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

THE SASSAFRAS SILT LOAM.

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

THE SASSAFRAS SILT LOAM.

GEOGRAPHICAL DISTRIBUTION.

The areas of the Sassafras silt loam which have been encountered by the soil survey are confined entirely to the Coastal Plain portions of New Jersey, Pennsylvania, Delaware, and Maryland. A total area of 518,142 acres of this type has been included in 12 different soil surveys in these 4 States. It is probable that the soil type does not occur farther north than New Brunswick, N. J., nor farther south than Norfolk, Va. The type is confined to seaward portions of the Coastal Plain in each of these States.

CHARACTERISTICS OF SOIL AND SUBSOIL.

The surface soil of the Sassafras silt loam, to an average depth of 9 or 10 inches, is a soft, friable brown silt loam occasionally containing small amounts of fine gravel. This is underlain to a depth of 36 inches in nearly all cases, and frequently to a depth of 7 or 8 feet, by a yellow or reddish-yellow heavy silt loam, which is generally sufficiently heavy to be called a clay in the localities where it occurs. At a depth varying from 3 feet to 8 or 10 feet this subsoil is frequently underlain by beds of gravel or gravel and sand, which separate the mass of soil and subsoil from underlying formations. In the southern portion of the Maryland-Delaware Peninsula, however, this gravel bed is frequently lacking, and the subsoil rests not infrequently on beds of sand. While the subsoil is rather stiff and heavy, it is still sufficiently granulated and friable to give reasonable underdrainage, and it is only in case of depressions occurring throughout the type that drainage is likely to be deficient.

The Sassafras silt loam is easily distinguished from the soils of the Elkton series, which occur in the same region, since the latter possess gray to brown surface soils and mottled yellow and gray subsoils. It is best distinguished from the soils of the Norfolk series by the slightly reddish cast of its deeper subsoil. It does not possess the black surface soil of the Portsmouth series of soils, which is sometimes found in the same localities.

SURFACE FEATURES AND DRAINAGE.

Throughout the region in which it occurs the Sassafras silt loam occupies low undulating or nearly level terraces, which slope from the inland regions gently to a rather steep frontal escarpment where the type ordinarily terminates, and is replaced at lower levels by other soils. In southern New Jersey the soil type is found at an altitude of 25 to 50 feet on the low terraces which border the eastern shore of the Delaware River and Delaware Bay, and it rises gently inland to a higher level at about 90 feet altitude. Some portions of the type between the low and the higher terrace are rolling to sloping in their surface features. In the Maryland-Delaware Peninsula the highest altitudes of the type are found in the form of narrow terraces where the Coastal Plain section borders on the Piedmont. Some of these higher terraces rise to an altitude of 200 feet or more. In general the highest altitudes of the Sassafras silt loam within the Coastal Plain proper are found at about 100 to 110 feet above tide in the vicinity of Chesapeake Bay, and the surface slopes gently eastward toward Delaware Bay through Maryland and southern Delaware, reaching its lowest level of about 10 feet above tidewater in the east-central portion of the State of Delaware. In southern Maryland the Sassafras silt loam exists along the west shore of Chesapeake Bay and along the main tidewater embayments tributary to the bay in the form of distinct terraces, having an altitude of 60 to 100 feet above tidewater. Some of these terraces extend a considerable distance inland along the principal streams, and their surface rises gently with the slope of the stream bed to altitudes of over 200 feet. In all regions where it occurs the surface is so level that power machinery may be used upon all parts of the type when it is properly cleared of its natural hardwood growth. The altitude above the local water level renders the natural drainage effective over the greater portion of the type. Slight hollows and regions remote from the drainage courses constitute the only exception to this general rule.

LIMITATIONS OF YIELD.

Although the Sassafras silt loam is remarkably uniform in its inherent characteristics from its most northern extension to its southern limits, there are noticeable variations in the yields of the general farm crops which are produced upon the type. In the more northern regions, where this soil is highly esteemed for general farming, it has been the subject of the most careful tillage and treatment. As a result the yields of all the farm crops are high, and the soil is rarely sold at a price lower than $75 to $100 an acre. Farther south, where a different and less effective system of farming has been in use, the yields are less, the price of the land is not more than one-

third as great, and the surface soil is more yellow and lacks sufficient organic matter. It is also more likely to be compacted and clodded when cultivated in a moist condition. These differences in its condition indicate the chief limitations upon the producing capacity of the Sassafras silt loam. Where a careful and systematic crop rotation is practiced, where stable manure and other organic manures are used, and particularly where moderate amounts of lime are applied in connection with the seeding down of the grasses, maximum yields are always secured, and the soil is found to be in its best condition. On the contrary, where organic manures are not used, where liming is never practiced, and where hoed crops are cultivated year after year upon the same area, the soil is much less productive and much less esteemed for the production of crops. The introduction of better methods in the regions last referred to will slowly increase the producing capacity of this soil and render it as fertile and as valuable as in the locations where it has received better treatment in the past. In all cases the natural capacity of the soil is above the average for each region where it occurs.

IMPROVEMENTS IN CROP YIELD.

The necessary steps for the improvement of crop yields upon this type have already been indicated in the discussion of the limitations of such yields. One of the paramount necessities is the application of all stable manure which is available, and in case this supply is not sufficient to meet the needs some leguminous crop like crimson clover or the medium red clover should be produced for the sole purpose of being plowed under to increase the humus content, preferably with an application of 2,000 pounds of lime per acre. In certain localities difficulty has been encountered in securing a good stand of clover upon this soil type. Liming will largely overcome this difficulty, and better results can be obtained by seeding the clover without a nurse crop.

There are small local areas within the general area of the type where additional artificial drainage would prove beneficial. These usually consist of small saucer-shaped depressions or of flat interstream areas where the headwater drainage of the streams is only partially established.

THE EXTENT OF OCCUPATION.

Practically every available acre of the Sassafras silt loam has been brought under cultivation in the various regions where it occurs. It is one of the most highly prized general farming soils of the North Atlantic Coastal Plain section, and the original hardwood timber was cleared from its surface from 100 to 200 years ago. The soil type

was early sought for the production of corn, wheat, and grass, and certain special crops have been produced upon it with success as transportation facilities and market demands increased. While there is considerable variation in the yields produced, owing to more or less efficient management, it is naturally an excellent soil for general farming.

TILLAGE REQUIREMENTS.

It is apparent from the textural characteristics of the Sassafras silt loam, from its level to gently undulating surface topography, and from the classes of crops best suited for production upon this soil that the equipment required for its most economical tillage will differ very materially from the equipment to be used upon such other Coastal Plain soils as the Norfolk fine sand or sandy loam, which are more easily worked and are not so universally planted to the general farm crops. The Sassafras silt loam should be plowed to a depth of 8 or 9 inches, and if the natural soil is not so deep as this the depth should be gradually increased from year to year.

It would be practically impossible to secure such adequate tillage of the type with light weight one-horse or one-mule outfits, which are perfectly adequate for the handling of such soils as the Norfolk sandy loam or fine sandy loam, or others of that class. Economy in the conduct of tillage operations demands that at least two-horse teams where each animal will weigh from 1,300 to 1,500 pounds should be used, and the most economical working of land of this class would justify the four-horse hitch, which is used to special advantage upon the heavy general farming soils, such as the limestone soils of Maryland and Pennsylvania and the prairie soils of the Central States.

For the same reasons the lightweight turning plow used upon the more sandy soils of the Coastal Plain is totally inadequate for the proper tillage of the Sassafras silt loam. In its place there should be used either the one or two gang sulky plow, or the two or three blade disk plow. These implements drawn by adequate horsepower are capable of turning and thoroughly pulverizing the surface soil to the required depth of 8 or 9 inches. Less powerful equipment, either of team or tools, is not competent to bring out the best qualities and the full efficiency of the soil.

Both the soil and subsoil require frequent stirring, and it is desirable to use such implements as the disk harrow, the spring-tooth harrow, or the spike-tooth harrow to secure this preparation of the land. Wherever possible, power machinery should also be used for the planting and intertillage of crops.

In the same way that heavier teams and tools are required for the proper tillage of the Sassafras silt loam, so also are more expensive

and commodious farm buildings requisite. These exist in New Jersey and on the Maryland-Delaware Peninsula, where the soil type is most profitably tilled. The storage of grain, hay, and straw and the proper housing of tools and work stock, even in the absence of the dairy industry or of cattle breeding, require the more elaborate equipment of buildings and barns.

Thus the nature of the soil and its characteristic properties determine the character of the best farm equipment in the form of work stock, machinery, and buildings.

CROP ADAPTATIONS.

The Sassafras silt loam is probably the best general farming soil to be found in the Coastal Plain regions. Its level surface, its soft, friable surface soil when properly handled, the considerable depth of both surface soil and subsoil, and the adequate drainage features of the type all tend to render it suitable for the production of the principal farm crops of the latitude in which it occurs.

The Sassafras silt loam is well suited to the production of corn. The dent varieties are principally grown, and the yields obtained depend upon the previous preparation of the land and its treatment for a series of years. Where the land has been properly manured with stable manure, where lime has been applied at least once in the rotation, where a regular rotation of crops has been practiced for a considerable period of time, the yields of shelled corn range from 50 to 80 bushels per acre. The latter yield, of course, is only secured by the best farmers under the most favorable circumstances. It is probable, however, that the average yield for the type upon well-tilled areas will be in excess of 50 bushels per acre. Corn is grown not only for the shelled grain, but also for silage purposes, particularly in southern New Jersey. Yields of silage corn frequently exceed 12 tons per acre, although the average yield may be stated at from 10 to 12 tons.

The Sassafras silt loam is almost universally used, also, for the production of winter wheat. In the more northern areas, especially in southern New Jersey, wheat yields from 20 to 25 bushels per acre, and yields of 35 and even 38 bushels are not infrequently secured when the land is in the best condition and the season is favorable. A good grade of hard winter wheat is produced, and even though the value of the land is unusually high the excellent yield of wheat and its good quality warrant its production upon the Sassafras silt loam.

Although oats are not seeded so extensively as wheat upon the Sassafras silt loam, still the yields per acre are good wherever the crop is grown. In some of the eastern Maryland counties yields of 40 to 50 bushels per acre of oats are reported, and it may be said that a yield of 35 to 45 bushels may normally be expected.

Both timothy and red clover are commonly seeded with one or the other of the small grain crops in regular rotation in order to furnish hay. In general, clover makes a good stand, especially if the land has been limed, and timothy is equally satisfactory. The mixed hay will yield from 1½ to 2 tons per acre, and where the soil is in particularly good condition this yield, even, may be exceeded.

These principal farm crops are usually grown upon the Sassafras silt loam in regular succession. There is some diversity in the order of the crop rotations, but in general the sod land is fall plowed and fitted in the succeeding spring for the production of corn. In this fitting the application of stable manure, either upon the sod before plowing or upon the plowed land before the planting of the corn is the usual practice. In the latter case the manure is thoroughly harrowed into the surface soil. Commercial fertilizers are also used in connection with the stable manure and a complete fertilizer, carrying 3 or 4 per cent of nitrogen, usually about 4 per cent of potash and 10 to 12 per cent of phosphoric acid is quite commonly selected. The amount of the application varies considerably in different localities, ranging from 250 pounds an acre to as much as 500 pounds an acre in the more intensively farmed districts. Frequent cultivation of the corn during the growing season is the rule where the largest crops are secured. Corn is usually followed by wheat either for one or two crops. The second crop of wheat is not infrequently replaced by oats. In either case the land is seeded to timothy and clover with the second crop of grain and remains in grass for two years or more.

Special crops.—In the Chesapeake Bay region where the Sassafras silt loam is extensively developed upon both sides of the bay a considerable canning industry has been developed. This type of soil has contributed largely to the maintenance of the industry, through the extensive production of sweet corn and of tomatoes. The canning corn is picked in the husk and sold, usually by the ton, to the local factories. The yield varies from 2½ to 3½ tons per acre under normal conditions. Prices, of course, vary, but the crop usually brings in a cash return of $25 to $35. The blades and stalks remain as rough forage to be fed upon the farm and constitute a valuable by-product to those farmers who feed live stock or dairy cows.

Tomatoes are produced extensively on the Maryland-Delaware Peninsula and around the head of Chesapeake Bay in general. The soil is usually prepared for tomato growing by the application of such stable manure as is available and by the application of a complete commercial fertilizer. The plants are set to be cultivated in both directions and are not supported in the field. Yields vary materially. Where the ground has not been occupied previously for the production of this crop the Sassafras silt loam has been known to

produce 12 tons or more of tomatoes per acre. In general, average yields, however, run from 6 to 8 tons upon this type of soil. The tomatoes produced upon the Sassafras silt loam are well known for quality and flavor, but constitute a late crop suitable for canning purposes rather than an early crop for market shipment.

The medium to late summer crop of Irish potatoes is also largely produced upon the Sassafras silt loam, both in southern New Jersey and upon the Maryland-Delaware Peninsula. The preparation of the land does not differ materially from that of the preparation for corn, although spring plowing is possibly more generally practiced for the potato crop. In the fertilization commercial fertilizer is used in larger quantities, applications of 1,000 pounds or more per acre being made by the best growers. A fertilizer high in potash content is usually employed. The yields vary from about 100 bushels per acre for the earlier potatoes to over 200 bushels per acre for the later crop in a favorable season. The Sassafras silt loam is almost an ideal late potato soil for the North Atlantic Coastal Plain, provided the ground is properly prepared. It would, therefore, seem that a rotation such as is used in the more northern potato-growing sections might be adopted to advantage. This would bring potatoes into the place of corn, following the clover sod, with an application of 500 to 1,000 pounds of commercial fertilizer per acre applied in the drill at the time of planting. Under this system yields of Irish potatoes might be increased to an average of 200 to 250 bushels per acre after a few years of careful management. The potato crop might well be followed in the succeeding season by either beans or peas for the canning factories. Either crop could be removed from the ground in time for the sowing of the winter wheat crop in the fall. The land should be limed with the bean or pea crop and commercial fertilizer again applied with the wheat crop. The clover should only be allowed to stand one year, the early summer cutting being harvested for hay and the aftergrowth or rowen crop should again be turned under as a basis for the restoration of organic matter to the soil preceding the planting of potatoes.

A four-year rotation approximating this course has been found particularly successful in some of the northern potato-growing sections and has resulted in the increase of average yields from about 150 bushels per acre to 200 and even 300 bushels upon farms where it has been most systematically practiced. The principal points of the rotation are the restoration of organic matter through the plowing in of the clover, the production of two leguminous crops in the four-course rotation, the use of organic matter as the principal fertilizer preceding the potato crop, and the use of lime with the production of the beans or peas. Wherever areas of the Sassafras silt loam are located near to transportation facilities so that the potatoes

do not need to be hauled more than 2 or 3 miles to the shipping point this crop will prove an excellent money crop for the land.

In certain localities near to the canning factories, tomatoes might well take the place of potatoes in this rotation on the Sassafras silt loam.

Locally, both in southern New Jersey and on the Delaware-Maryland Peninsula, asparagus is produced to a considerable extent upon the Sassafras silt loam. The beds are long-lived and productive, but the asparagus is not ready for marketing as early in the spring as the crop which is grown upon the more sandy soils, although the quality is excellent.

The Sassafras silt loam was at one time extensively used on the Maryland-Delaware Peninsula for the production of peaches and proved its value for this crop. Owing to the invasion of certain diseases many orchards have been cut out, and their area is at present devoted to the general farm crops. If it should ever seem desirable to reestablish some of these orchards, the Sassafras silt loam will still be found to be an excellent soil for peaches, though it may be regarded as rather too heavy and retentive of moisture for an ideal peach soil. The fruit is usually large and well colored, the trees fairly long-lived and thrifty, and the yield large.

Recently the Sassafras silt loam has been extensively planted to pears, the Kieffer being the variety usually selected. The Kieffer is fairly resistant to blight, makes a strong growth, and usually gives a heavy yield. In both Maryland and Delaware thousands of bushels of Kieffers are annually canned in the local canneries. A considerable proportion of this crop is produced upon the Sassafras silt loam.

The Sassafras silt loam is undoubtedly one of the best soils for apple production in the Maryland-Delaware Peninsula and in southern New Jersey. Several varieties are adapted to this type, but it is probable that the Winesap group, including Winesap, Stayman Winesap, and Paragon, and the Grimes Golden are best suited for this particular soil, under the climatic conditions existing in those sections of New Jersey, Pennsylvania, and of the Chesapeake Bay region where the type is developed. Wherever apples are to be planted upon this type there should be some elevation to the soil body and good natural drainage, both for water and for air.

Where the Sassafras silt loam is encountered in southern Maryland a considerable amount of the Maryland pipe-smoking tobacco is still grown upon it. The soil is generally considered rather too heavy and retentive of moisture to produce the best quality of leaf and the area planted to tobacco is gradually being restricted.

It will be seen from the discussion of the above crop adaptations of this soil that it constitutes one of the best general farming soils to be encountered in the Atlantic Coastal Plain. In fact it is generally

preferred above all others in the North Atlantic district for the production of the crops enumerated. It is a strong, fertile, well-drained, level-surfaced soil, and every acre of it has usually been cleared and placed under cultivation. In the hands of skillful farmers its crop-producing power has been increased from year to year until yields higher than the average for other soils in its localities are habitually produced. It is practically the only soil in the Atlantic Coastal Plain which compares favorably with the soils of the Limestone Valleys for the production of corn, wheat, and grass. It is one of the best soils in the Coastal Plain for the production of apples, pears, and peaches. It is well suited to the production of Irish potatoes, and of tomatoes and sweet corn for canning purposes. Its improvement may easily be accomplished through the restoration of organic material to the surface soil, aided by the application of lime.

The Sassafras silt loam furnishes an excellent example of the contrast between a well-drained upland soil with level topography and other soils of similar texture, but with different characteristic drainage and topographic features. It is thus strongly contrasted with the Portsmouth silt loam which occurs in the same general region of the Atlantic Coastal Plain, but which lacks the excellent natural drainage of this type. The two soils are only comparable in the production of corn, where each produces from 40 to 60 bushels per acre under ordinary circumstances. Winter wheat, however, is not suited to production upon the Portsmouth silt loam. Oats may only be raised as a summer crop, and in the seeding to grass, timothy and redtop are suited to the Portsmouth silt loam, whereas timothy, red clover, and crimson clover may be grown upon the better drained Sassafras silt loam. While potatoes and tomatoes are well suited to the Sassafras silt loam, neither can be raised to particularly good advantage upon the Portsmouth silt loam, but the latter is far the better soil for the production of cabbage and onions.

The Portsmouth silt loam is not under any circumstances favorable to the production of apples and peaches, but is one of the chosen strawberry soils of the Middle Atlantic States.

It is thus apparent from these contrasts between the two types, which are so closely similar in the texture of their soils and subsoils, but which differ materially in their drainage and in the source of materials from which they are formed, that slight differences in the characteristics of soils frequently exert a strong controlling influence upon the character of crops which may be raised economically upon the different types.

As a natural consequence of the suitability of the Sassafras silt loam to the production of corn, oats, the grasses, and the leguminous forage crops, the type is one of the best soils in the North Atlantic

Coastal Plain to serve as a basis for the establishment of the dairy industry. Where the price of land is high, ranging from $65 to $100 or more an acre, the conduct of the operations should be upon a decidedly intensive basis. Pasturage should only constitute part of the regular rotation, and no land of this type should be set aside as permanent pasture. It is possible so to arrange the crop production of a farm upon the Sassafras silt loam that the corn silage and corn for the grain, peas, oats, and barley as soiling crops, rye or winter wheat as an early soiling crop, and the mixed grasses or even alfalfa may all be produced for forage purposes. The capability of producing these crops, taken together with good transportation facilities and the abundance of fresh pure water throughout the region, render the soil and its products ideal as a basis for dairying.

Wherever rough land or pasture land of lower value is included in a farm made up principally of the Sassafras silt loam, sheep raising is also a profitable industry. The keeping of sheep in connection with the dairy industry has proved profitable in several locations.

The Sassafras silt loam is practically the only one of the Atlantic Coastal Plain soil types upon which the fattening of beef cattle could hold rank comparable with that of the beef production of the Limestone Valleys or the Central Prairie States.

SUMMARY.

The Sassafras silt loam occurs in southern New Jersey, southeastern Pennsylvania, and in Delaware and eastern Maryland.

Its surface soil is a mealy, soft, brown loam which may be somewhat yellow in areas where organic matter is deficient. The subsoil is a stiff, yellow, heavy silt loam approaching a clay in texture. The depth of soil and subsoil is considerable, but the mass of the type usually rests upon gravel or sand, thus insuring adequate drainage.

The surface of the Sassafras silt loam is level to gently undulating.

The natural drainage of the type is normally adequate, and only small areas require artificial drainage.

The Sassafras silt loam is well suited to the production of corn, wheat, oats, timothy, clover, and Irish potatoes among the general farm crops.

It is well suited to the production of tomatoes and sweet corn for canning purposes.

Certain varieties of apples and pears are grown to advantage.

In certain of the more southern locations tobacco is grown, but as the crop is not particularly well suited to this soil it might well be abandoned in favor of other more profitable crops.

It is in these latter localities that the restoration of organic matter and the application of lime are particularly desirable, in order to in-

crease the productivity of the type and enhance its value for general farming purposes.

The Sassafras silt loam requires adequate equipment of heavy work stock and tillage machinery and of farm machinery and buildings.

It is suited to maintain the dairy industry and to produce beef cattle for market.

Practically every available acre of the Sassafras silt loam in all localities is held under cultivation.

The acreage value of the soil varies with its distance from market or from transportation facilities, and with the previous treatment which the soil has received. Prices range from $75 to $125 in the more favorable locations, and from $25 to $40 an acre in those less favorably situated.

Approved.

JAMES WILSON,
Secretary of Agriculture.

APPENDIX.

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

In the first column is stated the particular 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 the Sassafras silt loam encountered in the soil survey.

Survey.	Area of soil.	Year of publication, Field Operations.
	Acres.	
Delaware:		
Dover area [1]	32,960	1903
Maryland:		
Anne Arundel County	31,040	1909
Calvert County [2]	8,850	1900
Cecil County [2]	50,500	1900
Easton area	130,944	1907
Harford County [2]	29,810	1901
Kent County [2]	59,140	1900
Prince Georges County [2]	9,090	1901
St. Marys County [2]	16,200	1900
New Jersey:		
Salem area [2]	64,930	1901
Trenton area [2]	82,560	1902
Pennsylvania:		
Chester County [1]	6	1905
Trenton area, N. J. [2]	2,112	1902

[1] Mapped as Norfolk silt loam.

[2] Mapped as Sassafras loam.