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SOILS OF THE EASTERN UNITED STATES AND THEIR USE—XIII.

THE MEMPHIS SILT LOAM.

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THE MEMPHIS SILT LOAM.

GEOGRAPHICAL DISTRIBUTION.

The Memphis silt loam consists of finely divided silty material, known as the loess, which had its origin in the more northern portion of the central States in conjunction with the glacial invasion of that section. Unlike the other soil types derived from the loess, however, the Memphis silt loam is derived from those deposits that extend southward from the confluence of the Missouri and the Mississippi Rivers almost to the margin of the Gulf of Mexico. In this respect it is unique among loess-derived soil types. This material, originated in connection with the glaciation of the North Central States, was carried southward by the waters resulting from the melting ice, and distributed along the drainage ways through the Mississippi Valley. Thence, it is supposed that a considerable proportion of the material has been reworked and redistributed, through wind action, being deposited principally upon the eastern side of the Mississippi River, from the vicinity of St. Louis, Mo., southward to Baton Rouge, La. It thus comprises a long narrow belt along both sides of the Mississippi River in southern Illinois and eastern Missouri, covering a considerable proportion of the upland in western Kentucky, a belt 50 to 70 miles broad in western Tennessee, a continuous belt, varying from 50 miles in width in northern Mississippi to a narrow strip, 15 to 20 miles broad, where it passes across the southern line of Mississippi into eastern Louisiana and terminates between Baton Rouge and New Orleans. It also occurs covering a considerable territory on the west side of the Mississippi in northeastern Arkansas.

Throughout its entire extent this characteristic glacial silt was carried far southward by water action, from a truly glaciated region, and distributed by the action of both wind and water principally over the uplands to the east of the Mississippi River. It covers the various Coastal Plain formations and, in its more northern portion, even the consolidated rocks of the outward edge of the Ozark uplift.

The Memphis silt loam has been mapped to the extent of 1,863,290 acres. It has been encountered in 12 separate areas in 6 different States.

CHARACTERISTICS OF SOIL AND SUBSOIL.

The surface soil of the Memphis silt loam in its characteristic development is a brown or brownish-yellow silt loam, containing nearly 80 per cent of silt and 15 to 20 per cent of clay, with very small amounts of coarser material, although a little very fine sand is not infrequently present. The depth of this surface soil varies materially in the different parts of any area where it may be developed. Upon all the steeper and more hilly portions of the type the surface covering is from 2 to 4 or 5 inches thick, while upon the more level areas, where erosion has not been so active, the surface brown loam may attain a depth of 8 to 15 inches. It grades downward into a chocolate-brown to yellow silt loam, which is a little more stiff and compact than the surface soil, through the presence of a slightly higher content of clay.

This material usually extends to a depth of 3 feet or more, and in the majority of cases rests directly upon the soft but compact yellow silt, sometimes mottled with gray, which constitutes the characteristic section of the loess wherever it is fully developed. In other instances, and particularly near the eastern margins where the total thickness of the loess dwindles to 3 or 4 feet, the deep subsoil may be somewhat modified by the presence of small amounts of medium to coarse sand, with occasional pebbles and noncontinuous bands of gravel. In such instances the entire section is liable to be distinguished by a brown or chocolate color. In the less eroded areas where weathering has proceeded uninterruptedly to greater depths, the subsoil is reddish-yellow to a deep chocolate brown. In such instances it is frequently somewhat more stiff and clayey through the breaking down of the silt particles and may locally be known as yellow or red "clay," depending upon the prevalent color tone.

The Memphis silt loam is usually sharply contrasted with all of the soils in the region where it occurs. In the first place, it is the one great silty soil which extends from southern Illinois southward through the Coastal Plain region to the Gulf of Mexico, being contrasted with the more sandy or more clayey soils derived from other formations in the general region. It is widely known by a number of popular terms, such as the "brown loam" or the soil of the "Cane Hills" and "Flat Hills" regions where it occurs.

It has been found desirable in all of the more recent surveys to separate this material on the basis of the topography and prevalence or absence of erosion into two soil types. Of these the more eroded, or the rolling and hilly section commonly found in the "Cane Hills" district, constitutes the characteristic Memphis silt loam, while the less eroded brown loam of the "Flat Hills" section has in several instances been mapped as the Richland silt loam. The erosion fea-

tures and the consequent topography, together with their resultant effects upon agriculture, constitute the fundamental basis for this separation. The materials are practically the same, except that in the case of the Richland silt loam the surface brown silty loam material normally extends to a depth of 10 or 15 inches, while in the case of the typical Memphis silt loam it has a depth varying from 2 to 12 inches.

Along the eastern margin of the region in which this silty material is developed, where the total depth of the loess is less than 3 feet, the presence of the red or reddish-yellow sands and gravels of an older formation gives rise to a type of soil known as the Lexington silt loam, distinguished by the presence of this sand and gravel in the deeper subsoil.

SURFACE FEATURES AND DRAINAGE.

The usual topography of the typical Memphis silt loam is rolling to hilly. The type occurs along the rivers. At places more remote from the bluff-line the surface becomes slightly rolling to undulating, and in all of the more remote upland occurrences of the type there are considerable areas of practically flat land, which in the later classification will probably be classed as the Richland silt loam, because of this topographic difference.

The Memphis silt loam follows the bluff-lines bordering the Mississippi drainage in Missouri, southern Illinois, and in western Kentucky, Tennessee, and Mississippi. This bluff rises to an altitude of 150 to 250 feet above the adjoining bottom lands or above the waters of the river itself, which frequently wash the foot of the bluff. For a considerable distance back from the bluff-line the front of the escarpment is broken at frequent intervals by deep V-shaped valleys, through which the short tributary streams flow down to the main drainage courses of the bottom land. At greater intervals the larger streams have cut broad valleys through the soft loessial deposit or have formed basins and amphitheaters that open out into the Mississippi bottoms. Away from the crest of the escarpment the surface of the country consists of sharp ridges and cross ridges separated from one another by narrow, steep-sided valleys. The crests of these ridges are frequently level and are occupied by tilled fields. They become broader as one passes away from the bluff-line until they merge into the level plateau of the more remote upland, covered principally by the Richland silt loam. All of the minor streams which flow into the larger tributaries or directly down to the Mississippi itself have cut back rapidly into the soft, unconsolidated materials of the Memphis silt loam, giving rise to a network of minor stream channels and gullies, spreading out like the branches of a tree. With every heavy rainstorm each of these valleys or

gulleys cuts deeper into the loess material and removes more and more soft earth from the upland areas. As a result the originally level plateau has been carved into rough and hilly topography along the bluffs and throughout the region where this material and this topography have been developed. From the mouth of the Ohio southward this section is commonly known as the "Cane Hills."

The surface of the Memphis silt loam attains to elevations of 500 feet or more in eastern Missouri and in southern Illinois, where it mantles the uplands as well as follows the bluffs of the Mississippi and its major tributaries. The surface of the type gradually descends southward; it occurs at altitudes of 300 to 350 feet above tide in western Kentucky and western Tennessee and the extreme northern portion of Mississippi; thence it gradually slopes southward to an altitude of about 100 feet above sea level at the Mississippi-Louisiana line and descends to an altitude of less than 50 feet between Baton Rouge and New Orleans.

Similarly, the bluffs separating the upland from the great alluvial bottoms are higher and more eroded in the more northern portion, rising not infrequently 250 feet above the adjoining alluvial bottoms in western Tennessee and northern Mississippi. Farther south these bluffs rise from 15 to 50 feet above the river, and south of New Orleans constitute only a low, bounding ridge to the east of the alluvial delta lands. The smaller ridges to the west of the Mississippi River, particularly in Arkansas and in northern Louisiana, rise to altitudes of only 15 to 35 feet above the bottom lands by which they are usually surrounded. Thus there is a considerable difference both in absolute elevation above tide level and in the relative elevation above adjoining low lands through the wide extent of territory covered chiefly by the Memphis silt loam.

The natural drainage of the type is quite complete along the bluff lines and in close proximity to the larger drainage ways and there is practically no difficulty encountered through excess of moisture. In the smoother country somewhat remote from the streams, and particularly in the "Flat Hills" region, latterly mapped as the Richland silt loam, there are considerable level areas and even minor depressions where the natural drainage of the Memphis silt loam is deficient. Such areas are always marked by a light-gray to ashy-white surface soil, except where the drainage is so obstructed that local swampy areas have been formed and the shallow mucky accumulation over the silty material gives a darker color to the surface soil.

In practically all instances of this kind there is a further pronounced indication of deficient drainage through the presence of small iron concretions, locally known as "iron buckshot" or "iron gravel," to be found both in the surface soil and at a slight depth below it, where the gravel is not infrequently accumulated as a layer

or band of partly compacted pebbly material. In all such instances, also, the deeper subsoil is marked by a prevailingly light-gray color only slightly mottled by yellow iron-stain along joints, crevices, and root holes. The indications above mentioned are practically infallible in detecting poor drainage conditions in the areas of the Memphis silt loam and its associated type, the Richland silt loam.

Erosion is by far the most important problem in connection with the tillage of the Memphis silt loam. Owing to the soft, noncohesive character of the materials, not only of the surface soil and subsoil, but also of the underlying silt; because of the elevated position of a large proportion of the type above adjoining drainage ways and the great alluvial bottoms; and because of an almost universal tendency to produce the intertilled crops upon this type, particularly cotton, through a long series of years, great difficulty has been experienced in preventing erosion. In fact this soil may only be maintained against ruinous washing in the vicinity of the bluffs by allowing a large proportion of its surface to remain in the native forest growth of post oak, scarlet oak, Spanish oak, hickory, beech, and tulip poplar. Even the ordinary pasture grasses are not competent to serve as effective soil-binders upon the steeper slopes near the edge of the bluff. The bond formed by the grass roots and the surface vegetation is not infrequently undermined by the cutting back of the gullies to such an extent that great masses of the surface soil fall into the gullies beneath and are dissolved and carried away by the torrents resulting from heavy rainfalls. In the more gently sloping areas, however, the covering of the native grasses, such as Bermuda, lespedeza, and crab grass, is competent to maintain the soil against erosion. Each has a low habit of growth and each develops an intricate root system well suited to soil-binding purposes. All of these grasses have a value, not only for pasturage purposes, but also for the cutting of hay, and would be more generally appreciated for these uses except for the cotton farmers' universal objection to any form of grassy growth within the areas of cultivated fields.

Upon the more level uplands, which are not threatened by the backward cutting of gullies and the larger streams, the principal occupation of the type occurs. In such areas the surface water is usually absorbed to a great degree by the deep surface soil, and erosion is not serious. However, the areas possessing these gentle slopes occupy but a small percentage of the total extent of the typical Memphis silt loam, and these, particularly in the more southern localities, are anually occupied to their full limit for the production of intertilled crops like cotton and corn. Unless considerable care is taken in laying off the rows to form contours around the slopes, and unless incipient gullies are immediately checked by the construction of brush dams, erosion is liable each year to invade even these upland portions

of the type to such an extent as to destroy them for agricultural purposes.

It is extremely fortunate under these circumstances of prevalent excessive erosion that the subsoil materials and the parent loess are capable of becoming transformed into fertile and productive soil within a very brief period of time, provided proper care is taken to plow the subsoil material thoroughly and to incorporate organic matter for the formation of a complete soil. There are very few soils in the United States, and practically none except those derived from similar deposits of loess, which show such marked characteristics of speedy recuperation from excessive erosion.

LIMITATIONS IN USE.

The principal limitation to the use of the Memphis silt loam for the production of cultivated crops lies in the tendency toward excessive erosion already mentioned. The type taken as a whole may only be tilled to the extent of 15 to 20 per cent of its total surface area in the "Cane Hill" regions, and to the extent of about 30 or 40 per cent of its surface in the more gently undulating portions of its development. The balance of the type must be left either in forest upon the steeper slopes or covered with the native grasses upon the more gentle slopes, not only for the protection of these slopes themselves, but also to prevent the invasion of tilled areas through the formation of gullies and of deep washes. This limitation, of course, applies only to the area which may not be tilled and not to the portions where crops may be grown.

Excessive erosion in many instances has also adversely affected the depth and condition of the surface soil of the Memphis silt loam. Although even in the most eroded areas a surface soil may be developed by proper cultural methods in two or three years time, there are considerable areas where the requisite organic matter for the formation of a complete surface soil is only present to a depth of 2 or 3 inches. In all such areas and even over a considerable proportion of the tilled fields upon the Memphis silt loam the incorporation of organic matter is one of the prime necessities for the production of adequate crop yields. In all areas where the type is found, whether in the more northern grain-growing sections or in the more southern cotton-producing areas, the restoration of organic matter to the Memphis silt loam constitutes an important problem for the maintenance of the type under agricultural occupation.

The tillage difficulties encountered in the use of the type consist chiefly in those resulting from a tendency toward erosion. The soil itself is soft, friable, easily broken, and easily tilled. Drainage is a problem only to a limited extent over the flatter portions of the type, and throughout its extent it is stone free, and not encumbered by other obstructions to tillage except the gullies already mentioned.

The development of the type in a long, narrow belt extending from the central United States almost to the Gulf of Mexico gives rise to a wide variation in the climatic surroundings under which it is cultivated, and this factor of climatic influence modifies to a considerable degree the crop adaptations of the soil in its different localities. In the more northern regions the general farm crops, particularly corn, winter wheat, oats, and grass, are well suited to the Memphis silt loam. In the central regions, including Kentucky and western Tennessee, tobacco is also grown to advantage, though to a very limited extent, while cowpeas and even cotton are produced. From western Tennessee southward the climatic surroundings are such that cotton constitutes the principal money crop, and even corn is grown in subordinate acreage. With the exception of cowpeas for forage purposes, and of local developments of market-gardening and trucking crops, the more southern portions of the Memphis silt loam are devoted almost exclusively to the growing of cotton, with corn as a supplementary crop.

IMPROVEMENT IN SOIL EFFICIENCY.

Protection from erosion is the prime necessity for the better development of the Memphis silt loam. This may be accomplished in a variety of ways, depending upon the declivity of surface slopes, upon the amount and character of the annual rainfall, upon the proximity of deep-cut drainage ways or of shallow stream valleys and gullies, and to a considerable degree upon the selection of crops made in the natural adjustment to climatic conditions. In the more northern areas where the Memphis silt loam is developed, very little attention to erosion problems is necessary beyond the production of grass upon the more gentle slopes, and the occupation of the steeper slopes by forest. Even the moderate slopes may be planted to orchard fruits, provided a little care is taken to arrange the rows according to the contours of the land. Such a use of this type has been made to a considerable extent in one or two areas, and very little difficulty from erosion has been experienced in such cases. Farther south the adoption of contour farming, of terracing, of the construction of brush dams to prevent the invasion of gullies upon tilled land, the grassing of the steeper slopes, and the forestation of declivities along the bluff are methods requisite for the prevention of erosion.

On the more gently sloping surfaces deeper plowing to form an absorptive reservoir for rain water, the careful construction of water furrows to prevent the too rapid off-flow of excess water, and the adoption of a crop rotation which shall leave the surface of the land occupied by cover crops during the winter months and by grass cover during a portion of the rotation are all desirable methods for main-

taining the land under cultivation, and, while doing so, for preventing erosion.

Over a considerable proportion of the type from the Ohio River southward the deeper plowing of the Memphis silt loam is essential for the increase of crop yields. In the general practice of the region plowing to a depth of 3 or 4 inches is considered adequate. In the case of a silty and somewhat clayey soil like the Memphis silt loam, deeper plowing is strongly to be recommended. Upon all of the more level areas the heavy 2-horse or 2-mule hitch and the breaking plow should be used in place of the light 1-horse hitch and the small turn plow. The plowing should also be done "broadcast," as in the case of the central prairie regions, instead of the usual method of plowing out the previous rows and bedding up in the water furrows. The thorough working of the surface soil to increase its depth to 12 or 15 inches will result in decidedly increased crop yields, whether of cotton and corn or of the grain and grass crops.

Throughout a large part of the area where the Memphis silt loam is found, the incorporation of additional organic matter is decidedly essential. This should be accomplished either through the production of a winter cover crop, which may be plowed under in time for the production of a succeeding summer crop, or through the growing of a leguminous crop like cowpeas, lespedeza, or bur clover. These may be partially grazed off or may even be cut, but they leave all of the roots and a considerable part of the stubble to be turned into the soil. Wherever it is possible it is recommended that the green crop thus produced should be cut and fed to farm animals rather than that it should be turned under in its full growth. A greater value is secured from the crop and the restoration of organic matter is nearly or quite as efficient.

It would be difficult or impossible to recommend any fertilizers or classes of fertilizing material aside from organic matter which would be efficient for use upon the Memphis silt loam under the widely varying conditions of climate, of crop production, of drainage, and of erosion, which effect the type in the different areas of its development. The adoption of proper methods of fertilization should follow the lines developed by local experimentation as applied not only to this soil type, but also to the kind of crop to be grown upon it under the attendant climatic circumstances.

LIMITATIONS UPON SPECIAL CROPS.

In the more northern regions where the Memphis silt loam is developed it is well suited to the production of quite a number of general farming crops, and also to orchard fruits. Its use for these purposes will be described in the discussion of the crop adaptations of the type. Farther south tobacco is also grown in the proper environ-

ment, and is a fairly successful crop. In the more southern extension cotton is practically the dominant crop, and it has only been within recent years that any diversification of agriculture has occurred, aside from the growing of a limited area of corn for the feeding of work stock upon the cotton farms. From Baton Rouge northward, however, the Memphis silt loam is well suited to the production of certain classes of market-garden and truck crops, particularly of cabbage, turnips, lettuce, radishes, asparagus, tomatoes, English peas, and snap beans. It is not well suited to the production of the earliest truck crops even in these locations, since they are forced to an earlier maturity upon more sandy lands, and the crops grown upon the Memphis silt loam are at a slight disadvantage when competing in the early northern markets.

However, the yields secured upon the Memphis silt loam are frequently superior to those obtained from the more sandy lands, a fact which compensates to a considerable degree for the slightly later date of maturity accompanied by somewhat lessened prices. It is only within those portions of the type which are located near to through lines of transportation that the production of the market-garden or trucking crops is advisable, since their value is largely determined by the possibility of rapid transportation to city markets. Consequently only a small proportion of the total area of the Memphis silt loam, and that located favorably with regard to shipment, can be recommended for development for market gardening and trucking purposes.

The soil itself through its inherent characteristics is particularly well suited to the production of the later market-garden crops, and of all such crops as may be used for the purposes of canning. It is especially well adapted to the growing of tomatoes, peas, and beans, both for shipment and for canning purposes. Such use of the Memphis silt loam should be confined to the well-drained and little-eroded portions of the type.

EXTENT OF OCCUPATION.

The more southern portions of the Memphis silt loam were occupied to a limited degree for agricultural purposes by the civilized tribes of Indians before white occupation had gained any extensive foothold in the States where it is found. Since 1825 practically all of the more level areas of the Memphis silt loam, wherever it occurs, have been gradually cleared and occupied for crop production. The chief limitation upon the agricultural development of this soil has been that imposed by erosion. As a result, throughout a considerable proportion of its extent, not over 25 to 35 per cent of the total area of the type may be occupied, and in some localities, particularly near the bluffs, not over 5 to 10 per cent is sufficiently level to permit of

tillage. The fundamental cause for this lack of occupation still exists, and in some localities even to a more pronounced degree than in the pioneer days. It is therefore scarcely possible that any greater area of the Memphis silt loam may be successfully tilled than at present. There is, however, an excellent opportunity for the more intensive occupation of those portions of the type suited to tillage purposes, and a beginning has already been made along these lines in many areas where fruit growing, market gardening, and the production of canning crops are made possible by adequate transportation facilities. Along the main lines of railroad extending from Louisiana northward to the cities of the central States there are many locations upon the Memphis silt loam which may become as well known as Crystal Springs and Durant, Miss., for the production of market-garden and truck crops. The first of these localities is known as the greatest tomato-shipping point in the United States, and it has maintained this preeminence for 25 years. At the second point market gardening is of more recent development, but considerable areas are very profitably planted to the market-garden crops, and the usefulness of the Memphis silt loam and its associated type, the Richland silt loam, has been thoroughly demonstrated.

CROP ADAPTATIONS.

Taking into consideration the entire extent of its development, corn constitutes the principal crop grown upon the Memphis silt loam. Owing principally to differences in climatic surroundings, but also in some degree to differences in cultural methods, the corn yields are uniformly larger in the more northern regions occupied by the Memphis silt loam, particularly in Illinois and Kentucky. The yields range from 20 to 35 bushels per acre in these localities, giving an average yield of about 25 bushels per acre through a long period of years. In western Tennessee and in Mississippi corn is subordinate in acreage to cotton, which constitutes practically the only other crop grown upon the type. The yields are uniformly low, ranging from 10 to 20 bushels per acre and averaging about 18 bushels per acre in Tennessee and not over 15 bushels per acre in Mississippi. Considering the inherent properties of the soil, these yields may only be ascribed to one of two fundamental causes or to both operating together. The first of these would be climatic conditions unsuitable to the production of the corn crop; the second, cultural methods which were incompetent to bring out the best properties of the soil for the production of this crop. In these more southern regions the existence of certain well-tilled corn fields within the area of the Memphis silt loam demonstrates beyond question that the average yields secured by the majority of farmers by no means measure the capabilities of this soil for the production of corn. Where complete

commercial fertilizers are used with the corn crop, supplemented by the application of 300 or 400 pounds of cottonseed meal per acre, yields of 30 and 35 bushels per acre of corn are readily obtained and not infrequently exceeded. It may, therefore, be said that the Memphis silt loam even under the conditions of the long, hot summers of the more southern latitudes, is a fairly good corn soil when properly treated.

In Illinois the Memphis silt loam is extensively devoted to the production of winter wheat, the acreage of which ranks next to that of corn. The yields are low, amounting to not over 10 bushels per acre on the average, although proper tillage methods and a moderate amount of fertilization result in the production of 15 bushels an acre or more.

A small amount of winter wheat is also grown in western Kentucky, but the yields are very low and the acreage is decreasing.

Cotton is grown to a considerable extent upon the Memphis silt loam in western Tennessee, and constitutes the dominant crop in all Mississippi areas where the type has been encountered. In Tennessee the average yield for a considerable period of time is about one-third bale per acre, although the better farmers secure one-half bale or more through better tillage methods and the application of larger quantities of commercial fertilizer.

In the State of Mississippi the Memphis silt loam, so far as it is cultivated to cotton, constitutes an excellent upland soil for the production of this crop. It must be held in mind that because of topographic difficulties and because of erosion not over 20 per cent of the Memphis silt loam in the "Cane Hills" region is cultivated to any crop, while not more than 35 to 40 per cent of the type is occupied by crops in the "Flat Hills" region. The more level areas possessing the deeper soil and being in the best condition for crop production are devoted to cotton in both of these sections.

The average yield through a considerable period of years upon the Memphis silt loam in Mississippi is between two-fifths bale and one-half bale per acre. Again the better farmers upon well-cared-for lands produce average yields of approximately three-fourths bale per acre, and this yield might readily be attained over practically the entire tillable area of the type through the use of better methods of tillage and the employment of additional amounts of commercial fertilizer used in conjunction with applications of cottonseed meal at the rate of 300 to 400 pounds per acre.

The showing made by the Memphis silt loam as a general crop soil is not particularly favorable, with the single exception of cotton in the Mississippi counties where it is developed. In the majority of instances the yields of corn reported are scarcely sufficient to pay the interest upon the investment and the annual charges for working

the crop. In the case of winter wheat it is difficult to see where any profit can be made from the production of the crop. In the case of cotton, however, fair profits may be secured on the showing made by this type. The failure of the Memphis silt loam to produce adequate crop returns may not be attributed to the inherent characteristics of the soil itself, since in all areas where it has been encountered, under varying climatic conditions, the best farmers of those regions have easily doubled the average crop yields reported for the counties.

One of the principal necessities for increasing the yields of corn, wheat, or cotton upon the Memphis silt loam is the adoption of some well-regulated crop rotation, planned with the definite purpose of incorporating organic matter in the surface soil. In the more northern States a rotation consisting of corn the first year, followed by oats or winter wheat the second year, followed by two years devoted to the growing of the mixed grasses, including clover, will materially increase the crop-producing power of this type if the rotation be adhered to for a few years. In the more southern areas a crop rotation should be adopted which will provide for the sowing of a winter cover crop between the rows in the corn field at the last working of the corn, or of a winter cover crop to succeed the cotton. In the majority of localities where the Memphis silt loam is found south of the Ohio River, crimson clover and winter vetch are both available for this purpose and may be grown without interfering seriously with the cultivation or the picking of the cotton crop. Either crop provides a considerable amount of green manure to be turned under the succeeding spring in preparation for a succeeding crop. It is also a fact that a rotation providing for the growing of cotton followed by corn, followed by winter oats, these to be followed by a crop of cowpeas will materially aid in maintaining the Memphis silt loam against erosion and in restoring much needed organic matter to the surface soil.

To secure the best results in crop production upon this type of soil, fall or winter plowing—6 to 9 inches deep—is requisite. The lands should be "broadcasted" instead of having the ridges plowed out into the middles. In the spring the land should be thoroughly pulverized with a disk harrow and manures and fertilizers applied prior to the planting of the crop. Except in the more sloping areas, where it is necessary to adopt the contour method of tillage, ridge cultivation is scarcely necessary upon the type. Instead, the cultivation of the crops should be accomplished through the shallow stirring of the surface soil by the use of the spiked-tooth cultivator, and the small turn plow or sweep should be used, particularly during the latter part of the season, only to plow out areas which are badly in weeds or grass.

For the increase of the yields of the general farm crops upon the Memphis silt loam, thorough preparation and tillage of the land, the incorporation of organic matter, the rotation of crops, and the use of cottonseed meal or other organic sources of nitrogen are all essential, particularly in the more southern areas of its occurrence. When, in addition, the usual excellent natural drainage of this type is supplemented by the installation of tile drains to remedy conditions of deficient drainage over small level areas, the Memphis silt loam may be depended upon to bring crop returns commensurate with the care taken in its tillage.

In addition to the tilled crops already enumerated, the lespedeza, or Japan clover, and Bermuda grass make excellent growth upon this type of soil, the former growing particularly well in the shaded areas of the thinly forested slopes, while the Bermuda forms its characteristic mat of thick vegetation over open fields. Both of these grasses are extremely valuable for grazing purposes and each makes a fair cut of hay when its use for this purpose is desirable. The Bermuda yields rather the larger tonnage of hay, but the lespedeza hay is of excellent quality and of high feeding value. The use of these grasses, together with cowpea hay, should enable the farmers from the Ohio River southward who are tilling the Memphis silt loam to keep such a number of live stock, either for meat or milk production, as may seem desirable under the local conditions.

Market garden and truck crops.—In some of the more southern areas where the Memphis silt loam has been encountered it has been developed successfully as a market-gardening and trucking soil. In the Crystal Springs area, Mississippi, it constitutes an important soil for the production of tomatoes and has contributed largely toward the establishment of the reputation of that region for the production of this crop. In addition to the tomatoes, English peas, Irish potatoes, cabbages, turnips, strawberries, and asparagus are all successfully produced upon the Memphis silt loam. A similar development has taken place at Durant, Miss., upon the closely related type known as the Richland silt loam. In both cases these similar soils have been shown to be well adapted to the production of these market-garden, trucking, and fruit crops. In addition, both Irish and sweet potatoes are raised to advantage on the Memphis silt loam from Louisiana northward to Illinois. Irish potatoes yield from 75 to 150 bushels per acre and are grown as an early trucking crop in the southern areas and as a summer trucking crop or staple crop in the more northern localities. Sweet potatoes are grown in Mississippi, Tennessee, and Kentucky upon the Memphis silt loam, yielding from 75 to 250 bushels per acre of potatoes of fair quality. The sweet potatoes are marketed both as a truck crop and a staple crop, those reaching maturity at the earlier dates constituting the truck crop.

Fruit crops.—In addition to strawberries, which are grown in connection with the market-garden and truck crops in Mississippi, the Memphis silt loam is also well suited to apple orcharding in the more northern areas where it occurs. When care is used in the selection of the orchard site to secure good air and water drainage, the standard varieties for the region may be grown with profit. From Kentucky southward the Memphis silt loam is also a good peach soil, although but few commercial orchards have been developed upon it. These and numerous small plantings, principally for home use, have demonstrated that the trees are thrifty and long lived, and that the type might well be used throughout all its more southern development for the production of peaches.

A considerable proportion of the Memphis silt loam remains in forest growth. Wherever transportation is accessible a large part of the mechantable timber has already been cut. The growth of forest trees upon the type is rapid and with almost all of the species suited to the soil and climate, commercial forestry would undoubtedly be a desirable form for the utilization of the more eroded and hilly portions of the type. The post oak, Spanish oak, scarlet oak, hickory, black ash, and tulip are the native trees which dominate the forests upon the type. Beech also grows in the ravines and hollows in the cooler and more moist locations. Since these steeper portions of the Memphis silt loam should remain in forest, in order to protect such areas and adjoining tilled fields from excessive erosion, it would seem desirable that the farm woodlot or the small individual forest plantation should become a feature upon the majority of farms occupied by the Memphis silt loam. In a great number of instances such occupation would only require the careful selective cutting of timber now growing, together with the protection of the areas from excessive grazing and from fires. In case of necessity this practice might be supplemented by the planting of such varieties of forest trees as are needed to supplement the present stand.

The native grasses growing through the forested areas and upon certain abandoned fields to be found within the area of the Memphis silt loam are used to a limited extent for the pasturing of dairy cows, beef cattle, and hogs. The extension of such forms of animal industry upon the Memphis silt loam may be easily brought about when it is economically desirable in any particular locality.

FARM EQUIPMENT.

In the majority of cases the equipment of teams and tools upon the Memphis silt loam is scarcely adequate to the thorough and profitable cultivation of the type. In too many instances the 850-pound mule and the light-weight, one-mule plow, together with a few minor tools, constitute practically the entire working equipment.

Since the soil needs deeper and more thorough cultivation, heavier work stock and better tools should be employed in its tillage. The Memphis silt loam is stone free, soft and friable, and easily worked, unless it is handled when there is too much moisture present in the surface soil. Except for the fact that many of the fields are of small area and are circumscribed by deep gullies and eroded valleys, the use of power machinery would be advisable over its entire extent. Aside from this topographic limitation, the heavier machinery may well be used. It would be particularly desirable to use the disk plow and the disk harrow in the management of this soil, in order that it might be thoroughly stirred to a considerable depth, and in order that the trash, weeds, and other organic matter of the tilled fields might be completely turned in and incorporated with the soil.

The equipment of farm buildings upon the Memphis silt loam varies with the different areas in which it is found. The average equipment is neither better nor worse than the buildings found upon other types of the region.

SUMMARY.

The Memphis silt loam is an extensive soil type found principally upon the east side of the Mississippi River from the confluence of the Missouri southward to the vicinity of Lake Ponchartrain, but found also in other localities in southern Illinois and in Arkansas and Louisiana.

The surface soil is a brown or yellowish-brown silty loam of extremely variable depth, from 2 inches to more than 1 foot. The subsoil in almost all instances is a chocolate-brown or yellowish-brown heavy silt loam.

The soil type is derived from the weathering of the loess, a silty material associated with the glaciation of regions farther north.

The Memphis silt loam occurs at all altitudes from 50 feet above sea level in Louisiana to 500 or 600 feet above sea level in Illinois and Missouri. In general the drainage is good, although local areas marked by a gray surface soil and the presence of iron concretions or iron gravel are in need of tile underdrainage.

Owing to its soft, silty nature and its considerable elevation above adjoining bottom lands, a large part of the Memphis silt loam has been subjected to destructive erosion, and in such areas not over 20 per cent of the total extent of the type can be brought under tillage. In other areas, more remote from active stream erosion, fully 35 per cent of the type may be tilled, although erosion still constitutes a serious problem in the handling of this soil.

In the more northern areas corn and winter wheat constitute the dominant general farm crops produced upon the Memphis silt loam, while apples constitute the principal fruit crop. In the more southern areas cotton dominates all other crops, with corn second in acreage.

The yields of the principal crops vary decidedly under different attendant climatic conditions, and particularly with variations in the effectiveness of the tillage and maintenance of the soil type.

The yields of the staple crops may best be increased through careful attention to the prevention of erosion, the incorporation of organic matter in the soil, the deeper and more thorough preparation of the land, and the use of stable manures and cottonseed meal. Locally, drainage is also required.

In certain localities, particularly in Mississippi, the Memphis silt loam is a valuable soil for the production of market-garden and truck crops. Of these, tomatoes, green peas, cabbages, turnips, asparagus, strawberries, and Irish and sweet potatoes are the best suited for production upon the type.

In these more southern locations also, the Memphis silt loam is suited to the planting of commercial peach orchards, as has been shown by small plantings of fruit for home use.

For the proper preparation and cultivation of the Memphis silt loam heavier work animals and improved farm machinery are requisite.

The inherent capabilities of the type are not fairly represented by the crop yields at present secured, and improvements in yields should follow the better cultural practices suggested in this circular.

Approved:

JAMES WILSON,
Secretary of Agriculture.

WASHINGTON, D. C., *June 12, 1911.*

APPENDIX.

The following table shows the extent of the Memphis silt loam in the areas surveyed to this time.

In the first column is stated the particular soil survey in which the soil was encountered; in the second column, its extent of development in acres; and in the third column, the volume of the Field Operations of the Bureau of Soils in which the report upon the area may be found. Those desiring a detailed description of the soil and of the general conditions which surround it in any particular area may consult these volumes in almost any public library.

Areas of Memphis silt loam encountered in the Soil Survey.

Survey.	Area of soil.	Year of publication, Field Operations.
Illinois:	*Acres.*	
Johnson County	167,104	1903
O'Fallon area, Missouri	192	1904
St. Clair County[1]	138,560	1902
Kentucky:		
McCracken County	139,776	1905
Louisiana:		
East Baton Rouge Parish	16,640	1905
Mississippi;		
Crystal Springs area	46,016	1905
Holmes County	220,288	1908
Jackson area	410,624	1904
Montgomery County	126,848	1906
Smedes area	52,288	1902
Yazoo area	140,090	1901
Missouri:		
O'Fallon area	5,184	1904
Tennessee;		
Madison County	197,120	1906

[1] Mapped as Miami fine sandy loam.