-17	Dark brown (7.5YR 3/2) loam, moderate medium granular and moderate medium subangular blocky structure; friable; many fine roots; common worm casts; gradual smooth boundary.
B1	17-26	Brown (7.5YR 4/4) sandy clay loam with distinct dark reddish brown (5YR 3/4) mottles; compound moderate coarse prismatic and moderate medium subangular blocky structure; friable; common fine roots; few worm casts; gradual smooth boundary.
B2t	26-36	Yellowish red (5YR 4/6) sandy clay loam with prominent dark reddish brown (5YR 3/4) mottles; moderate coarse prismatic and moderate medium subangular blocky structure; friable; moderate continuous clay films; few fine roots; diffuse smooth boundary.
B3	36-42	Reddish yellow (7.5YR 5/5) sandy clay loam with distinct yellowish red (5YR 4/6) mottles; weak coarse prismatic and weak medium subangular blocky structure; diffuse smooth boundary.
IIC	42+	Red (2.5YR 4/6) Permian Redbeds.

The color of the A horizon is brown to dark brown hue 7.5YR, value from 4 to 3, and chroma from 2 to 3. Texture is mainly loam. The texture of the B1 horizon is heavy loam to clay loam, and the color is brown in hue 7.5YR. The color of the B2t horizon is reddish brown to

TABLE XI

CHEMICAL AND PHYSICAL ANALYSES OF ZANEIS LOAM, 1-3% SLOPES (9B)

FIELD SOIL TYPE OR PHASE: ZANEIS LOAM

SOIL CLASSIFICATION: UDIC ARGIUSTOLLS, FINE-LOAMY, MIXED, THERMIC

LOCATION: 600' S.E. OF N.W. CORNER OF SEC. 36-T18N-R2E,
PERKINS FARM, PERKINS, PAYNE COUNTY.

SAMPLER: DALE ROGERS DATE: MAY 12, 1969

PROFILE DESCRIPTION:

SAMPLE NUMBER	HORIZON	DEPTH	THICKNESS	COLOR (M)	TEXTURE	STRUCTURE	CONSISTENCE
69-OK-60- 5- 1	AP	0- 6"	6	7.5YR 3/2	L	1MGR-1MSBK	MFR
69-OK-60- 5- 2	A3	6- 17"	11	7.5YR 3/2	L	2MGR-2MSBK	MFR
69-OK-60- 5- 3	B1	17- 26"	9	7.5YR 4/4	SCL	2CPR-2MSBK	MFR
69-OK-60- 5- 4	B2T	26- 36"	10	5.0YR 4/6	SCL	2CPR-2MSBK	MFR
69-OK-60- 5- 5	B3	36- 42"	6	7.5YR 5/5	SCL	1CPR-1MSBK	MFR

CHEMICAL DATA: ANALYST: JIM FORD

SAMPLE NUMBER	PH1:1 H2O	PH1:1 KCL	CEC	EXTRACTABLE CATIONS, MEQ/100 GMS H	CA	MG	K	NA	AL	BASE SATURATION NAAC	SUM OF CAT.	% OM	P.P.M. TOTAL P
69-OK-60- 5- 1	6.1	5.1	9.2	4.69	3.30	3.40	0.45	0.04	0.00	78.5	60.6	1.98	196.3
69-OK-60- 5- 2	5.6	4.9	11.6	6.50	5.40	3.60	0.26	0.09	0.00	80.9	59.0	1.85	180.3
69-CK-60- 5- 3	5.8	4.9	12.2	2.78	5.40	4.70	0.33	0.11	0.00	86.3	79.7	2.00	138.1
69-OK-60- 5- 4	5.9	5.0	12.1	4.98	6.30	4.30	0.38	0.11	0.00	91.6	69.0	1.50	101.8
69-OK-60- 5- 5	6.3	5.2	11.9	5.02	5.70	5.20	0.42	0.13	0.00	96.3	69.6	0.23	80.0

PHYSICAL DATA: ANALYST: JIM FORD

SAMPLE NUMBER	%SAND	%SILT	%CLAY	TEXTURE	%>2MM	% SAND SUBFRACTIONS %VCS	%CS	%MS	%FS	%VFS
69-OK-60- 5- 1	49.7	17.8	32.5	SCL	0.0	0.2	1.2	9.8	18.5	20.3
69-OK-60- 5- 2	45.4	20.2	34.4	SCL	0.0	0.0	1.1	8.9	17.3	18.3
69-OK-60- 5- 3	47.9	15.8	36.3	SC	0.0	0.0	1.2	9.9	18.8	18.2
69-OK-60- 5- 4	54.9	8.2	36.9	SC	0.0	0.0	1.7	11.0	22.8	19.6
69-OK-60- 5- 5	46.1	23.8	30.0	SCL	0.0	0.1	0.5	4.8	17.7	23.2

INTERPRETIVE CALCULATIONS:

SAMPLE NUMBER:	CA/MG	CEC/CLAY	CLAY FREE PARTICLE SIZE DISTRIBUTION % SILT	% VCS	% CS	% MS	% FS	% VFS
69-OK-60- 5- 1	0.97	28.31	26.37	0.15	1.78	14.52	27.41	30.07
69-OK-60- 5- 2	1.50	33.72	30.79	0.00	1.68	13.57	26.37	27.90
69-OK-60- 5- 3	1.15	33.61	24.80	0.00	1.88	15.54	29.91	28.57
69-OK-60- 5- 4	1.47	32.79	13.00	0.00	2.69	17.43	36.13	31.06
69-CK-60- 5- 5	1.10	39.67	34.00	0.14	0.71	6.86	25.29	33.14

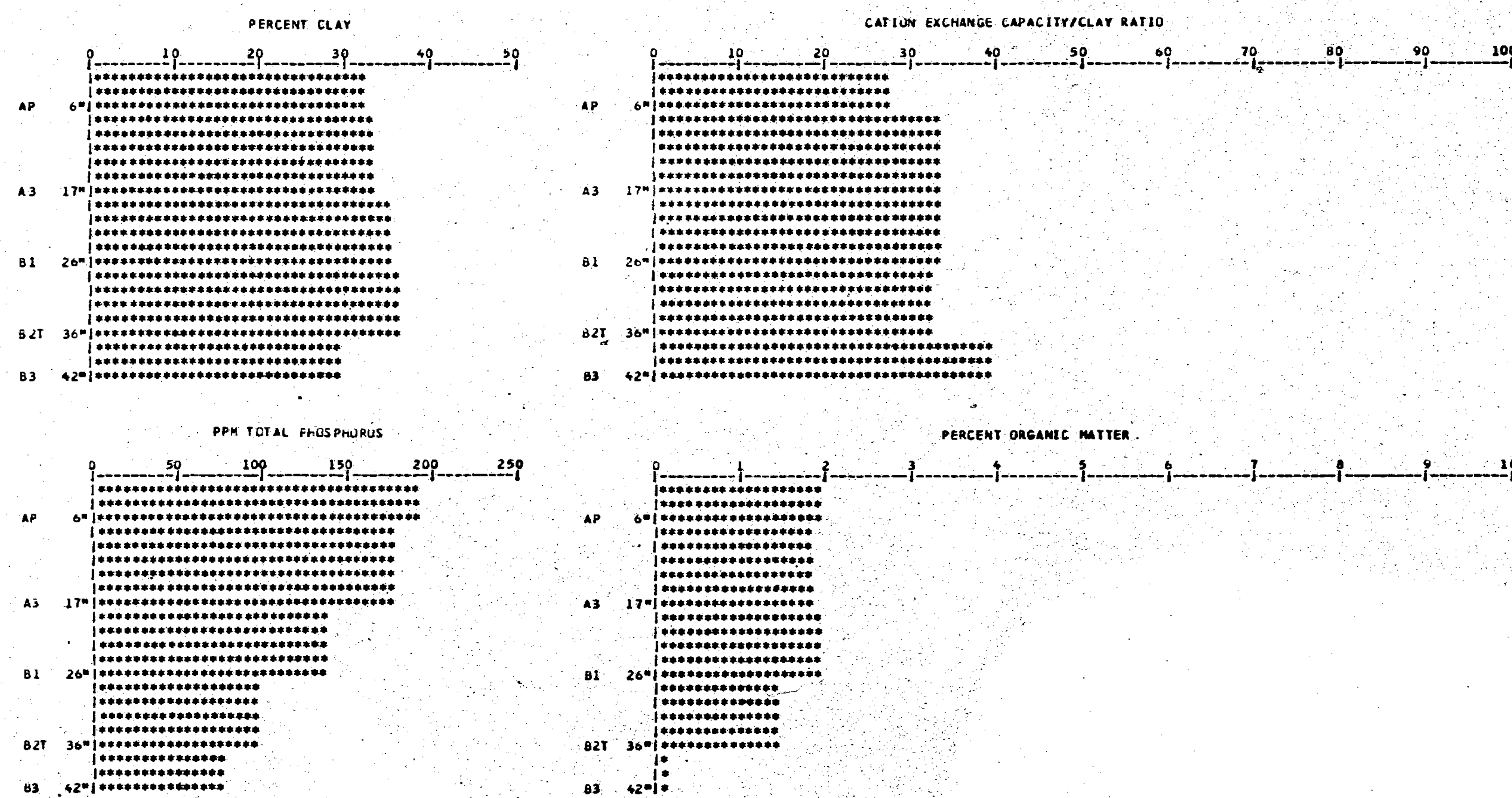

Figure 11. Graph Analysis of Zaneis Loam (9B) Profile No. 5.

reddish yellow in hue 7.5YR with value of 6 to 4 and chroma of 5 to 6. Clay content of the B2t horizon ranges from 25 to 36 percent. The higher values for clay occur where the Permian is relatively close to the surface. The C horizon is composed of old alluvial sediments or highly weathered Permian materials.

Zaneis Loam, 3-5% Slopes (9C)

This mapping unit is very similar to the one described above. These soils occur on gently to moderately sloping convex slopes and have high natural fertility, but they are subject to water erosion when tilled. There are several localized slickspots within this mapping unit.

Carwile Fine Sandy Loam, 0-1% Slopes (10A)

Carwile fine sandy loam occupies a depressional area on the southeast corner of the station. There is no natural water outlet which results in the area being ponded for long periods during the year. This soil has apparently developed from alluvial materials deposited when ponding occurred. This soil has a grayish colored clay or sandy clay B horizon mottled with yellowish brown and dark brown. Vegetation consists of johnsongrass, purple lovegrass, rosin weed, and some bermudagrass. Carwile soils are somewhat poorly drained. Runoff is slow to very slow, and water commonly ponds on the surface. Wind erosion is a hazard due to the sandy nature of the surface. These soils are moderately high in natural fertility. Profiles sampled in the field were very similar to the one described in the previous survey. Therefore, the description of the Carwile soils from that survey is reproduced here. This profile of Carwile fine sandy loam was sampled 300 feet north and 330 feet west of the southeast corner of Section 36, T18N, R2E, Payne County.

Horizon	Depth (Inches)	Description
A11	0-13	Light brownish-gray (10YR 6/2; 4/2, moist) fine sandy loam, structureless to very weak granular; friable; permeable; pH 6.5; grades to the layer below.
A12	13-20	Light gray (10YR 7/2; 5/2, moist) fine sandy loam mottled with yellowish-brown, weak medium granular; permeable; pH 7.0; contains many fine pores and a few very fine black concretions; rests abruptly on the B21t layer.
B21t	20-30	Light brownish-gray (2.5YR 6/2; 4/1, moist) clay mottled with strong brown, weak coarse blocky; compact; extremely firm; very slowly permeable; pH 8.0; sides of peds have a weak shine; numerous black concretions; at 24 inches is a layer of dark gray clay slightly more compact than that above; grades to the layer below.
B22t	30-42	Gray (10YR 5/1; 4/1, moist) clay with a few dark brown specks and mottles, weak coarse blocky; very compact; very slowly permeable; pH 8.0; concretions of $CaCO_3$ become numerous below 30 inches; grades shortly to the layer below.
C	42-72+	Light gray (10YR 6/1; 5/1, moist) light clay streaked with light brownish-gray (2.5Y 6/2), moderate fine subangular blocky; firm but crumbly when moist; hard dry; pH 8.0; contains a number of fine pin holes and occasional fine roots.

Surface layers are 16 to 26 inches deep. Mottling occurs approximately 10 inches deep and continues throughout the profile. Texture of the A horizon ranges from loam to fine sandy loam. Colors are dark grayish brown to light brownish gray to light gray, hue 10YR. The B2t horizon is grayish-brown to gray clay that is mottled with varying shades of browns, grays, and reds.

Carwile Fine Sandy Loam, 1-3% Slopes (10B)

These soils are similar to the description given above. They occur on nearly level to gently sloping areas along drainageways where natural drainage is poor. The soils in this mapping unit are not ponded as frequently as those on the zero to one percent slopes. Surface soils are thinner than on the one described above, and subsoil textures are less clayey.

Wet Clayey Alluvial Land, 0-1% Slopes (11A)

This mapping unit consists of soils which probably developed from an old oxbow of the Cimarron River. These soils are poorly drained and are ponded most of the year. Surface soils are grayish-brown clay loams or clays over clayey subsoil. The profiles are highly stratified and vary from location to location. Sedge and smartweed are a major part of the vegetation.

The following profile of Wet clayey alluvial land was described 2310 feet west and 180 feet north of the southeast corner of Section 36, T18N, R3E, Payne County.

Horizon	Depth (Inches)	Description
A11	0-14	Very dark grayish brown (10YR 3/2 moist) silty clay loam streaked with light brownish gray (2.5Y 6/2) mottles; moderate fine subangular blocky structure; firm; gradual smooth boundary.
A12	14-31	Very dark grayish brown (10YR 3/2 moist) silty clay streaked with light brownish gray (2.5Y 6/2) mottles; strong medium subangular blocky structure; firm, abrupt boundary.

Horizon	Depth (Inches)	Description
C1	31-40	Strong brown (7.5YR 5/8 moist) sandy loam stratified with sandy clay loam, with pale gray mottles; massive; friable.
C2	40±	Strong brown (7.5YR 5/8 moist) very fine sandy loam stratified with silt loam, slightly mottled with light olive brown and pale gray; massive; friable.

Varying shades of red and brown mottles occur throughout the profile, hue varies from 2.5YR to 7.5YR. The C horizon is predominantly fine sandy loam stratified with sandy clay loam and silt loam. These soils are too wet for cultivation under natural conditions.

*Textures are those described in the field; final correlation of soil phases was based on particle size analyses from the Soil Classification Laboratory, Oklahoma State University.

Physical and Chemical Properties of the Soils

The surface texture of the Zaneis soils (Tables X and XI) is loam. The clay content (Figures 10 and 11) of the surface soil of profile No. 11 is 15 percent and up to 32* percent in profile No. 5. Clay content of the subsoil for the two profiles ranges from 20 percent to 36.9* percent.

Chemically, the Zaneis soils are slightly acid in the surface horizons; the subsoil ranges from medium to strongly acid. Organic matter is medium to medium plus and in general decreases with depth (17). Base saturation of profile No. 5 of Zaneis loam is 78.5 percent in the surface and increases with depth. The dominant cation in the A horizon is hydrogen with calcium being second. Calcium is dominant in the remainder of the profile. Base saturation of profile No. 11 of Zaneis loam is about 81 percent in the A horizons, drops to approximately 70 percent in the B1 horizon, and then remains around 87 percent. The dominant cation in the surface is magnesium while calcium is dominant throughout the rest of the profile. The cation exchange capacity of the two Zaneis soils is moderately low.

The surface textures of the Farnum soils (Table VIII, Figure 8) is silt loam with slightly more than 50 percent of the particles being silt size. Very fine sand is the dominant sand subfraction in the first 28 inches with fine sand dominant in the remaining part of the profile.

Chemically, the Farnum soils are slightly acid in the upper 28 inches, and the remaining part of the solum is moderately acid. Organic matter is medium in the surface and decreases with depth. The cation exchange capacity of the soils is approximately 6.5 in the lower horizons and around 18 in the area with the heaviest clay accumulation. Cation exchange capacity is approximately 10 in the surface horizon. Base saturation by sodium acetate is over 70 percent in all horizons, and the dominant cation is calcium.

The Teller soils (Table IX, Figure 9) are moderately acid to slightly acid. Organic matter is low to medium in the surface and decreases with depth. Cation exchange capacity in these soils is moderately low, i.e., approximately 12. Base saturation by sodium acetate is 60 percent or greater, and the dominant cation is calcium. Maximum clay content ranges from 22 to 25 percent.

The Konawa soils (Tables III, IV, and V; Figures 3, 4, and 5) are sandy on the surface with 50 to 75 percent of the particle sizes being sand. Clay content ranges from 8.8 to 16.6 percent in the Ap horizons and up to 25 percent in the B2t horizons.

Chemically, the Konawa soils are slightly to strongly acid in the surface and remain medium to slightly acid in the remaining horizons. Profile No. 2 is neutral in the lower horizons. The Konawa soils are low to medium in organic matter in the surface horizon and decrease with depth. The percent base saturation of Konawa soils by sodium acetate is over 50 percent and generally runs over 75 percent base saturation which is the limit for this series. The dominant cation is calcium. The cation exchange capacity of these three soils is low to moderately low.

The Dougherty soils (Table VI, Figure 6) have fine sandy loam surface textures. The clay content of these soils is eight to nine percent in the surface horizon with a maximum clay content of approximately 23 percent in the subsoil.

The Dougherty soils are approximately the same pH as the Konawa soils. This more sandy soil is lower in organic matter, approximately one percent in the surface layer, than the Konawa soils. The base saturation by sodium acetate is 77.6 percent in the surface, up to 93.4 percent in the A2 horizon, and then remains between 65 and 70 percent throughout the remainder of the profile. The dominant cation is magnesium.

The surface texture of the Eufaula soils (Table VII, Figure 7) is fine sandy loam. This very sandy soil has a clay content of approximately 13 percent in the A horizons and 26 percent in the B horizons. Fine sand is the dominant sand subfraction.

Chemically, Eufaula fine sandy loam is slightly acid in the surface horizon. The remaining portion of the A horizon is neutral to mildly alkaline. The B2t and B3 horizons are medium acid to slightly acid. Organic matter of this soil is low in the surface and decreases with depth. Base saturation by sodium acetate averages approximately 76 percent in the A horizons and drops to 50.7 and 42.3 in the B2t and B3 horizons, respectively. The dominant cation is calcium. Cation exchange capacity in these soils is low.

*This high clay content may be due to poor dispersion.

Clay Mineralogy of the Soils

The X-ray diffraction patterns for the A, B, and C horizons of the Zaneis soil (profile No. 11) are given in Figure 12. The coarse clay maxima of the A horizon at 9.71 and 9.9A° indicate very good crystalline structure of micaceous material (illite). The 7.19A° maximum reflects the presence of kaolinite. There is some second-order kaolinite at 3.59A°. The 14.5A° maximum points out that possibly montmorillonite, soil vermiculite, or chlorite is present. The maximum at 4.22A° suggests that third-order soil vermiculite is present while the 3.59A° maximum also demonstrates that there is possibly some forth-order soil vermiculite present. Interstratified montmorillonite and third-order mica by the maximum at 4.33A°. Well crystallized quartz is indicated by the 3.35 and 4.29A° maxima.

The coarse clay fraction consists of more crystalline clay minerals than do the fine clays as manifested by the intensity of the peaks. The fine clay maximum at 22.04A° in the magnesium-saturated sample suggests that there is considerable low angle scatter due to interstratified and interlayered montmorillonite; however, this does not show up in other treatments. At 10.64A° interstratified mica appears in the magnesium-saturated sample, but a very well crystallized

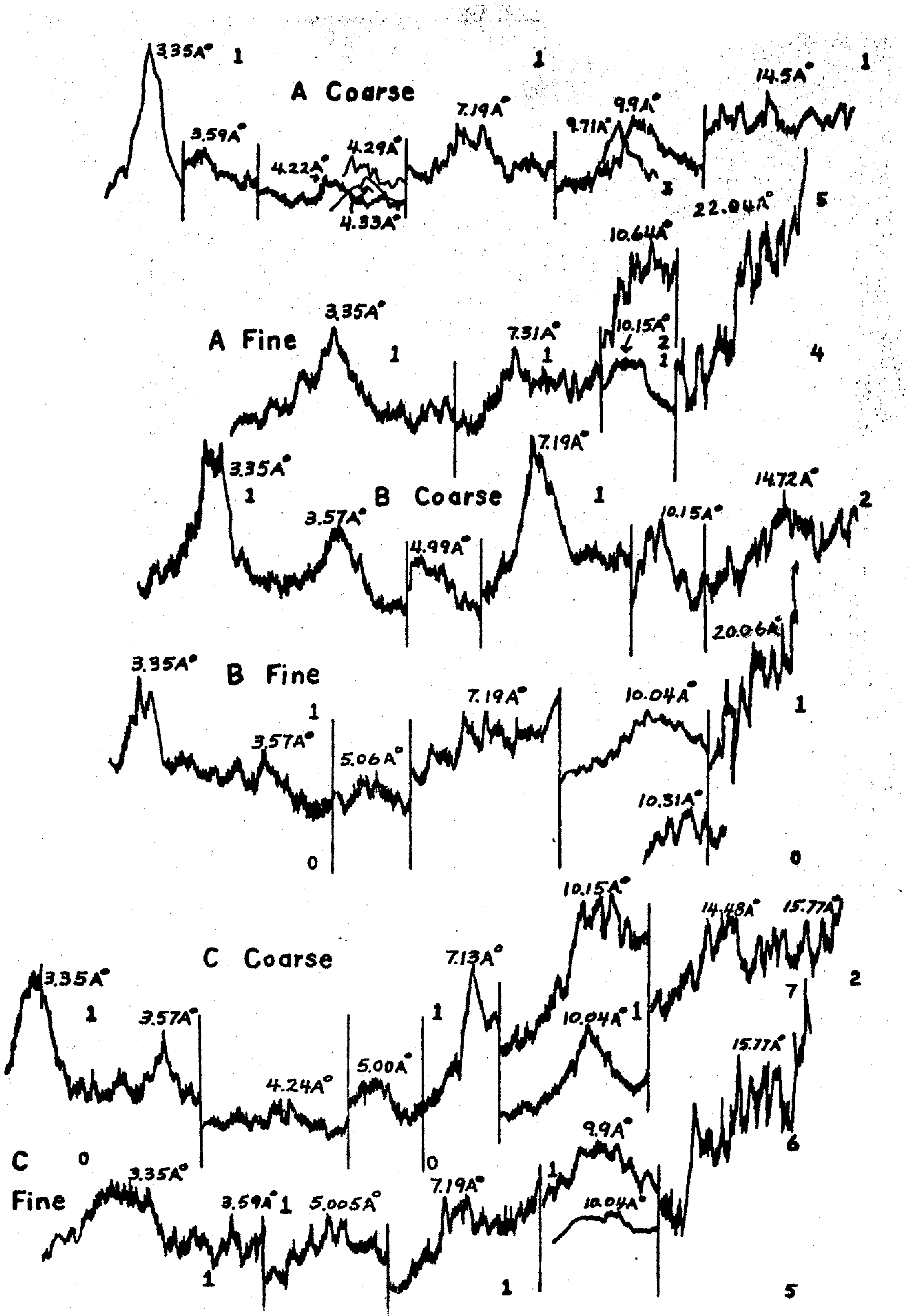

Figure 12. X-ray Diffractographs of Zaneis (Profile No. 11) Showing Patterns for Coarse and Fine Clay in A,B and C Horizons.

mica is suggested at 10.15A° in the heated sample. A poorly crystallized kaolinite is possibly disclosed by the 7.31A° maximum in the magnesium-saturated sample and a 7.15A° in the glycerol-saturated sample. There is a very good quartz maximum at 3.35A°.

The B horizon shows more intense peaks than the A horizon. The coarse clay fraction predicts interstratified soil vermiculite and montmorillonite at 14.72A°, and a poor forth-order soil vermiculite at 3.57A° indicates that vermiculite makes up a larger part of the interstratified material. The 10.15 and 4.99A° maxima intimates a micaceous material (illite), and the 7.19A° maximum discloses some well crystallized kaolinite. Quartz is apparent from the 3.35A° maximum.

The fine clay fraction of the B horizon suggests minerals with low crystalline structure. The 10.31 and 10.04A° maxima indicate a micaceous interlayered material (illite-interlayered). Kaolinite is present as defined by the 7.19A° maximum. There is some interlayered and interstratified montmorillonite and soil vermiculite present as displayed by the maxima at 20.06, 5.06, and 3.57A°. The broad maximum at 3.35A° suggests some very fine quartz is present.

The coarse clay fraction of the C horizon has a broad maximum at 15.77A° which demonstrates that some interstratified soil vermiculite and montmorillonite are present. There is a good maximum at 14.48A° for soil vermiculite and a good second-order maximum at 7.13A°. The 7.13A° maximum also is indicative of the presence of kaolinite. There is a very good second-order kaolinite and forth-order soil vermiculite at 3.57A°. The presence of mica (illite) is suggested by the peak at 10.04A° and 10.15A°. There is a second-order mica (illite) at 5.00A°. Quartz is defined by the maxima at

3.35A° and 4.24A°.

The fine clay fraction shows some interstratified and interlayered montmorillonite and soil vermiculite around 15.77A°. Interstratified and poorly crystallized micaceous material is possibly expressed by the maximum around 10.04A° in the heated sample. There is a good maximum for mica (illite) at 9.9A° in the glycerol-solvated sample. A second-order maximum for mica (illite) at 5.005A° is present. There is a good 7.19A° maximum for kaolinite and a second-order maximum at 3.59A°. This may also be a forth-order of soil vermiculite. Quartz is present as shown by the 3.35A° maximum.

The X-ray diffraction patterns for the A, B, and C horizons of the Konawa soil (profile No. 2) are given in Figure 13. The coarse clay fraction of the A horizon has a good 10.04A° maximum for mica (illite) and a second-order maximum at 5.00A°. A good 7.18A° maximum demonstrates the presence of kaolinite. There are quartz maxima at 3.36 and 4.29A°. The fine clay fraction exhibits good 10.27A°, 5.00A°, and 9.9A° maxima for mica (illite). There is probably less than 5 percent kaolinite as hinted by the maximum at 7.18A°. The shape of the maximum at 3.35A° predicts that the quartz is fine and poorly crystallized.

The coarse clay fraction of the B horizon shows a broad maximum between 15.77 and 12.27A° which discloses that some interstratified montmorillonite and soil vermiculite is likely present. The maxima at 10.27 and the one at 5.00A° show the presence of micaceous material (illite). When the sample was heated, the maximum for mica (illite) was 10.04A°. Presence of kaolinite is indicated by maxima at 7.18, 3.57, and 7.25A°. Quartz is also present as proclaimed by the maxima

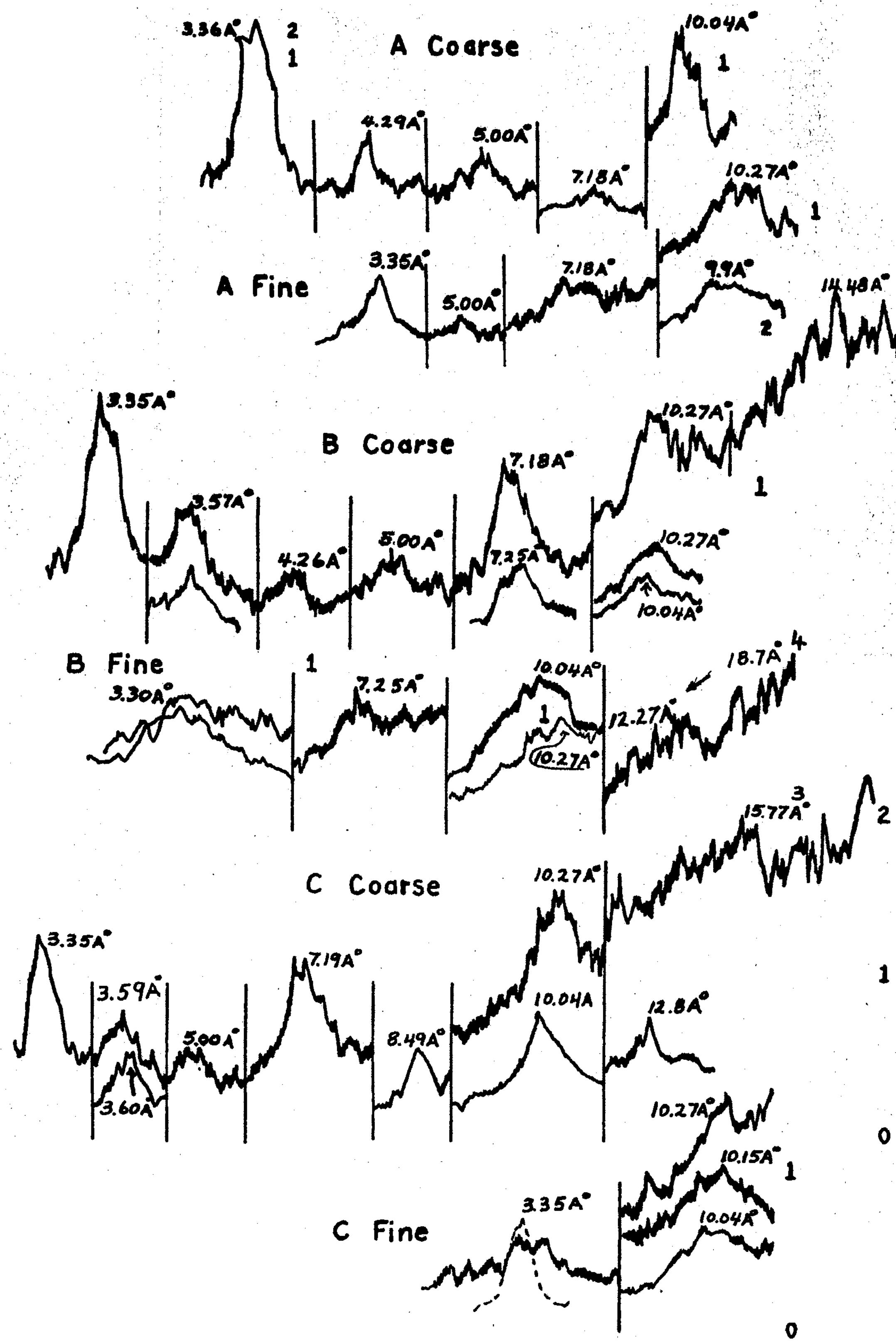

Figure 13. X-ray Diffractographs of Konawa (Profile No. 2) Showing Patterns for Coarse and Fine Clay in A,B and C Horizons.

at 4.26 and 3.35A°.

The X-ray diffraction curves for the fine clay fraction of the B horizon plainly shows that there is considerable interlayered montmorillonite between 12.27A° and 18.7A°. Mica (illite) is indicated by the peaks at 12.27A° and 10.04A°. There is some very fine kaolinite present as evidenced by the 7.25A° maximum. There is also some very fine, poorly crystallized quartz at the 3.30 and 3.35A° maxima.

X-ray diffraction patterns for the coarse clay in the C horizon is comparable with that of the B horizon. The broad maximum at 15.77A° predicts the presence of interlayered montmorillonite and soil vermiculite. The presence of these minerals are also indicated by maxima at 12.8, 8.49, and 3.6A°. The 10.04A° maximum is for mica (illite), and the 7.19 and 3.59A° maxima are for kaolinite. The 3.35A° maximum is characteristic for quartz. The diffraction patterns for the fine clay fraction shows the presence of mica (illite) at 10.27, 10.15, and 10.04A°. The 3.35A° maximum is again quartz.

Soil Genesis

Genesis of the Zaneis Soil (Mollisol)

This hypothesis assumes that development proceeds in a geomorphically stable upland site in moderately thick post-Permian alluvial and/or loessial sediments deposited over the older eroded Permian Redbeds. This approach of soil genesis for a Mollisol, Model 1 (Figure 14), is discussed below.

Minimal Stage of Soil Development. In the first stage, soil development begins with calcareous sandy loam interstratified with loam to clay loam. At this stage of development, no additions or deletions are assumed. Accumulation of organic matter is enhanced by the prairie vegetation. Addition of organic matter equals or exceeds losses so that a mollic epipedon is developed and maintained. The high carbonate content of the parent material acts as an inhibitor to the leaching of bases and weathering of silicate clays. However, carbonates are continually being transferred downward by leaching. Percolating water moving through the solum transfers some bases to the depth of water movement. Continuing carbonate and base removal under the prairie vegetation forms a weak cambic horizon and increase the thickness of the solum. This dominates the first stage of soil genesis. The surface remains predominantly alkaline due to the recycling of bases by the prairie vegetation.

Medial Stage of Soil Development. Reorganization of oxides into mineral coatings and negligible translocation of clays aid in increasing the expression of the thickening cambic horizon. The leaching process removes bases from the surface layer leaving it neutral to slightly acid, thus increasing the rate of weathering. The translocation of inherited fine clays are moved downward along root channels, cracks, and pores to a depth where they are redeposited with the evaporation of water. This gives rise to a minimal argillic horizon.

Maximal Stage of Soil Development. The maximal stage of soil development is strongly dependent on a stable, level relief. This provides a more humid microclimate which in turn aids in the weathering process. There is further loss of bases and a decrease in pH in the surface layer. However, predominance of exhcangeable cations inhibits many weathering processes. Thus, the recycling of bases probably impedes mineral weathering at or near the surface. Continued eluviation

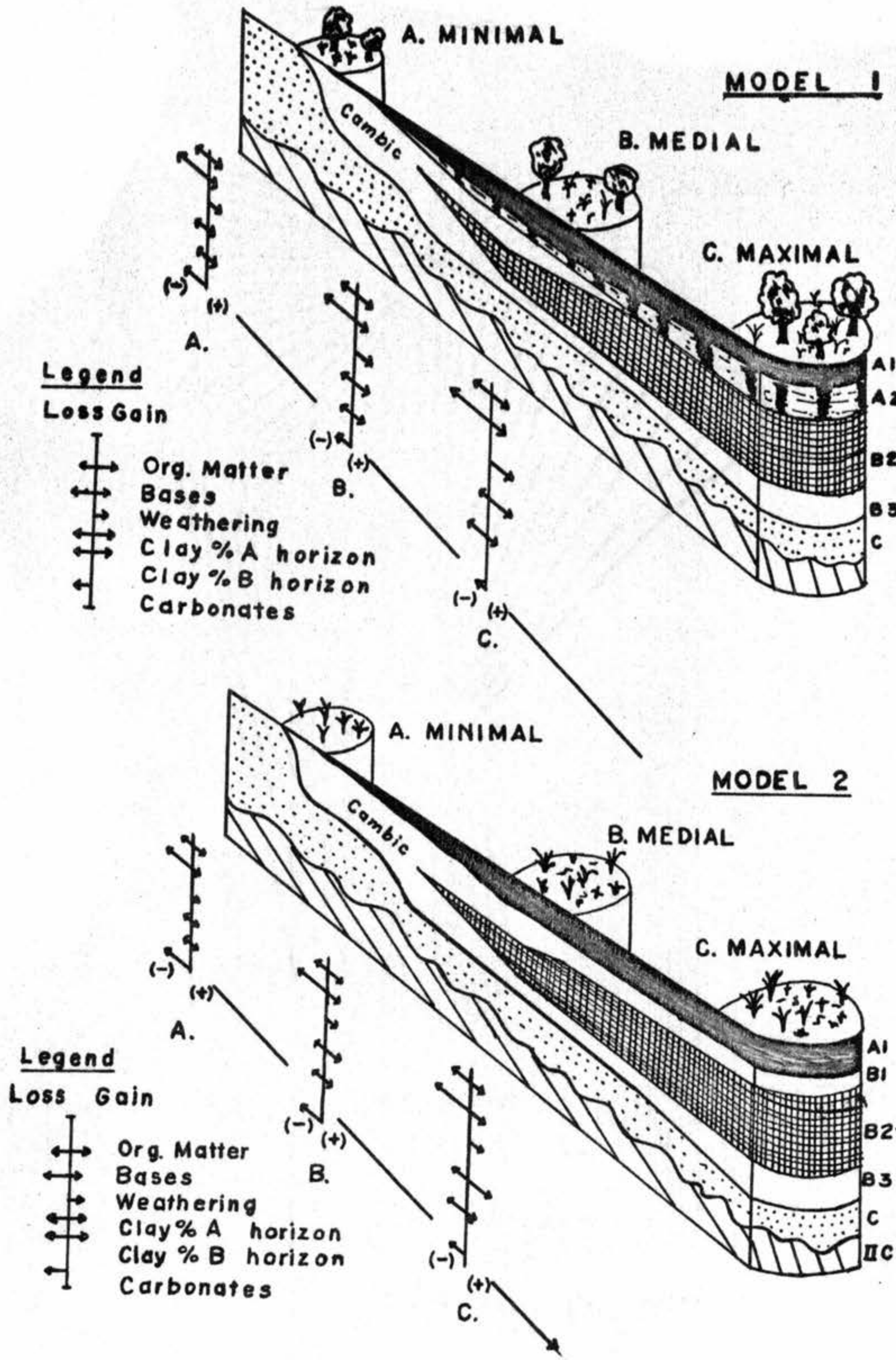

Figure 14. Proposed Hypothesis Illustrating Morphology Changes and Process Rates for An Alfisol (Model 1.) and A Mollisol (Model 2).

of clay and silt size particles, especially fine clay, promotes development of the argillic horizon. These processes characterize the maximal stage of development. As these processes continue, the fine clay blocks the small pores and channels and gives further expression to the argillic horizon. Since the lower horizon or parent material is coarser in texture, there is greater tension and water tends to be retained in the fine capillaries above. As the water evaporates or is withdrawn by roots, the suspended materials precipitate. It is in this stage that a definite clay bulge can be seen (Fig. 10) in the argillic horizon. The data on pH, cation exchange capacity, and particle size distribution (Table X) suggest that silicate clays have been physically translocated from the A horizon to the argillic horizon.

Genesis of the Konawa Soil (Alfisols)

It is assumed in this hypothesis that development also proceeds in a geomorphically stable upland site with no additions or losses of the initial parent material. Parent material is assumed to be the same as in the previous hypothesis. The changing soil properties result under the influence of deciduous forest and tall grass, probably approximating a true savannah vegetation. This approach of soil genesis for an Alfisol, Model 2 (Fig. 14), is discussed below.

Minimal Stage of Soil Development. Additions of organic matter almost equal losses, and an ochric epipedon develops and is maintained. Due to the high content of organic acids released by leaf litter, the net rate of base removal is faster under deciduous forest than under prairie grass. Losses due to weathering and translocation of clays and free iron and aluminum in the surface layer produce an albic horizon.

With continued leaching of bases and negligible amounts of clay from the moderately acid upper albic horizon, a "color B" or cambic horizon develops.

Medial Stage of Soil Development. Losses of bases continue to be greater than organic matter additions, and an ochric epipedon is maintained. Due to leaching, the albic horizon tends to migrate upward. Continued leaching of bases leaves the surface layer neutral to slightly acid. Negligible translocation of clays and reorganization of oxides into mineral coatings increases the thickness of the cambic horizon. The rate of weathering is increased due to the slightly acid condition of the surface. The inherited fine clays are moved downward along root channels, cracks, and pores to a depth where they are redeposited with the evaporation of water. As this process of illuviation continues, a minimal argillic horizon develops.

Maximal Stage of Development. Losses of bases continue to be greater than additions of organic matter, and the ochric epipedon is maintained. This is caused by the increased acidity of the surface layer. As continued eluviation of clays and silt size particles occurs, especially the fine clays, further development of the argillic horizon is promoted. The argillic horizon develops upward as the fine pores and channels are filled with the fine clays. Clay coatings can be found on sand particles and ped faces. The argillic horizon reaches its maximum development while the leaching action in the surface layer causes the A2 horizon to progress upward into the A1 horizon, reducing its thickness.

Use and Management of Soils

Use and Management Practices

The soils of the Perkins Agronomy Research Station are highly subject to wind and water erosion. Erosion claimed a portion of the west half of the station before the area was terraced. The east half of the farm is highly subject to wind erosion, and carefully selected management practices should be followed there.

Management is not only needed for controlling erosion but for maintaining a suitable level of organic matter, improving or maintaining tilth, and conserving soil moisture. Surface crusting may also require special attention. The most effective methods for controlling erosion in this area are tilling the soil as little as possible to maintain it in good condition, growing a winter cover crop, or strip-cropping. Other helpful practices would be growing grasses, legumes, or both in a long-term rotation with tilled crops, returning as much residue as possible to the soil and keeping it near the surface, constructing terraces, and farming on the contour. All waterways should be put into sod and constantly maintained. To minimize wind erosion on the sandy soils such as the Dougherty, Eufaula, and Konawa, overgrazing should be prevented; and plant residues should be used for protection.

Predicted Yields

The predicted yields (Table XII) for each crop-soil combination are based partly on records kept by the Oklahoma Agricultural Experiment Station on fertility studies, crop varieties, and crop rotation

TABLE XII

PREDICTED YIELDS FOR SELECTED CROPS ON THE SOILS LOCATED ON THE PERKINS AGRONOMY RESEARCH STATION

Map Symbol	Soil Phase	Slope Phase	Wheat C[4] Bu/A	Wheat I[4] Bu/A	Oats C Bu/A	Oats I Bu/A	Barley C Bu/A	Barley I Bu/A	Cotton C lbs/A	Cotton I lbs/A	Gr. Sorghum C lbs/A	Gr. Sorghum I lbs/A	Alfalfa C T/A	Alfalfa I T/A	Peanuts C bu/A	Peanuts I bu/A	Tame pasture: Common bermuda-grass C num[2]	Tame pasture: Common bermuda-grass I num[2]	Tame pasture: Improved bermuda-grass C	Tame pasture: Improved bermuda-grass I	Forage Sorghum as dry wt. C T/A	Forage Sorghum as dry wt. I T/A
1B	Konawa fsl	1-3	12	20	28	38	24	34	200	400	25	40	2.0	3.0	25	50	3.0	5.0	4.0	6.3	---	---
1B-3	Konawa fsl, mod. eroded	1-3	12	18	25	35	20	32	200	300	22	32	1.0	2.0	---	---	2.0	4.5	3.5	6.3	2.0	3.0
1C	Konawa fsl	3-5	---	---	26	38	---	---	200	325	24	40	1.5	2.3	22	45	3.5	5.6	5.3	7.0	---	---
1C-3	Konawa fsl, mod. eroded	3-5	---	---	24	34	---	---	160	275	20	33	---	---	15	30	2.1	4.5	3.0	6.3	---	---
1D	Konawa fsl	5-8	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
2B	Dougherty fsl	1-3	10	17	18	32	22	32	125	275	18	30	1.0	2.0	25	45	---	---	---	---	---	---
2C	Dougherty fsl	3-5	8	13	14	26	20	30	100	200	14	24	---	---	23	40	---	---	---	---	---	---
3B	Teller fsl	1-3	16	25	27	40	25	37	275	365	18	24	1.3	2.0	---	---	175[3]	275[3]	---	---	---	---
3C-3	Teller fsl mod. eroded	3-5	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
4A	Pulaski soils	0-1	12	24	25	40	25	40	220	300	20	35	1.7	3.0	---	---	---	---	---	---	---	---
5B	Eufaula fsl	1-3	9	16	16	30	14	22	---	---	17	23	---	---	12	18	---	---	---	---	1.5	2.0
6A	Farnum sil	0-1	21	31	40	45	35	48	300	400	32	48	3.0	4.0	27	47	---	---	---	---	---	---
8A	Teller loam	0-1	19	25	28	42	---	---	325	415	34	46	1.8	3.1	800[1]	1,300[1]	---	---	---	---	---	---
8B	Teller loam	1-3	17	24	24	38	---	---	290	375	28	40	1.4	2.5	700[1]	1,200[1]	---	---	---	---	---	---
8B-2	Teller loam, slightly eroded	1-3	17	24	24	38	---	---	290	375	28	40	1.4	2.5	700[1]	1,200[1]	---	---	---	---	---	---
9B	Zaneis loam	1-3	16	26	25	40	25	40	225	370	28	38	1.2	2.0	---	---	3.5	5.0	4.0	6.0	2.2	3.2
9C	Zaneis loam	3-5	14	24	23	38	21	33	170	260	26	36	---	---	---	---	3.2	4.3	3.5	5.5	2.0	3.0
10A	Carwile soils	0-1	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
10B	Carwile soils	1-3	14	20	---	---	18	28	---	---	22	35	---	---	---	---	---	---	---	---	1.5	2.5
11A	Wet clayey alluvial land	0-1	---	---	---	---	---	---	---	---	---	---	---	---	---	---	100[3]	175[3]	---	---	---	---

(1) lbs./acre.
(2) An animal unit - month is the number of months that one acre will provide grazing for 1 animal.
(3) Lbs. of beef.
(4) C = customary management, I = improved management

and tillage trials. The experiments have been conducted for many years on both permanent and experimental sites and on farmers' plots. Data were also taken from soil surveys of surrounding counties with similar soils. Many different cultural practices, varietal types, etc. are involved in these yield estimates so they may be considered as no more than rough indicators of the relative performance of these crops on these particular soils.

Capability Classification

The land use capability subclasses for the soils of the Perkins Agronomy Research Station are defined below and are shown for each mapping unit in Table XIII:

I-2 Deep nearly level, well drained, medium-textured soils on high alluvial benches.

I-3 Deep, nearly level, well-drained, medium-textured soils with a thick dark surface layer.

IIe-1 Deep, dark-colored, well drained, gently sloping soils that have a medium-textured surface layer.

IIe-2 Deep, dark-colored, well drained, nearly level and gently sloping soils that have a moderately coarse-textured surface layer.

IIe-4 Permeability of these soils is slow to moderately slow. These soils are deep and moderately deep, gently sloping to moderately sloping. The Permian material is within three feet of the surface in parts of this area.

IIw-1 Deep, frequently flooded soils of the local bottomlands that have a moderately coarse textured to moderately fine textured surface layer.

IIIe-1 Deep, dark-colored well drained, moderately sloping soils that have a moderately coarse-textured surface layer.

IIIe-2 Deep, well drained, nearly level to gently sloping soils that have a coarse-textured surface soil.

IIIe-3 The soils are similar to those in capability unit IIe-4, but they are subject to severe water erosion.

IIIe-4 Deep and moderately deep, well drained, brownish gently sloping soils on timbered upland.

IIIe-5 Deep and moderately deep, brownish, well drained, moderately sloping soils on timbered upland, moderately eroded.

IIIe-6 Deep to moderately deep, gently sloping soils on uplands which are well drained and have medium-textured surface layers.

IIIe-7 Deep and moderately deep, well drained, brownish, moderately to strongly sloping timbered upland.
IIIe-8 Deep and moderately deep, brownish, well drained gently sloping soils on oak-timbered uplands, moderately eroded.
IIIw-1 Nearly level to gently sloping soils with surface layers of fine sandy loam and very slowly permeable, mottled clayey subsoil. These are somewhat poorly drained and occur in depressions. Practices are needed to improve drainage and maintain fertility.
IVe-1 Deep, light-colored, well drained, moderately sloping to strongly sloping soils that have a coarse-textured surface layer and a moderately fine-textured subsoil.
IVe-2 Same as Unit IVe-1 except for moderate erosion.
IVe-3 Moderately deep and deep, dark-colored, well drained, moderately sloping soils with a moderately coarse-textured surface layer, moderately eroded and gullied.
IVs-1 Deep, brownish, somewhat excessively drained, level to very gently sloping sandy soils.
Vw-1 Frequently flooded land types that have a high water table and are on bottomlands with fine-textured materials over coarser-textured sediments.

Range Sites and Condition Classes

A range site is a distinctive kind of rangeland that is sufficiently uniform in climate, soil, and elevation to produce a particular type of climax vegetation. In the same pasture area, there may be several range sites with each range site requiring different stocking rates and different management practices.

The name of range sites for each given mapping unit can be found in Table XIII. A description of each type of site as taken from Soil Survey of surrounding counties with similar soils is given below.

Deep Sand Savannah Range Site. This range site consists of nearly level to strongly sloping loamy soils. These soils permit deep penetrations of roots which encourages growth of trees and woody plants. Post oak, blackjack oak, and other woody plants increase greatly if these areas are overgrazed. Where this site is in excellent condition, the estimated annual yield of air-dry herbage, except for trees and brush, is 3,800 pounds per acre in years of favorable moisture and 1,900 pounds per acre in years of unfavorable moisture.

Sandy Prairie Range Site. This range site occurs mostly in cultivated areas. It consists of soils that have a fine sandy loam surface

TABLE XIII

GUIDE TO THE MAPPING UNITS ON THE PERKINS AGRONOMY RESEARCH STATION

Map Symbol	Mapping Unit	Slope Phase	Acreage	Percent	Capability Unit	Range Site
1B	Konawa fine sandy loam	1-3	84.2	13.20	IIe-3	Deep Sand Savannah
1B-3	Konawa fine sandy loam, mod. eroded	1-3	12.5	1.10	IIIe-4	Deep Sand Savannah
1C	Konawa fine sandy loam	3-5	32.8	5.11	IIIe-7	Deep Sand Savannah
1C-3	Konawa fine sandy loam, mod. eroded	3-5	5.2	0.81	IIIe-5	Deep Sand Savannah
1D	Konawa fine sandy loam	5-8	16.4	2.61	IIIe-7	Deep Sand Savannah
2B	Dougherty Fine sandy loam	1-3	49.7	7.80	IIIe-2	Deep Sand Savannah
2C	Dougherty fine sandy loam	3-5	28.1	4.50	IVe-3	Deep Sand Savannah
3B	Teller fine sandy loam	1-3	73.1	11.40	IIe-2	Sandy Prairie
3C-3	Teller fine sandy loam, mod. eroded	3-5	6.3	1.00	IVe-3	Sandy Prairie
4A	Pulaski soils	0-1	16.5	2.57	IIw-1	Loamy Bottomland
5B	Eufaula fine sandy loam	1-3	19.0	2.96	IVs-1	Deep Sand Savannah
6A	Farnum silt loam	0-1	20.0	3.22	I-3	Loamy Prairie
8A	Teller loam	0-1	61.0	9.70	I-2	Loamy Prairie
8B	Teller loam	1-3	76-3	12.00	IIe-1	Loamy Prairie
8B-2	Teller loam, slightly, slightly eroded	1-3	89.0	14.00	IIe-1	Loamy Prairie
9B	Zaneis loam	1-3	16.3	2.60	IIe-4	Loamy Prairie
9C	Zaneis loam	3-5	6.7	1.10	IIIe-3	Loamy Prairie
10A	Carwile soils	0-1	10.6	1.70	IIIw-1	Sandy Prairie
10B	Carwile soils	1-3	7.8	1.22	IIIw-1	Sandy Prairie
11A	Wet clayey alluvial land	0-1	8.5	1.40	Vw-1	Wet Land
			640.0	100.0		

layer. The subsoil is somewhat finer textured and slows penetration of water. Prairie vegetation is most common, but some woody plants grow and increase if the range is not well managed. Big bluestem, little bluestem, and indiangrass are the principle grasses. Woody plants include elm, coralberry, and oak. Where this site is in excellent condition, the estimated yield of air-dry herbage is 4,800 pounds per acre in years of unfavorable moisture.

Loamy Prairie Range Site. This range site consists of nearly level to gently rolling soils. These soils generally have a loam or silt loam surface layer that is granular and porous. They are permeable to water, are easily penetrated by roots, and have good capacity for storing moisture. This is the most productive range site in the uplands. In areas in excellent condition, the climax vegetation is about 80 percent decreaser grasses, about 5 percent legumes and forbs and about 15 percent increasers. The decreaser grasses are mainly big bluestem, little bluestem, indiangrass, and switchgrass. The legumes and forbs include tickclover, leadplant, gayfeathers, and sunflower. Among the increasers are sideoats grama, tall dropseed, meadow dropseed, wild-indigo, and heath aster. Where the site is in excellent condition, the estimated annual yield of dry herbage is 5,000 pounds per acre in years of favorable moisture and 1,600 pounds per acre in years of unfavorable moisture.

Loamy Bottomland Range Site. This range site consists of deep, fertile, loamy soils on bottomlands. If this site is in excellent condition, vegetation consists of a mixture of tall grasses and woody plants. Among the tall grasses are eastern gramagrass, prairie cordgrass, big bluestem, switchgrass, broadleaf uniola, and wildryes. The woody plants include pecan, walnut, indigobush, and trumpet vine. In areas in excellent condition, grasses cover about 75 percent and woody plants cover the rest. The condition of the range declines to poor in some areas that have been cultivated and then abandoned because of flooding. In these areas the plant mixture consists mainly of johnsongrass, bermudagrass, pecan sprouts, trumpet vine, seacoast sumpweed, and other related plants. There are also some indiangrass, big bluestem, switchgrass, and purpletop. Where this site is in excellent condition, the estimated annual yield of air-dry herbage is 8,500 pounds per acre in years of favorable moisture and 4,500 pounds per acre in years of unfavorable moisture.

Wet Land. Wet clayey alluvial land is the only mapping unit in this range site. It is made up of sandy materials stratified with clays. The water table is high most of the year. The kinds of vegetation that can grow are limited by the excess of moisture. Purple lovegrass, rosin weed, johnsongrass, bushy bluestem, and some switchgrass grow in varying stands.

Management of Soils for Windbreaks and Post Lots

Much of the timber has been cleared from the Research Station to allow for the land to be used as crop land. The post-oak, blackjack oak forest itself is of little commercial value in the area. The trees which occur on the more sandy areas of the station help stabilize the soil and prevent loss of top soil. Careful management is required on these areas once the timber is removed.

Engineering Interpretations of Soils

Several soil properties are of special interest to engineers because they affect the construction and maintenance of roads, airports, pipelines, building foundations, water storage facilities, erosion control structures, drainage systems, and sewage disposal systems.

The properties which are most important to the engineer are permeability to water, shear strength, compaction characteristics, grain size, plasticity, and reaction. Topography, depth to water table, and depth to bedrock are also important.

Information in the Soil Survey can be used to:

1. Locate probable sources of gravel and other construction materials;
2. Make soil and land use studies that will aid in selecting and developing sites for industries, businesses, residences, and recreational areas;
3. Make preliminary estimates of the engineering properties of soils in planning of agricultural drainage systems, farm ponds, irrigation systems, and diversion systems;
4. Make preliminary evaluations of soil and ground conditions that will aid in selecting locations for highways, airports, pipelines, and cables and in planning detailed investigations

at the selected location;

5. Correlate performance of engineering structures with soil mapping units and thus develop information that will be useful in designing and maintaining the structure;
6. Determine the suitability of soil mapping units for cross-country movement of vehicles and construction equipment;
7. Supplement the information obtained from other published maps and from reports and aerial photographs for the purpose of making maps and reports that can be used readily by engineers; and
8. Develop other preliminary estimates for construction purposes (6).

This survey did not specifically include an on-site study of engineering properties of the soils encountered, but soil surveys of surrounding areas can be used as a general guide for estimated engineering properties and engineering interpretations of soils similar to the soils found on the Perkins Agronomy Research Station.

Comparison of the New Soils Map with the Previous One

The following section is a discussion of the changes which were made in soil units and the criteria involved in making these changes.

Portions of phases 3C-1, 3B-1, and 6B-1 of the Norge soils in the previous soil survey were changed to phases 9B and 9C of the Zaneis soils in the new survey. Norge is a Millisol which developed under the influence of native grasses. These soils belong to the subgroup Udic Paleustolls, and they are in the fine-silty textural family.

To be a "pale" soil, the soil must have a vertical clay distribution such that the clay does not decrease by 20 percent of the maximum clay content within 60 inches of the soil surface. However, the particle size analysis of profiles No. 5 and No. 11 (Tables X and XI) and clay content with depth (Figs. 10 and 11) show that there is, indeed, a 20 percent decrease in clay from the maximum clay content within 60 inches. Therefore, these soils should be classified in the Great Group of Argiustolls instead of Paleustolls (such as Norge). Also, the family textural grouping was used as criteria in changing the soil name from Norge to Zaneis. Particle size analyses of profiles No. 5 and No. 11 (Tables X and XI) indicated that both of these soils have 15 percent fine sand or coarser in the control section which places these soils in the fine-loamy textural family with Zaneis rather than in the fine-silty family with Norge.

Phases 10B-1, 10C-3, 10C-1, and the remaining portions of phases 6B-1 and 3B-1 of the Norge soils of the previous survey were changed to phases 8B, 8B-2, 3B, and 3C-3 of the Teller soils in the new survey. As stated above, Norge soils are in the Great Group of Paleustolls and belong to the fine-silty textural family. The particle size analysis of profile No. 10 (Table IX) and clay content with depth (Fig. 9) indicate that these soils have a greater than 20 percent decrease in clay content from the maximum within 60 inches. Therefore, these soils should not be classified as Paleustolls but as Argiustolls. Another classification criteria used was the family textural grouping. The particle size analysis of profile No. 10 (Table IX) demonstrates that there is more than 15 percent fine sand and coarser within the control section which prevents this soil from being in the fine-silty family. It is in the fine-loamy textural family, and it has been classified as

Teller. These soils have moderate permeability; whereas, the Zaneis and Norge soils are moderately slow in permeability.

Phase 1A-1 of the Vanoss soils of the old survey were changed to phase 6A of the Farnum soils and 8A of the Teller soils. The soils being considered as Farnum occur in an area that has possibly received depositon from above causing an extra thick surface layer which meets the color requirements of a mollic epipedon. This condition is known as "Pachic". The profile description of Farnum silt loam exhibits this characteristic. The dark thick layer is not typical of the Vanoss soils.

The textural family was also a criteria for changing the series name of this soil. Vanoss soils are fine-silty while Farnum soils are fine-loamy. Particle size analysis of profile No. 1 (Table VIII) indicates that this profile has 15 percent fine sand and coarser in the control section which definately establishes the profile as being fine-loamy.

The remaining area of phase 1A-1 of the Vanoss soils was changed to phase 8A of the Teller soils. Here again, the basis for making this change is the textural family. As stated above, Vanoss soils are fine-silty and Teller soils are fine-loamy. The particle size analysis of profile No. 10 (Table IX) shows this profile to have more than 15 percent fine sand and coarser in the control section which renders it fine-loamy, the textural family to which Teller belongs.

Approximately one half of phases 2B-1, 2D-1, and 2D-3 of the Dougherty soils of the previous survey were changed to phases 1B, 1B-3, 1C, 1C-3, and 1D of the Konawa soils. The Konawa series was proposed for soils which were formerly classified in the Dougherty series but do not qualify as arenic. Other characteristics are held in common for both soils. Descriptions of Konawa soils show that all of these soils have A horizons less than 20 inches in thickness; therefore, they can not be arenic. As a consequence, those soils which have 20 to 40 inches of surface soil are classified as Dougherty, and those having less than 20 inches of surface soil are classified as Konawa. Also, Dougherty soils are loamy while the Konawa soils are fine-loamy. Particle size analysis of Konawa profiles No. 2, 3, and 6 (Tables III, IV, and V) indicate that these soils have greater than 15 percent fine sand and coarser in the control section and between 18 and 35 percent clay which classifies these soils as fine-loamy, i.e., the textural family to which the Konawa soils belong.

Particle size analysis of Dougherty soils, profile No. 8 (Table VI) demonstrates that it has greater than 15 percent fine sand and coarser in the control section, but the average clay content of the control section is less than 18 percent which places it in the coarse loamy textural family. Therefore, the thickness of the surface soil and the textural family classification are criteria for changing these soils from Dougherty to Konawa.

In order to emphasize the differences in the previous survey and the new one, a comparison of land use capability subclasses between the mapping units in the two surveys is presented in Table XIV.

Classification of the Soils on the Research Station

The soils of this study area were classified according to the 7th Approximation (21) and the results are given in Table XV.

Considering all data, the Mollisol characteristics are more

TABLE XIV

COMPARISON OF LAND USE CAPABILITY SUBCLASSES BETWEEN MAPPING UNITS IN THE TWO SURVEYS

Soil symbol	Mapping Unit	Acreage	Percent	Cap. Unit	Acres in each class or subclass
1B	Konawa fsl, 1-3% slopes	84.2	13.20	IIe-3	I-81.0
1B-3	Konawa fsl, 1-3% slopes mod. eroded	12.5	1.10	IIIe-[illegible]	IIe-345.6
1C	Konawa fsl, 3-5% slopes	32.8	5.11	IIIe-7	IIw-16.5
1C-3	Konawa fsl, 3-5% slopes mod. eroded	5.2	.81	IIIe-5	IIIe-116.4
1D	Konawa fsl, 5-8% slopes	16.4	2.61	IIIe-7	IIIw-18.4
2B	Dougherty fsl, 1-3% slopes	49.7	7.80	IIIe-2	IVe-34.4
2C	Dougherty fsl, 3-5% slopes	28.1	4.50	IVe-3	IVs-19.0
3B	Teller fsl, 1-3% slopes	73.1	11.40	IIe-2	Vw-8.5
3C-3	Teller fsl, 3-5% slopes mod. eroded	6.3	1.00	IVe-3	640.0
4A	Pulaski soils, 0-1% slopes	16.5	2.57	IIw-1	
5B-	Eufaula fsl, 1-3% slopes	19.0	2.96	IVs-1	
6A	Farnum sil, 0-1% slopes	20.0	3.22	I-3	
8A	Teller loam, 0-1% slopes	61.0	9.70	I-2	
8B	Teller loam, 1-3% slopes	76.3	12.00	IIe-1	
8B-2	Teller loam, 1-3% slopes slightly eroded	89.0	14.00	IIe-1	
9B	Zaneis loam, 1-3% slopes	16.3	2.60	IIe-4	
9C	Zaneis loam, 3-5% slopes	6.7	1.10	IIe-3	
10A	Carwile soils, 0-1% slopes	10.6	1.70	IIIw-1	
10B	Carwile soils, 1-3% slopes	7.8	1.22	IIIw-1	
11A	Wet clayey alluvial land, 0-1% slopes	8.5	1.40	Vw-1	
		640.0	100.00		

Soil symbol	Mapping Unit	Acreage	Percent	Cap. Unit	Acres in each class or subclass
1A-1	Vamoss loam	73.0	11.4	I-2	I-74.5
1a	Vamoss loam, clayey sub-strata	1.5	.25	I-1	IIe-260.0
2B-1	Dougherty fsl, 1-3% slopes	80.0	12.48	IIIe-2	IIw-41.0
2D-1	Dougherty fsl, 3-[illegible] slopes	88.0	13.73	IVe-3	IIIe-117.9
2D-3	Dougherty fsl, 5-8% slopes eroded	8.6	1.36	IVe-4	IIIw-8.0
3B-1	Norge loam with 7 to 12" A horizon, 1-3% slopes	92.0	14.30	IIe-1	IVe-106.6
3C-1	Norge loam with 7 to 12" A horizon, 3-5% slopes	8.3	1.3	IIIe-6	IVs-26.0
4B-1	Eufaula lfs	26.0	4.1	IVs-1	Vw-6.0
5B-1	Teller fsl, 1-3% slopes	17.0	2.65	IIe-2	640.0
5C-1	Teller fsl, 3-5% slopes	17.6	2.75	IIIe-1	
[illegible]	Norge loam with 12 to 18" A horizon, 1-2% slopes	91.0	14.20	IIe-1	
7A-1	Pulaski soils	41.0	6.40	IIw-1	
8A-1	Carwile fsl	8.0	1.25	IIIw-1	
10B-1	Norge fsl, 1-3% slopes	60.0	9.44	IIe-1	
10C-1	Norge fsl, 3-5% slopes	12.0	1.9	IIIe-1	
10C-3	Norge fsl, 3-5% slopes eroded	10.0	1.55	IVe-3	
11A-1	Wet clayey alluvial land	6.0	.94	Vw-1	
		640.0	100.00		

TABLE XV

CLASSIFICATION OF SOILS OF THE PERKINS AGRONOMY RESEARCH STATION

Soil Series	Family	Subgroup	Order
Carwile	Fine, mixed, noncalcareous, thermic	Typic Argiaquolls	Mollisols
Dougherty	Loamy, mixed, thermic	Arenic Haplustalfs	Alfisols
Eufaula	Sandy, siliceous, thermic	Psammentic Paleustalfs	Alfisols
Farnum	Fine-loamy, mixed, thermic	Pachic Argiustolls	Mollisols
Konawa	Fine-loamy, mixed, thermic	Ultic Haplustalfs	Alfisols
Pulaski	Coarse-loamy, mixed, nonacid, thermic	Typic Ustifluvents	Entisols
Teller	Fine-loamy, mixed, thermic	Udic Argiustolls	Mollisols
Zaneis	Fine-loamy, mixed, thermic	Udic Argiustolls	Mollisols

strongly expressed on the west half of the Research Station while Alfisol characteristics are more strongly expressed on the east half. The Entisol characteristics are expressed in lower areas that receive fresh alluvial sediments.

CHAPTER V

SUMMARY AND CONCLUSIONS

The objectives of this study were to obtain a modern soil classification and map according to the 7th Approximation and collect and utilize all data and information for making interpretations in regard to land use and management purposes. Samples were taken from the more extensive mapping units of the farm for laboratory analysis. The Mollisols occur on the older, more stable land-forms of the area, while the Alfisols and Entisols occur on the younger, less stable land-forms.

Field studies and laboratory data verify the changes in mapping units and the classification of soils according to the 7th Approximation. Data collected indicate that portions of phases 3C-1, 3B-1, and 6B-1 of the Norge soil of the previous soil survey correlate more highly with the Zaneis series listed as phases 9B and 9C on the soils map of the present study. This change was based on the family textural grouping and vertical clay distribution with depth in the profile. Phases 10B-1, 10C-1, 10C-3, and the remaining portions of phases 6B-1 and 3B-1 of the Norge soils of the earlier survey were changed to phases 8B, 8B-2, 3B, and 3C-3 of the Teller soils in the new soils map. The family textural grouping and vertical clay distribution with depth were criteria used in making this change as well. Also, Teller soils have moderate permeability while Norge and Zaneis soils are moderately slow.

Phase 1A-1 of the Vanoss soils of the previous survey was changed to phase 6A of the Farnum soils. This change was justified because of the "Pachic" condition of the surface layer and the family textural grouping. The remaining area of phase 1A-1 of Vanoss soils of the earlier survey was changed to phase 8A of the Teller soils. This change was based on the criteria of family textural grouping. Portions of phases 2B-1, 2D-1, and 2D-3 of the Dougherty soils of the previous survey were changed to phases 1B, 1B-3, 1C, 1C-3, and 1D of the Konawa soils. Criteria for making this change were the thickness of the surface layer and the family textural grouping.

The results of this study allowed the soils of the Perkins Agronomy Research Station to be characterized and classified according to the 7th Approximation. Specific land use and management interpretations and recommendations may be found for each soil in Chapter IV (i.e., the Results and Discussion).

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APPENDIX A

ELEMENTS AND TERMS

ELEMENTS AND TERMS

Formative Elements in Names of Great Groups and Suborders	Connotation
aqu	characteristics associated with wetness
fluv	associated with flood plains
ust	of hot climates, usually dry summers
hapl	miminum horizon
pale	old development
arg	an argillic horizon
ultic	ultimate in weathering
typic	typical, soils which typify the central concept of the Great Group
olls	Mollisols
alfs	Alfisols
ents	Entisols
psamm	sand textures
udic	of humid climates
arenic	soils which must have surface epipedons between 20 to 40 inches thick that have textures of loamy fine sand or coarser throughout
pachic	soils with a surface layer in excess of 20 inches that has characteristics of a mollic epipedon

Surface epipedons:

Mollic--A layer of soil more than 4 inches thick if underlain directly by a lithic contact or more than one-third the thickness of the solum if the solum is less than 30 inches, or more than 10 inches thick if the solum is greater than 30 inches. It must contain at least one percent organic matter and base saturation must be over 50 percent. For color of the mollic epipedon, the value must be darker than 3.5 when moist and 5.5 when dry, and chroma of less than 3.5 when moist. Structure is usually porous granular type.

Ochric--Epipedons too light in color, too high in chroma, or too thin to be mollic or any other diagnostic surface horizon, or they are both massive and hard when dry.

Diagnostic subsurface horizons:

Argillic--An illuvial horizon in which silicate clays have accumulated.

Cambic--A subsurface horizon which must have some evidence of pedongenic processes at work but not strongly enough to be an argillic or other subsurface horizon.

Lithic contact--A boundary between soil and a continuous, coherent underlying material with a hardness of 3 or more on the Mohs scale.

Paralithic contact--Differs from lithic in that the hardness of the underlying material is less than 3 on the Mohs scale.

Particle-size classes for Family groupings:

Coarse laomy--with less than 18 percent clay.

Loamy--More than 15 percent fine sand or coarser and between 0 and 35 percent clay.

Coarse loamy--Less than 18 percent clay and greater than 15 percent fine sand or coarser.

Fine-loamy--More than 18 percent clay but less than 35 percent clay and greater than 15 percent fine sand or coarser.

Fine-silty--with more than 18 percent clay but less than 35 percent clay and more than 15 percent fine sand or coarser.

APPENDIX B

FIGURES AND TABLES

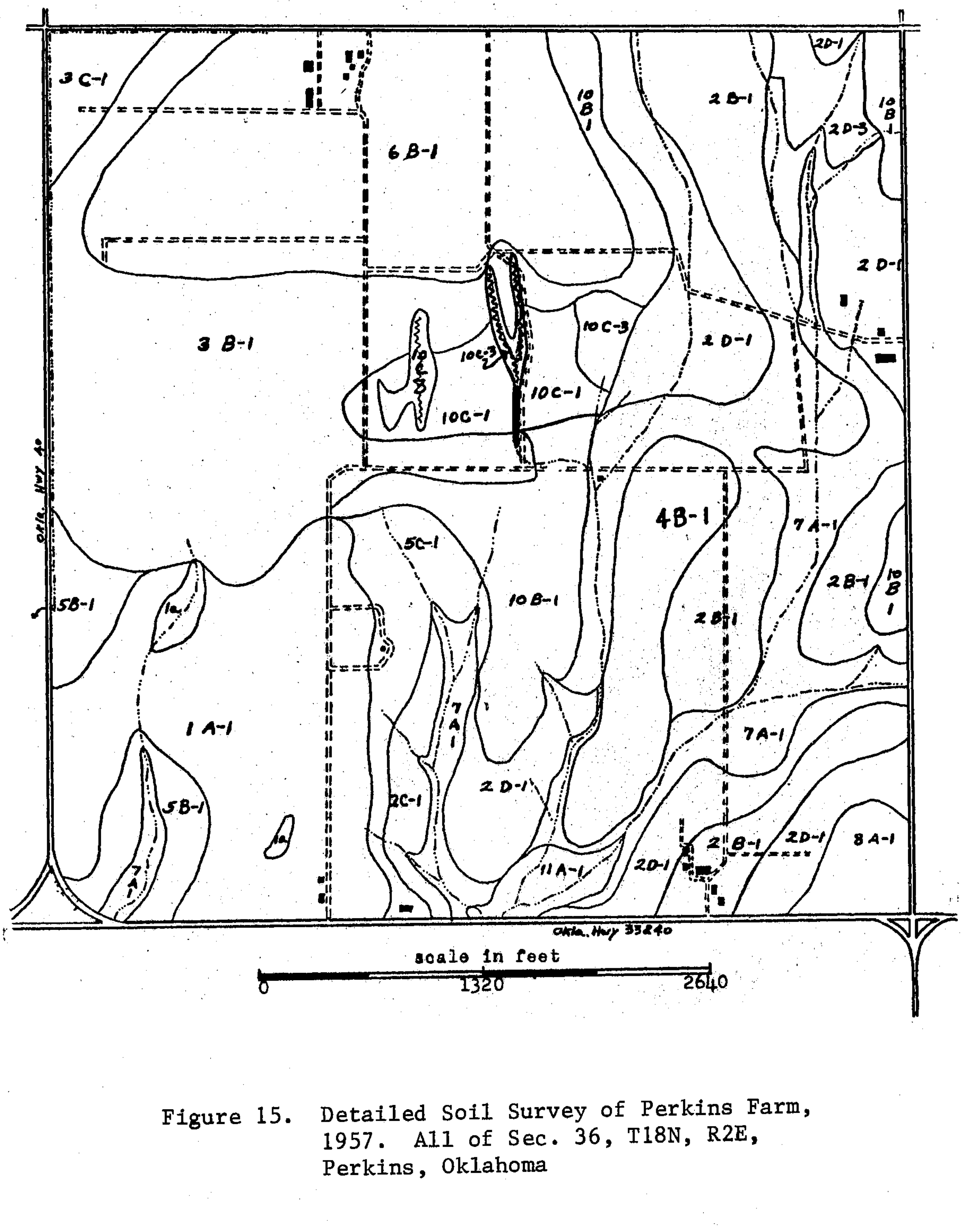

Figure 15. Detailed Soil Survey of Perkins Farm, 1957. All of Sec. 36, T18N, R2E, Perkins, Oklahoma

TABLE XVI

DETAILED SOIL SURVEY PERKINS FARM - PERKINS, OKLAHOMA
ALL OF SEC. 36, T18N; R2E

Symbol	Soil Name	Symbol	Soil Name
1A-1	Vanoss loam	5B-1	Teller fine sandy loam, 1-3% slopes
1a	Vanoss loam, clayey substrata	5C-1	Teller fine sandy loam, 3-5% slopes
2B-1	Dougherty fine sandy loam, 1-3% slopes	6B-1	Norge loam with 12 to 16 inch A horizon, 1-2% slopes
2D-1	Dougherty fine sandy loam, 3-8% slopes	7A-1	Pulaski soils
2D-3	Dougherty fine sandy loam, 5-8% slopes, eroded	8A-1	Carwile fine sandy loam
3B-1	Norge loam with 7 to 12-inch A horizon, 1-3% slopes	10B-1	Norge fine sandy loam, 1-3% slopes
3C-1	Norge loam with 7 to 12-inch A horizon, 3-5% slopes	10C-1	Norge fine sandy loam, 3-5% slopes
4B-1	Eufaula loamy fine sand	10C-3	Norge fine sandy loam, 3-5% slopes, eroded
		11A-1	Wet clayey alluvial land

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