

Suggestions  
*for*  
IMPROVING  
SLICK-SPOT SOILS

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# Suggestions for Improving Slick-spot Soils

By HORACE J. HARPER and MAX J. PLICE\*

“Slick spots” are often seen on freshly plowed land in central and eastern Oklahoma following a period of heavy rainfall. Most of these spots are only a few feet in diameter, (Figure 1) so the loss they cause in reduced crop yield is relatively small. Where terrace ridges cross these areas, breaks frequently occur because of the unstable character of the soil. They are also objectionable in a cultivated field because of the uneven appearance of crop growth. Many inquiries are received about how to improve slick spots. This publication was prepared to answer such inquiries.

Slick spots are sometimes called “alkali spots,” but they must be handled differently than a “white alkali” soil. The surfaces of a slick spot and an alkali (or “salty”) spot may look very much alike, especially after a period of heavy rainfall; but after a dry spell a white deposit will appear on the surface of the alkali spot (Figure 2). Slick spots are found mostly in central and eastern Oklahoma. Alkali soils are found chiefly in central and western Oklahoma, in bottomlands where salts rise to the surface from a shallow watertable, or on sloping areas where lateral movement of saline water appears at the surface and salts accumulate as the water evaporates.

A slick spot represents a retarded soil forming process that for several hundred or perhaps thousands of years, has resisted the effort of nature to make it more productive. Therefore no one should expect to change such a soil to a normal condition in a short period of time. The right treatment will gradually improve it, but the time required may be discouraging, especially when rainfall is limited. Usually the cost will be greater than the increased value of the crops produced. The principal reasons for improving these areas will be to obtain personal satisfaction from the improved crop growth, and to reduce the erosion hazard on sloping areas of cultivated land.

## Characteristics of Slick Spots

Analyses of slick spot soils show that they vary considerably in structure and chemical composition.\*\* Hence it is difficult to

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\*\* This information is based chiefly on analyses of slick-spot soils and adjacent, normal appearing soils from 29 Oklahoma counties where slick spots are most numerous. The complete data is available from the Experiment Station.

make accurate recommendations for improvement that will apply to all areas. In general, however, the following conditions were commonly found:

Presence of sodium has been an important factor in developing an unfavorable physical structure of the soil in these areas. Hence addition of gypsum (calcium sulfate) is usually a helpful part of the treatment to improve the physical condition of such areas. This treatment dehydrates the clay particles and allows water to penetrate the soil more rapidly. The calcium in the gypsum also replaces the sodium on the clay particles, and the sodium sulfate thus produced is carried downward into the deeper subsoil by drainage water during periods of abundant rainfall.

Most slick spots are very low in organic matter, therefore covering them with straw or other organic residue is usually helpful. This treatment not only adds organic matter to the soil and protects the soil from the packing effect of rain, but also retards the rate of runoff so that more water will be absorbed by the soil to carry the sodium sulfate formed by the addition of the gypsum into the deeper subsoil.

A high percentage of slick spots are very low in available phosphorus, hence phosphate fertilizer must be applied to increase the growth of crops planted on these areas. Often, too, they need a nitrogen fertilizer, or a legume crop to provide nitrogen for other crops which will be planted on the land.

Slick spots are usually alkaline rather than acid. This condition may require the use of sulfur or iron sulfate (copperas) to bring the soil nearer to a neutral reaction, unless large quantities of organic matter can be applied to provide a more favorable pH value for plant growth.

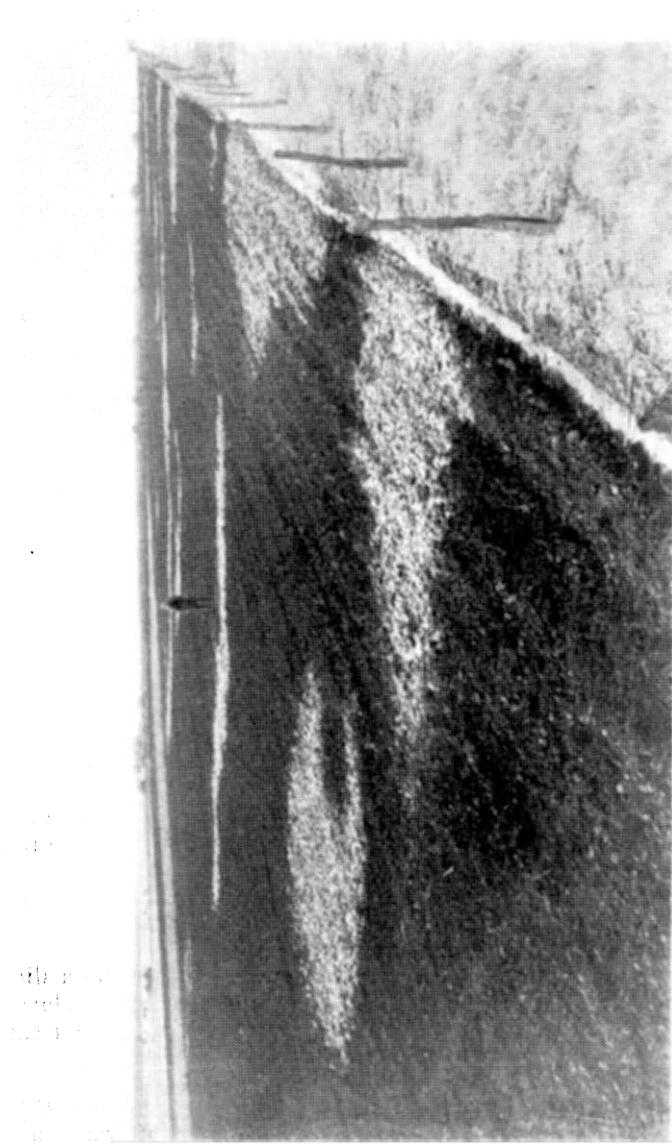
### **Treatment of Slick Spots**

The best time to begin a soil improvement program on a slick spot would be just before planting small grain\* and sweet clover. The soil should not be plowed for at least three years after treatment is started to obtain the best results.

On gently sloping areas a small levee, or terrace ridge, can be built on the lower side of a slick spot to collect runoff water and thus increase the amount of water that will pass downward into the subsoil. Improvement of slick spots on steep slopes presents a

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\* Spring oats, winter barley or winter oats in 14 inch rows is preferable to winter wheat or rye.



**FIGURE 1.**—Slick spots are very noticeable in a plowed field because of their lighter color as compared with the surrounding area.



**FIGURE 2.**—Salt spots in a fertile bottomland field resulting from the upward movement of capillary water from a shallow water table. Although the soil aggregates on these areas have been destroyed by the high content of sodium, poor crop growth is due principally to the high concentration of soluble salts in the soils.

more difficult problem, because it is harder to hold the water needed to leach the undesirable salts produced by treatment from the soil profile.

If the slick spot soil is moderately alkaline (pH 7.9 or above), sulfur or iron sulfate (copperas) should be applied during the process of seedbed preparation.\*\* The rate of application will depend on the degree of alkalinity. Super phosphate may be applied broadcast at the rate of 300 pounds per acre or drilled in the row with the small grain at time of planting at the rate of 200 pounds per acre.

After the small grain is planted, gypsum\*\*\* (calcium sulfate) should be applied broadcast on the surface of the ground at the rate of 2 to 4 tons per acre, depending upon the amount of clay and exchangeable sodium in the soil. It is quite probable that an application of gypsum and additional organic matter may be needed at regular intervals in a cultivated soil. It is impossible to increase the organic matter content of a soil when cultivated crops are planted every year without the addition of more organic matter than can be supplied by crop residues.

Where slick spots areas are badly eroded, soil improvement will be more difficult than on non-eroded areas, because of the higher clay and sodium content of the exposed subsurface soil. The irregular topography of an eroded area not only increases the problem of holding water on the area, but the density of the exposed subsoil also provides a very unfavorable condition for the development of plant roots. The best treatment on badly eroded land (Fig. 3) probably would be to build a diversion ditch above and below the slick spot area, apply phosphate and plant it to sunflowers followed by some permanent vegetation to protect the soil from further erosion.

### Identifying Slick Spots on Virgin Land

Slick spot soils can be identified on virgin areas by observing the character of the vegetation and the topography.

On gently sloping land, the surface of the slick spot is normally lower than the surrounding area, and water loving plants are often

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\*\* One pound of sulfur is equivalent to 8.6 pounds of ferrous sulfate (copperas) containing 7 molecules of water. One pound of sulfur added to 100 square feet of sandy soil containing no free carbonate will reduce the pH of the surface soil from 0 to 6 inches about 1 pH. Three pounds of sulfur should be applied to medium textured soil and 4½ pounds to a similar area of clay soil to obtain the same reduction in pH value.

\*\*\* Agricultural gypsum can be purchased in carload quantities from the U. S. Gypsum Company, Southard, Oklahoma, or from the Universal Atlas Cement Co., at Watonga, Oklahoma.



**FIGURE 3.**—Severe erosion showing the subsoil of a slick spot near Paden, Oklahoma. Sheet erosion is dominant on the right, whereas gully erosion has developed on the center and left part of the area. Some tunnels may be seen near the lower left corner of the picture.

found in the depressions. During periods of severe drought little or no vegetation will be present in the depressions. The term "buffalo wallow" has often been applied to these areas.

On steeper slopes, a sparse vegetation with a break of four to six inches in surface topography on the upperside of the area with the subsoil exposed and a poor growth of vegetation on the lower side of the area, is a good indication of a slick spot soil.

In many places slick spots cannot be detected by the topography of the land: but, because of the impervious nature of the subsoil, native grasses suffer from drought on these areas before plants on adjacent areas of normal soil are affected. In many instances short grasses will be present on slick spot soils, whereas tall or mid grasses will be present on the surrounding area.