Sweet Potato Culture for Profit,

BY R. H. PRICE, B. Sc.

ILLUSTRATED.

PUBLISHED BY
Texas Farm and Ranch Publishing Co.,
DALLAS, TEXAS.

Sweet Potato Culture for Profit.

A

FULL ACCOUNT

OF THE

Origin, History and Botanical Characteristics

OF THE

SWEET POTATO.

(ILLUSTRATED.)

Full and Complete Instructions from How to Grow the Plants to Harvesting and Storing the Crop for Both Southern and Northern Latitudes. Complete Discussion of the Diseases and Insects which Injure the Crop. A description of 47 Varieties with a New System of Classifying them. The Chinese Yam and the Vineless Variety are Discussed. Latest Improved Machinery Discussed, &c.

BY R. H. PRICE, B. Sc.,

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PREFACE.

"HOW can our present condition be improved?" is a question which comes up at some time in the affairs of all working men. Progress forward should ever be our watchword. We owe it to ourselves, to humanity, and to our Maker.

How the farmer may use the information to best advantage contained in this little volume, and how the teacher may readily get hold of the facts to present to his students are two objects constantly kept in view by the author while writing this book, which is the outcome of four years careful experimental work with the sweet potato. About all the results obtained by the author and given in this volume have been published in bulletin form by the Texas Experiment Station, but as requests for these bulletins have come, not only from nearly every state in the Union, but from foreign countries, so as to rapidly exhaust the editions of each one, have prompted him to put his own results together with many of those from other experimenters along this line, in permanent book form. He has been able to find only one small volume and two pamphlets on the sweet potato for sale, neither one of which pretend to be exhaustive nor up with the times. Consequently, the author has experienced difficulty in giving accurate information on this subject to his students in the class room. It is believed the author's new system of classification, recent results obtained on "mixing or sporting" of varieties, and the chapter on the vineless or bunch varieties, will help greatly to clear up the confusion which now exists on these points. New methods of transplanting and recent improved machinery will help greatly to lessen the cost of production.

In the preparation of this volume the author has found it a labor of love done during his spare moments from arduous and exacting duties. Inaccuracies may have crept in as they have in most books, and if such be found, the author will consider it a favor to have his attention called to them. The

author wishes here to acknowledge his obligations to those who have so kindly assisted him in the preparation of this volume: The Horticultural Department of the Louisiana Experiment Station for the cuts on varieties, Prof. Byron D. Halstead for several cuts on diseases of the Sweet Potato, and to Prof. Hugh N. Starnes and others mentioned in the book.

If this little volume should point the way of prosperity to some debt-ridden and discouraged farmer who has relied upon the ordinary farm crops for success, and has failed; if it should help in any small degree the increase of human happiness, he will feel his labor has not been in vain.

"THE AUTHOR."

College Station, Texas,
August 25th, 1896.

Agriculture is the nursing mother of arts.—XENOPHON.

Tillage and pasturage are the two breasts of the State.
—SULLY.

The first farmer was the first man, and all historic nobility rests on possession and use of land.—EMMERSON.

Agriculture is the most healthful, most useful, and most noble employment of man.—WASHINGTON.

There seem to be but three ways for a nation to acquire wealth: the first is by war, as the Romans did in plundering their conquered neighbors—this is robbery; the second, by commerce, not always fair; the third, by agriculture, at all times honest, wherein man receives a real increase of the seed thrown into the ground in a kind of continual miracle wrought by the hand of God in his favor as a reward for his innocent life and virtuous industry.—FRANKLIN.

CONTENTS.

ERRATA.

Third word in 20th line of preface, for "wihch" read which.

In last line on 6th page, for "Experimental" read Experiment.

In foot line on 8th page, for "Experimental" read Experiment.

First line in III. division of table XII., for "silver" read soda.

On page 63 figure "43" should read 34.

On page 67 in line next to last which reads there "has" been, should read there have been.

INTRODUCTION.

Once an American farmer thought there was a better place for him to live than the one at which he had been born. He had read short accounts of a place described in the agricultural papers which seemed to suit him. Once a small, modest book on the same subject had reached his hands. All the information he could obtain from such sources was read with great interest and pondered over well. Good common sense, which was this man's best earthly friend, told him that the location of this place in which he had become interested was favorable in regard to latitude and longitude. Salubriousness of climate and fertility of soil seemed very probable. Large and wealthy cities were of easy access by rail and by boat. The trend of population seemed to be in that direction. Fearing, however, that possibly it might be an overlauded place, he concluded it would be best to go and see it before leaving his home and moving there. It was a serious thing for him to leave the home of his childhood. His grandfather had come over from England with several others a century ago and had purchased a large homestead at small cost, and established a community which had now grown large and thickly settled. Nearly all his grandfather's children and grandchildren had married and settled around the old homestead. They were all interested in the same occupation in which their grandfather had been so eminently successful. Somehow, the occupation did not seem so remunerative as formerly, the soil had become worn by continuous cropping in the same kind of crops. The products did not sell so well in the markets as they had in days gone by.

In meditating over the future, common sense taught this man that he must change occupation or location. Things could not go on as they had; in fact he thought a change was coming over the entire country, and he must prepare himself to meet it successfully. * * *

CHAPTER I.

THE SWEET POTATO (*Ipomea Batatas, Lam.*). BOTANICAL CHARACTERISTICS—ORIGIN.

The sweet potato belongs to the well known morning glory family, *Convolvulacea*. It is a perennial, though cultivated as an annual. The creeping stems, in some varieties, grow 20 feet long and frequently send out roots at the nodes which, in favorable seasons, bear small potatoes. There are three main types of leaves, the round, the shouldered, and the lobed or split. Color of the stems and leaves varies from dark green to light purple. No flowers are produced except occasionly in Southern latitudes. When peduncles appear they are axillary and bear three to five small purple flowers which are white around the border and purple in the throat. The pod contains four one-seeded cells. Flowers of the sweet potato shown in figure 2 were photographed by Mr. Bridgewater of Tennessee. The potato is an enlarged, farinaceous, tuberous root, which frequently contains 12 per cent. to 15 per cent. of sugar after being stored a while. The word

FIG. 1. SWEET POTATO TUBERS.

FIG. 2. Sweet Potato Flowers.

potato was first applied to the sweet potato and is a corruption of the Indian word "Batatas." In the middle of the sixteenth century, when irish potato tubers were being shipped to foreign markets, the word "potato" was also applied to the tubers of *Solanum Tuberosum*, the common irish potato. Even down to the middle of the seventeenth century we are told that the sweet potato is generally understood where the word potato is used by English writers. Now, in the market quotations wherever the word potato occurs, the irish potato is meant, and for the other tubers the word "sweet" is placed before the word potato.

"Tuber is an annual thickened portion of a subterranean stem or branch, provided with latent buds called eyes, from which new plants ensue the succeeding year."

Tubers of the sweet potato vary much in shape, size, color and texture of flesh. Shape varies from roundish to much elongated, frequently tapering at both ends. On some varieties, vein-like ridges appear over the surface. Texture of the flesh when baked varies from soft and mealy to soft and mushy. Many varieties give off an agreeable odor when being baked. Color of skin varies from pale white to yellowish red and sometimes purple. Color of the flesh when baked is nearly always dull yellow or brownish yellow. Flavor is greatly influenced by soils and seasons.

Comparison with the irish potato. The irish potato is an enlarged subterranean stem, as evidenced by the fact that it contains well-defined "eyes" or axillary buds. It will assume a greenish color when exposed to the sunlight, due to the development of chlorophyll which is characteristic of a stem. Nearly always the tubers are borne on the ends of small roots. This vegetable is not sugary. It belongs to the nightshade family, *Solanacea*. The sweet potato has no well-defined eyes when first dug, and will not turn green when exposed to the sunlight. Its tubers are borne near the surface of the soil on the upper ends of long roots.

ORIGIN OF THE SWEET POTATO.

Knowledge concerning the native habitat of the sweet potato is not clear. Strong arguments in favor of its origin, both in the eastern and the western hemispheres have been advanced. Some of these arguments given by De Candolle in

his "Origin of Cultivated Plants" will be given here, beginning with those in favor of an American origin. This origin is advocated by Humboldt, Meyer and Boissier. Humboldt says that according to Gomara, Christopher Columbus, when he appeared for the first time before Queen Isabella, offered her various productions from the New World, sweet potatoes among others. Clusius, who was one of the first to mention the sweet potato, says he had eaten some in the south of Spain, where it was first supposed to have come from the New World. Rumphius says positively, that, according to the opinion, sweet potatoes were brought by the Spanish Americans to Manilla and the Moluccas, whence the Portuguese diffused it throughout the Malay Archipelago. It is certain that it was unknown to the Greeks, Romans and Arabs.

On the other hand, the Chinese Encyclopedia of Agriculture speaks of the sweet potato and mentions varieties.

Bretschneider has proved that the species is described for the first time in a book of the second or third century of our era. Boyer, Choisy and others hold to its Asiatic origin. Oviedo, who wrote in 1526, says that he found the potato extensively cultivated by the natives of St. Domingo and had introduced it himself at Avila, in Spain. According to Thunberg, the sweet potato has been carried to Japan by the Portuguese.

The plants cultivated at Tahiti and the neighboring isles, and in New Zealand under the names of *umara*, *gumarra and gumalla*, described by Foster under the name of *Convolvulus Chrysorhizus*, is, according to Sir Joseph Hooker, the sweet potato. Seemann remarks in journal of Botany, 1866, that these names resemble the Quichuen name of the sweet potato in America, which is, he says, *Cumar*.

De Candolle concludes that the arguments in favor of an American origin seem to him much stronger. However, there is a probability of prehistoric communication between Asia and America, and this vegetable having been in cultivation so long it may have been transferred.

CHAPTER II.

CHINESE YAM (*Dioscorea Batatas D'ene.*).

Origin and Meaning of Word "Yam." Origin of the Vegetable. Botanical Characteristics. Cultivation.

Since the little word "Yam" is the cause of great confusion in the nomenclature of sweet potatoes, especially in the Southern States, it may be well to give some space here to the discussion of the vegetable of which the word is more properly the name.

The word Yam: French, *Ignama de la China*; Spanish, *Igname;* Hughs says it is of African origin and means "to eat" in several negro dialects on the coast of Guinea.

The generic name of the vegetable was given in honor of a Greek physician and florist by the name of Dioscorides. There are several species of Yams belonging to this genera, such as *D. Villosa, D. Japonica, D. Alata, D. Sativa, Etc.* The latter one with its varieties, Wood says,* is understood to be that which is known as the "Sweet Yam" cultivated in Georgia and Florida and all tropical countries, on account of its sweet and nutritious tubers. If this be true it is readily understood how the word "Yam" came to be applied to the soft, sugar varieties of the sweet potato, and hence the confusion.

Fig. 3. Chinese Yam.

The Chinese Yam is sometimes called Cinnamon Vine. It is, perhaps, native of the Phillippine Islands. It is extensively cultivated in China under the name *Sain-in.* Was introduced into France in 1848, through the agency of M. de Montigny, the French Consul at Shanghai. Soon afterwards it was sent to this country from the *Jardin des plantes de Paris.*

DESCRIPTION.

The vegetable is very hardy, perennial, annual, twining stems, which are green bluish color, and grow from 6 to 10

*Wood's Class Book of Botany.

feet long. Leaves are opposite, heart shaped, and have a glossy upper surface. White, small flowers grow in clusters and are dicœcious. Little bulblets are produced sometimes instead of flowers, and from them the vegetable can be propagated. From the roots, fleshy tubers grow down almost perpendicular two or three feet, and are called botanically *rhizomes.* Shape of the tubers is somewhat like that of an Indian club. The fact that they grow so deep down into the soil makes the tubers difficult to dig. This is the main objection to the vegetable; however, the tubers are frequently left in the ground and dug as wanted. When baked the flesh is floury, white and light in texture. It keeps well and is worthy of culture, especially where the sweet potato does not grow well.

CHAPTER III.

USES OF THE SWEET POTATO.

For the Table. For Canning. For Drying. As Food for Stock. Value of the Tops and Vines for Stock.

As a diet for human food, the sweet potato may properly be considered a luxury. Fortunately, however, it is a luxury which nearly all the human family may enjoy. Those varieties which become soft and sugary when baked, and are sometimes erroneously called "Yams," are considered the leading vegetables in many Southern States. A garden in the Southern States that has not the sweet potato in it is the exception. In ante-bellum days this vegetable formed one of the chief elements of the negro's ration. It is frequently his practice in the South now to peal and eat the tubers raw like apples. He is almost as fond of it as the water melon, and takes a pride in planting it round his log cabin home of the South. Here, cotton, sweet potatoes, water melons, the negro and the mule have become almost inseparable.

While the soft sugary varieties are most appreciated in the Southern States, quite a different variety is most appreciated in the Northern States. Mealy varieties, such as the "Nansemonds," "Jersey Sweets," "Fancy Vineland Sweets," sell higher than any other potatoes, the irish not excepted in the Northern States. The following table shows results of

analyses of sweet potato tubers made at California Experiment Station and at Texas Experiment Station:

TABLE III, ANALYSES OF SWEET POTATOES.

	A. Per cent. on Fresh Substance.							
	Water	Pure Ash	Crude Protein	Crude Fat	Nitrogen-Free Extract.			Crude Fiber
					Sugar by Copper Test.		Total Nitrogen-Free Extract.	
					Before Inversion.	Total After Inversion.		
Averages of 17 varieties from analyses made at California Agr. Expt. Station	69.00	1.15	2.08	1.00	2.33	5.55	24.23	2.62
Averages of 21 varieties from analyses made at Texas Agr. Expt. Station	70.27	1.14	2.41	.99	3.42	6.81	24.00	1.26

	B. Per cent. Calculated to Water-Free Substance.							
	Water	Pure Ash	Crude Protein	Crude Fat	Nitrogen-Free Extract			Crude Fiber
					Sugar by Copper Test		Total Nitrogen-Free Extract	
					Before Inversion.	Total After Inversion		
Averages of 17 varieties from analyses made at California Agr. Expt. Station		3.60	6.23	3.17	7.73	19.00	78.70	8.35
Averages of 21 varieties from analyses made at Texas Agr. Expt Station		3.83	8.10	3.33	11.50	22.90	80.73	4.25

COMPOSITION OF THE IRISH AND THE SWEET POTATO COMPARED.

The relative nutritive value of the sweet potato can be more readily understood when compared with that of the irish potato, which is recognized as a valuable food product the civilized world over.

The analyses in the following table were made at Storr's Agricultural Experiment Station and at California Agricultural Experimental Station:

TABLE IV. COMPOSITION OF IRISH AND SWEET POTATOES.

	Number of Analyses.	Water, Per Cent	Nutrients, Per Cents					Potential Energy in One Pound
			Total	Protein	Fat	Carbohydrates	Mineral Matter	
Irish Potatoes (Connecticut)	12	78 90	21 10	2 10	.10	17 90	1 00	375
Sweet Potatoes (California)	17	69 00	31 00	2 08	1.00	24 23	1 08	537

It will be seen that the sweet potato contains ten times as much fat as the irish potato, the protein is about equal, and that the potential energy is one-third greater. The sweet potato has the sugar which the irish potato lacks, and also contains 8.9 % more dry matter. The sweet potato does not make a perfectly balanced "ration." Since it is lacking in protein, it should be used in connection with more nitrogenous food, such as beans, peas, eggs and lean meat. This also applies to the tops which are sometimes used for salad.

The table quality of sweet potatoes, while often good when the tubers are first dug, improves during storage. This seems to be due mainly to the loss of water and the increase of sugar. To test this 16 varieties were analyzed for me by the chemist of the Texas Experiment Station in November, in December, and in March, 1893-'94; the results are given in the following table:

TABLE V. ANALYSES OF THE TUBERS AT DIFFERENT PERIODS.

Name of variety.	November 1, 1893			December 20, 1893			March 6, 1894		
	Water	Invert Sugar	Total Sugar	Water	Invert Sugar	Total Sugar	Water	Invert Sugar	Total Sugar
Bunch (Yam)*	70 83	2 14	3 74	68 92	6 41	12 50	68 85	4 06	14 38
Early Bunch (Yam)	73 26	2 66	4 60	65 01	5 55	10 00	60 81	7 25	19 71
Vineless	66 06	4 16	6 41	66 03	6 02	12 50	62 90	6 10	16 42
Nansemond	71 81	3 33	5 00	70 34	3 73	5 88	70 14	3 09	8 00
Red Nose	77 59	3 27	5 20	72 84	3 15	6 00	68 76	4 75	11 13
Brazilian (Yam)	67 23	2 52	5 26	66 98	5 55	11 11	60 55	5 80	15 30
Negro Choker	68 23	2 84	7 69	66 71	5 00	9 60	61 72	5 75	11 50
Tennessee	65 83	2 19	2 77	64 01	5 26	11 63	59 81	7 16	13 80
Southern Queen	61 58	5 10	9 20	60 00	7 35	10 50	58 12	5 56	10 64
Red Bermuda	75 81	2 77	5 26	71 47	6 10	7 20	70 82	3 45	8 84
Early Golden	74 70	3 00	6 75	66 56	4 54	7 14	.....	.....	.....
Peabody	79 04	3 35	6 41	76 97	3 50	6 00	70 00	3 31	10 30
Delaware	78 26	2 08	5 00	67 87	5 50	7 46	50 00	1 15	7 55
Barbadoes	75 44	2 92	6 98	61 64	5 00	8 98	59 50	2 79	11 50
Norton	66 69	4 67	11 90	65 26	6 66	12 10	.....	.....	.....
Pumpkin	69 19	3 76	8 07	69 66	6 25	9 95	67 00	4 60	13 27

*Bunch, Early Bunch and Vineless are the same—R. H. P.

The following comments were made by the chemist upon these analyses: "In many cases, the quantity brought in for analysis was too small to furnish average samples. It was expected, according to popular belief, that the water would decrease as the winter advanced. This was true in a general way, and is clearly shown by reference to the table. The increase of invert sugar, 'comprising grape sugar and fruit sugar, is not so uniform as that of total sugar, comprising cane sugar in addition to invert.'

"The highest total amount of sugar on March 6th was found in the Early Bunch (Yam), although it was not the highest initial amount. Next to this came the Vineless in final total sugars. The Norton and the Pumpkin (Yam) and the Southern Queen carried the largest amount of total sugars on November 1st, the time when first analyses were made. As to the amount of water, the above three varieties together with the Vineless, the Brazilian (Yam), the Tennessee and the Negro Choker, were lowest in water or moisture when the analyses were first made.

But the amount of water which they lost on keeping seems to have been very little. The greatest percentage loss of water was in the Delaware, next to this came the Early Bunch (Yam); but with a difference of eleven per cent. of sugar in favor of the Yam. So far as these analyses indicate, the Early Bunch (Yam) would seem to be the best potato for table use, when a dry potato with a large amount of sugar is wanted. The next best answering the purpose would be the Pumpkin (Yam). But I believe it is a fact, that dry mealy potatoes, low in sugar, are more appreciated in the Northern market than are the 'Yellow Yams' rich in sugar."*

CANNING SWEET POTATOES.

Canning sweet potatoes is, of course, a new industry. It is gratifying to learn from those who have tried it, that there are prospects of it being made profitable. Since the vegetable comes in after nearly all other vegetables are gone, it would enable the factories to run a longer time during the year. Markets for this vegetable could then be extended, even to the very cold climates where it cannot be grown.

*Bulletin 36, on Sweet Potatoes, Texas Experimental Station.

Upon this subject I cannot do better than give the results of those who have tried it, and were kind enough to write out the following statements for me:

WATER VALLEY CANNING AND MANUFACTURING CO.,
Water Valley, Miss., Dec. 9th, 1895.

"Replying to your communication of December 6th, relative to canning sweet potatoes: The above factory packed some potatoes in 1893 and a small lot in 1894, but could not make the packing profitable, therefore, did not pack the present season. The main hindrance to the successful packing of potatoes in the South, our experience at least, is the excessive freight rates to market. No potatoes are sold south of Chicago, very few east of there, and the bulk in the West, Colorado and Minnesota.

"Baltimore and Maryland pack the bulk of the potato output of canning factories, and get freight rates to Chicago and the far West for much less than half the price Southern packers are compelled to pay. We packed a first-class line of goods, sold them right along in the Chicago markets, side by side with the best Maryland pack, but could not obtain within 30 cents a dozen of the price paid for Maryland goods. We paid farmers here 30 cents a bushel of 60 pounds for the potatoes. We packed an average of 20 cans to the bushel and sold at from 85 to 90 cents per dozen, Chicago delivery. We had several communications this season asking us for prices, parties who had used the goods in 1893 and 1894, but as stated above, we did not pack." G. D. BROWN, Secretary.

BOONEVILLE CANNING COMPANY,
Booneville, Miss., Dec. 16th, 1895.

"Replying to your favor of the 6th instant, will say that in 1892 we packed about 500 cases of the Jersey Yams, and sold them in Chicago at fair prices. While they are salable only in certain sections where the natural product cannot be easily obtained, and are, therefore, not very staple. I, from our experience, believe it to be a profitable industry."

JOHN T. BURNSIDE, Manager.

DRYING SWEET POTATOES.

Upon this subject the author can write with only a limited experience. The author has dried them successfully in the

sun when they presented somewhat the appearance of dried fruit.

Dried potatoes were among the Japan exhibit at the World's Fair. Their method of preparing them is stated as follows: "Cleanly washed potatoes are placed in a suitable basket and immersed in boiling water for a short time; when taken out of the basket, they are cut into thin slices and spread over mats and exposed to the sun for two or three days. In order to make a superior quality, the skin of the potato is peeled off before slicing."

Instances have been reported wherein the dried product was successfully ground into flour. How useful the vegetable may become in these lines, remains to be seen, but it seems safe to conclude now, that evaporation would be important in preserving the vegetable for stock food, at least, and also for shipping it long distances.

FOOD FOR STOCK.

It is not always convenient and advisable to ship sweet potatoes, and the question how to profitably dispose of a large crop may frequently come to the grower. In many cases there may be no better way than to feed the tubers to stock. They have been successfully fed to hogs, cattle, horses and poultry. Perhaps it pays better to feed the tubers to hogs, because they can do their own harvesting. For other animals the tubers should be sliced, and it is frequently the practice to boil them. At first there is some danger of producing colic if fed in large quantities.

By reference to table No. 3, we find that 100 pounds of sweet potato tubers contain 69.00 to 70.27 pounds of water, 1.14 to 1.15 pounds of ash, 2.08 to 2.41 pounds of protein, (so called flesh formers, the most costly of food constituents), .99 to 1.00 pounds of fat, 24.00 to 24.23 pounds nitrogen free extract (starch, sugar, gums, etc.), and 1.26 to 2.62 pounds of fiber. However, a clearer conception of the food value of sweet potatoes may be obtained by comparing the composition of the tubers with that of corn.

TABLE VI. RELATIVE FOOD VALUES OF CORN AND SWEET POTATOES

	Dry Matter lbs	Protein lbs	Nitrogen free extract lbs
100 pounds corn contain	89.1	10.5	75.0
300 pounds sweet potatoes contain*	87.9	7.2	72.0

*Analysis Texas Experiment station.

From the previous table we see that three pounds of sweet potatoes contain nearly as much dry matter, about two-thirds as much protein, and about as much carbonaceous material as is contained in one pound of corn. One-half pound of cotton seed meal or one pound of cowpeas (seed) to 10 pounds of sweet potatoes will fully supply the deficiency in protein. There are many acres of land that produce only 40 bushels of corn per acre, which if they were planted to sweet potatoes would produce 200 bushels, as the yield is often 5 to 8 times greater. The value from a food standpoint, leaving out the vines, is two-thirds greater than that of forty bushels of corn.

VALUE OF THE VINES AND TOPS.

Farmers usually allow the tops to decay on the ground. In this way a considerable per cent. of the fertilizing materials is returned to the soil. This practice will also furnish some of the necessary humus, which is often lacking in the cotton fields of the South. On the other hand, the tops and vines make a very important food for stock, and especially dairy cattle. This is quite an important item during very dry seasons when pasturage is scorched and killed by drouth. When the ground is dry, stock may be turned on in the fall to harvest the vines and tops, and will not injure the tubers. It is best to feed the vines and tops while green as they do not cure well and are said to become slimy in the silo. Short, stubby vines of the Vineless variety throw up heavy and long peduncles, which bear a large mass of foliage. This foliage can be easily cut with a scythe, and, if the ground be nearly level, with a mower; thus leaving the short gritty runners on the ground. The writer has grown over 300 bushels of this variety per acre, and intended to cut the tops with a mower, but the frost got in its work first. However, it could have been easily done. The Vineless variety mentioned will be discussed further in another chapter. The yield in pounds of vines and tops per acre is about twice that of the tubers, in Southern latitudes, but does not appear to be so much in Northern latitudes.

Green, succulent vines were taken from the field in October, 1893, and were analyzed at the Texas Station, the results of which analysis are given in the following table:

TABLE VII. COMPOSITION OF VINES AND TOPS.

Water	84.720
Ash Content	2.735
Protein	2.420
Crude Fibre	2.320
N. fr. Ext	7.215

COST OF PRODUCTION AND PROFITS.

Upon this subject I cannot do better than quote from a bulletin issued by the United States Department of Agriculture, 1895:

"Sweet potato growers in a number of states furnished the data used below in estimating the cost of growing sweet potatoes. Neither rent, cost of fertilizers, nor cost of shipping are included in the following statements.

"Averaging the returns of several experienced growers in New Jersey, we have the following figures, which may be taken as representative of the cost (less fertilizers and rent), of growing an acre of sweet potatoes in New Jersey, Delaware and the tide-water counties of Virginia: Sets grown or purchased, $5; preparation of the soil, $1.97; transplanting (with wooden tongs), $2.12; horse cultivation, $1.62; hoeing and other hand work, $3.75; harvesting, $6.50; total, $20.96. To this, in addition to rent or interest, must be added $10 to $40 per acre for fertilizers or stable manure.

"The following figures are averages from six statements selected from among those sent in by growers in the Southern States, and give the cost of cultivating an acre: Seed potatoes for sets or vine cuttings, $1.98; preparation of the soil, $2.79; transplanting sets or cuttings, $2.91; horse cultivation, $1.87; hoeing and other hand work, $1.62; harvesting, $5.66; total, $16.83. The figures used in making up these latter averages vary between the following limits: Seed potatoes, $1.25 to $4.75; preparation of land, $1.25 to $4.50; transplanting, $1 (doubtless for vine cuttings) to $6; horse cultivation, $1 to $3; hoeing, etc., 50 cents to $3.50, and harvesting, $3 to $8.

"Numerous other estimates of the cost of growing an acre of sweet potatoes in the Southern States approximate closely to $16.83 and confirm the correctness of this figure. Returns from this section of the country indicate that this crop is too frequently left without manuring.

"As regards costs per bushel, an Arkansas horticulturist who grows sweet potatoes on a large scale, places the cost of a bushel of sweet potatoes in the ground at 4½ to 11½ cents when the yield is 150 to 300 bushels per acre; digging and storing cost him 2½ to 3½ cents, making a total cost of 7 to 15 cents per bushel in the cellar. From Illinois and from Georgia come statements that 20 cents is the cost of growing and harvesting a bushel.

"When we come to consider selling price and profits, we find difficulty in generalizing, on account of the wide fluctuations to which the price of this vegetable is subject in the large cities, and to the fact that over a great extent of country there is practically no market, except for small quantities.

The principal markets for Eastern growers are New York, Baltimore, Philadelphia, Boston, and Providence, and in spite of wide fluctuation in price, the sweet potato crop is usually profitable in localities favored with cheap transportation facilities to these cities. During the period from July 15 to August 15 there is only a limited supply of sweet potatoes in Northern markets, and potatoes of good quality find a ready sale at relatively high prices. The sweet potato is a profitable crop where local sales can be effected. In localities remote from markets the profit in growing this crop on a large scale must come from converting sweet potatoes into pork or other valuable animal product. As a partial substitute for corn in the food of hogs the sweet potato should be extensively used in localities where, on account of poor, sandy soil, corn does not give large yields."

CHAPTER IV.

Climatic Influence.

The sweet potato reaches its highest development in Southern climates. While this is true, it will mature a crop in the greater part of the temperate zone. In warm, sandy loam soils and with earlier varieties which are now coming into cultivation, it seems that the latitude in which it is now profitably grown can be much extended. As an instance, Maine is credited in the census report of 1890 with 267 bushels.

At the Experiment Station of Geneva, New York, the estimated yield of Southern Queen was 292 bushels per acre, and the estimated yield of Spanish Red was 383 bushels per acre.

In some parts of New Jersey, growing the sweet potato is quite profitable. The report of the New Jersey Station for 1891 contains the following: "The raising of sweet potatoes is an important industry in the State, though few are raised north of Monmouth County. The chief shipping centers are Swedesboro, in Gloucester County, and Vineland, in Cumberland County. In Gloucester County, and especially about Swedesboro, it is estimated that one-fifth of the cultivable area is given to this crop. In those sections great skill has been acquired in growing large crops of excellent quality; the market reports now quote New Jersey Sweets at higher prices than those grown in other sections. * * * When grown in hills, 220 bushels of large potatoes per acre is considered a good yield; when grown in drills 250 bushels per acre is nearer the average; 300 bushels per acre is a good crop, though larger yields are frequently obtained."

In all the Southern States, and in many of the Western States, the sweet potato grows to perfection, even during dry seasons when many other crops fail. This drouth resisting quality of the sweet potato is due mainly to the roots going down into the soil so deep. The number of bushels grown in the states is shown in table 1.

CHAPTER V.

Influence of Soil on Quality of the Potato. The Best Soil for Potatoes. Preparation of Soils.

The character of the soil has very much to do with the quality of the sweet potato. When grown on a damp clay soil the per cent. of starch seems lower, and the table quality is not the best. Such a soil makes the tubers rough and uneven. Dirt adheres to them and greatly injures the appearance. Neither do they keep so well when grown on such a soil. This difference of the tubers, however, is not so important when it is intended to feed them to stock as it is when they are intended for table use.

Sweet potatoes reach their highest development on a well drained, sandy loam soil. Light, warm, slaty soil will often grow good sweet potatoes. Not much moisture is needed after the plants are well started if the ground is in good condition. The Pumpkin variety, which, to my taste, is the best table variety when grown on a light, sandy loam soil, yet, I have grown it on a damp clay soil when the table quality was so poor one would not recognize it as being the same variety. Recently cleared land usually grows potatoes of good quality.

PREPARATION OF THE SOIL.

Sod land is not desirable because it cannot be worked so well, and cut worms are very troublesome. If it is used, it is often best to plow it in the fall so that the sod will rot. The soil should be in fine tilth. If it has been in some hoed crop like cabbage, it is better. Sweet potatoes may also follow corn. If the land has been in corn or cotton a few years, it would often be best to sow clover or cowpeas on it and turn them under to enrich it and add vegetable matter to it, which has been exhausted. Wherever crimson clover will grow successfully it may be sown, frequently during August in the corn, and be turned under the following April or May in time for a sweet potato crop.

It is claimed by some growers that in order to obtain the short, well-rounded tubers, which sell best in the market, the ground should not be broken over three or four inches deep. Our experience does not accord with this. The best potatoes I have grown were produced on land which was plowed eight inches deep, once in the fall and once in the spring (though it should be stated the land was rather stiff). During very dry seasons I have seen roots which had gone down a great distance after moisture through a very hard subsoil and were enlarged about one inch in diameter to two and three feet, thus forming no regular tuber at all. In my experience, the shape of the tuber depends very much upon the season, the dryer the season the longer the tuber.

Preparation of the soil will depend somewhat upon its drainage and upon the kind of machinery to be used in transplanting. Transplanting machinery will be discussed in another chapter. If the soil is low and is inclined to be damp, it

is best to plant in ridges. If ridges are used they should be thrown up with a turning plow, three feet apart after the ground has been well prepared by plowing and harrowing. For many varieties grown in the South, four feet is better. A plank drag is a good thing to even these ridges just before setting time, and level them down to four or six inches of the surface of the ground. Level and ridge culture are discussed on page No. 31.

CHAPTER VI.

Manures. Analysis of Potatoes Showing Fertilizing Ingredients. Chemical Fertilizers. Profits in their use. Formulas for using.

No one fertilizer can be safely recommended as the best for a crop on all soils, because soils vary in composition. Some are poor in nitrogen, some in potash, and some in phosphoric acid. Chemical analysis of a soil, while often very important, is not an infallible guide to the fertility of a soil, because some of the fertilizing ingredients shown to exist in the soil by chemical analysis, may be only partially available to the plant. If all the soils were alike, analysis of the vines and tubers would, perhaps, afford the best basis upon which to compound a profitable fertilizer, and which could be widely recommended. Since the composition of the sweet potato varies less than the composition of soils, analysis of the potato would seem to afford the more rational basis of the two, but the only sure way to find out the amount of certain fertilizers which can be advantageously applied to a given soil for a particular crop is to experiment. Chemical analyses point out the lines in which the best results are most likely to be obtained. Each farm should, in a certain sense, be an experiment station, and the owner, the director, the soil his laboratory and the plants his chemists. From analysis of all parts of the sweet potato taken as a basis, the individual can compound a fertilizer of his own and experiment to find out the need of his soil for this particular crop. It may be stated, however, that a complete fertilizer, containing nitrogen, phosphoric acid and potash, is safer to use until experience has

shown that one or two of these may be left out or used in less quantity.

The roots and vines which grew on a highly fertilized field near Washington, D. C., were collected from a large plot and weighed. The roots averaged 17,898 pounds per acre, or about 350 bushels. Fresh vines completely covered the ground when cut, October 1st, 1894, and they weighed 10,374 pounds per acre. Vines of many of the stronger growing varieties will weigh much more in many of the Southern States. Vines and roots from several varieties have been collected by the author at College Station, Texas, where they had grown upon good soil, and in every instance the vines weighed twice as much as the roots and sometimes more. However, as there is no very great difference in chemical composition of vines and roots, except that the vines contain about 10 per cent. more water, the results obtained at Washington will be taken as the average.

Fresh vines referred to were analyzed at Washington and proved to contain the following: Water 83.06 per cent., nitrogen, 0.42; phosphoric acid, 0.07; potash, 0.73; lime, 0.44; total ash, 2.45.

Fresh sweet potato roots were analyzed at the New Jersey Experiment Station, and were found to contain the following: nitrogen, 0.23 per cent.; phosphoric acid, 0.10; potash, 0.51.

From Farmer's Bulletin No. 26, United States Department of Agriculture, the following information is taken concerning fertilizers needed for the sweet potato:

"If we assume 10,000 pounds of roots (equivalent to 185 bushels) and 8,000 pounds of vines per acre as a fair yield, we have the following figures showing the amounts of fertilizing ingredients contained in roots and vines of a crop of this size:

TABLE VII. FERTILIZING INGREDIENTS IN ROOTS AND VINES OF SWEET POTATOES GROWN ON ONE ACRE.

	In roots lbs	In vines lbs	In roots and vines lbs
Nitrogen	23	34	57
Phosphoric acid	10	6	16
Potash	50	58	108

"Much more potash than nitrogen and much more nitrogen than phosphoric acid is appropriated by the sweet potato, and

this is true whether we look only at the roots, the part always removed from the soil, or at the entire growth of roots and vines.

"Assuming that sweet potato vines are left on the land, and that wheat straw is finally returned to the soil from whence it came, we find that 185 bushels of sweet potato roots remove practically as much nitrogen and phosphoric acid and more than seven times as much potash as 20 bushels of wheat.

"The amounts of nitrogen, available phosphoric acid, and potash contained in a sweet potato crop of 185 bushels of roots and 8,000 pounds of vines would be supplied by the following amounts of commercial fertilizers:

TABLE VIII. COMPARISON OF FERTILIZERS.

57 pounds nitrogen in—	16 pounds* available phosphoric acid in—	108 pounds potash in—
363 pounds nitrate of soda, or 542 pounds dried blood, or 803 pounds cotton-seed meal, or 11,600 pounds barnyard manure	96 pounds dissolved bone-black, or 138 pounds superphosphate†	210 pounds muriate of potash, or 320 lbs sulphate of potash, or 793 pounds kainit, or 475 pounds cotton-hull ashes

*According to an analysis made at the Texas Experiment Station about 25 pounds of phosphoric acid, i e, 150 pounds of dissolved bone, or 215 pounds superphosphate, is required.

†Called also acid phosphate and dissolved South Carolina rock, and containing 11 6 per cent available phosphoric acid

It may be considered sufficient in some cases to apply only the quantity of fertilizing material that is removed by the roots of the sweet potato, the vines being left on the ground. Ten thousand pounds of sweet potato roots contain fertilizing ingredients equal to those found in the kinds and amounts or fertilizers given below:

TABLE IX. FERTILIZING INGREDIENTS IN DIFFERENT FORMS.

23 pounds nitrogen in—	10 pounds available phosphoric acid in—	50 pounds potash in—
146 pounds nitrate of soda, or 218 pounds dried blood,* or 324 pounds cotton seed meal†. or 4,694 pounds barnyard manure§	60 pounds dissolved bone black or 86 pounds superphosphate	97 pounds muriate of potash, or 150 lbs sulphate of potash, or 367 pounds kainit. or 220 lbs cotton hull ashes‖

*Containing also about 4 pounds phosphoric acid

†Containing also about 10 pounds phosphoric acid and 6 pounds of potash

§Containing also about 15 pounds phosphoric acid and 20 pounds of potash

‖Containing also about 17 pounds of available phosphoric acid

A large per cent. of vegetable matter is required in a soil to grow the best crop of sweet potatoes, and often chemical

fertilizers will not give their best results when this vegetable matter is lacking. Truck farmers frequently apply large quantities of woods earth, composted pine needles and other vegetable material with beneficial results. By plowing under such leguminous plants as clovers and cowpeas, this vegetable matter is easily secured to the soil, and in addition that most costly of fertilizers, nitrogen, which such plants bring from the atmosphere in an available form for plant food. Wherever crimson clover will grow successfully, for instance, it may be sown in the corn fields late in summer and be turned under the following May, and the soil be prepared at once for sweet potatoes. Lime will be found beneficial in some instances where the soil is heavy.

DOES THE FORM OF NITROGEN USED IN CHEMICAL MANURES INFLUENCE THE GROWTH OF SWEET POTATOES?

While as much as 57 pounds of nitrogen is found in 185 bushels of sweet potatoes, including vines, yet heavy applications of nitrogenous mineral fertilizers do not seem to be required for this vegetable in the extreme Southern States. In some instances where heavy applications of nitrate of soda have been used in the Southern States, the results were injurious. During 1894 the writer applied at the rate of 460 pounds sodium nitrate per acre on five different plots, by itself, with sulphate of potash, with muriate of potash, with bone black, and with all three combined, and in each instance the yield of potatoes was lowered below the average of three other check plots with no fertilizer, and in all others, except in the one instance where bone black was used. Perhaps this may be accounted for by the fact that the sweet potato having a long period of growth, and during hot months when nitrification is active in soils containing a large per cent. of vegetable matter. It might also have been due to the fact that nitrogen in this mineral form is not the best for the sweet potato. The same negative results were also obtained by the writer when nitrogen in this form was used at the Texas Station upon irish potatoes.

At New Jersey Station, "organic forms of nitrogen, as dried blood, are more desirable than nitrate of soda." However, experiments conducted there later were more favorable for nitrate of soda.

At the Georgia Station, "cotton seed meal is preferable to nitrate of soda as a source of nitrogen." So far cotton seed meal has proved better than nitrate of soda as a source of nitrogen with the writer.

From fourth annual report of New Jersey Station, 1893, the following is taken:

TABLE X. PROFITS FROM DIFFERENT FERTILIZERS.

	Cost of Fertilizer	Net value of crop per acre	Net gain	Net Gain, 1892	Average for two years
Unfertilized	.....	$113 33	.....	.....	.....
Minerals alone	$ 7 70	144 01	$30 68	$25 31	$28 00
" with nitrate	12 34	139 70	26 37	23 30	24 84
" " blood	12 34	118 71	5 38	35 14	20 26

"The net gain from minerals alone is $30.68 per acre. The net gain from minerals with nitrate is $26.37 per acre, or a difference in favor of minerals alone of $4.31 per acre. The nitrogen costs $4.64 per acre, hence, while there was a slight increase in yield from its use, it was not sufficient to pay the extra cost. This result is in accord with that of 1892.

"The use of dried blood in connection with minerals resulted in a lower yield than was secured from the minerals alone, and consequently a much decreased net gain. This effect of dried blood is the reverse of that shown in a similar experiment in 1892 and others in 1891, which showed an increased yield from nitrogen, and that organic forms, as dried blood, were more useful than the nitrate of soda.

ARE COMBINATIONS OF CHEMICAL AND HORSE MANURES MORE PROFITABLE THAN HORSE MANURE ALONE?

This method of manuring is highly regarded by some of the best growers, because it admits of securing the advantages that may be derived from the mechanical and biological properties of the horse manure and from the greater solubility of the chemical manures. Plot 7 received one-half as much, and plot 13 the same amounts of manure and chemicals as were used when each was applied singly. The result stands as follows:

"TABLE XI. VALUE OF CROP FROM DIFFERENT FERTILIZERS.

	Cost of fertilizer	Net value of crop per acre	Net gain or loss	Net gain 1892	Average net gain or loss for two years
Unfertilized	.....	$113 33	.....	.....	.....
Manure and chemicals, one-half	$26 17	118 69	$ 5 36	$14 68	$20 02
" " " whole	52 34	92 43	—20 90	16 02	—2 44
Manure alone	40 00	106 76	—6 57	4 57	—1 00"

"The only net gain was secured from the combination of small quantities of the manure and chemicals; this gain was but $5.36 per acre. Twenty tons of manure per acre, both alone and in combination, with full quantities of minerals, though increasing the yield, resulted in a considerable loss."

PHOSPHORIC ACID.

Applications of phosphoric acid to the sweet potato crop have been profitable in most instances. Since it is one of the necessary elements in a complete fertilizer, and 16 to 25 pounds are found in a normal crop grown on an acre, it could not be left out when the fertilizers are to be applied to soils deficient in this element, as is the case with most Southern clayey soils. The writer has found it decidedly profitable on such soils.

Since the phosphates, when first applied to the soil, largely enter into forms in which they are not immediately available as plant food, larger quantities should be used than are necessary for the immediate crop. Phosphoric acid may be purchased in the form of dissolved boneblack, acid phosphate (superphosphate), floats, slag and some other forms. While floats and slag contain larger amounts of phosphoric acid than bone black and superphosphate, yet, in this form the phosphoric acid is more insoluble and consequently acts more slowly on plant life.

POTASH.

Potash is the most important fertilizer for sweet potatoes. This is reasonable, since a normal crop contains 108 pounds per acre, and sandy loam soils upon which the vegetable grows best are deficient, usually, in this element.

Potash in the form of muriate proved best at New Jersey Station, kanit at Georgia Station, and sulphate at Texas Station. It seems that further work is necessary to demonstrate more fully which form is the best for most soils. Kanit, which is a low grade fertilizer, can be bought cheaply near seaport cities, and at such places it is apt to prove the most profitable form to use.

HORSE MANURE, OR BARNYARD MANURE.

One advantage that horse or barnyard manure has over chemical fertilizers is that the results are seen for a longer

time after the application to the soil. None of this material which is produced on the farm should be allowed to go to waste. It is decidedly better to haul it at once directly from the barn to the fields, than it is to let it be exposed to leeching rains and then haul it out once a year. Perhaps a better way to use it for the sweet potato crop is to first compost it so that it will be well rotted when applied to the soil in the spring. In doing this it is a good idea to keep the compost covered with about two inches of clay dirt or with some plaster (gypsum) to prevent the escape of nitrogen. After it becomes wet and heated, it should be turned. It should be turned two or three times at intervals of about two weeks, so as to hasten its rotting. Apply it broadcast at the rate of 10 or 20 tons per acre, according to the fertility of the soil.

HOW THE FARMER MAY PREPARE HIS OWN FERTILIZER.

By reference to table 9, it will be seen at a glance the amount of material a normal crop of sweet potatoes take from the soil. It will often pay to buy the ingredients and mix the fertilizers on the farm during winter months when other work is not pressing. They should be well pulverized and mixed thoroughly.

In the following table are formulas which have given good results at some of the experiment stations:

TABLE XII. FERTILIZER FORMULAS FOR SWEET POTATOES.

Kind and amount of fertilizer per acre	Nitrogen	Available phosphoric acid	Potash
I.	Pounds	Pounds	Pounds
150 pounds of nitrate of soda 350 pounds superphosphate 150 pounds muriate of potash	24	41	77
II.			
285 pounds dried blood 320 pounds boneblack 160 pounds muriate of potash	29	53	82
III.			
100 pounds nitrate of silver 160 pounds boneblack 80 pounds sulphate of potash 10 tons barnyard manure	*114	†27	113
IV.			
360 pounds cotton-seed meal 320 pounds superphosphate 640 pounds kainit	26	‡43	94

*The manure supplies 98 pounds of nitrogen, the nitrate of soda only 16 pounds.
†In addition to 64 pounds of phosphoric acid in stable manure.
‡In addition to 11 pounds of phosphoric acid in cotton-seed meal.

The above formulas, which are taken from Farmer's Bulletin previously referred to, are for complete fertilizers and are intended for rather poor soils deficient in nitrogen, phosphoric acid and potash. The quantities mentioned in the formulas will be found rather large for most soils, and the farmer himself must find out by experimenting how much or what fertilizers pay best on a given soil. In the Southern States where cotton seed meal and cotton seed hull ashes may be easily obtained, a good fertilizer for an acre may be made by mixing 300 pounds cotton seed meal with 200 pounds cotton seed hull ashes. If fertilizers in this form are used, they should be applied to the soil some time before the crop is planted, so that the fertilizing ingredients in these organic forms will become available when the young plants most need them.

CHAPTER VII.

Propagation of the Sweet Potato. The Best Tubers for Seed. The Plant Bed.

The sweet potato may be propagated in four ways: by seed, by pieces of tubers, by slips or draws, and by vine cuttings. As the sweet potato rarely matures seed in the United States, propagation in this way is impracticable. The hall variety is said to have come up among some morning glory seed planted by a lady. This is one way in which new varieties may be started, but it is not the only way. Sweet potatoes, like some other plants, produce "sports." If the seed of the sweet potato were abundant it would be impracticable to grow a crop from them because the tubers would be few and small from them the first year, owing to the very small size of the seed. No one attempts to grow a general crop of irish potatoes from the seed borne in the small, round balls on top of the vines. They are grown almost exclusively from the tubers. This is one of the main reasons why the irish potato has lost the power of growing much seed. The same reasons may answer in part for the non-seed producing habit of the sweet potato. It should be stated, however, that in warm climates near the equator much more seed is produced.

PROPAGATION BY PIECES OF THE TUBER.

The sweet potato can be grown from pieces of the tuber, just the same as the irish potato is grown. But, as the sweet potato is more susceptible to injury from cold, damp weather, the tubers will usually rot before sprouting if planted in northern latitudes. After testing this method, I feel confident that it can be used more extensively, with profit, in warm climates where cold, damp weather is not so apt to prevail for any great length of time during spring. The tubers should not be put into the ground until it is time to plant melons. Tubers should be cut transversely into about one ounce pieces. This method is rather costly as it would take as many bushels of sweet potatoes to plant an acre, as it would irish potatoes when they are cut to two eye pieces. It will take the tubers from two to four weeks to throw up sprouts, owing to the condition of the weather.

PROPAGATION BY SLIPS, DRAWS OR SETS.

We mean by slips, draws or sets, shoots which come from the roots that are planted in hot beds. The word "slip" we prefer to use, as it seems the most fitting. This method of propagation is the one most commonly used. It is about the only one for northern latitudes. There are various ways of starting the plants, which will now be mentioned.

THE PLANT BED.

The simplest form of plant bed which may be used in the warmer climates, consists in selecting a warm, well drained and sheltered place; dig up the soil carefully, place the tubers on it, cover them two inches with rich loam soil and keep moist. It takes the slips some time to come in this way without bottom heat. The kind of bed used will depend upon the climate and on the degree of forcing required.

The method most frequently used in furnishing bottom heat is that of using fermenting manure. In using this method, select a location well drained and protected from the northern winds. Dig a pit 12 to 18 inches deep, six feet wide and as long as desired. Drive stakes down in each of the four corners and along the sides of the pit, to which nail plank along the sides of the pit to keep the dirt from falling down,

and to prevent mice and moles getting in. The stakes must project above ground so that plank may be nailed to them on the outside above the ground. These planks should be twelve inches wide on the north side and six inches wide on the south side. Pile dirt up around these outside planks to keep out cold. The pit is now ready for the manure. Before putting this in, a layer of leaves or straw three or four inches deep, should be spread over the bottom of the pit to help keep in the heat. Fresh stable manure from the horse is best because it reaches a higher degree of heat. The amount required depends upon the climate. For the Gulf States, a layer of three or four inches thick is enough, while for the New England States, the layer should be eight or ten inches thick. After the manure is put in it should be tramped down and slightly watered if not already wet enough. In good manure the heat will reach 100 degrees Farenheit; in three or four days I have known it to go as high as 140 degrees. At the end of three or four days the manure should be turned over with a fork so as to make the fermentation even all over, tramp it down again and water if not wet enough. If the temperature should run very high it can be kept down by watering. If made too wet, fermentation may be almost entirely checked. To use the proper amount, therefore, requires some experience and judgment. When the temperature comes down to 85 degrees, dirt can be put on and the potatoes be planted. Rich, loose, sandy loam soil is best. Woods earth is very good. Put on a layer of about three inches. Place the tubers on this dirt about one-half inch apart. Cover with three inches of sand, good garden soil will do. For top covering of the hot bed various things are used, such as sash, boards, cloth, straw and leaves. A layer of six inches of straw or leaves is often used until the plants grow three or four inches high, when the cover should be removed during the day, if not too cold. The main objection to this open bed is that rain may soak the bed and chill the tubers. A layer of leaves covered over with plank is better, provided some are left off during the day to give ventilation. Sash are best because they keep in the heat and do not obstruct the sunlight, but they are more costly and require closer attention as to ventilation and watering.

It should be stated here that in the extreme Southern States, horses frequently are not stalled and stable manure is scarce. As a substitute, a layer of about four inches of cotton seed is used instead of manure, cotton seed hulls are also sometimes used, but the heat generated by them is slight.

FIRE BEDS.

In the more northern latitudes, where growing the plants is a regular business, perhaps some form of fire bed is best. These beds vary much with the material used, and in the manner of construction. There are two main classes, the hollow bed and the tile bed.

A successful New Jersey sweet potato grower described his method of growing plants in this way in the *Rural New Yorker*, as follows:

"My bed is made by scooping out a space 12 feet wide by 50 feet long, to the depth of one foot. At one end is built a brick furnace two feet high, two feet wide and three feet long. The top of the furnace is arched, and on a level with the bottom of the pit. A hole must be dug in front of the furnace for an entrance. Two flues are laid from the furnace to within three feet of the opposite end. They should rise a little—four or five inches in the whole distance will be enough. They may be made of six inch drain tile, terra cotta pipe, or brick, whichever is the cheaper; I make them of brick. The ground is made perfectly smooth and firm, and two rows of brick set on edge six inches apart, for each flue. The top is covered with brick laid crosswise, all joints made with mortar.

Eighteen inches from the bottom of the pit, is the floor. I use cedar rails from three to four inches in diameter. Three strong pieces are laid on blocks or posts at the required height, the full length of the bed, one in the middle and one at each side. The rails are cut 12 feet long, and laid crosswise. The sides are made of inch boards, and should be 20 inches high above the floor. They are nailed to stakes driven in the ground, and are banked clear to the top with the earth thrown out of the pit. The smoke-stack is built over the furnace, but has no direct communication with it. There is an opening into it from the space under the floor. This arrangement insures a good draft at all times. As soon as a fire is started in the furnace, the air in the stack is heated, and begins to

rise at once, drawing a fresh supply from the space under the floor. This creates a vacuum which is filled by the smoke and heat from the flues. Some beds made on this plan, have the flues go only half the length of the bed, with the smokestack at the opposite end from the furnace. I like the former plan better, for the reason that a good draft is assured, all the heat is utilized, the furnace may be smaller, and less fuel is required."

In Farmer's Bulletin No. 26, of U. S. Department of Agriculture, the following method is given:

"The flues have a slight grade and terminate in a chimney directly over the furnace. The four-inch space between the double wooden walls which inclose the hot-air space below the bed, is filled with sawdust. The two by four-inch studs of this wall, which support the bed, are three feet long. Earth is heaped against the walls on the outside."

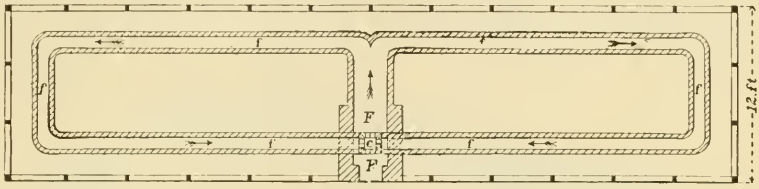


FIG. 4. Sweet-potato bed, with furnace and flues.
F, furnace; f f f, flue; c, chimney. The arrows indicate the direction of hot air current.

WHEN TO BED OUT THE TUBERS.

When to bed out the tubers depends upon the location, the season, and the amount of bottom heat used. Under ordinary circumstances, slips may be grown from four to six weeks after bedding the tubers. Slips are ready for setting out in the field when they are about five inches high above the ground. Before they are set, they must be sufficiently "hardened off" by leaving the bed open frequently and letting the plants be gradually exposed to the atmosphere. It is sometimes the practice when plants are large enough to set before it is time for them to go out, to detach them from the roots and "heel them in" at some protected place. This must be done with care or the plants will rot if crowded together when in a rather moist condition. From three to four "drawings" can be made from one bed. After the drawings, the roots may be taken out of the bed and fed to hogs.

At the following dates, plants are usually set out: Jacksonville, Fla., March 20 to April 1; other Southern States such as Alabama, Mississippi, Georgia, Arkansas and Texas, April 1 to 25, and southern part of New Jersey they can be set from May 1 to 15. It must be remembered, however, that plants can be set much later than the above mentioned dates, and will produce a good crop. Most varieties will not produce tubers fit to be dug before 90 days, though I have grown a good crop of the "Gen. Grant" variety in 75 days from vine cuttings when the season was good. When the tubers are dug so early in their sappy, half-matured state, it must not be expected that they will ship very far.

KIND OF SWEET POTATOES FOR SEED.

Tubers to grow slips from are used from the size of a cigar up to several pounds. Large potatoes take less space per bushel than small potatoes. A bushel of large potatoes will require about fifteen square feet; a bushel of medium size potatoes will require about twenty square feet; a bushel of

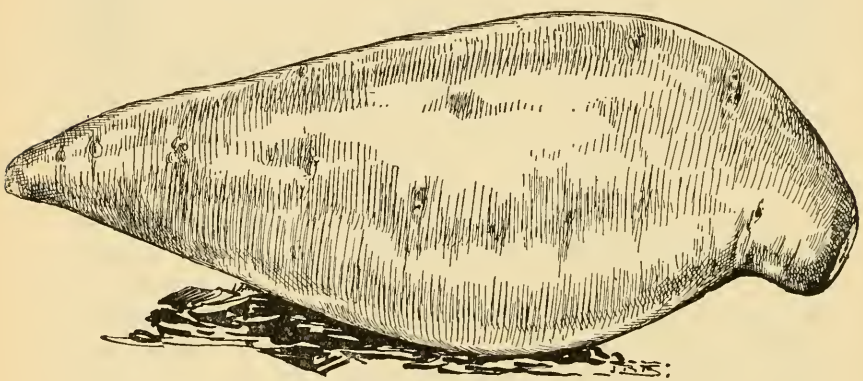


Fig. 5. Best tuber for seed.

small ones, about twenty-five square feet. The amount of potatoes to grow sets from is hard to estimate, because of the conditions of the bed and the number of plants per acre, vary in different localities all the way from 5,000 to 10,000. Medium size potatoes will produce from 2,000 to 3,000 plants per bushel in two drawings. There is a great lack of definiteness in reference to the size of tubers. From definite experiments I have found that tubers the size of a cigar will produce com-

paratively few slips, while those which are very large (4 to 5 pounds) will not produce as many slips per bushel as those from one inch to an inch and a half in diameter. The best size we have found is shown in figure No. 5 made by the *Rural New Yorker* to illustrate the best size used by a successful grower in New Jersey.

The sweet potato is sometimes compared with the irish potato, and it is, therefore, claimed that slips from small tubers will not grow as large a crop as slips from large tubers will. This comparison is wrong as will be seen upon a moment's reflection. In the case of the irish potato, a part of the tuber is cut off and remains in the soil from which the vine continues to draw some of its nourishment. Slips are taken from the sweet potato while the tubers remain in the bed, and they have an independent life while growing in the field, so that the tuber could not influence the food supply, and therefore would seem not to affect the yield materially. This reasoning is borne out by my experiments, the results of which are reported in the following table:

TABLE XIII. YIELD FROM SLIPS TAKEN FROM DIFFERENT SIZES OF TUBERS.

	Calculated bushels per acre		
	Large	Small	Total
Shanghai, yield from a tuber weighing 5 pounds..	315 34	10 40	325 74
Shanghai, yield from very small tubers	402 72	13 32	416.04
Vineless, yield from very large tubers ..	285 08	25 82	310 90
Vineless, yield from very small roots	354 66	17 66	372.32

In the above experiments each plot contained the same number of plants. It would not be safe to conclude from the above given facts that slips from very small tubers will always give larger yields than slips from large tubers. A safer conclusion would be that slips from small tubers will produce fully as large tubers as slips from large tubers, because this experiment was carried on only one year. Some growers go over the field at harvest time and select short, stubby tubers for seed. If this practice is followed tubers should be selected from vines bearing the largest number of the type desired. It appears that the sweet potato can be improved upon by this selection.

PROPAGATION BY VINE CUTTINGS.

As a rule, I have obtained much better results by using cuttings from vines which are strong and vigorous, like those of such varieties as Hall, Southern Queen and Shanghai. All the leaves should be taken off the cutting so that the vitality will not be exhausted before the cutting takes root. The tip of the vine is too tender to be used with success. Any other part of the vine will do. The cutting should be about 12 inches long. One inch is enough to project above ground when the cuttings are put into the field.

Propagation by vine cuttings is the cheapest way. One acre of a vigorous growing variety will produce enough vine cuttings to plant one to three other acres. Continuous cutting off the vines lowers the yield some. It should not be done late in the season. Some plants should be set very early for this purpose. They will pay well when the tubers are costly. Tubers from vine cuttings are usually rather small, long and smooth. They are the best for seed the following year, and can be grown in nearly all the southern states from Virginia to the coast.

In Texas I have grown a crop of 150 bushels per acre with the vineless variety from cuttings planted ont 19th of July. During a fair season many of the vigorous growing varieties will produce a fair crop from vine cuttings in 90 days. For these cuttings the ground should be thoroughly prepared and kept well stirred after setting. If the soil is in good condition and irrigation can be used the cuttings will grow quickly and make almost a perfect stand. How best to set them is discussed more fully in the chapter on transplanting.

CHAPTER VIII.

Transplanting. When to Transplant. Ridge and Level. Distance Between Plants. Transplanting Machinery.

By transplanting is meant setting the plants in another place. It is sometimes the practice of growers to transplant when the ground is very wet. This is not at all necessary, on the contrary it frequently leads to bad results, the dirt becoming dry and baked around the young plants and thus preventing the rapid growth of young roots. The plants frequently be-

come yellow and start off to grow very slowly. While the sweet potato plant is very susceptible to injury from cold, it will stand with impunity considerable dry weather. The soil is in the very best condition for transplanting when it is just right for plowing. I have set the plants in the ridges after the plow during a warm sunny day and did not lose one per cent. It is best, however, to set during a cloudy day or late in the afternoon. The main point in this case, as with other plants, is to press the dirt *firmly* around the roots. Growers sometimes pour a cup full of water around the plants. This is not necessary if these instructions are followed, neither for plants nor for vine cuttings. If the ground is dry a cup full of water put around the roots and dry dirt be raked over immediately, it will be beneficial. If the roots of the plants be thrust into a mud batter made of loamy soil and water before transplanting, it will be beneficial.

WHEN TO TRANSPLANT.

It will pay to wait until the ground becomes thoroughly warm. When the ground is warm enough to plant lima beans it is nearly warm enough to transplant sweet potatoes. In the extreme southern states plants are frequently set April 15th to 25th. In New Jersey, for instance, transplanting is done one month later.

TRANSPANTING ON RIDGES AND ON LEVEL.

Both methods are in use among growers. The ridge warms up first in the spring. On the contrary, it dries out quicker and is a little more difficult on which to use transplanting machinery. However, the ridge is more generally used and appears to give generally better results.

At the Louisiana station the results given in the following table were obtained after two years experimenting and show a decided advantage of the ridge over the level:

TABLE XIV. HEIGHT OF ROW—AVERAGE FOR TWO YEARS.

No. Ex.	Height.	Yield in Bushels.	
		Merchantable.	Culls.
1	On the level	130 03	33 57
2	Four inches	219 84	22 53
3	Eight inches	197 07	17 33
4	Twelve inches	221 59	16 45
5	Sixteen inches	261 18	25 45

At the Georgia station during 1893 and 1894 the results were conflicting, but showed a slight difference in favor of the ridge.

At the Texas station during 1895, the following results were obtained: Level culture, 173.66 bushels; ridge, 6 inches high, 211.44 bushels.

DISTANCE APART BETWEEN THE PLANTS.

In New Jersey "two methods are followed in regard to the setting of plants in the field, one in which the plants are set in hills two and one-half feet each way, the other in which they are grown in drills eighteen inches by two and one-half feet." If the plants are set by the check method the crop may be cultivated easier, but it is seldom used in the southern states. The distance apart at which the maximum crop may be grown depends much upon latitude, soil and variety. Vigorous growing varieties require a greater distance than weaker growing ones. The vineless variety may be planted very close.

In the following table will be found the results of the Louisiana station obtained during three years, except in the fifth plot the results of which were obtained during only one year:

TABLE XV. AVERAGE OF THE LAST THREE YEARS IN DISTANCE IN ROW.

No. Ex.	Distance.	Yield Per Acre in Bushels.	
		Merchantable.	Culls
1	Eight inches	252 07	13 36
2	Twelve inches	258 31	11 01
3	Fifteen inches	275 01	10 48
4	Eighteen inches	281 82	11 71
5	Twenty-four inches (1893)	249 08	15 96

At the Georgia station for 1893, the following results were obtained:

TABLE XVI. DISTANCE TEST.

Plat.	Distance.	Calculated Yield Per Acre in Bushels.		
		Marketable.	Small.	Total.
1	Eighteen inches (1½ ft.)	202 04	65 58	267 62
2	Twenty-four inches (2 ft.)	184 74	52 34	237 08
3	Thirty inches (2½ ft.)	179 64	50 11	229 75

If the plants are set 30 by 30 inches, which is claimed to be the least distance that is convenient, it will take about 7,000 plants per acre.

TRANSPLANTING MACHINERY.

The cost of transplanting is usually expensive. When done with a dibble or stick by hand it is hard work. The writer, after testing a number of machines and methods, finds that one of the best and easiest ways to transplant the slips is with a common one horse turning plow; though transplanting can only be done in this way on a level. Cheap and unskilled labor may be used. When a furrow is being thrown open the plants may be dropped along against the straight side of the furrow after the plow. When the end of the row is reached the plow may be turned around and the dirt be thrown back on the plants. The droppers may also come back along the furrow and step on the dirt just above the plants to press the dirt against them firmly. The writer has also set vine-cuttings in this way successfully. In this way three men and a mule will plant about 3 acres in a day. This method is shown in the following figure, and is original with the author:

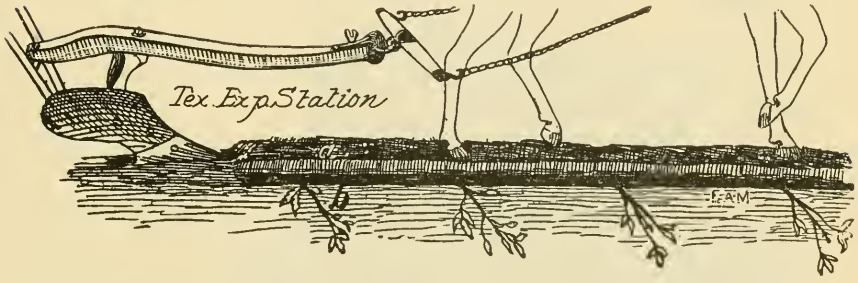


FIG. 6.—Transplanting with a plow and a mule. a, Dirt thrown up by a plow. b, Plants laid along on straight side of furrow.

In figure No 7 is shown a very simple transplanter manufactured by J. W. Parker, Paulsboro, N. J. This machine consists of two wooden strips which slide up and down against each other, and are held together by tin cross bands. The one with a paddle on one end punches the vine or cutting in the ground and is then raised, while the other with a foot on the end is pushed down by the side of the plant to

press the dirt firmly around the roots. If the ground is in good condition this machine will put the plants in the ground as fast as one man can drop them. The plants are dropped along the row with the roots toward the transplanter. It might be stated that there is rubber on the end of the paddle to prevent it from injuring the plants while they are being pushed down into the ground. The machine may be used either for slips or for cuttings.

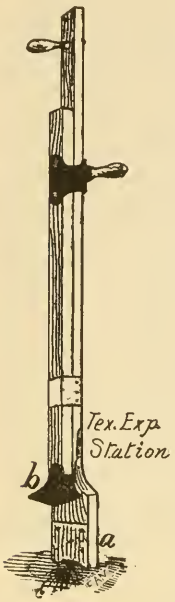


FIG. 7.--Sweet Potato Transplanter. a, The paddle which pushes the plant down. b, The foot which presses the dirt around the roots.

A very convenient and simple machine any one can easily make is a common wooden dibble. Break off a well seasoned limb of hard wood just below a fork and leave it about three feet long and sharpen the other end. If some tin be nailed over this end smoothly the dirt will not be so apt to stick to it, and thus bother the work of transplanting.

FIG. 8—Showing the convenience of Ordinary "Dibble."

A more costly machine is made by W. A. Lake Manufacturing Co., Harriman, Tenn., and is shown in figure No. 9. This machine works well with small plants, but if they are leafy they do not slip through the schute so readily. It is better adapted for such plants as tomatoes and cabbage. It is known as The Peerless Plant Setter.

There is a larger machine known as the Bemis transplanting Machine, manufactured by Fuller & Johnson Manufacturing Co., Madison, Wis., which is desirable for transplanting on a large scale. This machine is drawn by two horses. One man drives and two boys set the plants when the horses are going in an ordinary walk. It will set from three to six acres

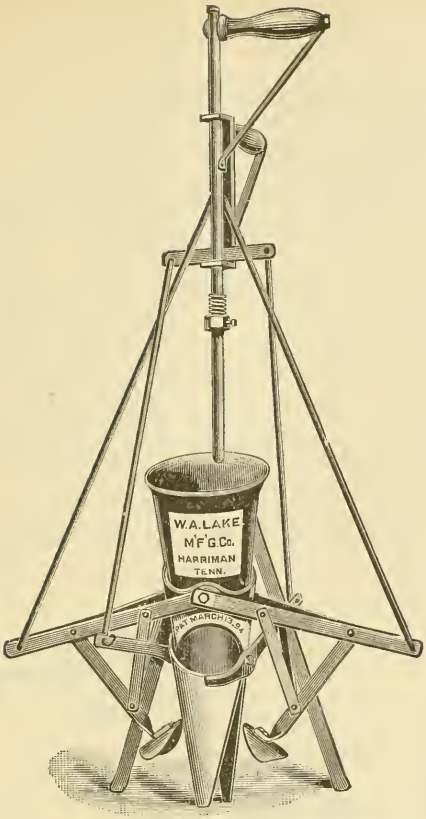


Fig. 9—Peerless Plant Setter.

per day depending upon the skill of the boys and the closeness of the plants. It has a water attachment which puts the water around the roots before they are covered. From four to six barrels of water may be used on an acre. It has also a fertilizer attachment which distributes the fertilizer along in the row. Slips and vine-cuttings may be set by it. It is a very valuable machine and may be used on the farm for setting many other kinds of plants. The only objection one could have is its cost, which is about $75.00.

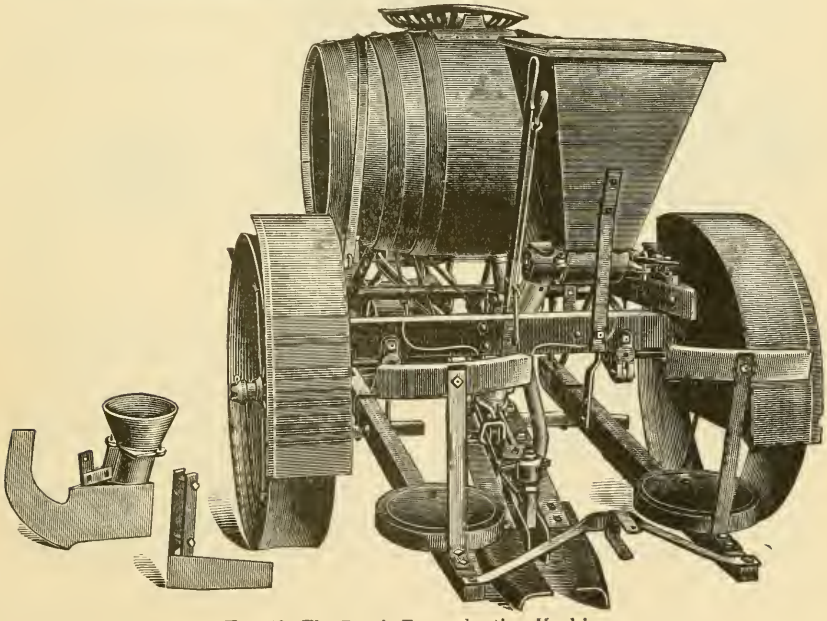


Fig. 10—The Bemis Transplanting Machine.

CHAPTER IX.

Cultivation, Shallow or Deep. Raising the Vines. Pinching off the Ends of the Vines.

The soil should be well cultivated after the plants are set so as to keep it loose and moist, also to keep down weeds. Usually after the ground dries when a hard rain has fallen, the cultivator should be started. Cultivation should be kept up till the vines cover the rows. Care should be taken not to throw dirt on the vines with the cultivator as they will take root at such places. Some growers use a special cultivator which lifts the vines so that the rows may be cultivated closer and later in the season. Shallow cultivation is usually the best since it does not break the fine roots which go far in search offood.

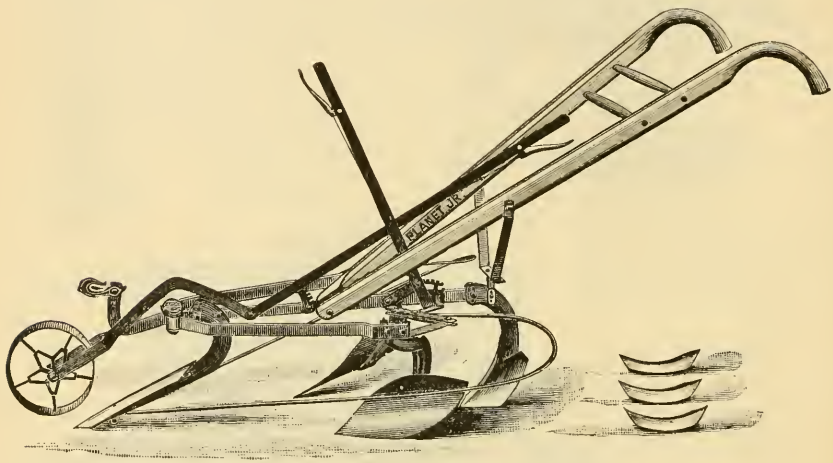


Fig. 11—Cultivator with Vine Lifter.

RAISING THE VINES.

There seems to be some difference of opinion among growers as to whether lifting the vines and not allowing them to root at the nodes is beneficial or not. The method of raising the vines has been tested at the Louisiana and Georgia stations and at each one it lowered the yield. In the following tables are given the results beginning with those obtained at the Louisiana station:

TABLE XVII. VINE-LIFTING EXPERIMENT (LA.) 1893.

No. of Experiment.	Treatment.	Yield in Bushels Per Acre, 1892.			Yield in Bushels Per Acre, 1893		
		Merchantable	Culls.	Total.	Merchantable.	Culls.	Total
1	Vines left undisturbed	352 49	76 78	429 23	310 2	25 7	335 9
2	Vines lifted twice per wee	226 85	20 94	247 79	294 5	20 0	314 5
	Difference	125 64	55 84	181 44	15 7	5 7	21 4

TABLE XVIII. VINE-LIFTING EXPERIMENT (GA.) 1893.

Plat.	Treatment.	Calculated Yield Per Acre in Bushels.		
		Marketable.	Small.	Total
1	Not allowed to root along vines	148 1	8 2	156 3
2	Check plat (normal treatment)	254 9	15 4	270 3
	Difference in favor of normal treatment	106 8	7 2	114 0

PINCHING OFF THE VINES.

It is sometimes the practice of growers to pinch back the vines, believing that it will increase the productiveness. This practice also seems to be injurious. This method has been tested also by the Louisiana and Georgia stations and the results are given in the following tables beginning with those from Louisiana, obtained during 1893:

TABLE XIX. VINE-PINCHING EXPERIMENT (LA.)

No. of Experiment.	Treatment	Yield in Bushels Per Acre.		
		Merchantable.	Culls.	Total.
1	Vines left undisturbed	310 2	25 7	335 9
2	Pinched continually (to two feet)	257 2	16 5	273 7

TABLE XX. VINE-PINCHING EXPERIMENT (GA.)

Plat.	Method.	Calculated Yield Per Acre in Bushels.		
		Marketable.	Small.	Total.
1	Undisturbed (for check plat.)	195 7	5 6	201 3
2	Pinched weekly to 2 feet through season	85 1	19 8	104 9
3	Pinched weekly to 2 feet after Sept. 1st	37 8	12 3	50 1

CHAPTER X.

Harvesting. When to Harvest. How to Harvest. Storing. Pit method of Storing. House Method of Storing. Leaving the Tubers in the Ground until Wanted.

If the crop is intended for stock food, cattle may be turned on in dry weather to harvest the vines and tops, afterwards hogs may be turned on to harvest the tubers. In this way nearly all the crop may be saved at a minimum cost.

If the crop is intended for storage or for sale at once, considerable care should be taken in harvesting it properly. It is sometimes the practice of growers to harvest part of the crop about the middle of August and sell it. The tubers are palatable as soon as dug, and often very good profits are realized by harvesting and shipping early, though the yield be only one-half as great at this time. Owing to the sappiness of the tubers at this time considerable risk is run of great loss by soft rot, especially when shipped during hot, damp weather.

For storage the tubers are not in condition to be dug until growth nearly ceases and the tubers are more mature. There is a difference of opinion as to when the tubers are in the best condition to be dug. Some contend just after a frost; others contend just before a frost. The first frost which merely kills the tops and seems to have no effect upon the tubers. The author has left the tubers in the ground and dug them in December and they kept well. The best test the writer has found by which to tell when the tubers are in condition to be dug is to break several tubers and expose the pieces to the air for some time. If sufficiently mature to keep well the original color is maintained while the exposed places "heal over;" if not mature the exposed places assume a dark or greenish appearance.

Do not dig when the ground is wet because dirt will adhere to the tubers and injure the sale, and they are also much more difficult to keep. It is better to wait two or three weeks for proper conditions than to run such a great risk of losing the greater part of the crop. The tubers are not apt to be injured much by being left in the ground some time after

frost. At the Texas Station the writer has left them in the ground all winter and they kept well during a dry winter, during a wet winter the tubers spoilt. Severe frosts and freezing of the ground a quarter of an inch did not hurt the tubers except those which came to the surface of the ground. This will be discussed further under the head of storing. Dig in the forenoon of a bright day and gather up the tubers in the afternoon.

HOW TO HARVEST THE TUBERS.

Digging may be done with a spading fork, a plow or with a digger made for the purpose. It is much more difficult to get digging machinery to work on the sweet potato than it is on the irish potato, because the tubers are more oblong and extend down into the ground further and the vines are much in the way. The skin of the tubers is very tender and susceptible to injury. Wherever a bruised place appears the soft rot is apt to start. To keep them well, therefore, they must be harvested carefully.

Vines may be cut off with hoes, corn cutters or with a rolling coulter on the beam of a turning plow. The latter method the writer has found to work very satisfactorily if the rolling coulter is sharp. The rolling coulter is fastened on the beam of a one horse turning plow and extends down about one-half inch below the point. This plow is run on each side of the row, cutting the vines and throwing some dirt away from the row at the same time. If the plow is run too close to the center of the row some of the tubers are apt to be cut also. The field should be gone over in this way if the crop is left after the first frost. To throw the potatoes out the coulter is taken off and the plow run a little to one side of the row. Two horses should be used for this. The pickers then come along and pull the tubers out and scatter them along on top of the ground. They should not be thrown in piles because they are more apt to be bruised in this way. If the pickers be careful nearly all the crop will be gathered because all the tubers are attached to one vine. It sometimes pays to harrow the ground after picking so as to rake out any tubers which may be left under the dirt.

It is perhaps best to assort in the field as the potatoes are gathered. One man may pick up the "primes," another "seconds," and another small roots and bruised ones for stock food. Each class should be put in boxes or crates, which are placed in a wagon and hauled to the storage house.

If the vines have not been harvested before, they may now be gathered by running a heavy bull-tongue plow over the field and dragging them into piles. Afterwards they may be hauled off in the wagons.

PIT METHOD OF STORING.

The pit method is very much used in the extreme southern states and it is cheap and convenient. Select a warm, well drained place and spread over the ground about six inches of dry straw. Carefully pile about twenty-five bushels in a heap on the bed of straw and cover thickly with corn stalks, wheat straw or pine needles. If corn stalks be convenient it is better to put them on first to give better ventilation. It is best to put a shed over this heap. Leave the potatoes with no other covering but straw for about two weeks, if the weather does not get too cold, when they will have gone through a sweat. Put a few inches of dirt on which may be increased as the weather gets colder. Some straw or stalks should project out leaving places for ventilation. Ventilation may also be provided for by having tiles or something similar project up through the pit. If the pit be

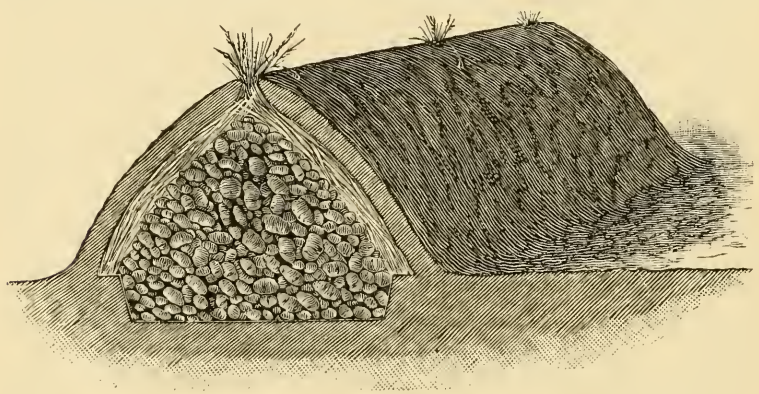


Fig. 12—Potatoes stored in a pit.

not covered with a shed it is best to cover these ventilating places with a board during rainy weather. In the previous figure the pit method is shown where the potatoes are placed down into the ground several inches, this makes it easier to cover with dirt but it should not be done unless a drain is cut around the pit to carry off the surplus water and prevent it injuring the potatoes.

HOUSE METHOD OF STORING.

Houses are frequently built especially for storing sweet potatoes. The potatoes when stored this way can be examined easily at any time and can readily be taken out when wanted. In the northern states these houses must be built tighter and with more care than in the southern states. Artificial heat is used during very cold weather in many northern states. The following extract from the *Rural New Yorker* gives the method of a New Jersey grower in storing "Fancy Vineland Sweets:"

"The best form of storehouse is a one-story building with a basement, with the heater in the basement. An ordinary heating stove is used: the size needed will depend on the size of the house. The tighter and better built it is, the less heat it will require to heat it. The floor should be on a level with an ordinary wagon body; this will allow unloading and loading without any heavy lifting. The marketable potatoes may be stored on the first floor, and the seed and feeding potatoes in the basement. Provision should also be made in the basement for a coal bin. The potato bins should all have false bottoms raised two or three inches from the floor, and slatted sides set the same distance from the walls, to give free ventilation all around the potatoes. It is better to have the bins divided by partitions every three or four feet; this will allow the taking out of a small quantity without disturbing the rest, and will also allow filling the bins clear to the ceiling. It will do no harm to have the potatoes piled seven or eight feet deep, if the filling is done carefully. They should never be moved or disturbed in any way, unless they are to be disposed of at once, as a great many will rot in a few days after being moved. The temperature should be kept at 90 or 100 degrees while the house is being filled, and for a week or so after-

wards, giving free ventilation all the time. This dries them out quickly, and carries them through "the sweat" in a short time, making what is called a kiln-dried sweet. After they are through sweating, and the sprouts are just beginning to show on the tops of the bins, the temperature should be lowered to 55 or 60 degrees, and kept there. The more even the temperature, the better they will keep."

By some it is claimed that the temperature may come as low as 45 degree Fah. when the outside temperature is low. The object being to keep the tubers a little warmer than the surrounding air, so that the moisture will not condense on them.

In southern latitudes this heating by fire seems not necessary to make the tubers go through the sweat, neither does it seem necessary in keeping them over winter. The sweet

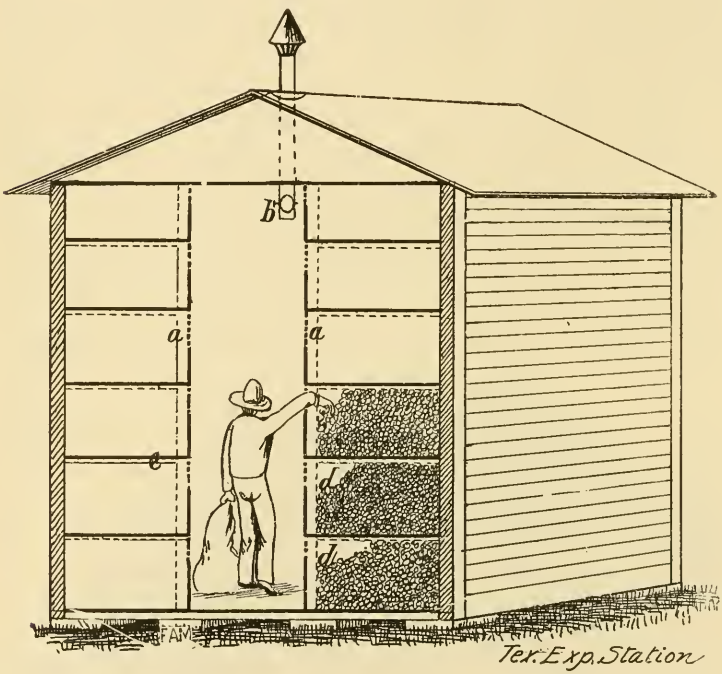


Fig 13—a, Posts which go up through the center from floor to ceiling. b, ventilator which may be opened in warm weather and closed in cold. c, Double wall. d, Potatoes stored in sand. e, Cross-pieces which run from posts to wall.

potato, while quite susceptible to injury from cold, will stand much more than is commonly supposed. That peculiar, slightly bitter and unpleasant taste frequently met with in stored tubers and quite commonly believed to be due to having been frozen, is very often due to being affected by the black rot fungus. A very small infected place will taint the whole tuber.

The writer has been very successful in keeping the tubers from being frozen and from being injured by mice by storing them in a house built according to the following plan at the Texas Station:

It consists of two outer walls with a dead air space between. Also two doors, a double floor, and a ventilator. The ventilator may be opened and closed at will. During warm days in the fall the doors are left open for further ventilation. Inside are upright pieces which project from the floor to the ceiling. Strips reach from these across to the wall, and on these planks are laid lengthwise, which are also nailed against the sides of the posts, thus forming a long box. The potatoes are stored in these, and dry road sand mixed with them. Mice can not get through dry sand. Potatoes kept well in this house last winter (1894—1895) when the temperature went down as low as 7 degrees Fah. and not one per cent was injured by freezing. The sand must be changed every year for sweet potatoes, because it is very apt to contain spores of disease which will infect the next crop when stored. Where we did not change the sand nearly all the crop was lost from black rot.

STORING IN A CELLAR.

In good houses, barnes or cellars, in southern latitudes, potatoes may be kept over winter easily.

A method of a farmer who has had large experience in northwestern Arkansas is given in a bulletin of U. S. Department of Agriculture, as follows:

"Divide inside of cellar into slatted stalls 6 feet wide, 3 to 4 feet deep, giving a foot space between the stalls. If stalls are one above another, leave 6 inch space between the stalls. For a large cellar 20 or 30 by 50 or 75 feet, leave a 3 or 4 foot hall lengthwise through cellar and build bins on each side of

hall. * * * Take sweet potatoes immediately from field to cellar and put in bins 3 or 4 feet deep. If ground is wet, sun a while so that the dirt will slip from the potatoes. * * * Put nothing around, over, or under them. Leave free to air. * * * Every night or day that the thermometer registers 40 degrees above zero, but mostly at night, if possible, keep all ventilators wide open; but should it get above 65 degrees outside, close all ventilators tight, for if you let hot air in your cellar it will condense or cause potatoes to get wet (sweat). * * * Keep as near 45 or 60 degrees inside as possible. But be sure never to have any part of this cellar stand open when the air outside is 15 degrees warmer than inside. This hot air not being allowed to strike the cool potatoes or walls and condensing is the whole secret in keeping them. Cool or cold air will go all through them and drive out all the moisture, but hot air will not."

It is sometimes claimed that vines can be kept over winter; after trying several methods and keeping them some time the author has failed.

LEAVING THE TUBERS IN THE GROUND OVER WINTER.

The tubers often keep well over winter in light, sandy soils in some of the extreme southern states if they are left undisturbed where they grew. If the soil is heavy and the winter a wet one they are apt to decay. If the tubers are to be left in this way, a turning plow should be used to throw dirt up over the rows leaving a furrow between to drain off the water.

CHAPTER XI.

Yield of Varieties from Slips. Character of Flesh when Baked. Table Quality. Yield from Vine-Cuttings.

The yield of different varieties is given from four experiment stations, New York (Geneva), Georgia, Louisiana and Texas. The character of flesh when baked is given as tested at Louisiana station and Texas station. Table quality when baked is given as tested at Texas station.

TABLE XXI. VARIETY TEST AT NEW YORK STATION (1891).

	Estimated Yield Per Acre. Bush.
Bermuda	244
Brazillian	131
Cuba Yam	89
Early Golden	143
Early Peabody	291
Old Maurice	104
Providence	388
Southern Queen	292
Spanish Red	383

It will be seen from this table that Spanish Red yielded at the rate of 383 bushels per acre, Providence at the rate of 388 bushels per acre, Southern Queen at the rate of 292 bushels per acre, and Early Peabody at the rate of 291 bushels per acre. This would seem quite favorable for sweet potatoes that far north.

TABLE XXII. VARIETY TEST AT GEORGIA STATION (1894).

Variety.	Calculated Yield Per Acre in Bushels.		
	Marketable.	Small.	Total.
White St. Domingo	339 4	42 5	381 9
Shanghai (or California)	327 1	47 2	374 3
Boone's White	312 0	32 1	344 1
Hayman	313 9	26 4	340 3
Early Golden	244 8	64 3	309 1
Tennessee (Yam)	231 5	69 9	301 5
Boone's Red	246 7	30 2	276 9
Norton	209 9	43 5	253 4
Peabody	211 8	37 8	249 6
Red Nose	182 4	58 6	241 0
Red Nansemond	204 2	32 1	236 3
Southern Queen	200 4	34 0	234 4
Black Spanish	204 2	24 6	228 8
Red Nansemond	162 6	65 2	227 8
Bermuda Red	175 8	51 0	226 8
Orleans Red (Choker)	203 0	22 7	225 7
Southern Queen	152 2	61 4	213 6
White Nansemond	130 4	78 4	208 8
Brazilian (Yam)	171 1	32 1	203 2
Big Stem Jersey	151 2	49 1	200 3
Yellow (Yam)	156 9	34 0	190 9
Yellow Jersey	104 9	86 0	190 9
Ticotea	117 2	71 8	189 0
Pumpkin (Yam)	160 7	28 2	188 9
Heckler (Yam)	128 6	45 4	174 0
Vineless	144 6	29 3	173 9
Yellow Nansemond	115 3	56 7	172 0
Jersey Sweet	118 9	45 4	164 3
Spanish (Yam)	138 0	20 8	158 8
Spanish Bunch	130 4	26 4	156 8
Barbadoes	90 7	37 8	128 5
Georgia (Yam)	86 0	32 1	118 1
Strasburg	83 2	19 8	103 0

From this table it will be observed that White St. Domingo yielded the largest number of bushels, followed by

Shanghai, Boone's White, Hyman, Early Golden and Tennessee. The finest varieties for southern table use, such as Pumpkin, Yellow and Vineless, did not yield as heavily as the coarser varieties.

TABLE XXIII. VARIETY TEST AT LOUISIANA STATION (1894).

Variety.	Character when Cooked.			Time of Ripening	Yielded in Bush. —planted May 1.		
	Color.	Hard or soft.	Wet or dry		Merchantable.	Culls.	Total.
Barbadoes	Nearly white	Soft	Medium	Medium	499 9	32 04	531 94
Bermuda	Nearly white	Hard	Dry	Late	302 59	53 09	356 75
Big Stem Jersey	Light yellow	Hard	Dry	Medium	296 6	24 8	321 4
Canal	White	Hard	Very Dry	Medium	336	12 4	348 4
Delaware	Light yellow	Medium	Moist	Medium	302 85	45 6	348 45
Dog River	Dark yellow	Hard	Dry	Late	160 2	16	176 2
Early Golden	Yellow	Medium	Dry	Medium	514 4	16 02	530 42
Georgia	Yellow	Medium	Medium	Late	560 05	20 8	580 85
Gold Skin	Yellow	Rather soft	Medium	Medium	257 2	29 5	286 7
Hayman	Light yellow	Medium	Dry	Late	638 8	12 4	651 2
Matejito	White	Hard	Dry	Medium	373 3	12	385 3
Negro Choker	Nearly white	Hard	Dry	Late	489 5	35 2	524 7
New Jersey	Nearly white	Medium	Medium	Medium	240 7	48 2	288 9
Norton	Nearly white	Soft	Medium	Late	638	16	654
Peabody	Yellow	Hard	Dry	Late	684 5	12 4	696 9
Padisha	Yellow	Soft	Wet	Medium	340 18	8 29	349 47
Pumpkin	Yellow	Hard	Dry	Late	299 6	24 8	324 4
Providence	Yellow	Soft	Wet	Early	1057 8	14 5	1072 3
Red Nansemond	Yellowish white	Medium	Rather dry	Late	696 9	20 7	717 6
Southern Queen	White	Rather hard	Dry	Late	622 2	18 6	640 8
Strasburg	Light Yellow	Rather hard	Dry	Late	352 6	35 2	387 8
Spanish (Yam)	Light Yellow	Medium	Medium	Late	501 9	18 6	520 5
Shanghai(or California)	White	Hard	Dry	Late	741 02	17 6	758 62
Sugar or Creole	White	Soft	Moist	Medium	377 5	14 5	392
Southern Red (Yam)	White	Hard	Dry	Medium	539 3	16 02	555 32
Southern Yellow (Yam)	Yellow	Soft	Wet	Medium	99 5	10 3	109 8
Ticotea	White	Soft	Wet	Late	514 4	53 9	568 3
Tennessee	Light Yellow	Soft	Medium	Medium	124 4	45 6	170
Vineless	Light Yellow	Soft	Rather moist	Early	280 5	37 2	317 7
Yellow (Yam)	Yellow	Medium	Medium	Medium	336	45 6	381 6
Yellow Nansemond	Yellow	Medium	Medium	Medium	170 9	37 2	207 29
Java No. 1	White	Medium	Medium	.....	204 8	20 8	225 6
Java No. 2	Pink	Soft	Wet	.....	87 1	41 6	128 7
Java No. 3	White	Soft	Wet	.....	120 3	12 4	132 7
Java No. 4	White	Soft	Wet	.....	64 3	16 02	80 32
Java No. 5	Dull White	Soft	Wet	.....	194 9	24 8	219 7

From this table it will be seen that Shanghai made the enormous yield of 758 bushels per acre, followed by Red Nansemond, Peabody, Norton, Hayman, and Southern Queen. Louisiana is one of the best states for the sweet potato, and the yield now (1896) is said to be over 3,000,000 bushels for the state. The experiment station for this state has done very much to encourage the growth of sweet potatoes and, it appears with very favorable results.

TABLE XXIV. VARIETY TEST AT TEXAS STATION (1894).

Name of Variety.	Character of flesh when Baked.	Season.	Yield per Acre in Bush.				Table quality 0, to 10.
			Merchantable.	Culls.	Total.	Average yield for 2 years.	
Barbadoes	Bluish white, soft, damp	Medium	373 34	30 11	403 45	215 80	5
Big Stem Jersey	Yellowish white, rather soft	Late	156 20	19 40	175 60	133 93	8
Black Spanish	White, dry, mealy	Late	143 86	3 88	147 74	151 88	7
Brazilian	White, dry, mealy	Late	275 20	12 05	287 25	203 44	8
Bronze	White, moist, sweet	Late	575 83	.....	575 83	.....	9
Canal	Pale yellow, mealy	Late	270 68	5 76	276 44	.....	7
Cavitt's Earliest	Light yellow, soft, moist	Early	303 98	2 88	306 88	.....	7
Chinese 30 days	White, soft, sweet	Medium	25 91	5 19	31 10	.....	9
Cuban (Yam)	Yellow, soft, damp	Medium	135 55	26 60	162 15	.....	7
Delaware	Cream yellow, soft, wet	Late	80 37	.....	80 37	147 37	6
Dog River	Yellowish red, soft, wet	Late	93 50	14 00	107 50	127 39	8
Early Golden	Light yellow, soft, dry	Early	436 20	7 76	443 96	271 25	5
Extra Early Caroline	Yellowish, soft	Early	89 57	.....	89 57	68 83	9
Florida (Yam)	White, soft, mealy	Late	324 35	8 89	333 25	.....	8
Georgia (Yam)	Yellowish, soft	Late	369 45	.....	369 45	196 22	7
Gen. Grant	White, soft, mealy	Early	614 35	3 88	618 23	.....	6
Gold Skin	Yellow, mealy	Early	101 70	11 90	113 60	77 13	9
Hall	Redish yellow, soft, moist	Early	319 93	20 77	340 80	.....	8
Hayman	Pale yellow, soft	Medium	311 06	7 76	318 82	179 61	7
Hayti Spanish	White, soft, dry	Late	311 12	19 61	330 73	.....	7
Jersey Red	Pale yellow, mealy	Late	105 56	....	105 56	....	7
Matejita	Creamy yellow, soft	Late	208 65	8 40	217 05	.....	7
Nancy Hall	Redish yellow, soft, moist	Early	143 56	3 88	147 44	.....	8
Nansemond	Yellow, damp, soft	Early	97 76	39 88	137 64	151 38	8
Negro Choker	Cream colored, soft, mealy	Late	275 73	56 55	332 28	227 73	8
New Jersey	Light yellow, soft, mealy	Early	155 40	4 60	160 00	104 96	8
Norton	White, soft	Late	320 00	.....	320 00	172 22	5
Orange	Redish, soft, wet	Late	101 43	6 75	108 18	.....	7
Padisha	Redish, soft, wet, strong	Early	194 44	15 56	210 00	.....	7
Peabody	Cream yellow, dry, mealy	Late	276 07	.....	276 07	190 76	8
Peruvian	Redish yellow, soft, wet	Late	262 94	14 58	277 52	.....	5
Pool's (Yam)	Dull yellow, soft, damp	Late	198 90	3 88	202 78	.....	5
Providence	Yellow, soft, damp	Late	138 12	10 33	148 45	.....	8
Pumpkin	Light red, soft, wet	Late	225 70	8 50	234 20	154 81	10
Queen of the West	Creamy yellow, mealy, dry	Late	103 70	....	103 70	.....	8
Red Bermuda	Cream colored, soft, mealy	Late	413 05	3 88	416 93	271 05	8
Red Nansemond	Pale yellow, soft, sweet	Late	411 14	.....	411 14	231 51	8
Red Nose	Light yellow, soft, mealy, strong	Medium	192 63	21 61	214 24	172 17	8
Rockport	Redish yellow, soft, wet	Late	300 76	10 37	311 13	.....	8
Shanghai (California)	White, soft, damp	Medium	402 72	13 32	415 45	307 60	7
Southern Queen	White, soft, damp	Late	277 50	8 88	286 38	185 98	7
Strasburg	White, soft, dry	Late	185 52	11 36	196 88	.....	4
Sugar (Creole)	White, soft, mealy	Late	150 00	5 20	155 20	.....	8
Tennessee	Yellow, soft, damp	Late	161 16	15 56	176 72	123 14	7
Ticotea	White, soft, dry	Late	102 06	26 16	128 22	.....	7
Vineless	White, soft, sweet	Early	290 98	24 89	315 89	251 60	9
White Brazilian	White, soft, damp	Late	272 22	.....	272 00	....	5
Yellow Jersey	Creamy yellow, mealy	Medium	110 92	.....	110 92	73 08	8
Yellow Nansemond	Creamy yellow, soft, damp	Late	276 07	.....	276 07	173 46	8
Yellow (Yam)	Light yellow, soft, dry	Late	77 80	17 50	95 39	85 26	8

From this table it will be seen that Gen. Grant made the largest yield for one year and Shanghai for two years. Other varieties which made the largest yield for two years are Early Golden, Red Nansemond, Negro Choker, Brazilian and Vineless. In this connection it should be stated that the year 1893 was an extremely dry one and consequently the yield of all the varieties was low. It gave a good test of the drouth resisting qualities of all the varieties, during which Shanghai made the heaviest yield, followed by Vineless. Shanghai was

the largest yielder at Texas and Louisiana stations and was second at the Georgia station. It is interesting to note that Southern Queen, Hayman, Peabody and Early Golden are heavy yielders at all the stations, though they are not, by any means, the best for table use. Red Nansemond, however, is an exception, as its table quality is quite good.

CHARACTER OF FLESH AND TABLE QUALITY.

Character of flesh as tested by the author and given in table twenty-four, may be relied upon when the tubers are grown upon a somewhat heavy, damp, clay soil. From this table the grower can select a variety which is apt to suit his liking. As stated previously, the author prefers a soft, sugary potato best, and therefore makes the Pumpkin the best in a scale from 0 to 10. However, the soft, mealy Nansemonds are very fine and are preferred in most of the northern states. They are mostly grown in New Jersey and sell higher than any other varieties in most northern markets. The vineless variety which is now attracting great attention is somewhat between a soft, sugary variety and a soft mealy one, and it is, therefore, not so apt to meet with so much objection from different parts of America on its table quality.

YIELD FROM VINE CUTTINGS.

It is well known that potatoes will grow from vine-cuttings if the cuttings are put into the ground in time to mature a crop before frost. They will mature a very fine crop in four months if the season is good. The author has grown a good crop from vine-cuttings of the Gen. Grant variety in 72 days. The readiness with which the vine-cuttings start off to grow depends somewhat on the variety. The heavy, vigorous vines start quicker and grow better than the weaker ones.

TABLE XXV. YIELD FROM VINE CUTTINGS AT TEXAS STATION (1894).

Length of Row, 50 feet.	Bushels per Acre.		
	Large.	Small.	Total.
Barbadoes, yield from vine-cuttings planted June 16th.....	99 80	18 50	118 30
Georgia Yam, yield from vine-cuttings planted June 16th	75 00	.....	75 00
Hayti Spanish, yield from vine-cuttings planted June 16th....	108 89	.....	108 89
Red Nansemond, yield from vine-cuttings planted June 16th..	106 50	14 10	110 60
Ticotea, yield from vine-cuttings planted June 16th.....	44 45	.....	44 45

TABLE XXVI. YIELD FROM VINE-CUTTINGS AT LOUISIANA STATION (1894).

Variety.	Yield in Bush. when planted August 15.	Per cent. Merchantable.
Barbadoes	36 3	Culls
Bermuda	51 8	Culls
Big Stem Jersey	31 1	Culls
Canal	18 1	Culls
Delaware	46 6	5 per cent.
Dog River	93 3	Culls
Early Golden	145 2	50 per cent.
Georgia	67 4	5 per cent.
Gold Skin	103 7	10 per cent.
Hayman	155 5	10 per cent.
Matejito	13	Culls
Negro Choker	10 3	Culls
New Jersey	31 1	Culls
Norton	114	5 per cent.
Peabody	186 6	30 per cent.
Padisha	197	60 per cent.
Pumpkin	82 9	Culls
Providence	124 4	80 per cent.
Red Nansemond	228	75 per cent.
Southern Queen	114	50 per cent.
Strasburg	186 6	50 per cent.
Spanish (Yam)	114	Culls
Shanghai (or California)	41 5	Culls
Sugar (or Creole)	82 9	15 per cent.
Southern Red (Yam)	134 8	20 per cent.
Southern Yellow (Yam)	108 9	5 per cent.
Ticotea	103 7	Culls
Tennessee	171 1	15 per cent.
Vineless	176 3	10 per cent.
Yellow (Yam)	114	Culls
Yellow Nansemond	51 8	Culls
Java No. 1	72 6	Culls
Java No. 2	238 5	25 per cent.
Java No. 3	67 4	5 per cent.
Java No. 4	82 9	10 per cent.
Java No. 5	103 7	30 per cent.

From this table it will be seen that Red Nansemond made 228 bushels from cuttings planted as late as August 15th, Early Golden and Strasburg each made 186 bushels. This is important to know, because of the fact that if for some reason one should fail to get a stand by first planting, a crop can be made from cuttings if the season be favorable, when they are planted in the southern states as late as August 15th. The best "seed" are obtained from vine-cuttings.

CHAPTER XII.

Classification and Description of Varieties. Nomenclature.

The great confusion existing among growers in regard to proper classification of sweet potatoes, and consequently the very indefinite way writers often refer to them, lead me to devote some space here to discussion of this subject

In regard to the character of flesh when baked, an attempt is frequently made to divide them into two classes: one with the soft, dry and mealy flesh is known simply as the sweet potato; and the other with soft and mushy flesh is known as "yam" potato. Especially is this true in the southern states. This classification is misleading, because varieties vary some with seasons and with soils. One variety may be known simply as sweet potato in one state and as "yam" potato in another. In chapter two it is stated that the word "yam" has been borrowed from a vegetable already described as Chinese Yam. The Yams, strictly speaking, belong to the genera *Dioscorea*. It would greatly clear up the confusion if this little word "yam" were dropped in reference to sweet potatoes, and used exclusively in reference to vegetables belonging to Chinese Yam type. After making the sweet potato a special study for four years, and being confronted all this time with a bad system of classification and confusing nomenclature, the author finally decided to divide them into groups according to the characteristics of the foliage. First group includes those with round or entire foliage; second group includes those with shouldered foliage, and third group includes those with split or lobed foliage. This system was adopted by the author December, 1893, and published in bulletin No. 28 of the Texas Experiment Station. It was stated then, that while variations in the foliage would appear on the same variety and often on the same vine, still all the variations would come under the three groups just mentioned, and one prevailing type would be found on each variety. The foliage varies most when old, and the true type is seen better when young.

This system would seem to be more rational than one based upon the character of the tubers, since the sweet potato has been propagated so long from tubers and not from true seed, as is the case with corn or cotton, so that great variation occurs in type of tubers, and also since the foliage comes next to the flower and true botanical seed which constitute the main basis of botanical classification of phanerogamic plants. If this "foliage system" is taken in connection with a short description of the color of the tubers and of the vines, there is scarcely a variety which cannot be distinguished from all other varieties.

At the same time, it must be understood that there are many so called varieties which are nothing more than synonyms of other varieties. These names have come about in most cases by there having been no well defined description of varieties extant for comparison and each individual grower thinking he had a new variety gave it a different name. That varieties do originate under culture cannot be successfully disputed, as an example, we have the Vineless variety; but in the interest of better nomenclature and clearer understanding, the author enters a plea here for growers to send samples of potato, including tubers and foliage to the experiment station of the state in which they live for identification if they think they have a new variety and they cannot determine from the classification and description given here whether it is or not. It might be well to state that the system of classification given here has already been adopted by two other experiment stations and great improvement has since come about in nomenclature. It is hoped this improvement will continue until we shall have as little confusion in sweet potato nomenclature as we now have in irish potato nomenclature. Before giving the varieties belonging to each group it may be well to give some rules for naming vegetables.

RULES FOR NAMING VEGETABLES.

An effort will be made in this publication to make all names of varieties conform to rules given in a report of a committee of experiment station horticulturists, published in 1889, in regard to naming vegetables. This committee was appointed by the Association of American Agricultural Colleges and Experiment stations, January, 1889. The following is a copy of the rules reported and recommended:

"1. The name of a variety should consist of a single word, or at most of two words. A phrase, descriptive or otherwise, is never allowable; as, *Pride of Italy*, *King of Mammoths*, *Earliest of All*.

2. The name should not be superlative or bombastic. In particular all such epithets as *New*, *Large*, *Giant*, *Fine*, *Selected*, *Improved*, and the like should be omitted. If the grower or dealer has a superior stock of a variety, the fact should be stated in the description immediately after the

name rather than as part of the name itself; as, '*Trophy*, selected stock.'

3. If a grower or dealer has produced a new select strain of a well known variety it shall be legitimate for him to use his own name in connection with the established name of the variety; as, *Smith's Winningstadt*, *Jones's Cardinal*.

4. When personal names are given to varieties, titles should be omitted; as, *Major*, *General*, *Queen*.

5. The term *hybrid** should not be used, except in those rare instances in which the variety is known to be of hybrid origin.

6. The originator has the prior right to name the variety; but the oldest name which conforms to these rules should be adopted.

7. This committee reserves the right, in their own publications, to revise objectional names in conformity with these rules.''

VARIETIES OF SWEET POTATOES CLASSIFIED ACCORDING TO THE CHARACTERISTICS OF THE FOLIAGE.

1. *Varieties with entire or round foliage.*

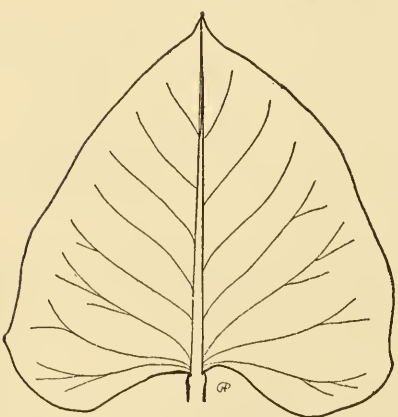


FIG. 14.

Ca nal,
D og River,
Florida (Yam),
Gen. Grant,
Hall,
Hayman (notched some)
Hayti Spanish,
Matejita,
Nancy Hall,
Orange,
Padisha,
Pumpkin,
Red Nose,
Shanghai,
Southern Queen (shouldered some).

*A *hybrid* is the product of a true species. There are few, if any, instances of true hybrids among common garden vegetables. The union of varieties gives rise to a *cross*.

2. *Varieties with shouldered foliage.*

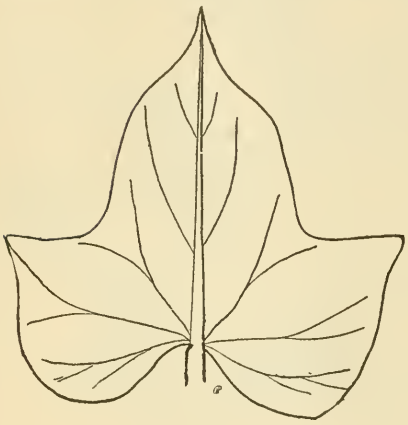


Fig. 15.

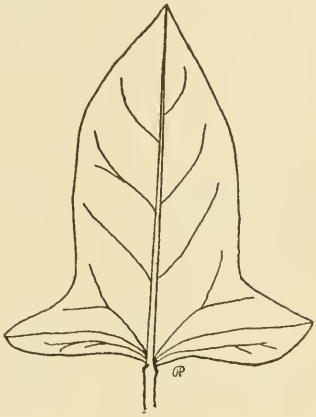


Fig. 16

Big Stem Jersey (Fig 15), Black Spanish, (Fig. 16), Brazilian (Fig. 16), Bronze (Fig. 15), Cavitt's Earliest(Fig.15), Chinese 30 days(Fig. 15), Cuban (Yam, Fig. 15), Delaware (Fig. 15), Extra Early Caroline (Fig. 15), Early Golden (Fig. 15), Gold Skin (Fig. 15) Jersey Red (Fig. 16), Nansemond (Fig. 15), Negro Choker, (Fig. 15), New Jersey (Fig. 15), Norton (Fig. 15), Peabody (Fig. 15), Peruvian(Yam, Fig 15), Pool's (Yam, Fig. 15), Providence (Fig. 15), Queen of the West (Fig. 15) Red Bermuda (Fig 15), Red Nansemond(Fig. 15) Strasburg (notched some), (Fig. 15), White Brazilian(Fig. 15), Yellow Jersey (Fig. 15), Yellow Nansemond (Fig. 15).

3. *Varieties with deeply cut or lobed foliage.*

Fig. 17.

Georgia (Yam),	Tennessee,	Yellow (Yam),
Rockport,	Ticotea,	Vineless,
	Barbadoes.	

VARIETIES CLASSIFIED ACCORDING TO COLOR OF THE SKIN OF THE TUBER.

1. *Varieties with white skin.*

Barbadoes,	Hayman,	Shanghai,
Cavitt's Earliest,	Hayti Spanish,	Strasburg,
Cuban (Yam)	Norton,	Tennessee,
Early Golden,	Pool's (Yam),	Ticotea
Florida (Yam),	Providence,	Vineless,
General Grant,	Rockport,	White Brazilian,
Georgia (Yam),	Southern Queen,	

2. *Varieties with a dull straw colored skin.*

Big Stem Jersey,	Extra Early Caroline,	Queen of the West,
Orange,	Gold Skin,	Red Nose,
Chinese 30 days,	Nansemond,	Yellow Jersey,
Delaware,	New Jersey,	Yellow Nansemond.

3. *Varieties with light red skin.*

Dog River,	Orange,	Pumpkin,
Hall (Nancy Hall),	Padisha,	Red Bermuda,
Negro Choker,	Peruvian (Yam)	Red Nansemond.

4. *Varieties with purple skin.*

Black Spanish,	Canal,	Matejita,	Brazilian.

DESCRIPTION OF VARIETIES.

1. *Varieties with entire foliage.*

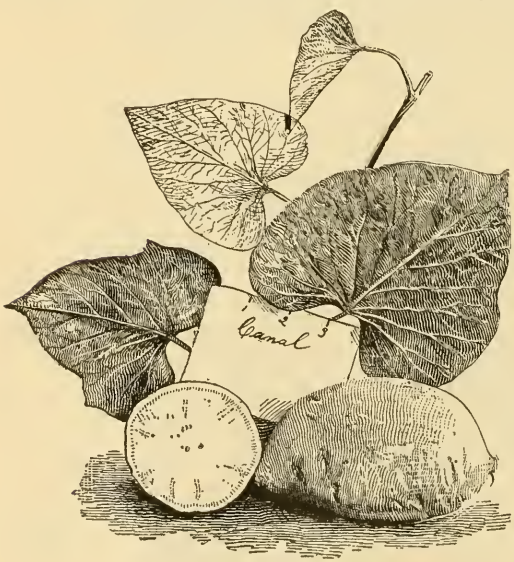


FIG. 18.

CANAL.–Vines purple, very strong and vigorous; tubers very large, oblong, smoother than Brazilian, which they somewhat resemble. It was introduced from Cuba. See figure 18.

DOG RIVER.—Foliage pale green, often a slight notch on the sides;

vines vigorous, root slightly, length seven feet; tubers roundish to oblong, medium size, skin white, having prominent veins. Has low table qualities. So named from being grown in the Dog River section of Alabama. See figure 19.

FIG. 19.

GENERAL GRANT (Florida Yam).—Foliage pale green, with purplish veins underneath; tubers very large, oblong, white. A vigorous grower, heavy yielder, and has very fair table quality; grows well from vine-cuttings. In some parts of Georgia it is called "Caddle Potato." The vines are rather short and heavy, which fact has led some to give it the name "Bunch Variety." It is a very heavy yielder.

HALL (Nancy Hall).—Foliage light green; tubers rather conical, light purple, grows vigorously and is a heavy yielder. Mr. A. J. Aldrich, Orlando, Florida, wrote me that it came up from a package of flower seed planted by Miss Hall, and hence its name.

HAYMAN.—Foliage pale green, abruptly conical with prominent notches on the side; vines vigorous, root profusely, length seven feet; tubers oblong, large and white. A promising variety but easily affected by drouth. The following is taken from a bulletin published by the Louisiana Experiment station:

"Dr. W. R. Capehart, Avoca, N. C., gives its history as follows: In 1856, Capt. Dan Hayman was master of the schooner, "Harriet Ryan," freighting between the West Indies and Elizabeth City, N. C. While on one of these trips he purchased a supply of sweet potatoes at one of the West India Islands. A Methodist clergyman on visiting the ship after its arrival in Elizabeth City was attracted by the fine appear-

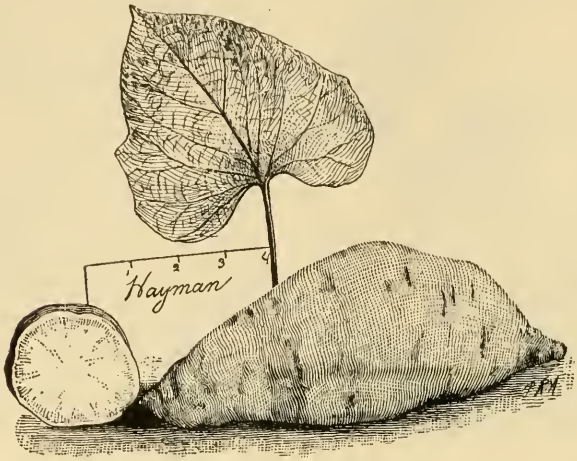


FIG. 20.

ance of the potato, obtained a few and propagated them. From this source came all the Hayman potatoes now grown in this country." See figure 20.

HAYTI SPANISH.—Foliage light green, with purple veins on under side; tubers large, oblong and white; a vigorous grower and heavy yielder. Perhaps same as Shanghai.

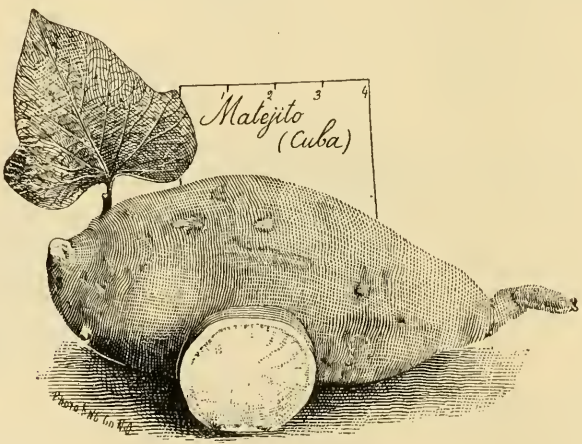


FIG. 21.

MATEJITA.—Foliage dark green, with purple veins; tubers rather oval, large, purple. A vigorous grower but does not

stand drouth so well. Supposed to have come from Cuba. See figure 21.

Orange.—Foliage light green; tubers medium size, light purple; affected considerably by dry weather. Table quality rather poor.

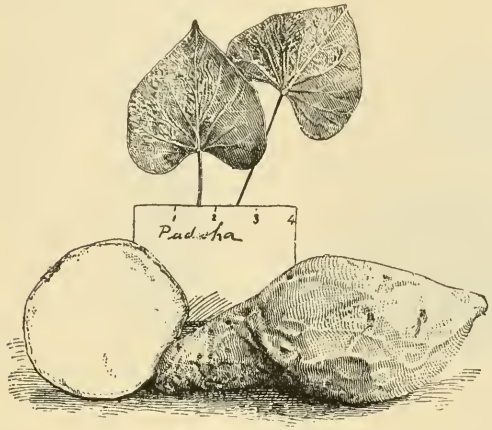


Fig. 22.

Padisha.—Foliage green; tubers resemble Pumpkin in type, but the quality is much poorer; large, light red. Originated in Georgia. See figure 22.

Pumpkin.—Foliage pale green, conical in shape; vines vigorous, root profusely, length six feet; tubers oblong, large, dull yellow. An excellent sugary variety, which is appreciated for its excellent table qualities in the southern states. It is not a vigorous grower nor a heavy yielder. The table quality is very much lowered when grown on a stiff, clay soil. When grown on a loose, sandy soil the author prefers it to all others. See figure 23.

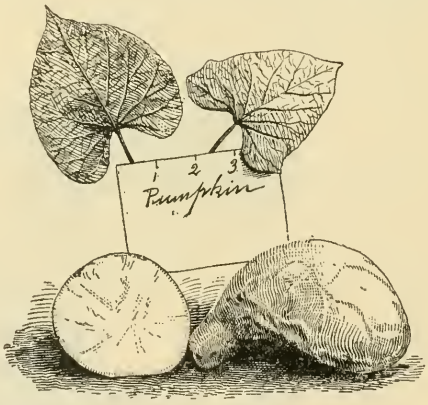


Fig. 23.

Red Nose (Heckler Yam.)—Foliage pale green, resembles Nansemond; vines root profusely, length six feet; tubers oblong, medium size, dull straw color; not red as the name would indicate; practically same as Nansemond.

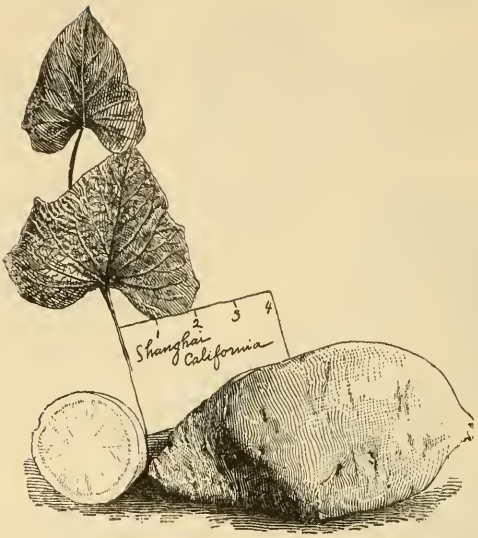


Fig 24.

Shanghai (California).—Foliage pale green, conical in shape; sides sometimes slightly notched; vines very vigorous, do not root; length five feet, tubers oblong to round, very large and white. Made the largest yield in a test made by the author during a very dry season. A valuable variety to grow for stock. It also makes a very fair table variety. See figure 24.

Southern Queen.—Foliage pale green, sometimes prominently notched on the side; vines very vigorous, root profusely, length eight feet; tubers obtuse, medium size, white. A reliable variety which is much grown in the south. It is, perhaps, the same as Boone's White, Cuba Yam and White St. Domingo. See figure 25.

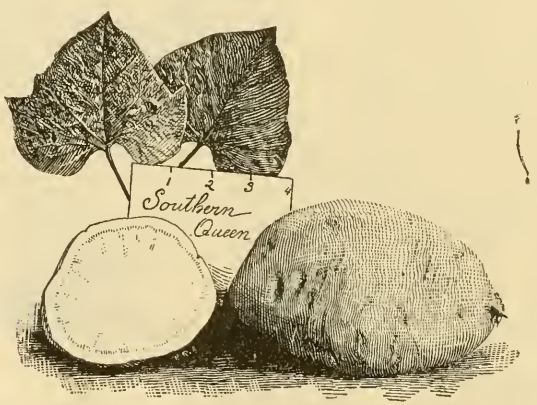


Fig. 25.

Southern Red—In foliage the variety somewhat resembles the Red Nansemond. Foliage green and heart shaped, vines slightly red; tubers pale red. See figure 26.

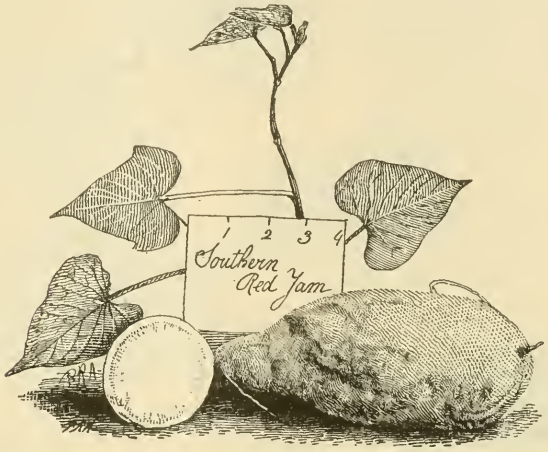


Fig. 26.

2. *Description of varieties with shouldered foliage.*

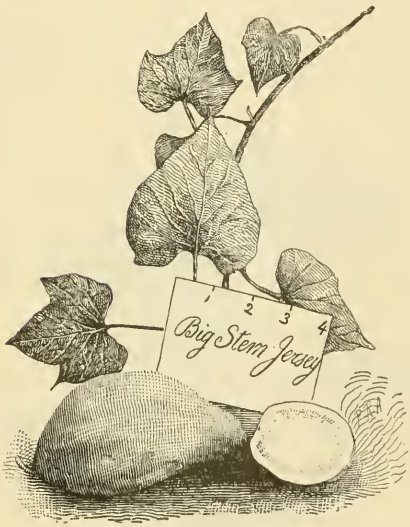


Fig. 27.

Big Stem Jersey.—Foliage often variable, pale green, vines vigorous tubers round to oblong, medium size, skin dull yellow. Has only fair table quality. See figure 27.

Black Spanish.—Foliage pale green; tubers variable in shape, but the variety is practically same as Brazilian; vines are vigorous and grow very long; tubers are spindle shaped, small deep purple, rough and uneven, grow widely apart. Table quality is only fair. Keeps well.

Brazilian.—Foliage purple when young, when older light green, sagitate; vines purple at tips, vigorous, root slightly, length twelve feet; tubers long, medium size and fair

quality, light purple; grow widely apart and deep down into the soil. Keeps well and has very fair table qualities.

Bronze.—Foliage dark purple; tubers oblong, dull straw color; table quality high; promising new variety. Originated in Kansas.

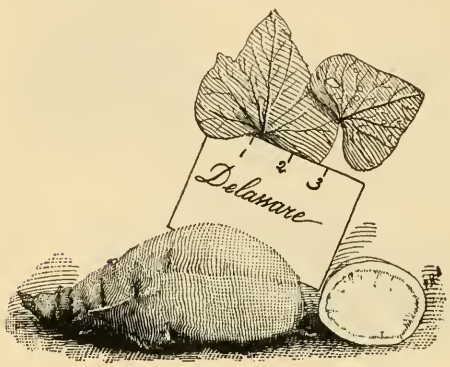


Fig. 28.

Chinese 30 Days.—Foliage when young is purple, and in this respect differs from nearly all others; tubers roundish, rather small, dull straw color; not a heavy yielder. Origin, China.

Delaware.—Foliage pale green, obtuse; vines root profusely; tubers oblong, medium size, dull yellow. Practically same as Gold Skin. See figure 28.

Earliest (Cavitt's).—Vines slightly purple; tubers large, roundish and white; one of the earliest varieties. Obtained from Major W. R. Cavitt, Bryan, Texas, who states that one or two hills were discovered by a farmer living north of Bryan. It is very early.

Caroline (Extra Early).—Foliage pale green, obtuse conical; vines root slightly; tubers oblong, rather small, dull yellow; grow in a bunch like Gold Skin.

Early Golden.—Foliage pale green, deeply shouldered;

Fig. 29.

FIG. 30.

vines root slightly, length seven feet; tubers conical, medium size, dull white. Appears to have originated in Virginia, as "a sport of the Early Red." See figure 29.

GOLD SKIN.—Foliage pale green, obtuse; vines root slightly, length five feet; tubers oblong, medium size, dull yellow, grow in a beautiful bunch near the surface. Rather weak and does not stand drouth well. During a favorable season it makes a large yield. See figure 30.

JERSEY RED.—Foliage pale green, with purple veins on foliage; tubers oblong, medium size and purple skin. Perhaps same as Brazilian.

NANSEMOND (Hanover, Mississippi Yellow, Yellow Nansemond, White Nansemond, Yellow Jersey, Jersey Sweet). Foliage pale green, leaves medium size, vines make medium growth; tubers oblong, smooth, dull straw color. Table quality very good. Perhaps the most popular variety grown at this time. Hence the great number of synonyms.

NEGRO CHOKER (Bermuda, Red Bermuda, Orleans Red, Louisiana Red, Negro Killer, Early Ireland).—Foliage pale green, deeply shouldered; vines vigorous, root considerably, length nine feet; tubers roundish, large, light purple, prominently veined, yields heavily and is easily grown. Recommended for stock. Keeps well.

NORTON.—Foliage pale green; a few slight projections on the sides; vines vigorous, root profusely, length six feet; tubers roundish, rather large and white. A rank growing variety of low table quality.

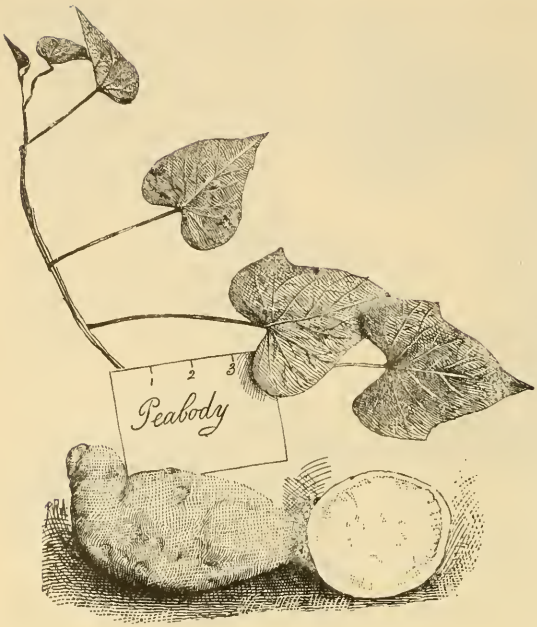


Fig. 31.

Peabody. — Foliage pale green, vines vigorous, root profusely, length ten feet; tubers oblong, large, light purple. Same type as Negro Choker. Said to have originated by Charles Peabody, Columbus, Georgia. See figure 31.

Peruvian. — Foliage green; tubers resemble Hall, roundish, light purple, vigorous grower, has poor table quality.

Pool (Pool's Yam).—Foliage green with purple veins; tubers roundish, very large, white. A vigorous grower. Obtained from Julius Schnadelbach, Grand Bay, Alabama, who states that the Pool's Yam was brought from Louisiana about eight years ago by Mr Pool, hence its name.

Providence. — Foliage green, with purple veins at base; tubers large, rather oblong, vigorous grower; said to have originated in Florida. See figure 32.

Queen (of the West). —Foliage green, tubers roundish, dull straw color.

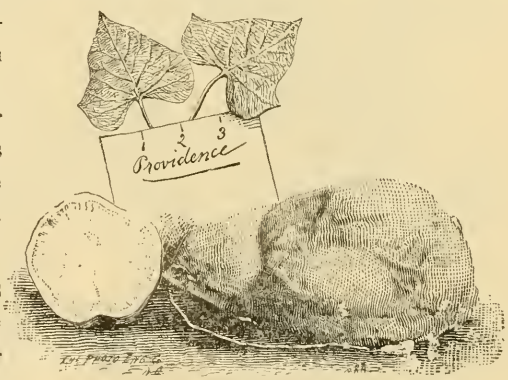


Fig. 32.

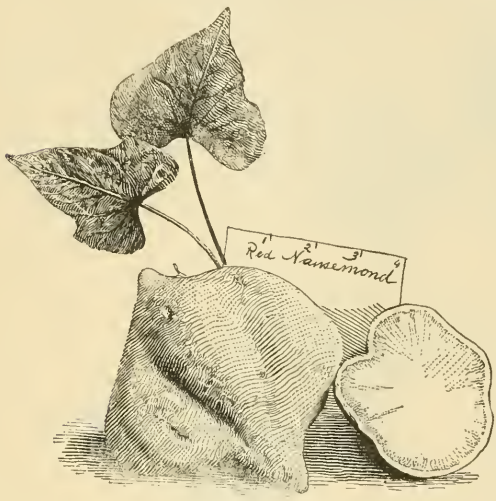


FIG. 33.

Seed obtained from Thomas Nicholson, El Modena, California, who stated it is a sport of the Red Jersey, found by him in 1890. A promising new variety.

RED NANSEMOND —Foliage pale green, deeply lobed, obtuse; vines root slightly, length seven feet; tubers oblong, medium size, color dull red; sells well in northern markets. A good variety of the dry and mealy character. See figure 33.

STRASBURG. —— Foliage green; tubers large, roundish, white. Stands drouth well but has poor table qualities. See figure 34.

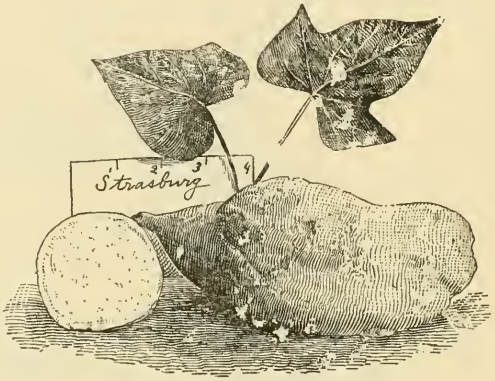


FIG. 43.

WHITE BRAZILIAN.—Foliage green and heavy; vine slightly purple; tubers medium size, oblong, white. A vigorous grower; table quality rather poor.

3. Description of varieties with deeply cut or lobed foliage.

LOBED VARIETIES.

BARBADOES.—Foliage pale green, practically same as Tennessee except a little larger, lobes prominent; vines root slightly, length seven feet; tubers oblong, medium size, whitish. Does not yield heavily. See figure 35.

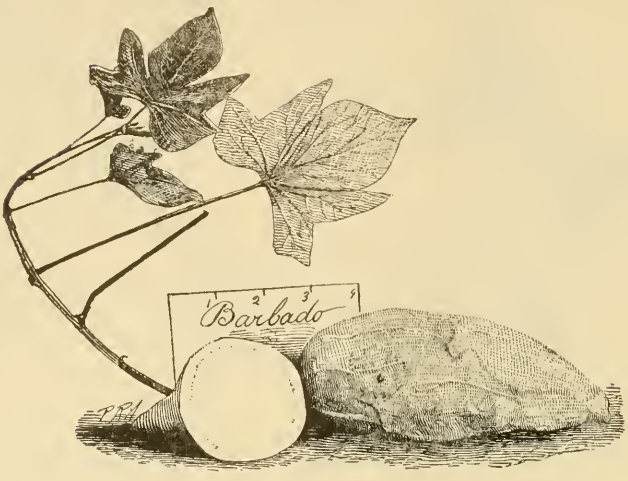


FIG. 35.

GEORGIA (Yam).—Foliage green, vines rather weak, not a heavy yielder. Has good table quality. An old variety. See figure 36.

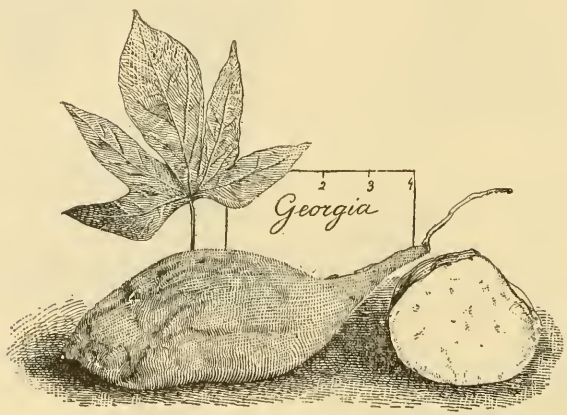


FIG. 36.

JAVA No. 1.—Lobes of foliage prominent; tubers rather large and smooth. After testing it one year, I see no special qualities to recommend it. Imported from Java by the Louisiana Experiment Station in 1893.

ROCKPORT.—Foliage green, tubers roundish, large, white; keeps well. Obtained from C. Falkner, Waco, Texas, who says that he obtained the variety from Mr. Duboise, who lives on the coast, in Aransas county, Texas. His family lived on Matagorda Island, and claims to have kept the seed for thirty years. Named Rockport from the fact it has been much grown at Rockport, Texas. I have known specimens to keep sound in the open air at Rockport for twelve months.

FIG. 37.

SUGAR (Creole).—Foliage green, very small and weak; vines root profusely, length seven feet, very weak like Tennessee; tubers oblong, medium size, dull white. Of good quality but yields slightly. See figure 37.

TENNESSEE.—This is not a strong growing variety, foliage green; tubers pale yellow and smooth, flesh cooks yellow. See figure 38.

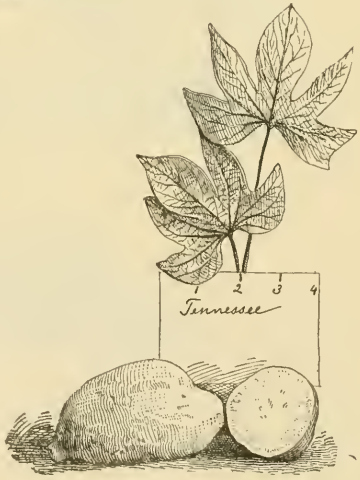


FIG. 38

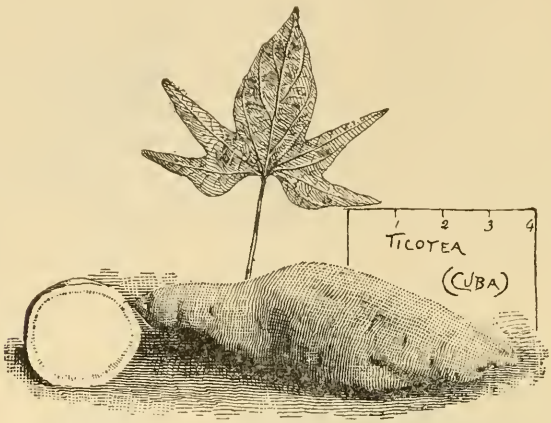


FIG. 39.

TICOTEA.—Foliage light green color; tuber white, long, smooth, not a heavy yielder. Came from Cuba. See figure 39.

FIG. 40.

SPANISH (Yam).—Foliage pale green, vines root slightly, length seven feet; tubers oblong, medium size, dull white. Injured by drouth. See figure 40.

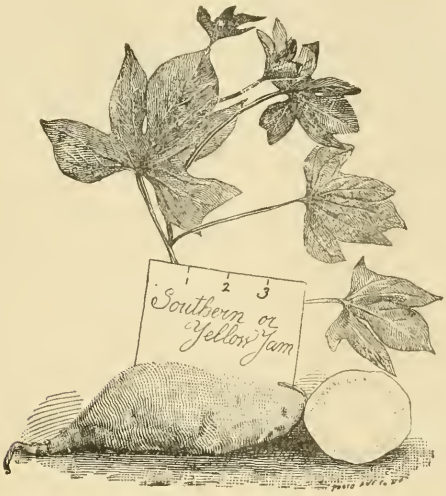


FIG. 41.

YELLOW (Yam).—Foliage dark green, lobes prominent; vines root profusely, length seven feet, tubers oblong, medium size, white, veins prominent, very fair quality. Perhaps the parent of the Vineless. Has excellent table quality. See figure 41.

VINELESS (Bunch Yam, Early Bunch Yam)—Foliage dark green, large, deeply lobed; vines vigorous, root profusely, length two and one-half feet, tubers oblong to nearly round, good size, white, veined. Stands drouth well. A valuable new variety. See figure 42.

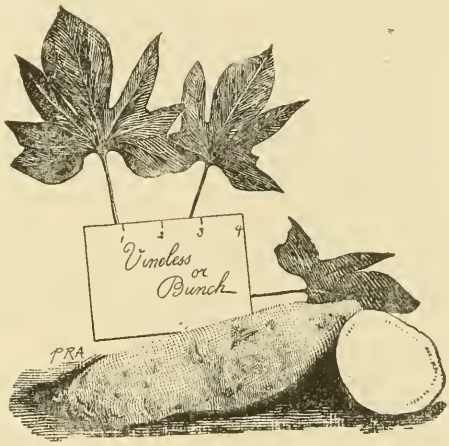


FIG. 42.

CHAPTER XIII.

Variation of the Tubers or "Sports."

The fact that tubers of sweet potatoes do vary in shape and color is well known to all sweet potato growers. Sometimes variations take place not only in the tubers but in the vines also. Some of our best varieties have come about in this way.

There has been various ways of trying to account for these variations. Some botanists have declared that there

could be no variation of the tuber without cross fertilization, but variations have been found where there could possibly have been no seed formed. In our experimental work tubers which showed streaks of red and white have been found and we were satisfied no seed were formed on the ground for several years previous, because no potatoes had been growing on the ground previously. Some have tried to account for the variation by advancing the theory that the sap mixed where the vines crossed. This hardly seems probable. In fact we do not know the cause. This fact can be explained no easier than can the fact that nectarines occur on the limb of a peach tree. In order to obtain the opinions of well known botanists and scientists on this point, a section of a tuber was sent them which showed one side to be light red and the other to be white. Their replies are given below in full:

Ithaca, N. Y., Feb. 11th, 1896.

Professor R. H. Price, College Station, Texas.

Dear Professor Price:—I have your letter and also the interesting piece of sweet potato. It is one of those things which cannot be explained, but I think that I can throw some light upon the question. It is, to my mind, just the same kind of phenomenon or variation which is likely to occur upon leaves or stems, or a flower petal, when those parts have a streak or stripe of unusual color. The same thing is occasionally seen upon apples and is ordinarily attributed to cross-fertilization, but such explanation is erroneous, as it is also in the case of your sweet potato. What causes these occasional stripes and markings upon parts of plants is a question which no one can answer, but it is simply an individual peculiarity of the plant and I believe has no distinct relation to the phylogeny of the plant. A distinct thing is bud variation or "mixing in the hill." Yours very truly,

L. H. Bailey.

U. S. Department of Agriculture,
Division of Botany, Washington, D.C.
February 11th, 1896.

Mr. R. H. Price, Agricultural Experiment Station,
College Station, Texas.

Dear Sir:—Your letter of February 3rd, accompanied by a slice of a sweet potato, was duly received. At my request, Mr. B. T. Galloway examined the specimen to ascertain whether the carrot-like color of the interior could have been caused by fungi, but he found no trace of such organism. In

the absence of any definite knowledge of the condition under which the potato grew, and therefore under which this sport was formed, it would be futile to attempt an explanation of it. There is no necessity, however, of assuming that it was caused by a cross between two varieties. Yours very sincerely,

FREDERICK V. COVILLE, Botanist.

Since writing this chapter I have received the following letter from the Horticulturist of the Georgia Experiment Station on variations of sweet potatos, and I am glad to be able to give the results of his experiments:

"The natural grafting or welding of the stalk or vine of two contiguous varieties when growing in the same hill, has been alleged by many growers to be the agency producing new varieties. C. C. L. Dill, previously referred to, who claims to be authority on potatoes, boldly advances this theory; but, if it ever had any foundation from a scientific standpoint, its practical possibility has been fully disproved by our Station the past season by artificially grafting some 300 hills of Bermuda Red and Early Golden, and Bermuda Red and Georgia Yam—red and white varieties together. While most of the grafts took well and grew finely, in no instance were mottled or "calico" tubers produced, but the roots on the side of the amalgamated stem (to use a word out of its proper signification) made white tubers, and those on the other side red tubers, with all the individual characteristics of the respective varieties preserved. We have not yet published this test, but facts are as stated.

Trusting soon to see your forthcoming work on the sweet potato, which will unquestionably be a most valuable contribution to our horticultural literature, I remain with high regards, Very truly yours,

H. N. STARNES."

"I neglected to state that 'approach' grafting was employed, the roots of both varieties remaining intact—so also the vines above the point of junction. They were simply converted into a sort of 'Siamese Twins'—the point of juncture just below the surface of the ground; but the union was much more perfect than could possibly have been establish by any natural process."

CHAPTER XIV.

Shipping and Marketing.

There are many places in different states, like the "Tide-Water" section of Virginia, where the sweet potato grows to success and may be shipped on water at small cost. If the farms are located further inland near streams, small boats

may be used to carry the tubers down to the markets. Transportation is cheap in this way and there is no risk from bruising. To bring the highest price the tubers should be rubbed off, so as to present a clean and attractive appearance. This will bring out most clearly their natural color. If the crop is grown in a sandy, loamy soil it will take but little trouble to clean the tubers properly. The grower should always seek to build up his trade by selling first-class potatoes put up in good shape and bearing the name of the variety and grower's private trade mark.

If the tubers are intended to be shipped long distances, they are usually put up in ordinary flour barrels holding about three bushels each. In cold weather it is best to line the barrels with two or three thicknesses of old newspapers. After the tubers are well shaken down in the barrel and filled up rounding full, the top is usually covered with some paper and then with some strong, coarse cloth. A hoop is pressed down over this cloth and nailed.

It is best not to risk shipping a large quantity at once, unless the condition of the market is known with certainty. If the grower has a good commission man whom he knows and can rely upon, it is of great benefit; otherwise it is apt to be found best to ship a few at a time until the condition of the market is known. In all cases, the grower should seek to build up a private trade by being honest, and by packing the tubers in a neat and attractive way, and by putting his own trade mark on each package. Grow the varieties the market demands. Let the tubers be dry when they are shipped, so that soft rot will not set in if warm weather comes while they are so closely confined in the barrels.

CHAPTER XV.

Diseases of the Sweet Potato. How to Prevent the Injury done by Them.

The sweet potato is subject to injury by many diseases. Many of them live upon the sweet potato and produce the condition commonly known as *rot*. They are in their nature similar to moulds, mildews, smuts, rust and black rot of the grape. They are low forms of vegetation belonging to the group known as fungi. A fungus is a chlorophyllous, sapro-

phytic, or parasitic plant. Fungi live upon other organisms and absorb their nutriment from other tissues, and produce the condition known as rusts, moulds, rots and mildews.

The life history of many of the fungus diseases of the sweet potato have been worked out by the aid of a compound microscope, and the specific cause of many of the rots is known with absolute certainty.

During the past two years the author has devoted considerable time to the study of some of these diseases and how to prevent the injury done by them, but many of the statements given here are taken from the excellent work of Prof. Byron D. Halstead on diseases of the sweet potato.* We are also indebted to Prof. Halstead for many of the following figures on this subject.

THE SOFT ROT.

(*Rhizopus Nigricans*, E'HR.)

The soft rot causes more loss, perhaps, than ony other fungus disease. It may be met with in the field at digging time, but it is most destructive soon after the tubers are dug. If the tubers are put in large heaps just after being dug, where the temperature is warm, the atmosphere close and damp, the fungus frequently spreads so rapidly as to cause a soft, worthless mass of the whole very soon.

This mould nearly always effects its entrance into the tuber through some broken place in the skin. Frequently at the

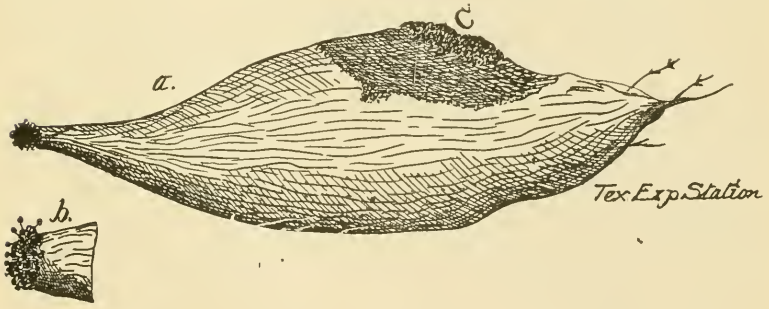


FIG. 43.—Diseased potato, showing soft rot. *a*, Diseased end where broken off. *b*, same magnified, showing spore sacks. *c*, Disease at bruised place.

*Bulletin No 76, New Jersey Experiment Station.

place where it was severed from the vine. If there be a bruised place it is apt to enter there also. In the foregoing figure 43, are shown both places where a tuber was infected after being left in our laboratory: a, where the tuber was severed from the vine; c, a bruised place.

The tuber when attacked at once becomes soft and worthless, and gives off an offensive odor. Mycelium (white threads of the fungus) soon grows over the tuber in a felt-like mass. The tuber then begins to shrink, and at the infected places will appear a dark, powdery mass of spores. These spores correspond to seed in higher plants, and are therefore capable, each of them, of starting an independent fungus.

In figure 44, *a*, is shown a highly magnified view of some of the irregular branched threads of the mould as they are formed in the potato. These portions of the fungus lie upon the cells composing the root, *b*, and give an idea of the relative size and shape of the mould filaments and of the cells of the sweet potato. These mould threads, as they advance within the tissue of the root, excrete a substance that is very active in causing the starch in the potato cells to dissolve, as also the walls of the cell to become partly decomposed. In this way the juice of a decaying sweet potato is able to induce similar decay in healthy roots. After the mould has grown for a short time in the sweet potato, it is ready to form its spores. These spores are produced in capsules, formed at the tips of the branches that rise from the rotten mass and stand upright in the air. If there are any broken places in the skin of the potato these spore-bearing threads are quickly produced. A tuber with no cut or bruised place in the skin, may become entirely rotten without showing an exterior sign of mould that has penetrated it in all parts, and if a rupture be now made, the spore bearing filaments quickly fill the exposed place, and, after a few hours, the black, spherical tips begin maturing multitudes of spores. In figure 44 is shown a single mould plant with its dark, root-like base, *g*, from which several threads arise. At *d*, is a capsule with the spores nearly ripe; *e*, shows another after the outer wall has fallen away and nearly all the spores have been removed. A collapsed empty capsule is shown at *f*. The spores are seen much more highly magnified at *h*, where one of them has sent out a

FIG. 44.—Soft Rot. *a*, fungus threads; *b*, cells of potato; *c*, mould fungus, much enlarged; *d*, spore capsule; *e*, older state; *f*, collapsed capsule; *g*, base of mould plant; *h*, spores. (After Halstead.)

slender tube in the process of germination. The mould, while very contagious, does not, so far as known, begin by infecting the leaves of the growing plant, and then pass down the stem, as is true of the soft rot of the irish potatoes.

PREVENTIVE MEASURES.

Dig the tubers when the soil is dry and during a clear warm day.

Handle them with care so as not to bruise them.

Store them in small piles where the atmosphere is dry and they can have good ventilation while going through the "sweat."

In the northern states a stove or furnace is frequently used to dry them out.

Take out all infected tubers as they appear.

If these suggestions are followed the tubers will be cured out in two or three weeks and after this there will not be much risk of loss from soft rot.

THE BLACK ROT.

(*Ceratocystis Fimbriata*, E. & HALS.)

After the soft rot there is, perhaps, no other fungus disease which causes more loss than the black rot. Unlike the soft rot, however, it continues its ravages all through the period of storage. This disease is usually evident at digging time, but many of the tubers show such small infected places that they are not usually noticed, and the tubers find their way into the store room, or into the market, where the damage is often great. Frequently the middleman and the consumer are the losers. An infected tuber when broken open has a dark greenish appearance at the point of attack. On close examination it will be found that an infected tuber gives off a slight odor, which, if detected, is always characteristic. The flavor of an infected tuber is slightly bitter. This bitter flavor has been attributed to being frozen by many, because a very small infected spot is overlooked and is sufficient to taint a whole tuber. In our experience, dry conditions do not have much effect in checking the spread of this disease. The rot begins at a certain point and gradually spreads in all directions until the whole root is decayed. When the spot is of the size of a half dollar or so it begins to break up at the center, as indicated by the darker irregular places in the middle of each decayed spot, illustrated in the engraving. "If a portion of the diseased tissue is left for a few hours, under favorable conditions of moisture and warmth, a large num- of fine threads will be found, as shown in figure 46. These threads are of a brown color and bear two sorts of tips, one of which, as at *b*, is tapering and ends in a number of cells placed end to end. The terminal cells fall away and appear as at *d*, still more enlarged, one of which has developed

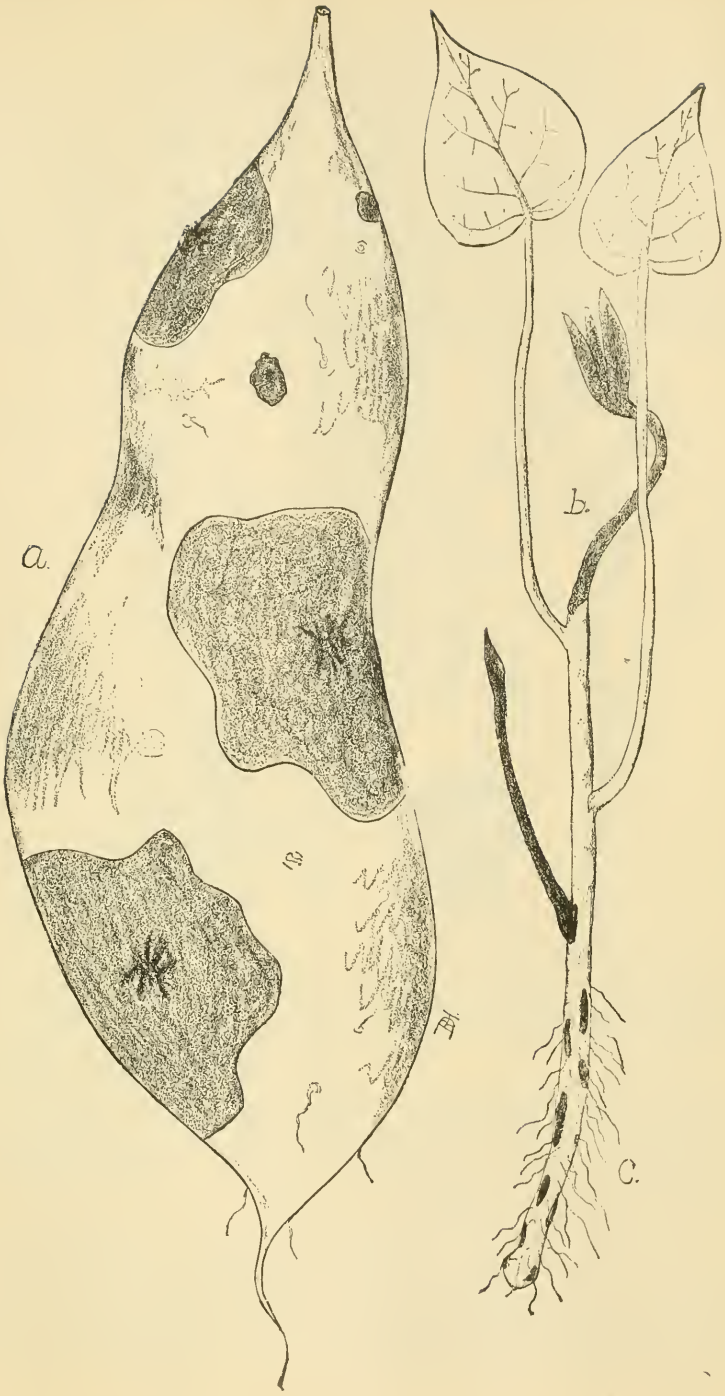


Fig. 45.—Black Rot. *a*, potato affected; *b*, tip of diseased sprout; *c*, base of sprout with black rot.

a germinal tube. A second kind of spore is formed as an enlargement of the tip of the branch, as shown at *c*. These are of a chestnut brown color and do not germinate quickly, as is the case with the colorless oblong ones above mentioned, and as shown at *d*. Occasionally two of the second form of spores are formed upon the same tip, as shown at *f*, and from this fact and the oblong shape, it seems evident that this is an intermediate form."

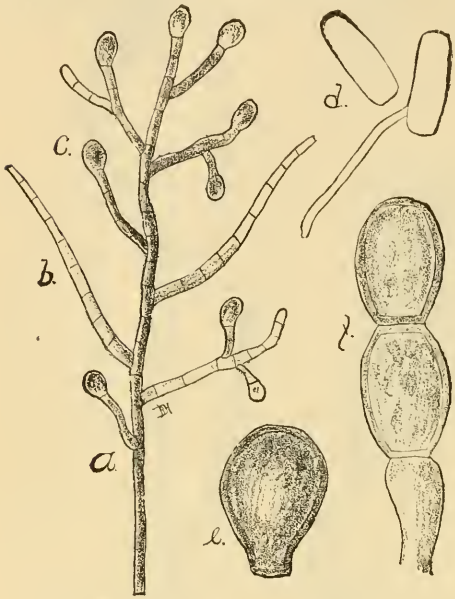


FIG. 46.—Black Rot fungus enlarged. *a*, branching filament; *b*, spore bearing branch; *c*, a second form of tip; *d*, oblong spores; *e*, oval dark spores; *f*, a midway form of spore.

"A third kind of spore is formed in the older portions of a rotted patch, as for example, in the center of the spots shown in figure 44. If a portion of the dark substance be magnified somewhat, it will be seen to contain a large number of black spherical bodies, each with a long neck. The lower, bulbous end is a flask in which spores are produced, and when ripe, they pass up a canal in the long neck and make their exit through a fringed end. As the spores are mixed with an adhesive substance, it is not unusual to find the tips capped by a globule of yellowish jelley, in which the spores are imbedded, as seen at *a*, figure 47, but are quickly dispersed when moisture is applied."

"The spores and the methods of their formation from strings within the flask are shown at *c*, figure 47. In a potato that is in the last stages of decay these flasks may be found throughout the whole substance, but in a young patch only the first two kinds are present."

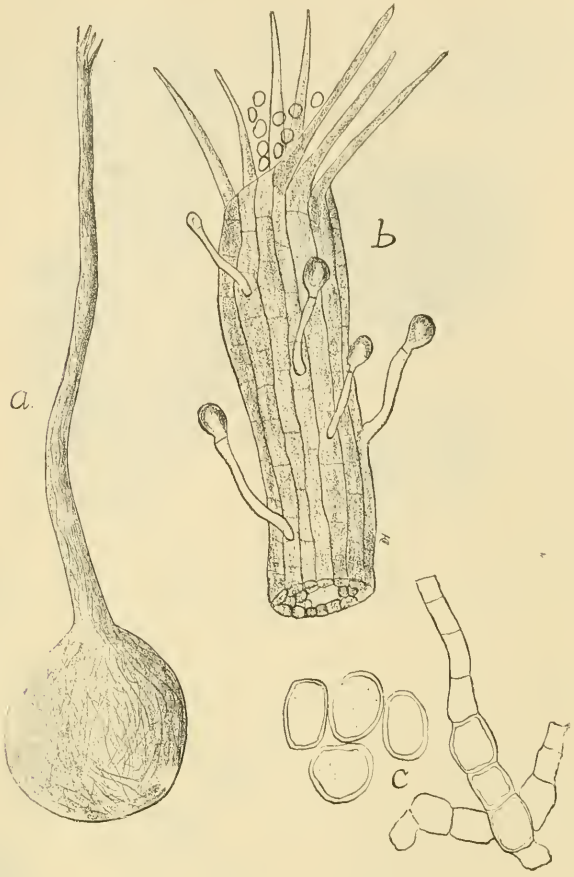


FIG. 47.—Black Rot. An enlarged view of a spore body at *a*; neck more enlarged at *b*, spores escaping; spores and their formation at *c*, much magnified. (After Halstead.)

Another form of black rot is sometimes found in which the substance of the potato becomes filled with minute black, irregular masses. The root thus affected takes on a color that looks like charcoal. Figure 48, *a*, shows a section of a root with this form when fully developed, while at *b* is seen the same at an earlier stage. A highly magnified view of a small portion of the fungus is shown at *c*, and it is seen to consist of black nodules with brown threads running from one to another. The origin and development of these black masses is

shown in figure 49. At certain places the threads swell, turn brown and divide into two or more small cells, as shown at *a*, *b* and *c*. These cells continue to increase in number until a mass like *d* is formed, which finally attains the structure and appear-

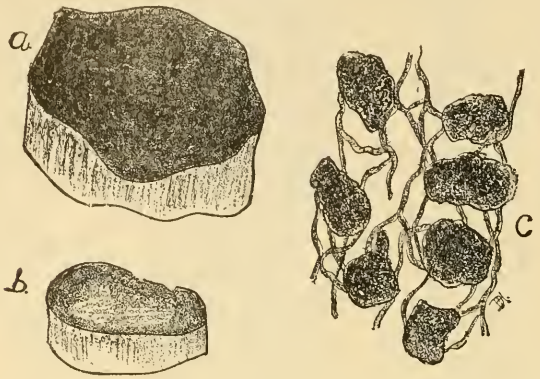


Fig. 48.—*a*, portion of black potato; *b*, the same when younger; *c*, a magnified view of a portion of *a*, showing nodules. (After Halstead.)

ance shown at *e*. In connection with these bodies the second form of spore is frequently met with, borne upon the tips of threads that make up a part of the surface. This is shown at *a* in figure 50, while at *b* is seen a view of a cross-section of one of the nodules. Many fungi have this form, which seems to be a provision for passing over times unfavorable for the immediate growth of the fungus. The vital energies are conserved in the well protected masses, which, while differing in origin and structure, perform the function of spores.

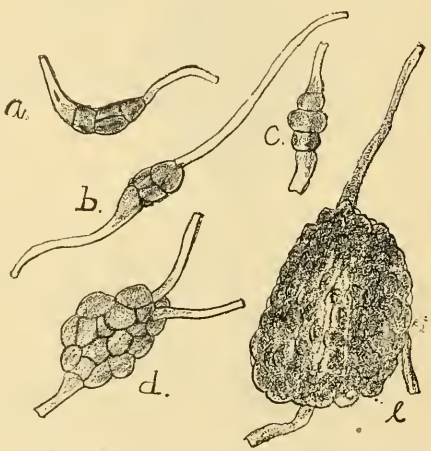


Fig. 49.—The developement of the nodules. *a*, a thread, thickening; *b* and *c*, the division more advanced; *d* and *e* later stages. (After Halstead.)

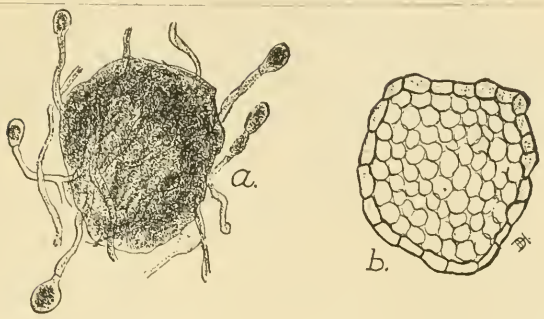


FIG. 50.—The nodule *a*, with spores upon the surface; *b*, the same in cross-section. (After Halstead.)

The black rot makes its appearance in the sequence of the seasons, early in the spring before the plants are out of the the hot-beds. The young sprouts furnish a tender substance particularly favorable for the growth of the fungus, and therefore if the roots used are not free from the disease, the sprouts are quite sure to become infected. The general appearance of a sprout that is almost destroyed by black rot is shown at *b*, figure 45. Large black, dead patches are seen upon the surface of the pale base, *c*, of the plant, while the first leaf and the entire upper portion are killed and brown. The whole heart of the stem is discolored and the plant is worthless for setting in the field. Sprouts as badly "marked" as the one shown are usually discarded at setting-time, but it is those that are only slightly affected, and therefore pass unnoticed, that are most dangerous. Such when placed in the field will continue to grow and nothing may be observed, unless it be a general feebleness, until harvest time, when one or all of the roots are found to be affected with the black rot.

From the investigation of the subject, it is seen that the black rot fungus is abundantly supplied with spores, and they may be found in one or more forms in every patch of diseased substance in the root or sprout. These spores being formed underground, as a rule, tend to charge the soil with the germs of infection. How long the spores can remain alive and inactive is not known, but very likely for many years, and the roots of one crop may become inoculated from the fungus of a previous crop upon the same soil. In like manner, the spores, being light as dust, can be carried from one field to another by the winds. The difficulties of applying a satisfac-

tory remedy are not easily overcome, for the trouble is so largely under ground. In the first place, there is no doubt but that only healthy slips should be used, which means the careful selection of perfectly sound roots for the hot-bed, in order to get the best plants it is possible to use some remedy in the hot-bed, as, for example, a compound of copper, the Bordeaux mixture, or similar subtance which will tend to keep the sprouts from out side contamination. There is also something in the setting of the plants, for if they get a poor start, as from chilling rains, they are weakened, and thereby made more susceptible to the attacks of the black rot. It must not be considered that the circumstances of the season or conditions of the soil are in any sense the cause of black rot, as a specific fungus is necessary for that, but it like all other living things, is dependent upon its surroundings. It seems impracticable to apply any substance to the soil to kill the germs that have accumulated there. As a rule, the only way is to let the fungus starve out by withholding the crop upon which it feeds until the germs become extinct. While a grower with superior sweet potato land may be loath to set aside his best crop, there is no doubt that in some cases, in the long run, it would be most economical. In our experience with the disease, we have found that the purple skin varieties resist the fungus best, the light red skin next and the white skin varieties least.

Wherever enough potatoes can be grown from vine-cuttings for seed the following year this fungus can be easily gotten rid of if the crop is planted on fresh land. The author has weeded out tubers badly infected with it and planted slips from them and the crop would be almost ruined. Vine-cuttings were taken from these badly infected tubers as they grew in the field and were planted out July 19th, and they grew a crop at the rate of 150 bushels per acre of clean, nice and healthy tubers. I consider this the very best way of getting rid of the fungus after trying several fungicides upon the tubers during storage.

Of course, vine-cuttings to grow seed from should not be planted on infected soil. This second crop can not be grown in the northern states because the season is too short. Enough

cuttings might possibly be started in the green-house to go out early enough to grow seed. Good crops from vine-cuttings have been grown successfully as far north as Maryland.

THE SOIL ROT.

(*Acrocystis Batatas*, E. & HALS.)

The life history of the soil rot has not been worked out with clearness. Its specific forms are rather obscure. The habits and spore formation are quite different from those of the black rot. The roots are usually attacked while quite

FIG. 51.—Two sweet potatoes showing the soil rot. (After Halstead.

small, sometimes at different places, in the worst cases nearly all over the surface. It is a peculiarity of the disease that the infected portion ceases to grow, while the healthy part on each side continues to grow. In this way the roots present a very uneven appearance. The parts surrounding the infected places are healthy and edible. The infected places are frequently not large, and they surround a small rootlet that may still be found fastened to the center. It is when the attack is early in the life of the root that the greatest damage is done for it is then that the young root is girdled or eaten into on one side so that its future growth is irregular and very much checked. As the root enlarges the old infected part becomes cracked and largely falls away. It is not unusual to find soil rot spots upon potatoes in the market, but as they do not harm the surrounding tissue and will not spread further, such small "marks," as they are termed, are not particularly damaging. Frequently the loss in a badly infected field is very heavy. It seems that infection takes place through the tender structure of the fine roots, and usually takes place while the whole root system is very small.

The fungus consists of branched threads that terminate in spherical bodies of considerable size. These spherical bodies gradually enlarge and become filled with spores. "When the brown portion of the patches are examined, it is found that minute brown bodies are scattered irregularly through the decayed substance. These are produced in the cells of the fungus, sometimes one at a point, as at *a*, figure 52, but more frequently in considerable numbers in enlarged places, as at *b*,

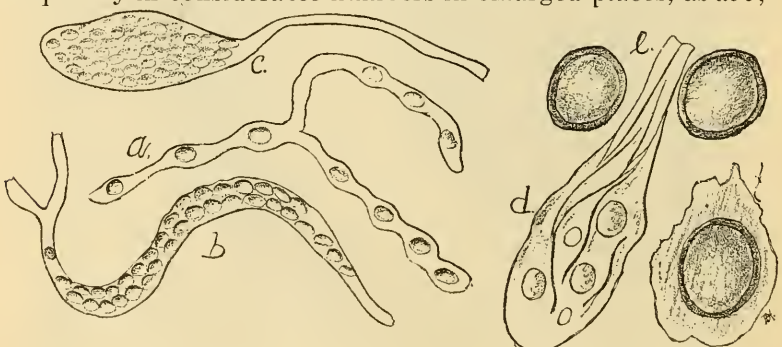


FIG. 52.—Soil rot. *a* and *b*, filament with spores; *c*, swollen tip, with spores; *d* and *e*, collapsed tip and enlarged spores. (After Halstead.)

and perhaps more often in swollen tips, as shown at *c*. The walls of such spore-bearing cells seem to dissolve at maturity, and the spores are thereby set free. At *d*, one of the collapsed tips is shown with only a few spores remaining, two of them still small and colorless. The appearance of the isolated spores is shown at *e*, very much magnified, but they often have an adhering envelope of jelly, as indicated at *f*.

An old spot of the field rot contains countless numbers of these spores, and they doubtless are capable of remaining inactive for a long time. As this fungus is subterranean, and the decayed spots soon become crustaceous and break into powder, it is evident that a large proportion of the spores remain in the soil where produced and render it unfit for future crops. These brown spores also offer an explanation of the passage of the soil rot from one field to another, as has often been observed. They are smaller and lighter by far than the particles of soil that are easily whirled along by driving winds, and being in the light, dry ground ready for movement, they go from the infested field to another that perhaps has never grown sweet potatoes, but will show signs of the soil rot whenever the first crop is attempted. From the conditions that surround the growth and preservation of this soil rot fungus, it is likely that it cannot be eradicated by any of the ordinary methods of spraying with copper compounds. It is most emphatically in the soil, as every sweet potato grower well knows. With the black rot, it has been shown that one of the great precautions is to have perfectly healthy sprouts, but this will avail almost nothing in the case of the soil rot. The infection is by means of the brown spores that are lying in and upon the soil. It might be possible to dip the roots in some substance not injurious to the sprout, that would destroy the germs afterwards coming in contact with the plants. In like manner, it is possible that some substance might be placed in the hills before the plants are set out, that would kill the fungus.

That the season may have much to do with the prevalence of the soil rot is to be expected, but that it is more abundant in a dry year, as all testify, at first thought, appears contrary to the common rule of fungus growths. It must be borne in mind, however, that the potato frequently outgrows the disease to a considerable extent. The attack may be so violent

as to cut off the crop, but usually there are multitudes of roots formed, although small and badly "marked." This fact that they are "marked," as it is termed, is only another way of saying that the deceased root is not destroyed. Long before harvest time the affected places have ceased to enlarge and the root has increased its healthy substance, often to such an extent that the rot spots are overgrown. In a dry season the plant is less able to push ahead and overcome the attack, and therefore the yield is light and the rot appears more abundant. That the season may be favorable, will always be a hopeful element in the grower's calculations."

Since writing the above, Prof. Halstead has carried on field experiments with several things in testing their effects upon checking this disease. The results are given in the following table:

TABLE XXVII. EXPERIMENTS IN PREVENTING SOIL ROT. (N. J. STATION 1895.)

	Clean.	Marked.	Clean.	Marked.
Lime	24	21	15	8
Sulphur	55	22		
Manure	4	25	18	30
Corrosive Sublimate	49	32		
Kainit	8	26	17	30
Sulphate of Copper	18	40		
Check	9	29		

These experiments indicate quite clearly that sulphur sprinkled along in the rows may prove very beneficial. Prof. Halstead makes the following comments on these experiments:

"The combinations are not, for the present to be recommended. If calculations are based upon the plot where the least sulphur is used, the difference between this and the adjoining checks is sixty pounds of clear roots—that is, a bushel —or fifty bushels per acre, worth at least $40.00 The cost of the sulphur at three cents a pound would be in this case $18.75, leaving a clear profit of $20.00 per acre.

It is too soon to conclude what will be the best practice upon soil rot infested land. The results of a single season, and that an unusual one in dryness at its close, upon a single field, indicate that a remedy may be found in both sulphur and corrosive sublimate. It remains to be seen whether the application of these substances will act favorably in succeeding years."

The tubers treated with sulphur were more smooth and kept much better.

THE STEM ROT.

"In the so called stem rot of the sweet potato, the vine dies at or close to the surface of the ground, and from there the decay extends down to, and for a short distance into, the potatoes, while in the opposite direction it works along the vines to the end, unless they have taken root at some joint, when they remain green beyond that point. The moulds constantly associated with the decay of the tips of the potatoes are not found in the distant ends of the dead vines, and the inference is that the decay of the stem at the point of union between root and stem, cuts off the supply of water and nourishment from the soil, and the vine consequently dies, unless as before stated, there are secondary roots at some joints along the way. This dying of the vines is followed by the formation of a fresh growth of short stems and leaves in the center of the hill and directly over the decaying roots. This characteristic second growth is due to the roots, often a half inch in diameter, putting out sprouts that reach the surface and struggle to develope new vines, but without success. A hill destroyed by the stem rot does not recover sufficiently to be of value.

In figure 53, *a*, is shown one of the larger roots of a hill affected with the stem rot in which the decay had proceeded for nearly half the root's length, and from the healthy lower portion a sprout had grown so vigorously and far that it was about ready to begin running. The line between the decayed and healthy portion is sharply drawn; in the former there only remains a dry blackened substance with the skin loosely attached. At *b* is a still larger root, from which there are several sprouts growing, and none have reached the surface of the soil. The dark, irregular upper end of the root indicates the extent to which the stem rot has wrought its destructive work. Another end of a root presenting a characteristic view of stem rot is shown at *c*, while at *d* is seen a much smaller root, the whole of which has become decayed and much shrunken.

The circumstances under which the stem rot is developed make it extremely difficult to assign the cause to any one of

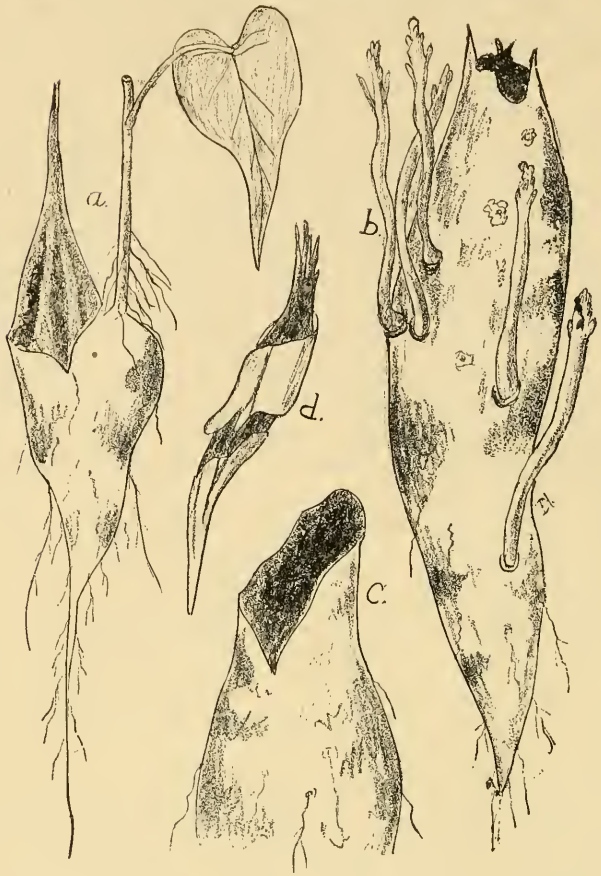


FIG. 53.—The stem rot in its different stages. (After Halstead.)

the fungi found present. Situated as the decay is, at or near the surface of the ground, it is a "catch-all" for any passing germs, so that, while finding several species of fungi present, and believing that one is the cause of the decay, it is impossible to fully decide the case until the trouble has been taken in its first stages, which it is difficult to do, but it is a point hoped for the coming season. It is probable that the stem rot fungus is most nearly related to the soil rot, and that the same methods of eradication are to be observed. The germs are in the soil and innoculation is direct. It is not, therefore, so much a question of healthy plants as a "healthy soil," if such an expression is allowable."

THE WHITE ROT.

A kind of decay very different from any previously described in this bulletin, naturally may take the name of white rot, for the diseased portions have an almost chalky color as well as consistency. Being a dry one, entirely inoffensive, and before the root is cut or the skin broken, comparatively inconspicuous, very little complaint has been made of this form of rot. It is, however quite destructive in some parts of N. J. This trouble is first noticed by the slight depression in the root at the base of one or more of the hairs. These depressions continue to enlarge and deepen, and, in bad cases, several may become confluent, and finally the whole potato is of a chalky consistency, and consequently worthless. In figure 54, *a*, is shown a portion of a root with four places that have

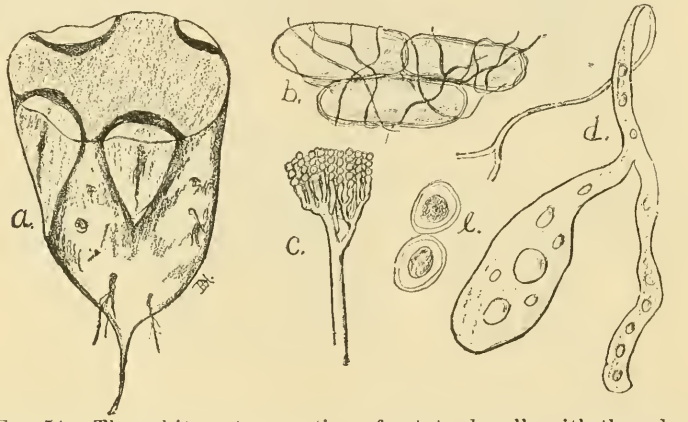


FIG. 54.—The white rot *a*, portion of potato; *b*, cells with threads; *c*, spore formation; *d* and *e*, a second spore developement. (After Halstead.)

become deeply infected with the white rot. It will be observed that the bottom of each white pit is a dark border; this is the portion undergoing the change from the healthy tissue to the dry, white and worthless condition mentioned above. It is a peculiar characteristic of this form of rot, that this border when cut, quickly changes from the ordinary color of the flesh of the potato to a peculiar dark olive. A fungus growth is found invariably associated with this decay, the threads of which are branched and very slender. At *b* is seen three cells of the diseased substance of the potato, with the filaments of the fungus passing over and among them in all directions.

When the diseased root is broken by accident, or purposely cut, and the inner substance exposed, under favoring conditions of warmth and moisture, long verticle threads are soon developed, which bear upon their tips a number of branches, each of which terminates in a row of spores, as shown at *c*, and the surface is soon covered with a thick layer of mould differing slightly, if any, from the blue mold so common everywhere. It was also noticed that a second form of spore is produced within the threads of the fungus as they grow in the substance of the decaying potato. Frequently they are formed in the ordinary slender filaments as local enlargements, and occasionally the tip of the thread broadens out considerably, as shown at *d*, and in these, from their contents, spherical bodies are formed that take on a thick wall and become free, as seen at *e*.

This form of rot has not been studied in the field, and its first developement cannot be definitely stated, but it seems reasonable to infer that the rootlet or its base is the point of attack. While it cannot be stated as a demonstrated fact, it is probable that the spores of the mould, which may abound in the air, reach the rootlets during the rains, and at other times effect a lodgement and germinate and enter the potato. The study of this kind of decay, associated with a species of Penicillium, will need to be prosecuted further."

THE DRY ROT.

(*Phoma Batato.* E. & HALS:)

"Another kind of sweet potato decay is illustrated in figure 55, and may be called dry rot. For example, the whole upper end of the root becomes dry, much wrinkled, and exhibits upon the surface a multitude of pimples. At *a* is shown a portion of the stem end of a sweet potato, and upon one side the roughened surface is exhibited. The whole substance of the potato is diseased, and, with the exception of certain pits for the production of spores, there is very little change of color, while an almost powdery condition of the substance has replaced the previous juicy tissue of the root, as seen in health. At *b* is seen an enlarged view of a section of the pimply surface, showing that the rind of the diseased potato is filled with minute pits, in which the spores of the fungus, causing the trouble, are borne. One of these conceptacles is still more

highly magnified at *c*, and the dark wall is a conspicuous feature, while the spores are still too small to be distinguished. At *d* may be seen some of the spore-bearing cavities as met with occasionally buried within substance of the decayed potato. The lining of the dense dark wall of the cavity is shown,

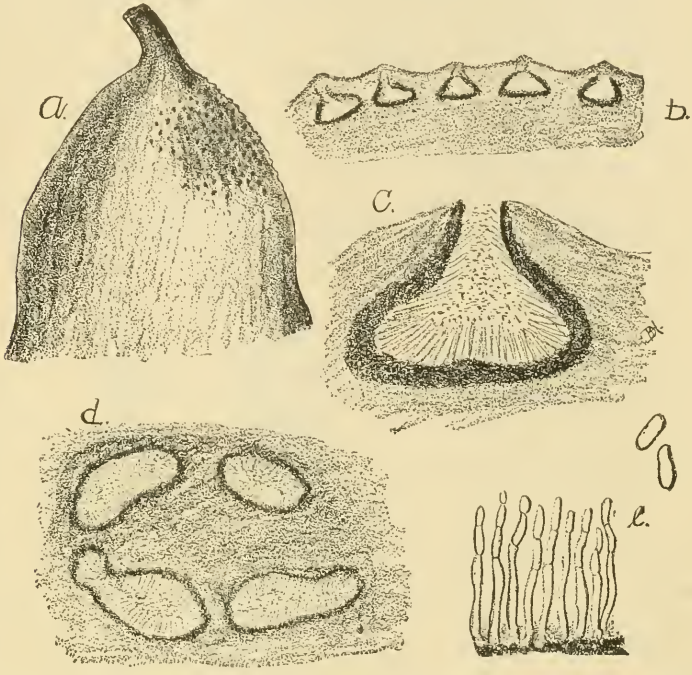


FIG. 55.—The dry rot. *a*, portion of affected potato; *b*, section showing fungus pits; *c*, same enlarged; *d*, interior spore formation; *e*, the spores and filaments within the pits. (After Halstead.)

much magnified, at *e*, where it is seen that slender filaments arise and bear the spores upon the tips. A simple cavity can thus produce an almost countless number of spores, and each spore, under the best conditions, is probably able to inoculate a whole potato.

As this form of rot is as yet only occasionally met with, there is no cause for alarm from it, but the fungus nature of the dry or pimply rot being established, it is evident that as a safe preventive all such decayed potatoes should be destroyed and not allowed to remain upon the soil, where the countless spores may mature and spread the trouble. All possible pre-

cautions should be taken in clearing away the rubbish after every crop.

THE SWEET POTATO SCURF.

(*Monilochætes Infuscans.* E. & HALS.)

While studying the various diseases of the sweet potato, many have asked for information concerning the brown and rusty coat that so frequently appears upon the roots. In some soils, nearly every potato will be wholly or in part covered with a scurf, while elsewhere the roots are free from it. It is quite objectionable, for while not causing the decay of the roots there is a shrinking of the potatoes, and for this reason and the less attractive appearance, the market value of scurfy potatoes is a half dollar or so per barrel below those that are bright and clean.

The scurf is due to the growth of a brown fungus that penetrates for a short distance into the affected root. At *a*, figure 56, is represented a potato partly covered over with the scurf. At those places where the mould is worst the root has a wrinkled appearnce, due to the drying out of some of the juices from the tissue beneath, and a consequent contraction. The fungus starts as a minute light-brown speck, and this keeps on spreading and darkening until the whole root may become of a quite dark color. The mould continues to spread after harvesting, and only stops when the root is completely covered with it, or the rind is thoroughly dried out in the storage room.

At *b* is shown a highly magnified view of the surface of a scurfy potato, and four projecting filaments of the fungus are represented. Beneath the rind of the root the threads of the mould penetrate in all directions near the surface, robbing the substance as they go, and cause the withering of the affected parts, as above mentioned and shown at *a*. One of the free, upright, dark chains of cells is shown, more highly magnified, at *c*, with two younger filaments coming from the same base, and the nearly colorless and smaller thread extending below as it penetrates the root and soon forks. At *d* is another chain with less regular cells than *c*, and a larger portion of the branched threads from below the surface, shown at *e*, some cells of which bear dark bodies that may be spores."

"The scurf is found upon the roots above the potatoes, particularly upon that portion from which all the potatoes arise. No attempts have been made to find a remedy for this trouble. It is likely that the fungus may pass from a scurfy root used for propagation, to the sprouts developed from it,

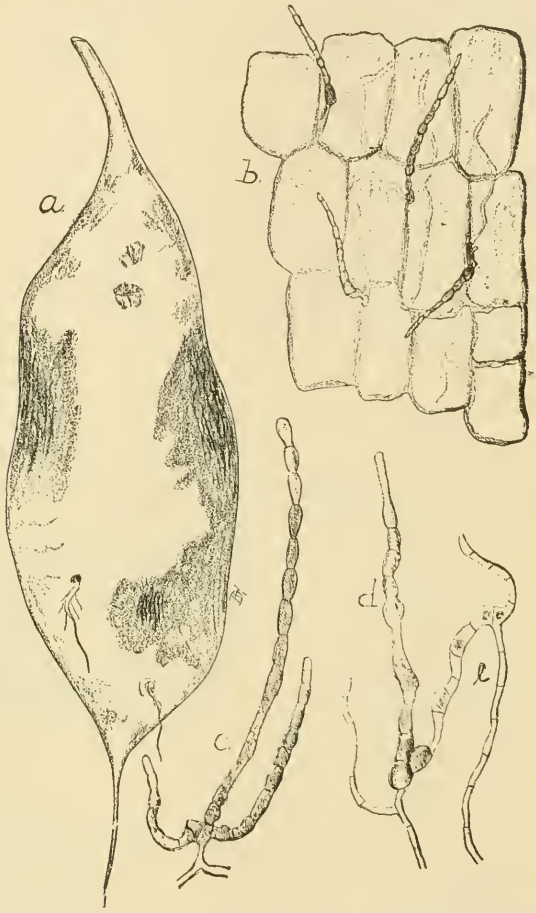


FIG. 56.—The scurf. *a*, affected potato; *b*, magnified surface; *c*, filaments of fungus; *d* and *e*, other threads, (*e*) from within the tissue. (After Halstead.)

and therefore it is a precaution to use, if possible, roots for the hot-bed that are bright and free from the scurf. It is also possible that some quality of the soil may favor the growth of this dark mould, and when this is known something may be

done to reduce the trouble. Some kinds of manure may favor its development, and it is likely something could be applied to the freshly-dug potatoes that would check the spread of the scurf. But until this mould becomes more damaging than at present, it is not probable that growers of "sweets" will complain, especially while they have such destructive enemies to contend with, as the soil and black rot previously treated in this bulletin."

THE LEAF BLIGHT.

(*Phylosticta batatícola*, E. AND M.).

"A fungus quite similar in its structure and spore-formation to the dry rot, is often met with upon the sweet potato leaves, where it produces white, dead patches.

"At *a*, Fig. 57, is shown a leaf thus affected with the blight. The fungus sends its filaments in all directions through the substance of the leaf, and after thriving for a time prepares for the production of its spores. Certain spots become dead from the excessive sapping by the fungus parasite at such places, and in these the spores are developed in flask-shaped bodies constructed for the purpose out of the filaments. At *b* may be seen such a spot highly magnified, with a few of the spore con-

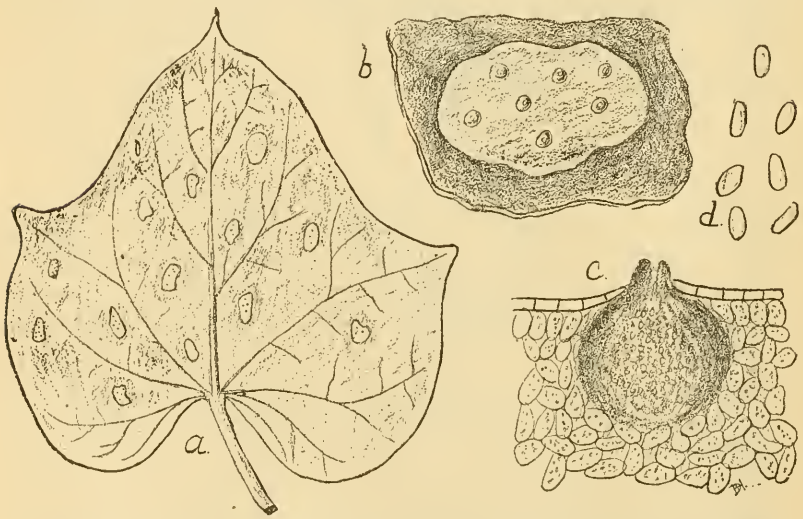


FIG. 57.—The leaf-blight fungus. *a*, leaf infested; *b*, an enlarged spot; *c*, section of one of the spore-bearing bodies; *d*, magnified spores. (After Halstead.)

ceptacles within the dead area. A section made through this portion of the leaf gives a longitudinal view of these bodies, as seen at *c*. The multitudes of spores formed within the flask pass out through the sharp neck when mature, which may be the following summer, when a new crop of leaves is ready to receive them. These spores are shown at *d*, highly magnified.

While this leaf blight may not attack the root, it nevertheless has a bad effect upon the plant. Anything that is injurious to the foliage invariably does harm to the whole plant, for the leaves are the organs in which the nourishment is prepared for the sustenance of all portions. The parasitic fungus attacks the vigorous foliage and causes the dead white patches to appear. There is but little doubt but that if it should become noticeably destructive it might be held in check by spraying the young vines with one of the many fungicides, but at the present time it is not to be expected that such attempts will be necessary."

THE LEAF MOULD.

(*Cystopus ipomoeæ-panduranæ*, FARL.).

"A second form of leaf fungi is much more abundant than the blight above mentioned, and no doubt often has a decidedly deleterious effect upon the crop. The affected leaves at first lose their healthful green color, and the paleness is soon followed by brown patches that after a time become quite dark. Upon the under side there may be seen small patches of a whitish color. These are places where the leaf-skin has been broken and multitudes of white fungus spores have formed. At *c*, in figure 58, is shown a small portion of the under side of a sweet potato leaf with a few of the mould patches. A section through a patch is shown at *d*, and the fungus appears as colorless threads, which, crowding together, have ruptured the leaf, and the rows of cells expose their tips, from which the older spherical spores are constantly ripening and falling away. The free spores, more highly magnified, are shown at *e*.

There is a second form of spore to this species of mould, but as far as known it is not produced upon the sweet potato plant. Some parasitic fungi flourish upon several kinds of plants, usually closely related, and this is true of the mould in question. Many of the morning glory family are subject to its attacks, and among others the wild morning glory, sometimes

called 'Man-of-the-earth.' This weed is not uncommon in the sweet potato regions of New Jersey, and is remarkable for the massive roots that are sometimes several feet in length and weigh twenty or thirty pounds. At one place, where this

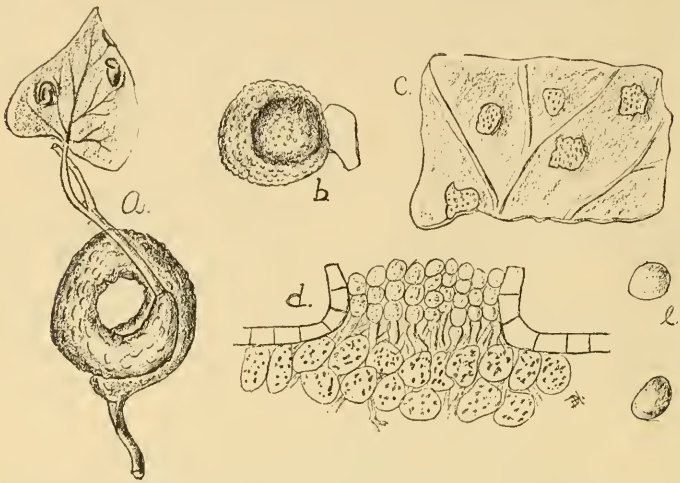


FIG. 58.—The leaf mould. *a*, vine as enlarged by fungus; *b*, winter spores; *c*, portion of leaf as affected; *d*, section through spot; *e*, spores, highly magnified. (After Halsted.)

vine-weed was found covering the ground in a large corn lot adjoining a sweet potato field, nearly every stem and many of the leaves were greatly distorted, as shown at *a*, in the figure. It is a peculiarity of this fungus that its second kind of spores are produced in swellings of this sort. These spores are many times larger than those borne upon the leaves, and are for the purpose of carrying the mould through the winter. When the thick, brittle galls break up in spring the spores are set free, and are ready to spread the mould to all susceptible plants, the sweet potato being one of the leading ones. The chief point in bringing in the weedy cousin in this connection is, that it is a means of harboring the mould and furnishing proper conditions for its propagation and continuance from year to year. Knowing this, it would be wise to treat the weed as such, and prevent it from maturing the galls filled with the winter spores of the sweet potato mould. This is not the only case in which a worthless plant serves as a home for fungi that also prey upon field or garden crops."

ANOTHER STEM ROT.

(*Nectria ipomeæ*).

Prof. Byron D. Halstead* has described this disease, which he found occurring on egg plants, under the common name of "egg plant stem rot." We have found it occurring with black rot on sweet potatoes, both in the field and in the storage room. The disease appears in small pink colored spots on all parts of the potato. These pinkish spots, when placed under a microscope, are seen to be spore sacks, containing immense numbers of spores. We have succeeded in making a pure culture of this disease, and infected a potato with the spores. The potato shrivelled up and became very hard and dry in the laboratory.

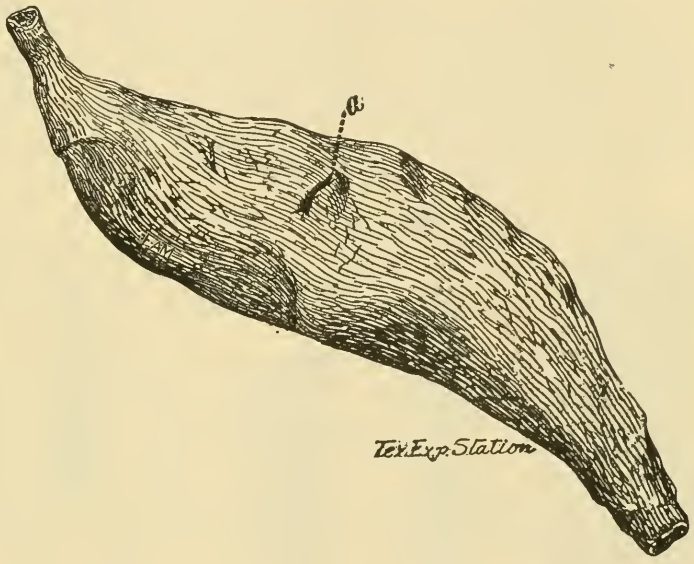


FIG. 59.—Shows the appearance of the potato that was infected with stem rot. *a*, cut place where the spores were put into the potato.

While this potato became very dry, shrivelled and hard in the laboratory, yet in the field where the soil is damp the infected tubers are rather soft, and the spores, which occur in pinkish spots, appear all over the surface.

*Twelfth Annual Report, N. J. Experiment Station, p. 281.

I have not yet noticed it upon the young plants, but it is evidently carried to the field on young slips from the bed. It is probable also that spores may come from egg plants and cause infection.

CHAPTER XVI.

Insect Enemies.

During most seasons the sweet potato is comparatively free from injury done by insects. Occasionally, however, the injury is quite serious. Most of the leaf eating insects can be easily killed at small cost. A brief discussion of the more injurious insects will be given, together with remedial measures.

Flea Beetles. These very small, dark, hopping insects, often do the young plants great injury when first set out, and before the roots have taken sufficient hold to force the plants along. They eat numerous small holes in the leaves. One of the best ways to prevent their injury is to dip the young plants in the following preparation before they are planted out:

Paris green or London purple, 1 pound; water, 175 gallons; lime, 1 pound.

If the insects should attack the plants at any time after they are set out, this mixture should be sprayed on them.

Cut Worms. These insects are quite injurious on sod land. In order to starve them out, it is a good idea to keep the field clean some time before the plants are set. If the field is made clean some time before planting, and the following precaution taken, the risk from damage will be greatly lessened: Thoroughly spray a patch of fine tender grass with one pound of London purple, stirred in 100 gallons of water, and then cut the sprayed patch close and place small heaps of the grass late in the afternoon to prevent wilting, at intervals of about ten feet, over the ground. The insects will eat the poisoned grass and die.

Sweet Potato Saw Flies (*Schizocerus spp*). If these insects become serious, spray with formula recommended for the flea beetles.

Tortoise Beetles (*Cassidæ*). Sometimes these insects do great injury in both their larva and pupa states, by eating the foliage. Spray with same formula recommended for flea beetles.

Sweet Potato Hawk Moth (*Macrosila Cingulata*).

Growers sometimes call this insect the "horn worm." Its large size renders it easily seen. Pick it off or spray with formula recommended for flea beetles.

Sweet Potato Root Beetle (*Cylas Formicarius*). This insect is supposed to have come from Cuba. It is spreading through some of the southern states, and has done considerable damage in Louisiana, Florida and Texas. It lives upon the roots. The larva tunnels its way through the tubers, and is, therefore, difficult to kill. Growers in the southern states should be very careful in buying new seed. The only way so far known to check it is to burn the tubers which have the insects in. It is a practice of some growers to feed the infested tubers to hogs. While this method will, no doubt, destroy a great many, still it is not so sure as burning the tubers.

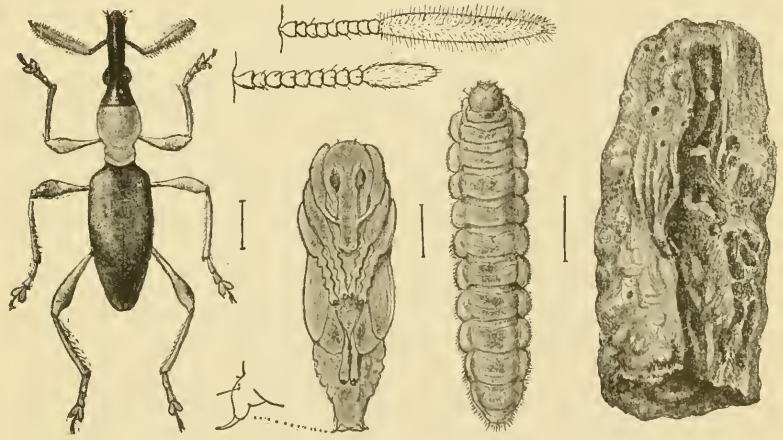


Fig. 60. The sweet potato root bore (*Cylas formicarius*). Extreme left hand figure, adult beetle, with enlarged antennæ at right. Figure at left center, pupa; at right center, larva; at extreme right, portion of sweet potato tuber channeled by borer. All figures except the last considerably enlarged; natural sizes indicated by hair lines. (Drawn by L. Sullivan).

CHAPTER XVII.

VINELESS SWEET POTATO.

Origin, History and Value.

There are a number of so-called vineless sweet potatoes, such as "Bunch Yam," "Spanish Yam," "Florida Yam," "Vineless Gold Coin Prolific," Etc. "Bunch Yam" is really a synonymn of vineless. After testing all the so-called vineless or bunch sweet potatoes, which I could obtain through extended correspondence, I have found only one variety, which comes near being a "Vineless" variety. The vines of this variety usually grow from two to four feet long, and bear a heavy dense foliage on thick fleshy stems, which range from six to twelve inches long, owing to soil and season. The character of the foliage of this variety is shown in Fig. No. 61. There are two variations from the vineless, both of which have foliage alike. The foliage of one is much smaller and less dense on the vine. The vines run from four to eight feet. While the tubers of one are just like the original, the tubers of the other are reddish yellow, and resemble very much the Pumpkin type. The character of the foliage on these two variations from the true vineless is shown in Fig. No. 62.

ORIGIN OF THE VINELESS.

The following in regard to naming this "sport," and its origin, was published in a bulletin by the author, December, 1893:

"We prefer to use the name 'Vineless' because it is shorter, and hope the seedmen of the State will so catalogue it that growers may not be deceived.

"It undoubtedly originated in Mississippi in 1884. The following in regard to its origin was received from J. A. Burkitt & Sons, Abbott, Miss., October 9th, 1893:

* * * "Yours of the 29th of September at hand, in reply will state that the Southern Bunch Yam originated on Mr. George Harvey's plantation, near Columbus, Miss." Also the following from Mr. C. C. L. Dill, Dillburgh, Ala., was received Oct. 2nd, 1893: * * * "The Vineless is no doubt the same as the Bunch, and I am positive that the Bunch Yam is a sport of the old fashioned Yam, since Harvey found it growing with that variety in 1884, and all the seed people have obtained, no

doubt, can be traced to the same source, no matter what name may be given them. I have written up the Bunch for most of the leading agricultural papers, and no one has successfully disputed its origin. Mr. Harvey lived just over the line in Mississippi, and it is only a few miles from here. I am personally acquainted with his family and his immediate neighbors, and all agree as to its origin, except that it is much larger."

This seems to be clear in regard to its origin, but while it may have been found then there is evidence to which my attention was called during the fall of 1895, that a "Vineless" variety was known earlier. On this point I quote the following, which was published in the *Atlanta Weekly Constitution*, December 26, 1893:

"In the year 1865 my father, T. D. Padleford, found in a patch of the old-fashion long-vine yam, a hill of potatoes with very short and heavy set vines, with its leaves set close together on vines. In the fall he dug this odd looking hill and found it to be exceedingly productive and large in size, and splendid for the table. The potatoes were found to be close around the stem or root in a cluster, the vines measuring one to two feet when fully grown, and covered the ground with a dense shade.

"The next season he tested this newly found curiosity along by the side of its parent, and when dug in the fall were found to outyield its parent by a little more than one-fourth, much earlier and easier to cultivate, owing to shortness of vines. He then gave the new oddity the name of "Bunch Yam," owing to its habits and general appearance, having a very bunchy top. My father, T. D. Padleford, claims to be the producer of the Bunch Yam sweet potato, near Edwards, Hinds county, Mississippi, though some one has—I suppose unthoughtedly—changed its name to the Vineless Yam, which name is, I think, not appropriate, as the name is liable to mislead any one not acquainted with the potato.

"The Bunch Yam is a sport of the old-fashioned long-vine yam; plants of various kinds that do not mature their seed, frequently sprout or spring off from the parent plant, and produce new varieties this way." * * *

A. S. PADLEFORD, Edwards, Miss.

After corresponding with Mr. A. S. Padleford, we found him convinced of the truthfulness of the above statement.

While we have some conflicting evidence in regard to its origin, the following points seem to be clear: 1st, it is a sport; 2nd, it came from the so-called "Yellow Yam." It resembles this variety in flavor, character of tubers, and in shape of the foliage.

VALUE OF THE VINELESS.

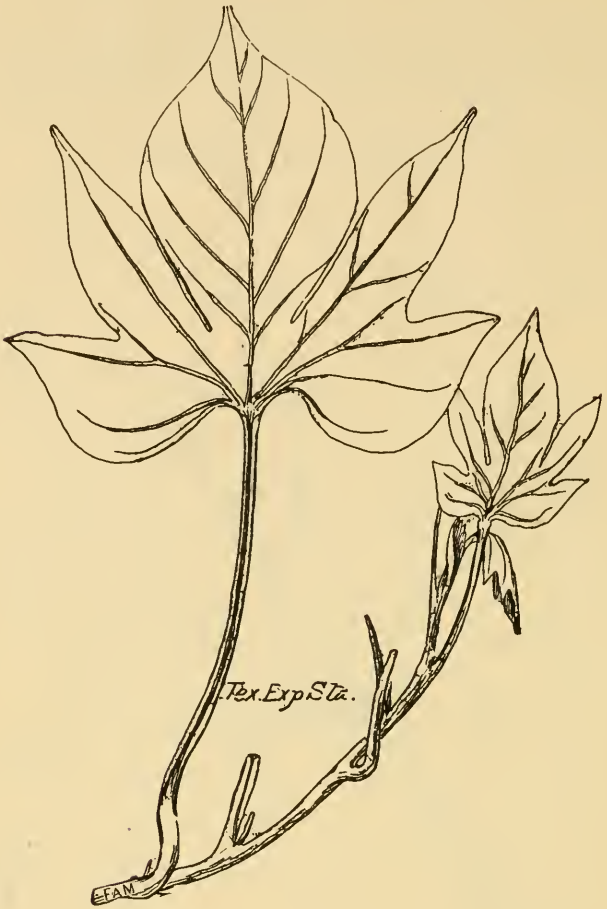
After testing the Vineless for three years with a large number of other varieties, the following was written in regard to it for one of our bulletins, and after testing it another year, I do not wish to make any change in what I have written concerning it:

"Perhaps no other vegetable novelty which has been introduced in the South in recent years has caused more comment than the vineless sweet potato. The experimental stage has been passed, and the value of this variety, like that of the bunch Lima bean, has been established beyond question. In Bulletin No. 28, we stated that the tops of the vines (leaves and stems) could be cut with a mower. It has been stated as an objection, that the ground is usually too rough to run a mower over. With nearly a level culture, we have grown over three hundred bushels per acre of this variety, and all the tops could have easily been cut with a mower. The high value of the tops for feed has been proven, but it is best to feed them green, as they do not cure well. Frequently it is a good practice to mow off the heavy tops and leave the gritty runners on the ground. Owing to the short vines of this variety, which seldom grow over two to four feet long, I have seen it planted in the corn fields and grown with fair success between the rows of corn. The ground can be cultivated later, and the crop can be harvested easier than when running varieties are used. There is only one strain of the Vineless potato that we can endorse. There are two others somewhat inclined to be vineless, but the foliage is much less dense, and the stems of the leaves are not near so long nor so heavy as in the case of the true Vineless. The other two, which are perhaps varieties of the true Vineless, judging from the resemblance of the foliage and vines, have not proven themselves to be as productive here as the true Vineless. This may account for the partial failure some have reported on the Vineless. In one of these strains there is not only a variation in the vines

and tops, but also in the tubers. One has all the flavor and color of the true Vineless, but the other resembles very much in color and quality the Pumpkin Yam. This being true, the Vineless is likely to become the parent of an entirely new race of sweet potatoes, ranging in quality from the soft sugary yams of the South to sweet mealy Nansemonds of the North."

(One-half natural size).

FIG. 61. This figure shows the arrangement of the leaf stalks on the vine of the Vineless variety.



(One-half natural size).

FIG. 62. This figure shows the arrangement of the leaf stalks on the two varieties from the Vineless variety.

CHAPTER XVIII.

Legal or Customary Weights of a Bushel of Sweet Potatoes in Various States.

(*Bailey's Rule Book*).

TABLE XXVII.

	Pounds.		Pounds.
Arkansas	60	Montana	60
California		Nebraska	50
Colorado		Nevada	
Connecticut		New Hampshire	
Delaware		New Jersey	54
Georgia	55	New York	
Illinois	50	North Carolina	
Indiana	55	Ohio	50
Iowa	46	Oregon	
Kansas	50	Pennsylvania	
Kentucky	55	Rhode Island	
Louisiana		Tennessee	50
Maine		Texas	55
Maryland	56	Vermont	
Massachusetts	54	Virginia	56
Michigan	56	West Virginia	
Minnesota		Wisconsin	
Missouri	56	Washington	

MISCELLANEOUS LEGAL SIZE.

"The heap bushel contains 2564 cubic inches in Connecticut and Kansas; 2150.42 inches in New Jersey, Pennsylvania, Nebraska, Tennessee, Missouri and Washington. The bushel measure must be 19½ inches in outside diameter, the half bushel 15½ inches, the peck 12½ inches, in New York and California.

The bushel inclosure must be 18½ inches in inside diameter, the half bushel 13¾ inches, the peck 10¾ inches, and the half peck 9 inches, in New Hampshire and Minnesota.

Produce sold by dry measure must be heaped as full as the measure will hold in Ohio, Illinois, Wisconsin, Minnesota, California, Oregon and Washington.

Heap measure must be cylindrical, with a plane bottom in New York and California.

The half bushel is thirteen and thirty-nine fortieths inches in interior diameter, and seven and one twenty-fourth inches deep in Ohio. It contains 1075 and one-fifth cubic inches in Indiana."—*Laws of* 1892, *Bailey's Rule Book.*

NUMBER OF PLANTS REQUIRED TO SET AN ACRE OF GROUND AT GIVEN DISTANCES.

One acre contains 43,560 square feet.

To find the number of plants to set an acre, multiply together the two distances in feet or tenths of a foot, at which the plants stand apart, and divide 43,560 by the product; the quotient will be the number of plants required.

	PLANTS		PLANTS
12x18 inches	29,040	15x60 inches	6,969
12x20 "	26,036	18x18 "	19,360
12x24 "	21,780	18x20 "	17,424
12x30 "	17,424	18x24 "	14,520
12x36 "	14,520	18x30 "	11,616
12x42 "	12,446	18x36 "	9,680
12x48 "	10,890	18x42 "	8,297
12x54 "	9,680	18x48 "	7,260
12x60 "	8,712	18x54 "	6,453
15x15 "	27,878	18x60 "	5,808
15x18 "	23,232	20x20 "	15,681
15x20 "	20,908	20x24 "	13,168
15x24 "	17,424	20x30 "	10,454
15x30 "	13,939	20x36 "	8,712
15x36 "	11,616	20x42 "	7,467
15x42 "	9,950	20x48 "	6,534
15x48 "	8,712	20x54 "	5,308
15x54 "	7,744		

CHAPTER XIX.

THE WEATHER

Barometer Indications.

"Stationary barometer indicates continuation of the present weather.

"Slowly rising barometer usually indicates fair weather.

"Slowly falling barometer indicates the approach of a severe storm. One-fifth to one-third of an inch is sufficient fall to give indications.

"Sudden rise of the barometer indicates the approach of a storm or the breaking of an existing storm.

"Sudden fall of the barometer indicates high winds and probably rain.

"When areas of low and high barometer are near together, heavy gales may be expected."

SOME POPULAR WEATHER SIGNS (HORT. RULE BOOK).

"Long lines of clouds extending up the sky from a common starting point, often foretells a storm from that quarter.

"When the fleecy or cirus clouds settle down into horizontal bars or ribs in the upper sky, wet and foul weather may be expected. This is 'mackeral sky.'

"If contiguous clouds move in various directions, rain is likely to follow soon.

"When small black clouds scud over and overcast the sky, heavy rain and bad weather may be expected.

"Cumulus clouds that preserve a well-rounded form, and float high in the air, indicate fair weather.

"Anvil shaped, cumulus clouds usually indicate thunderstorms.

"In spring and fall rain is often indicated by a dense bank of gray clouds in the east, in front of which are little shoals of blackish clouds.

"Cirro-cumulus clouds, like bunches and fleeces of wool, scattered high in the sky, are indications of still and dry weather.

"When the rays of the rising sun shoot far up into the sky, fair weather may be expected.

"When the ray-like shadows of clouds overlie a hazy sky, in the vicinity of the sun, rain is apt to follow. This is expressed in the phrase the 'sun is drawing water.'

"Gaudy lines of blue and purple at sunset prophecy rain and wind.

"A bright red sunset means fair weather for the morrow.

"A pale and diffuse sun at setting portends a storm.

"If the sunset is subdued purple, and the zenith is pale blue, fair weather may be expected.

"A deep morning sky is usually followed by bad weather.

"A rosy or gray morning sky means good weather.

"A sonorous condition of the atmosphere foretells rain.

"A bank of clouds across the southern horizon in winter, indicates snow. It is frequently called the 'snow bank.'

"If the sun rises clear, but becomes overcast within half an hour, prepare for rain.

"A halo about the moon indicates a rain storm.

"If the sky is white or yellowish, white nearly to the zenith after sunset, prepare for rain soon.

"Strong east winds indicate a storm.

"Haziness is indicative of dry weather. It is due to dust in the atmosphere.

"When haziness suddenly disappears and the sun sets pale, and the sky is very clear, rain is probable.

"When stars twinkle with unusual prominence, rain may be expected.

"Heavy dew indicates fair weather.

"Absence of dew for two or three mornings in succession, in summer, is a precurser of rain.

"When sunshine is very hot and the shade very cold, and the shadows very deep, 'there is frost in the air,' because the air is very dry and radiations of heat little checked."

CHAPTER XX.

COOKING SWEET POTATOES.

I have found the following to be a very fine method; after washing the potatoes, place them in a pan with a small amount of water; while the potatoes are baking in a stove, shake the pan occasionally so as to turn the potatoes over, to prevent them burning on one side; pour in more water if needed, keeping enough in so that the potatoes will be about dry when done; place in a dish and serve while hot; peel them like boiled irish potatoes. Just before eating, put butter and salt on them.

GLAZED SWEET POTATOES.

"Select potatoes of uniform size, pare and trim them into long oval shape. Cook in boiling salted water until nearly tender. Mix quarter of a cup of sugar and the same of butter, and melt them in half a cup of hot water. Arrange the potatoes in a granite pan. Moisten them with the sugar mixture. Set them into the oven and baste frequently with this syrup. Cook until they are covered with a rich brown glaze, but be careful not to let them burn."

FRIED SWEET POTATOES.

After slicing the potatoes thin, place them in grease with some white sugar, and fry like "saratogas" until done.

SWEET POTATOPIE.

"One quart of sweet potatoes boiled and well drained, three beaten eggs, three table spoonfuls of sugar, one table spoonful of butter, half a nutmeg grated, half tea spoonful of ground cinnamon, a little ground cloves, a little lemon peel, or a little essence of lemon, enough cream to make the mixture of the consistency of butter; make a rich pastry, and, covering your bake plate, pour in the mixture and bake with a top crust"

SWEET POTATO PUDDING.

"Two cups mashed potato (the potato must first be boiled), a cup of sugar, a small cup of butter, three eggs, one-fourth teaspoonful soda dissolved in a little hot water, a teaspoonful lemon extract, and a halfteaspoonful grated nutmeg. Beat the eggs until they are very light, rub the butter and sugar to a cream, and mix all with the potato; cover a deep plate or shallow pudding dish with a thick crust; then put in the mixture and bake slowly for three-fourths of an hour."

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