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By E. B. FERRIS and F. B. RICHARDSON.

Introduction.—For twenty successive years this Station in its two locations in South Mississippi has done more or less work with sweet potatoes, largely, it is true, in growing them as a commercial crop, but interspersing many experiments with varieties, fertilizers, storage and other tests necessary to meet the growing demand for information about this most valuable root crop. In its early location at McNeill our Station had newly cleared lands which were free from noxious grasses and inimical diseases and especially adapted to growing maximum yields of sweet potatoes at a minimum expense for labor.

At that time practically nothing had been done in South Mississippi toward growing this crop for outside markets and ours was possibly the first attempt at selling sweet potatoes in car lots to markets without the State. In 1906 our Station shipped from McNeill to Birmingham, Ala., three carloads of sweet potatoes, while local growers, encouraged by work we had previously done, added many more cars to the total number sent out from this small village and neighboring towns took up the work so that the sweet potato has now become a crop of considerable commercial importance in that part of the county contiguous to McNeill.

History.—Both sweet and Irish potatoes are of American origin, the sweet potato having been known and used for food before the Irish potato was discovered. It is said to have been introduced into Southern Europe many years before Sir Walter Raleigh introduced the Irish potato into England and then to Ireland. However, the white potato became the standard food crop of Ireland while in Southern Europe the growth of the sweet potato was largely discontinued for the reason, it is said, that they were too sweet for vegetables and not sweet enough for fruits. At present the growth of the sweet potato is confined largely to the southern part of North America, to Central America, the West Indies, Hawaii, and the Philippines. In no place are conditions more favorable to their growth than along the Atlantic Seaboard from New Jersey to Texas on Coastal Plains soils, particularly in the States of Alabama, Georgia and Mississippi as the census figures of production indicate.

Statistics.—Mississippi ranks third as a sweet potato growing state having produced in 1920 11,330,000 from 103,000 acres of land devoted to the crop. At the same time Alabama produced 17,764,000 bushels on 180,000 acres and Georgia 13,764,000 on 148,000 acres. There are produced annually in the United States 112,268,000 bushels of sweet potatoes and 430,458,000 bushels of Irish potatoes. Those of us who are accustomed to the sweet rather than the white or Irish potato greatly prefer the former on account of its palatability, and as experiments show the fuel value of the sweet potato when taken into the digestive system in the proportion of 560 calories in the one to 375 calories in the other, it would seem entirely possible and even probable that with better methods of handling and advertising the sweet potato might reverse positions with the Irish potato in the relative rates of consumption even though the latter might still be used in as great quantities as at present. If such should ever be the case the Coastal Plains soils of South Mississippi would come to their true

value as the most economical producers of the cheapest and best food for the human race.

Importance of Crop.—Because in the past a large part of the sweet potatoes actually grown have spoiled because of improper methods of curing, this crop has never been given the place in our farm economy that it deserved and this, too, rendered the extension of markets for the best varieties extremely uncertain so that until recently the trade has not been warranted in conducting any extensive advertising campaigns for extending these markets. However, with the introduction of the modern curing house, and the finding out that much of the decay in sweet potatoes was caused by preventable diseases, the keeping quality of the sweet is fast approaching that of the Irish potato and would appear to be only a question of time when it may become just as important an article of human consumption. Besides, the sweet potato is much more palatable to domestic animals than the white and to the extent of furnishing a carbonaceous diet is possibly not exceeded in acre value by any other feed crop that can be grown in South Mississippi. Based on a yield of 20 bushels of corn and 200 bushels of sweet potatoes to the acre, the potatoes would furnish approximately 50 per cent more protein and three times more carbohydrates than the corn and on the sandy lands of this section could be harvested by the hogs with no material injury to the land.

Climatic Requirements.—To be grown to best advantage the sweet potato should have a growing season of about five months. For home use its growth might extend to fully half the area of the United States including the states of Pennsylvania, Ohio, Indiana, Illinois, and parts of Iowa, Nebraska, Colorado, New Mexico, Arizona and California. A map showing the range of production for the crop as contained in Farmers' Bulletin No. 304 shows that it hugs the shore line of the Atlantic Ocean and Gulf of Mexico from New Jersey to Texas, covering the Coastal Plains soils of the several states between them and in the approximate center of this wide belt extending far north so as to include the greater part of all the states south of the old Mason and Dixon line. It is enough, however, for our purpose to say that the State of Mississippi is entirely within this belt and that sweet potatoes may be grown to perfection over the whole State so far as climatic requirements are concerned and, as a matter of fact, they are so grown; but, we regret to say, only to a very small fraction of the amounts that might be grown if markets were available and improved methods of curing the crop in more general use, with the elimination of black rot and stem rot from field and seed bed, the careful handling, housing and curing of the potatoes when grown, there should be no more doubt about the successful keeping of sweet potatoes than that of keeping the white potato. When this is assured the marketing of these potatoes would be extended over the entire year rather than over a few months of fall and winter and with proper propaganda for advertising this wonderful crop, such as has been repeatedly done by producers of other crops, notably the fruit crops of California, markets would soon be found for much greater quantities of these potatoes than we grow at present and would consistently increase in proportion to our efforts.

South Mississippi Soils.—The most of the soils of South Mississippi are especially suited to the growing of sweet potatoes. They are generally sandy loams, well drained, easily prepared and cultivated and ideal for the develop-

ment of smooth potatoes of medium size, the kind that sell best on discriminating markets. Poorly drained, stiff lands should be avoided at least to the extent of attempting to grow potatoes on a commercial scale. Only a very small per cent of the soils of South Mississippi have ever been brought into cultivation, possibly not more than five per cent. over the section as a whole and millions of acres of choice lands now have been denuded of their growth of pine timber and await development at the hands of the farmers. Comparatively speaking the sweet potato is the best crop that can be grown on such newly cleared lands. They make almost as heavy yields on new lands as they do when these lands are older and better developed mechanically and chemically; such new soils are free from diseases peculiar to the sweet potato, especially the black rot with which many of our older soils are infected; crab grass infests many of the older soils of the South and especially those of the Coastal Plains section and might be called the arch enemy of the sweet potato in that it runs the cost of cultivation to unreasonable bounds compared to that of new lands which for several years after clearing are free from this pest; besides, the majority of staple farm crops grown in South Mississippi do not thrive on newly cleared lands and the sweet potato is one of the few exceptions to this rule.

Think of the possibilities for such a crop in a section like our own where the seasons are long, rainfall abundant and ideal soils available to the extent of millions of acres. There are approximately ten million acres of Coastal Plains soils in South Mississippi, not five per cent. of which are in cultivation and the most of which might be made to grow maximum crops of sweet potatoes immediately after clearing. The best of these lands will, with the addition of only a few hundred pounds of commercial fertilizer, make yields of two hundred or more bushels of sweet potatoes per acre which in the present time of depressed values are selling field run to the canning factories for forty cents per bushel and which, if stored and cured, will sell in the late winter for more than one dollar per bushel. The same newly cleared lands if planted to corn would do well to produce twenty bushels per acre, would require fully as much expense to grow and would sell on present markets for little more per bushel than the sweet potatoes.

In many instances in our Station work we have grown ten times as many bushels of sweet potatoes on newly cleared lands as the same lands produced later when planted to corn and while two hundred bushels of sweet potatoes per acre is nearly twice the average of the State we have in many instances exceeded this yield by many bushels. As generally grown the sweet potato is made to follow other crops and consequently planted too late for maximum yields; setting is frequently done by inexperienced hands in great haste to take advantage of occasional showers and is often hastily done on poorly prepared land on time borrowed from that intended for corn and cotton. Notwithstanding poor preparation, late planting and generally poor stands, the average yield of sweet potatoes for Mississippi as a whole is about 110 bushels per acre while that of corn for the same years was sixteen.

Soil Requirements.—The sweet potato does best on sandy loam soils with sufficient clay in the subsoils to prevent the leaching of added plant food. Frequently the soils that most nearly meet these physical requirements are lacking in chemical plant food necessary to maximum production. Thus, in perhaps the majority of sweet potato soils, the use of commercial fertilizers is found to be

necessary. It is said that extremely rich delta soil is not adapted to the growth of the sweet potato though doubtless such soils will produce enough for home use. Soils made extremely rich by the application of animal manures have proven inferior for potatoes even in this section for the reason that the potatoes grow too large and both large and small ones crack open and are consequently fit only for feeding to animals and when stored have not kept well. On one occasion the writer had two acres of as fine potatoes as were ever grown at McNeill ruined entirely from having been grown on land highly fertilized with animal manures, placed the previous winter and immediately followed by an early truck crop. On this land the potatoes grew to an enormous size and many of them were cracked open to the extent that they could be divided with the hands by spreading the cracks already started.

Fertilizers.—As previously indicated the sweet potato often does best on lands below the average in fertility and made productive by the use of fertilizers. It has been our experience that it is a crop that does not require high fertilization and some of our most satisfactory yields have been made on newly cleared lands with moderate amounts of commercial fertilizers. The crop does not seem to respond to changes in kind and quantity of fertilizers as freely as does cotton and some other farm crops and the work that we have done first at Mc Neill and later at Poplarville with fertilizers under potatoes does not lead to any very positive conclusions on our part. A study of the fertilizer work carried on at other Southern Stations would also fail to lead us to any very definite conclusions as to how the crop should be fertilized. Thus in Florida as a result of carefully conducted fertilizer work extending over five years the most pronounced difference in yield due to fertilizers was the leaving off of potash from mixtures containing nitrogen and phosphorus. By so doing the yield as reported in Bulletin No. 156 of the Florida Experiment Station was reduced from 204 bushels with the complete fertilizer to 65 bushels where only nitrogen and phosphorus were applied. On the other hand one of the conclusions drawn from a number of cooperative tests conducted by the Alabama Experiment Station and reported in Bulletin No. 184 is, "Taken as a whole these experiments seem to indicate that the popular idea that potash is the most important constituent in a fertilizer for sweet potatoes is incorrect, at least as to practically all the soils here represented. On the other hand, these tests show that phosphate and nitrogen were much more important than potash."

While our Station was located at McNeill and before the soil had been influenced to any great extent by the application of fertilizers to other crops, we conducted a simple series of tests to show the effects of different plant elements alone and in combination on the yield of sweet potatoes. The land on which this was done was practically level and very uniform in character. Ten combinations were used each in duplicate and the several plats in the two series so placed as to do away as largely as possible with variations in yield due to inequalities in the soil, if perchance there should have been such, which we were unable to detect either before or after the work was done.

This work was started in 1906 and was repeated on the same land in 1907 with a considerable reduction in yield the second year over the first, but with no marked difference in the effects shown by the different kinds or combinations of plant food elements. One result alone was sufficiently marked to call atten-

tion to and that was the falling off of the check plat from 13,550 pounds in 1906 to 8,745 pounds in 1907, showing, as we believe, that the sweet potato is not a gross feeder and that the residue of fertilizer from previous crops was sufficient in 1906 to bring up the yield of the check plat almost to the level of those that had received fertilizer. However, this residue was largely used up in one year and the check plat in 1907 fell several thousand pounds per acre below the average of those receiving fertilizers.

We realize now that from a scientific standpoint it would have been much better if the work started at McNeill had been extended over a period of at least five years, but, as a matter of fact, no farmer ever attempts to grow potatoes more than twice in succession on the same land without interspersing other crops which he fertilizes according to their particular needs as he understands them, and so if this work had been continued it might have had little practical value.

Promptly on the removal of this Station from McNeill to Poplarville we began a much more elaborately planned experiment with fertilizers under sweet potatoes as suggested by a committee of horticulturists from the organization of Southern Agricultural Workers. This was started on land of unknown history and the results of the first two years were so conflicting that we do not give them here, though they have been published in our annual report for 1920. Doubtless much of lack of uniformity was brought about by the serious infection of the land with black and stem rots, and the presence of which caused us to abandon the experiment and start anew on supposedly clean land. This last work has been going on only one year and being on old land on which fertilizers have been used for a number of years the results of a single crop would be inconclusive.

The following table gives in detail the results of the two years work with fertilizers at McNeill. As each year's result is the average of duplicate tests, it would seem that fairly accurate conclusions might be drawn from a further average of the results of both years. At any rate we feel that the average grower of sweet potatoes on the Coastal Plains soils of South Mississippi will not go far wrong in using the ordinary cotton and corn fertilizers for sweet potatoes and that they will not require essentially larger applications than would be necessary on the same land for the most economical production of these two staple crops. The variety of potatoes used in the experiment was the Dooley Yam.

TABLE I.

Results from Two Years' Work with Fertilizers Under Sweet Potatoes.

No. of Plat	FERTILIZERS CALCULATED IN POUNDS PER ACRE	1906 Average yield of duplicate plats calculated in lbs. potatoes per acre	1907 Average yield of duplicate plats calculated in lbs. potatoes per acre
1	200 lbs. Cottonseed meal	14,320	11,385
2	200 lbs. Acid phosphate	16,000	11,660
3	200 lbs. Kainit	14,490	11,600
4	150 lbs. Acid phosphate 150 lbs. Cottonseed meal	14,820	12,320
5	150 lbs. Cottonseed meal 150 lbs. Kainit	14,300	11,990
6	150 lbs Acid phosphate 150 lbs. Cottonseed meal 150 lbs. Kainit	15,910	13,585
7	Check	13,550	8,745
8	150 lbs. Cottonseed meal 300 lbs. Acid phosphate	15,550	13,365
9	300 lbs. Cottonseed meal 150 lbs. Acid phosphate	14,830	12,705
10	150 lbs. Acid phosphate 150 lbs. Kainit	14,910	12,815

Selecting the Variety.

Before the discussion of this subject, the results of variety tests made at this Branch Experiment Station may be of interest and value to the reader. In the spring of 1914 seven varieties of sweet potatoes were planted here on land that had been given an application of animal manure the year before. The effects of this manure was to cause the potatoes to grow too large, to crack open badly and to keep poorly when put in the house. These seven varieties were grown in plats of one-tenth acre each and gave yields as follows, calculated in bushels of potatoes per acre: Bunch Yams 144; Gold Coin 174; Porto Rico 193; Early Triumph 167; Nancy Hall 93; Golden Yams 59; Dooley Yams 91.

An interval of two weeks elapsed between the setting out of the first four varieties and that of the last three varieties so that evidently they are hardly comparable. In numerous instances here in the past Dooley Yam potatoes have made as high as two hundred bushels per acre and while this variety has generally fallen below the Porto Rico, Triumph and Golden Coin in yields, the difference would be nothing like so great as indicated by the above results. Except that the Triumph does not sell so well on the Southern markets as the Doolies and Nancy Halls,—we prefer them here over any other kinds. The yields are heavier, the potatoes are more uniform in every way, they keep better and for home consumption are, in our opinion, the most desirable of all varieties that have been grown here.

Early in the year 1919 at the suggestion of and in collaboration with the extension forces of the State several bushels each of Nancy Hall, Porto Rico, and Triumph seed potatoes were treated with bichloride of mercury and bedded here. Slips from these potatoes were later used in a test to determine the relative yields of the several varieties as well as to conduct tests with fertilizers under a single one of these varieties. Mr. E. F. White, at that time Extension Horticulturist, obtained the seed potatoes for us from growers with whom he was acquainted, and we have never had any reason to doubt the purity of the varieties. Early in May of 1919 the field in which the variety work was to be done was fertilized with a mixture of two parts acid phosphate and one part cottonseed meal applied in the drill at the rate of about 400 pounds per acre, the rows being three and one-half feet apart, all were cultivated alike and equal areas of each were dug and weighed at two different times, August 28 and November 28, and yields calculated in bushels per acre, the potatoes at each time of digging being separated into two lots according to size which we designated as marketable and unmarketable.

In 1919 we had an abundance of slips to do all work outlined, but in 1920 our first bedding of these same varieties were so injured by continuous wet and cold weather extending into the early spring that all the first bedding rotted and there were not enough of the varieties left to give as many slips as were required to carry on experiments with varieties and fertilizers, hence we were compelled to cut the vines from the earlier plantings of Nancy Hall potatoes and this apparently greatly reduced the yields of this variery in 1920. We noted in this work during both years that the Nancy Hall potatoes had a tendency to die in the rows after the slips or vines had been set and had begun to grow. This tendency was much more pronounced with this variety than with either of the other two and we plan to have the plant pathologist do some co-operative work here another year in an effort to determine the true cause of this trouble with the hope that it may be corrected.

SWEET POTATO VARIETY YIELDS.

TABLE II.—SWEET POTATO VARIETY YIELDS (Given in Bushels per Acre).

VARIETY	HARVESTED AT MATURITY								Harvested for Early Market 1919 only (August 28)		
	1919			1920			Two years av. of total yields	Two years av. of Nos. 1 and 2			
	Marketable	Unmarketable	Total	Marketable	Unmarketable	Total			Marketable	Unmarketable	Total
Porto Rico	92	33	125	161 1–3	34 2–3	196	161 1–2	126 2–3	13	11	24
Nancy Hall	63	34	97	54 2–3	36	90 2–3	93 5–6	58 5–6	33	21	54
Triumph	117	40	157	157 1–3	53 1–3	210 2–3	183 5–6	137 1–6	31	23	54

In 1921, Triumph, Nancy Hall, and Porto Rico were again used. The plants were obtained late, and set July 8th, spaced 15 inches by 4 feet; harvested November 25th, before frost. Figuring the green potatoes at 60 lbs. per bushel, yields per acre were as follows:

VARIETY	MARKETABLE	CULLS	TOTAL
Porto Rico	120	35	155
Triumph	87½	35	113½
Nancy Hall	72½	41	113½

These yields are all low. In a fertilizer test of Nancy Halls, in the same field with the variety tests, check plats of this variety which had not received any fertilizer, averaged 316 bushels per acre of marketable potatoes. However, these were planted two weeks earlier than the variety test plat, and vine cuttings were used. Early planting is necessary for big yields.

Selecting the Variety.

In choosing the variety best adapted to a particular location, two main considerations must be kept in mind: (1) The value of the variety for its intended market, and (2) its adaptability to successful culture in the region where it is to be grown. Under the market considerations, the variety may be grown for the grower's use only; for the local market; for the shipping market; or for the canning factory. It should be needless to say that when sweet potatoes are grown for sale, the variety that the market demands should be grown, if it can be profitably cultivated in the locality. At present, the Dooley is the variety most in demand by the canning factories of this section; the firm texture of the meat holds together in canning, and presents an attractive appearance, outside of the high quality. However, it did not yield so heavily as Porto Rico and Triumph in past tests.

For home use, the selection of the variety is limited to personal taste, which is usually very discriminating. There are two general types to select from: (1) the dry, mealy-fleshed, such as Yellow Jersey and Big Stem Jersey; and (2) the juicy, sweet kinds, like Porto Rico, Nancy Hall, Triumph, and Dooley. For home use in South Mississippi, varieties of the second group only are grown; this statement also applies for the local markets of this section of the State. For these two market classes, the Dooley has led in the past, though in recent years Porto Rico has gained in favor as it has become more generally known, because of its superior high yields, and fine quality for general table uses. All the four moist-fleshed varieties named are well adapted to South Mississippi.

In establishing one of the juicy sweet potatoes on the Northern market, Southern growers have made only a small beginning. The Eastern producers of the dry-fleshed varieties grow only 15 per cent of the total sweet potato crop of the United States, yet statistics show that 85 per cent. of the sweet potatoes marketed come from this 15 per cent. section. In other words, the Northern market is a dry sweet potato market. The Eastern growers have attained this success through breeding up a good uniform variety, giving it good preparation for market, and forming a good selling organization to dispose of the product. The dry varieties have been given support by the grower, the shipper, and the

dealer. Nancy Hall has made some small gains on the Northern market, chiefly because of its color resemblance to the Eastern grown, dry-fleshed varieties. At the present, if we are to grow what the Northern market demands, it would be a dry-fleshed variety, as the Big Stem Jersey. However, this variety does not seem to be well adapted to the extreme South, because seed saved locally degenerate, or run out rapidly. Therefore, this condition would necessitate the buying of seed potatoes from the Eastern growers, an item adding considerably to the cost of production.

The salvation of the Southern producer of the superior, juicy-fleshed, sweet, sweet potato is dependent on at least three factors: (1) He must inform himself on the type of potato which is readily accepted on the market. This will be discussed later under "Marketing." (2) The potato must be properly cured. (Discussed under Storage.) (3) The Southern varieties must be promoted in the consuming markets by an intensive, well-supported system of advertising and selling. (See discussion under Marketing.)

With these factors accepted and rigidly adhered to by the Southern producers, they will be able to widely increase the use of the Southern varieties. At present, the truck growers in this State are confining their efforts to three varieties: Porto Rico, Nancy Hall, and Triumph. Triumph is used mainly for the green crop which is shipped in July and August; Nancy Hall has also been successfully used by one of the largest producers in this section of the State, and growers generally are finding that the Porto Rico is also adapted for early shipment. The selection between these three varieties will likely be Porto Rico, as it is already well established among growers, and from the past gains which this variety has made in acreage, it would not be surprising to see it used nearly exclusively as a truck farmer's variety. This concentration on one variety will help in development of better seed selection.

Seed Selection.

After the selection of the variety, one of the most important factors in successful crop production is the selection of the seed stock. While field selection of seed corn is a generally followed practice, selection of sweet potato seed at digging time, in the field, is a very rare practice. It is a practice, however, which must come into general use if the Southern producer of this valuable crop ever expects to maintain profitable production. As in corn, the individual plant, or hill, forms the basis of selection. The seed should be saved from fields free from disease, and preferably, from land on which potatoes have not grown previously. A disease-free crop can be best obtained by planting disease free cuttings on new land. An ideal hill from which seed should be saved would have the following characteristics: freedom from black rot, stem rot, and scurf; high production of uniform marketable-size potatoes; trueness to variety type. In saving seed from such hills, they had best be dug by hand, so that the hills may be kept separate, and each judged separately. Test each hill by splitting the stems; discard those whose stems are streaked with black inside. This method is being followed at this Experiment Station, and truck farmers who have seen this work in progress state that it is practical where seed must be saved for large acreages. It is certain that if the potato grower expects to produce high yields of the type of potatoes demanded on the market, he will have to adopt the method of hill-selection.

As a regular practice for systematic seed selection, a small patch of potatoes should be planted each year, grown from vines only, and in a location where potatoes have not been grown for at least four years. From this planting, potatoes from the best hills only should be saved, handled very carefully at digging to avoid bruising, and placed in well ventilated crates for storage through the winter. These crates should be marked, so that they will not get mixed with the field run crop. In judging a hill for its production of marketable-size potatoes refer to the table of U. S. Market Grades quoted later.

Bedding.

The time for bedding in the open ground is after danger of frost, the exact date varying from the Gulf Coast to Meridian and Jackson, ranging from March 1st to April 15th on the average. For early plant production in hotbeds, bed the potatoes four to six weeks before the danger of frost is over.

Bedding Space Required.—When planting in the field 15 inches by 3½ feet, 10,000 plants will be required per acre. If an acre is to be set out at the first drawing, from eight to ten bushels of average size seed stock will have to be bedded. If three drawings are to be depended upon, as is usually the case, three bushels of seed under good conditions should be sufficient. This amount of average size seed will require about thirty-six square feet of bedding surface, making a bed four feet wide by nine feet long. For the later crop grown from vines, only one-sixth of the area to be planted needs to be set with plants or draws. Thus, to set out an acre of potatoes from vines, one-sixth of an acre should be set in draws, requiring about 1,700. This number of draws under good conditions will be furnished by a half bushel of potatoes at three drawings. Figure 12 square feet of bedding space per bushel of average size seed stock.

Location, Construction, and Management of Plant Bed.—Locate the bed on a well-drained piece of ground, sloping to the south, and protected on the north by a windbreak of trees or buildings if possible. For an open bed, loosen the soil to a depth of five or six inches, and rake smooth. If the soil has grown potatoes before, it will be necessary to excavate and discard the soil to a depth of six inches, and replace with pure sand, or sandy loam, from a place where potatoes have never been grown. Place the potatoes on the smoothed surface as close as possible without touching each other, and cover one inch with pure sand. Water the bed thoroughly. When the plants begin to show through the soil, add two inches more of sand so as to establish a good root system to the plants.

For a manure-heated hotbed, start two weeks in advance of the time for bedding the potatoes, to prepare the manure. Fresh horse manure containing a fair amount of litter should be heaped up outside of the barn and allowed to heat. If the manure is dry, moisten it with water while it is being piled. As soon as the heating has well started, fork the whole pile over and stack it again. When the whole mass gets to heating through evenly, it may be placed in the hotbed pit. This pit should be at least eight inches deep, and slightly wider and longer than the frame itself. The frame for this pit should be twelve inches high on the north side, and six inches high on the south, so as to give a slope towards the sun, and also to give water drainage to the hotbed cover. Bank manure and soil around the outside of the frame, so as to drain away any excess

of water. The eight inch layer of manure should be well packed, and then covered with three inches of pure sand, or sandy loam. Do not bed the potatoes until after three or four days, on account of the high temperature developed at first by the manure. The hotbed cover may be of glass sash, or cloth. If cloth is used, heavy unbleached muslin will be satisfactory. A roller for this cloth will help in opening up the bed for full light and ventilation.

Fire-heated hotbeds are often used for forcing sweet potatoes where a large quantity of plants are wanted. The bed may be 50 to 75 feet long, and four feet wide. It is usually placed on a slight slope of a hill, so as to give an upgrade for the flue from the firepit to the smokestack. The flue is made by digging a trench lengthwise of the bed, 18 inches wide and eight inches deep This should be covered with sheet iron near the fire pit, but farther out may be covered with boards. Near the fire pit, the soil on which the potatoes are bedded should be 12 to 15 inches deep, grading to three inches in depth at the smokestack end. The fire pit is made by digging out below the level of the flue, and covering over with heavy sheet iron and mound of soil.

Allow plenty of ventilation for the bed, and whenever the weather permits, remove the cover entirely.

Disinfecting the Seed.—All sweet potato seed should be disinfected before bedding by soaking it ten minutes in a solution of one ounce corrosive sublimate in eight gallons of water. Use a barrel or other wooden container for this solution. The potatoes may be placed in a sack or hamper and dipped in the mixture. This solution is very poisonous if taken internally, and it should be thrown away immediately after getting through with it.

Drawing the Plants.—These are drawn by hand, holding the bedded potato in place with one hand, and removing the plants with the other. Good, stocky plants six or more inches long should be drawn, leaving the smaller ones until later. Four or five drawings can be made under good conditions, averaging seven to ten days apart.

Field Management.

The potato field should be a well drained piece of land. Low, poorly drained land often causes the potatoes to crack, or check, making unsalable stock. A deep soil is required, for best results, therefore plowing should be done at least seven or eight inches deep. This plowing should be done at least a month before planting time, so that all vegetable matter from the preceding crop will be decayed, or at least, in a rotting condition. If there is much trash on the land from the preceding crop, precede the plowing with a thorough discing.

Before planting, smooth the surface with a disc harrow followed by a smoothing harrow. Mark off the rows with a broad shovel, and apply the fertilizer by hand, or with a fertilizer drill. If it is applied with the fertilizer drill, a narrow shovel following the drill will help to mix the fertilizer with the soil, and make it more quickly available. Bed on the fertilizer with a one horse turning plow, which will leave the beds eight to ten inches high. Immediately before planting, the tops of the beds can be smoothed down by a two horse drag or float, built large enough to drag four beds at once. This light dragging will leave the tops of the beds leveled off, and in fine condition for setting the plants.

Transplanting.—Horse drawn machines which have been used for this purpose in this section have not proved satisfactory, so that even on the largest acreages, the plants and vines are set out by hand. The most common tool used in placing the plants in the soil is a small stick similar to a walking cane, which has a V-shaped notch in the end used for pushing the plants into the soil. The plants or vines are distributed and spaced at the required distance ahead of the planters. Draws are dropped with the root system at the center of the ridge, where they can be easily pushed deep into the bed by the notched stick. In the case of vine cuttings,—which are eight to ten inches long,—the cuttings are laid across the bed, and the notched stick is placed over the middle of the cutting to force it into the soil. leaving both ends sticking out, Shorter cuttings can be used, and the base ends only forced into the soil. Either method is satisfactory, when properly done. In any case, both draws and vines should be planted deep. During unusually dry seasons at planting time, watering of the plants is practiced to good advantage. The potato grower should not be content with less than a perfect stand of plants; a little time devoted to replacing dead plants will be time well spent towards securing large yields.

Continuous, clean cultivation must be practiced from the time the plants are set out until the vines cover the ground. The cultivation should be done shallow, but often. Because of the rapid growth of vines well cared for, this period of cultivation is of relatively short duration.

Harvesting.—If the crop from draws has been given an early start for the green market in July and August, the potatoes should be dug when the market demands are most favorable. For storage, the potatoes should be mature before digging. This can be tested by breaking a potato; if the exposed surfaces continue to flow the milky sap, the potato is not matured sufficiently. If, on the other hand, the wounds dry and heal over within a few minutes, the potato is mature enough for storage. A few tests like this over the field will give a good idea of the average maturity. Of course, if the vines are killed by frost before sufficiently mature, no further growth can be made, and the grower should start harvesting operations at once. Delay of digging after frost will damage the keeping qualities of the potatoes in storage. The dry season occurring the latter part of September, in October and early November, before frost, is the ideal time for digging. When potatoes are to be marketed, digging during wet spells will make it impossible to pack the bright clean potato which is favored on the consuming market; also the keeping qualities will likely be impaired.

Digging operations will be much easier if most of the vines can be cleared from the rows. Some growers in South Mississippi use a hay rake, removing the bulk of the vines from two rows at a time. Here at the Experiment Station a mowing machine has been used ahead of the hay rake, with good results. The mower enables the rake to remove more vines. Either method is more economical than cutting the vines from the row with hoes. The vines which have been piled by the rake can be loaded at once on hay racks and hauled for feed to stock pens, or can be pushed out of the way into the middles of the rows. After this preparation, use a large middle-burster drawn by two large mules, opening up every other row. A turning plow is often used for this digging, but is not so satisfactory as the middle-burster. Take up the potatoes and place them back

carefully in the same furrow. **Do not throw them against one another.** Carelessness in this one operation is responsible for much of the failure of potatoes in storage. A bruised potato is much worse than a cut or broken one. The cut potatoes will heal perfectly in dry, sunny digging weather, but the bruised potato will carry its injury to the storage house, and multiply rot to sound stock.

After every other row has been opened and the potatoes picked up and laid back in furrows, the remaining rows can be completed. The potatoes should be allowed to dry in wind and sun before being hauled to the storage house. Potatoes should not be left out over night, and it is best to stop digging early in the afternoon to give all the potatoes a chance to dry before being carried to the storage house.

Bushel baskets, hampers, and crates are used for collecting the crop in the field. The potatoes should be field graded and stored in one of these types of containers, and should not be handled again until shipping season, when they must be graded again in the storage house. When the potatoes are picked up in the field and placed in the container, they should be **laid** in, not **thrown** in.

GRADING.—The sweet potato grades which have been worked out by the Bureau of Markets of the United States Department of Agriculture should be followed in the grading work. These grades, briefly stated, are as follows:

U. S. GRADE NO. 1.—Size, 1¾ inches up to 3½ inches in diameter. Length, 4 to 10 inches. Potatoes shorter than 4 inches are included in this grade if they are not less than 2¼ inches thick. This grade must consist of sound sweet potatoes of similar varietal characteristics which are practically free from dirt or other foreign matter, frost injury, decay, bruises, cuts, scars, cracks, and damage caused by heat, disease, insects (including weevils), or mechanical injury. U. S. GRADE NO. 2 must be free from serious damage by the causes listed above; the diameter may vary from 1½ inches to 3½ inches.

In order to allow for variations incident to commercial grading and hauling, five per cent. by weight of any lot may not meet the requirements as to diameter, and, in addition, six per cent by weight may be below the remaining requirements of the grade. The Jumbo Grade includes potatoes from 3½ inches in diameter up, and length.

For field grading, the crates should be distributed in the field at grading points, where the gatherers bring the potatoes to the ones doing the grading. One experienced grader will keep even with three gatherers. The grader places three crates along side each other, for the three grades, No. 1, No. 2, and Jumbos. All cut or damaged potatoes are discarded, and used immediately for stock feed. Crooked, badly shaped potatoes should also be discarded, and only good marketable potatoes should be carried to the storage house. Another method of field grading consists of every gatherer doing his own grading. One man is assigned to pick up No. 1's, another follows who gathers the No. 2's, and a third gets the Jumbo grade. This method requires one less handling of the potatoes, and is to be recommended for this feature. However, it is difficult to train all the pickers to be good graders. This objection is partially eliminated when it is considered that regrading is necessary before shipping.

Storage.

While storage pits, or banks, have been used very largely in the past for saving the sweet potato crop, the storage house is making rapid gains in recent years. The main disadvantages to the banking method of storage are (1) large loss due to decay; (2) the inconvenience of getting the potatoes when needed, especially in cold and rainy weather; (3) the annual labor involved in construction of these storage banks, when all hands should be giving their full time to harvesting operations. With reference to the first point,—the large loss due to decay, it should be said that this is not true where care in seed selection, sanitation of seed beds and fields, care in harvesting, and proper construction principles of building the storage bank, have been observed. A good storage house will not correct carelessness in production, harvesting operations, or frost injury before digging.

The storage house of the Experiment Station grounds is of standard construction, 20 ft. by 20 ft., ten foot wall, capacity of about 100 bushels in crates. Storage records were maintained on 50 bushels of Nancy Hall potatoes last winter, 1920-1921. The remainder of the crop had to be dug before the Storage House was constructed. On March 1st, only one fourth of one per cent. of these potatoes had been damaged by soft rot. For all practical purposes, perfect storage resulted.

Oak wood is used to heat this house. Coal is better, because of more even heating.

The essentials in the construction of a good storage for sweet potatoes, whether the storage is a dirt bank or the modern potato house, are (1) Insulation, which protects the stored product from rapid changes in temperature, and (2) Ventilation, which provides for a circulation of air. Artificial heat is not always necessary in this section of the State; in the mild winters, a well insulated house alone will keep the potatoes from freezing. However, it is essential to be provided with heating facilities for curing the crop, or so that the house may be heated on short notice.

Outdoor cellars have been successfully used in this State. These approach the regular storage house in construction and management. Their capacity is limited to small crops. One of these cellars was excavated from a steep hillside, roofed over and covered with rubber roofing. The entrance end was boarded in and double-walled. The dirt walls were reinforced by boarding up. A small stove was used for heating. One ventilator in the entrance end and one roof ventilator took care of this feature. This type of storage house or cellar can be cheaply constructed, and proved to be successful in this instance. When located on the south, or protected side of a slope, it can be easily heated.

By observance of the principles of insulation and ventilation, old farm buildings may be reconstructed for storage houses at small expense. If possible, they should be used before erecting new storage houses. If the inside walls are not already sheathed, cover the studding with a good grade of building paper, and over the paper a tight layer of matched boards. This insulation should be carried up to the entire ceiling also. Make the house as tight as possible, so that when necessary the temperature can be controlled easily. For a small

house, for example, twelve feet wide by sixteen feet long, a twelve by twelve inch ventilator through the floor at each corner should be fixed so that they can be closed when necessary, and two ventilators of the same size through the roof at the ridge will take care of the roof ventilation. Any windows should be fixed so they can be closed tightly from the outside.

The details and specifications for construction of a modern storage house can not be given here; working plans for building the various size houses may be had upon application to the Department of Agricultural Engineering, A. & M. College, Agricultural College, Miss., or to the Bureau of Public Roads and Rural Engineering, U. S. Department of Agriculture, Washington, D. C. Farmers' Bulletin No. 970, of the U. S. Department of Agriculture, on "Sweet Potato Storage," can also be obtained by anyone wishing to construct a modern storage house, and to learn the full details of the curing process.

Marketing.

In an address prepared for the 1921 meeting of the State Horticultural Society, Mr. James H. Beattie, Horticulturist, Bureau of Plant Industry, U. S. Department of Agriculture, made the following excellent recommendations on marketing the Southern sweet potato:

> "It is useless to grow a fine crop of sweet potatoes, unless they can be profitably marketed. Many cases recently called to the writer's attention show that growers often find it impossible to ship sweet potatoes to Northern markets and realize the packing and shipping costs on them. I do not mean to imply that this is always the case, but it would seem that this phase of the problem is one that must have careful consideration. One source of difficulty has been due to the inclination of many growers to ship ungraded stock that has been badly handled and which suffers great loss in transit. It would seem that the logical thing to do would be to, first, grow only the best varieties and ones which are well known to the trade. Secondly, grade the stock carefully and ship only the best. Third, employ a type of package that will carry the potatoes in good condition and which will exhibit them to good advantage. Fourth, place the potatoes in storage so that they can be marketed throughout the season, and not forced on to the markets at digging time. Fifth, through cooperative growers and storage associations establish a standard product which will command a premium upon the market. Sixth, by the establishment of a suitable selling agency."

The third point referring to the type of package to use should be given especial attention by the shipper. Burlap sacks should never be used, since bad bruising and consequent decay will result. The bushel hamper, bushel basket, and bushel box crate, are now extensively used for shipping. When the hamper and basket are substantially built, they make excellent shipping containers. The bushel basket is gaining in favor in some sections of the South. It is a favorite container for the retailer to handle, and can be packed for an attractive display of the product. All these three shipping packages can be given attractive packs, and selection of any one of them for exclusive use by a sweet potato shippers' association will help much towards establishing and maintaining demand for a well graded product.

The fifth recommendation by Beattie is generally accepted in principle, and growers are beginning to develop cooperative associations in order to put the potato industry on a business-like foundation. A growers' organization is needed in order to establish a uniform, standard product on the market. It should center its efforts on one good variety, aim to produce a uniform, high quality product, and give it attractive package for market. Such a product will get a premium on an over-supplied market of inferior stock. A strong association of growers is necessary to develop such a product, and last but not least, an organization of this kind is necessary to maintain an efficient selling agency.

This last point is but little understood by the average producer. Recent investigations have been made by expert advertising and merchandising organizations to determine how much money would be necessary to properly sell good sweet potatoes. They find that six hundred thousand dollars would be needed for advertising alone, to sell the six million bushels of cured stock now in the South. This expenditure would be small for each grower in a South-wide organization, but it is a necessary expense before the Southern sweet potato is widely demanded on the Northern markets.

Diseases and Insects of the Sweet Potato.

Only brief descriptions and control methods can be given here; Bulletin No. 190, "Diseases of the Sweet Potato in Mississippi and Their Control," gives a detailed account of the diseases, and this bulletin should be in the possession of every sweet potato grower in the State. The remarks following on diseases are derived from that Bulletin.

Diseases.—"Sweet potato diseases may be divided into two classes,—(1) field diseases attacking roots, stems, and leaves, and (2) storage rots. Both groups are important and many of each occur in Mississippi.

FIELD DISEASES.

"Black Rot.—The most serious disease of the sweet potato in Mississippi. It may occur on any of the underground portions of the plant. On the sprouts, it usually begins at the base just beneath the soil line. Here the disease manifests itself as small spots varying from dark-brown to a lamp-black color. These gradually enlarge, extend up the stem, and it is here that we get the stage known as 'black-shank.' In many cases the plants in the seed bed and the field are often rotted off at the base by the shank stage of the fungus. On the roots, it produces circular, dark to olive-brown colored spots, which may cover more than one-third of the surface of the potato. Sweet potatoes infected with black rot are very bitter in taste, and this feature alone is very helpful, indeed, when one is in doubt as to its presence.

"Control.—Careful seed selection in order to insure healthy stock is of primary importance in controlling such diseases as black rot. If black-rotted potatoes are bedded, the sprouts produced therefrom will almost invariably have black-rot, or black-shank, as this stage of the disease is sometimes called. Such practice not only serves as a source of infection to the new crop, but the soil is rendered unfit for the growing of sweet potatoes,

since the fungus is able to live over in the field on diseased potatoes and vines. Before preparing the beds in the spring, the sweet potato seed-stock should be carefully selected, taking care to discard all potatoes having the slightest trace of black-rot or any suspicious spots. All discarded potatoes should be destroyed in some manner, and in no case should they be thrown indiscriminately around the beds. These may be boiled and then fed to stock or else buried in some remote place."

The method of seed treatment to destroy surface germs of this disease has been given under "Bedding."

STEM ROT OR WILT.—This is another field and seed-bed disease, but does not spread in storage like black rot. This disease is becoming established in many sections of the State, though it is not near so widespread yet as black-rot. Stem rot is often responsible for a loss of 50 per cent. in yield. Plants infected with this disease show a decided yellowing along the veins of the leaves, the young leaves showing the trouble first, afterwards the whole vine, giving the plant a dull, pale-yellow appearance. Wilting follows rapidly, especially during a dry season, and the plant soon dies. During wet weather, the infected plants appear stunted but are able to live for long periods before dying entirely out. By splitting the stem of a plant infected with stem-rot, near the base of the hill, it will be found to be streaked with black inside. Control measures of seed selection, etc., as have been given for black rot, serve as preventive to this disease also. Seed disinfection is of no value, however, as the disease is inside the potato.

SCURF, or soil stain, is another very common trouble of the sweet potato. It causes brownish spots scattered over the surface of the potato, lowering its attractiveness on the market, though not causing rot. Neither is the potato spoiled for eating. The disease is worse on low, poorly drained lands, and on soils heavily manured. Field and seed bed sanitation as discussed under "Seed Selection" are important preventives of this trouble, and seed should be treated with corrosive sublimate as recommended for black-rot.

Leaf diseases have been observed here at the Experiment Station, especially white-rust. Leaf-blight and leaf-spot are two other leaf troubles, but at this time none of the foliage diseases have caused much damage.

Foot-rot, sclerotial rot, Texas root-rot, and soil-rot are other field diseases of sweet potatoes that are of less importance to sweet potato growers in Mississippi.

STORAGE ROTS.

SOFT-ROT.—The most widespread and destructive of the storage rots. It produces a soft decay of the potatoes, and destroys the potato in a few days when there is a high temperature coupled with moist air. It often forms a thick, moldy growth on the surface of the potato. Soft-rotted potatoes soon lose their moisture and become hard and brittle, in which stage grower's name it "dry-rot.' Soft-rot gains entrance to the potato through cut or bruised places on the potato. Frosted potatoes always develop soft-rot.

RING-ROT.—Caused by the same mold that produces soft-rot, but the decay begins at a point between the ends, forming a ring, or collar around the potato.

BLACK-ROT, which has already been discussed under Field Diseases, when

present on the potatoes that are taken to storage, will develop under high temperature and humidity, and the disease spread to other healthy potatoes.

Storage rots should be **prevented.** It is next to impossible to control these troubles where the potatoes have already been placed in storage. Observe all the precautions given under careful harvesting of the crop, disinfecting of the seed at bedding time, sanitation of the seed-bed, crop rotation combined with a systematic method of seed selection. Storing potatoes in bins, in bulk, will invite disaster when rots get under way in the house; storing in crates, bushel baskets, or hampers is much to be preferred. If the potato house has been used for storing potatoes before, it should be thoroughly disinfected before storing the new crop. After the house has been swept out clean, it should be sprayed thoroughly inside with a solution of five pounds of bluestone to fifty gallons of water. After twenty-four hours, repeat this spray with the same solution.

Insect Pests.

In this State, the sweet potato has only one serious insect pest,—the sweet potato weevil. At present, this pest has been restricted to a few localities in four counties in South Mississippi, and vigorous efforts are being made to exterminate the pest by the State Plant Board, and United States Bureau of Entomology.

Products of the Sweet Potato.

A large number of products have been derived from the sweet potato, and there is certainly a great future to this crop from the standpoint of its wide and varied products. The following products and by-products should be named: sweet potato syrup; dehydrated potato chips; breakfast flakes; chocolate substitute, available for coating cakes, candies, and making ice cream; flour; starch, dextrine, syrup, caramel candy; tapioca; rubber substitute; dyes ranging from light yellow through brown into black; roofing paint; dehydrated syrup as a confection; vinegar; sour wine; malt health foods; alcohol.