

Scientist Traces Background of Holt's Soil

Prehistoric Waters Account for Varied Soil Deposits and Help Determine Productivity

By Lloyd Mitchell, State Soil Scientist

The soils of Holt county are the result of millions of years of geological activity and soil forming processes.

In order to properly understand them, it is necessary that we think about the county as a whole and how many different types of materials are present within its boundaries on which the soils have developed.

The present surface is part of what was once a nearly level to gently rolling plain. It was later cut into by headward erosion of the streams and drainages until in parts of the county the topography is quite rough and broken.

The establishment of the drainage system has exposed many different kinds of parent materials in the older lime rock and shale formations. These formations are the oldest sources of soil material.

The younger soil materials have been brought in by wind and flowing streams. The materials vary from gravel that was washed in from adjacent areas and deposited over the old surface, to silts and sands that have been blown in and deposited.

Another type of deposit that has furnished the material for part of the soils in the county is the river sediments such as occur along the Niobrara.

In order that we understand the various parent materials of the soils and the soils themselves, it is advisable that each of them be described. Beginning with the materials of the oldest geological ages up through the youngest, there is a definite sequence and type of soil developed.

They are as follows:

Parent Materials and Soils

PIERRE SHALE —

The Pierre shale is the oldest geological formation on which the soils of the county have developed. Typically it is a dark gray to black shale that has occasional thin brown colored zones in it. These latter zones are the result of weathering of material that contains a high percentage of iron. The formation is exposed along the Niobrara river. A typical example is near the Spencer dam.

The Pierre shale is quite thick in Holt county. It varies from about 200 feet in the northeast

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part of the county to about 700 feet in the northwest. It represents a period of deposition of clay in a large sea that at one time in past geological ages covered most of the central portion of the United States. Because the deposit is made up of fine sediments, the deposition probably took place during a time when the water was quite calm.

Geologists believe that this deposition was largely from sediments brought into the inland sea from land areas outside and around this sea. The soils that have developed on the Pierre shale have one characteristic in common, namely, their heavy subsoil.

The surface soils are for the most part very dark, and may range in texture from a loose, silty material that is easy to cultivate to one that is quite heavy, and difficult to plow. Much of the land occupied by these soils is too steep to cultivate and for this reason has been left in grass.

There are, however, some areas where these soils are found on gently rolling slopes or nearly level stream terraces that are now 25 to 50-feet above the valley floor. Where there is a sufficient depth of surface soil (18 to 24-inches) over the heavy shale subsoil and rainfall is plentiful, good yields can be obtained. Where erosion has been severe, and the surface soil has been removed, cultivation is difficult. Crop yields are reduced to a minimum chiefly because water cannot be stored in them and the plants die due to the drouthy condition.

These eroded soils take up rain very slowly and as a result much

of it runs off. For this reason farmers who cultivate this sort of land should use every means possible to keep their surface soils in place and maintain them in condition to absorb all the moisture that falls. This can be done by saving the crop residue and working them into the surface.

OGALLALA FORMATION —

The next younger formation on which many of the soils of Holt county have developed is the Ogallala formation. It is the bedrock that underlies much of the area north of O'Neill on the Holt table and is exposed in many places in the county. It rests directly on the Pierre shale. One of the most extensive exposures occurs along the valley slopes of Eagle creek.

Here, it has a light gray to white color and it is made up chiefly of sand that is loosely cemented with lime. Several other types of materials are included in this formation but for the most part the limey sandstones predominate.

The Ogallala formation represents a deposit of comparatively coarse material eroded from the Rocky Mountains to the west and spread over the plains by streams that once covered this area. Various divisions of this formation can be traced from Texas to South Dakota. Some of the limey deposits are the result of lime secreting algae which lived in ponds or lakes on the surface of the landscape during that time.

Other limey deposits are "caliche" that is formed by the evaporation at or near the surface of ground water that carries considerable quantities of lime in solution. The sandy and gravelly horizons that are found in this formation were brought in by eastward or southeastward flowing streams.

The soils that have developed on the Ogallala have moderately dark, silty, or slightly sandy surface soils that are about 10 or 12 inches thick under native vegetation. The next 8 to 10 inches below the surface soil is usually a light gray to almost white when dry silty material.

This is the material which some farmers call "sugary" because of its behavior when exposed to water. It appears to melt away like sugar as water runs over it in the small gully heads. Below this latter zone or horizon are materials that may be quite variable. It may be quite sandy or gravelly or it may be solid "caliche."

The soils developed on the Ogallala are variable as to depth. In places where there is 24- to 36-inches of relatively loose soil material over the unweathered parent material and erosion has not been severe, good crop yields can be expected in years of adequate moisture supply. Past experience has proven that where the underlying rock is within 6- to 12-inches of the surface, crop production is quite hazardous. Most of the land of this type has been left in grass for this reason.

The conservation measures required to protect this type of soil are also variable. Where erosion is severe the crop yields are low. On the steeper slopes this land is best suited to permanent grass. Where the sloping land is not severely eroded, terraces, grasses, waterways, and good rotations that include frequent legume crops are advisable. Where this soil occurs on nearly level areas, protection from wind erosion is necessary along with good crop rotations.

PLEASTOCENE GRAVELS —
Resting directly on top of the light gray or nearly white Ogallala formation is a deposit of sand and gravel that varies in thickness from 0 to 60 feet. It will average around 40 feet. These sands and gravels were deposited in this area by north-eastward flowing streams. The streams were partially blocked to the east by glaciers, causing them to deposit their gravel loads over the tableland areas. The surface of these deposits was comparatively level. Their variation in thickness is due largely to the uneven surface of the underlying Ogallala formation.

The establishment of a drainage system and valleys by headward erosion of streams on the nearly level tableland has left extensive exposures in many places in the county. The soils that have developed on the gravel deposits are mostly too shallow and porous to hold moisture.

For this reason, there are large areas on the Holt table that have remained in grass. On the basis of observations it appears that where there is less than 18- to 18-inches of soil material over the gravel, the soils are too drouthy for cultivation.

When there is 24- to 36-inches there seems to be sufficient moisture holding capacity to produce fair crop yields when the moisture supply has been favorable. Only the nearly level or gently sloping areas are cultivated. The conservation program on them should include practices that conserve moisture, such as residue management, stubble mulch tillage, strip cropping and protect the surface from wind erosion.

WIND-LAID DEPOSITS —

The wind deposits in Holt county are the principal parent materials of the soils and are of three general types. They are (1) silty (loess) deposits that are the parent materials of the good, deep, dark farming soils of the county; (2) the mixed silty and sandy deposits, also deep and quite dark, that are farmed extensively; and (3) sandhills.

The dark silty soils are not extensive in the county. The largest areas are east and northwest of Town Hall in Shields township and north and east of Page in the eastern part of the county. The topsoils are dark brown or dark grayish-brown and are about 10- to 14-inches thick where erosion has not been active. There is enough sand mixed with the silt on these soils to make cultivation quite easy. For the most part these soils occur on nearly level to gently rolling areas and are subject to only minor wind erosion losses.

The conservation treatment on these soils should include protection from wind erosion by use of strip cropping, stubble mulch tillage, and crop rotations that maintain a high level of fertility and soil structure should be used.

The soils that have developed

on mixed silts and sand deposits are good agricultural soils. They are found extensively in the area north of the Elkhorn river. They are closely associated with the soils that have silty parent materials and produce nearly as good crop yields. The topsoils are about the same thickness as the silty soils. Because of the fact that there are some variations that include sandy profiles in this group of soils, they are subject to more severe wind erosion. Also, since the relief is undulating to rolling, there is an additional hazard from water erosion.

The conservation treatment required for these soils should include adequate protection from wind erosion by the use of cover crops, strip cropping, contouring, terraces, windbreaks, and careful management of crop residues. Moisture conservation and maintenance of fertility should also be used.

SANDHILLS —

The major portion of the sandhills area of the county is located south of the Elkhorn river. The soils in this area have thin (4- to 6-inch) topsoils that are very sandy. Past experience has proven that this area is best adapted for the production of hay and pasture.

The tall grasses grown in the area are one of the finest crops

produced in Holt county. There are three major sandy soils that can be described in the area. These are closely associated with the surface relief and are separated on the basis of the quantity of finer material mixed with the sand and the dark colored humus content. The dune sandy or "choppy hills" are almost devoid of topsoil and are subject to severe losses by wind. In some instances the instability of the dunes has been caused by over-grazing the sparse grass cover. The conservation treatment of this type of land is a matter of adjusting the number of livestock so as to attain and maintain a mixture of grasses that will give the maximum productivity of forage on these soils with the moisture available. It also involves cautious grazing practices and ample livestock watering places.

When this land is over-grazed and the sand commences to move, the problem of reestablishing grass stands and stabilizing them again is very difficult. Damage to the adjoining

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LYNCH NEWS

Mr. and Mrs. Don Allen returned home Thursday, February 15, after a week's visit in Omaha. Mrs. Albert Kalkowski was

hostess to the Excello project club Monday, February 19, with Mrs. Arden Darnell as assisting hostess. Mrs. Glenn Davy presented the lesson on "Main Dish Meals." The souffle cheese sandwiches and sausage pie made in the demonstration were served during the lunch. The hostesses served fruit salad, cookies and coffee.

Mr. and Mrs. Lloyd Mills visited at Eldon Mills' home at Dorsey Sunday, February 18.

Truman Young, of Herrick, S. D., brought his son here for consultation with doctors Thursday, February 15.

Pat Cassidy and family visited at the Joe Loock home, south of the Niobrara river near Phoenix, on Sunday, February 18.

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